Cumulative Hydrologic Impact Assessment
Of the
Navajo Mine and Pinabete Permit Areas

Prepared By

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%RSD	Percent Relative Standard Deviation
AOC	Approximate Original Contour
APS	Arizona Public Service
AST	Above-Ground Storage Tank
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BMP	Best Management Practice
BNCC	BHP Navajo Coal Company
CCB	Coal Combustion Byproduct
CFR	Code of Federal Regulations
CHIA	Cumulative Hydrologic Impact Assessment
CIA	Cumulative Impact Area
CWA	Clean Water Act
FCPP	Four Corners Power Plant
HUC	Hydrologic Unit Code
LOM	Life-of-Mine
MAD	Median Absolute Deviation
MMCo.	BHP Mine Management Company
MSL	Mean Sea Level
NAPI	Navajo Agricultural Products Industry
NHD	National Hydrologic Database
NIST	National Institute of Standards and Technology
NMEMNRD	New Mexico Energy Minerals and Natural Resource Division
NNEPA	Navajo Nation Environmental Protection Agency
NTEC	Navajo Transitional Energy Company, LLC
NPDES	National Pollution Discharge Elimination System
OSMRE	Office of Surface Mining Reclamation and Enforcement
PAP	Permit Application Package
PCS	Pictured Cliff Sandstone
PHC	Probable Hydrologic Consequences
SMCRA	Surface Mining Control and Reclamation Act of 1977
TDS	Total Dissolved Solids
TOJ	Termination of Jurisdiction
TSS	Total Suspended Solids
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VWP	Vibrating Wire Piezometer

1 INTRODUCTION

The Office of Surface Mining Reclamation and Enforcement (OSMRE) is the regulatory authority for coal mining operations on Indian Lands under the Surface Mining Reclamation and Control Act of 1977 (SMCRA) (U.S. Congress, 1977). As such, OSMRE is responsible for the review and decisions on all permit applications to conduct surface coal mining operations within the boundaries of the Navajo Nation Reservation. On April 29, 2013, the Navajo Nation Council passed legislation to form Navajo Transitional Energy Company (NTEC), a Navajo Nation owned Limited Liability Company (LLC) organized under the Navajo Nation's Limited Liability Company Act. The Navajo Nation informed OSMRE that they are seeking to purchase all interests in BHP Navajo Coal Company (BNCC) from BHP Billiton New Mexico Coal, Inc. OSMRE has received and is reviewing a Permit Application Package (PAP) submitted by Navajo Transitional Energy Company (NTEC) to develop an approximately 5,600 acre new permit area to continue surface coal mining and reclamation operations post July 6, 2016 at the Navajo Mine (Navajo Tribal Coal Lease 14-20-603-2505). The new permit area, referred to as the Pinabete Permit (NM-0042A), consists of portions of the current Navajo mine permit area (NM-0003F) and unpermitted areas of NTEC's mining lease, located immediately south of the Navajo Mine permit area. NTEC's Navajo Mine and Pinabete permit areas are located on Navajo Nation lands and within the Navajo Tribal Coal Lease. By regulation, OSMRE must prepare a Cumulative Hydrologic Impact Assessment (CHIA) for these permit areas. The CHIA determines whether the proposed operation has been designed to prevent material damage to the hydrologic balance outside the permit area (30 Code of Federal Regulations (CFR) § 780.21(g)).

A CHIA is an assessment of the probable hydrologic consequences (PHC) of the proposed operation and all anticipated coal mining upon surface and groundwater systems in the cumulative impact area (CIA). The PHC is prepared by the applicant, as required by 30 CFR § 780.21(f), and approved by the regulatory authority. Congress identified in SMCRA (U.S. Congress, 1977) that there is "a balance between protection of the environment and agricultural productivity and the Nation's need for coal as an essential source of energy" (SMCRA, 1977 Sec 102(f)). The hydrologic reclamation plan required by the rules at 30 CFR § 780.21(h) recognizes that disturbances to the hydrologic balance within the permit and adjacent area should be minimized, material damage outside the permit area should be prevented, applicable Federal, Tribal, and State water quality laws should be met, and the rights of present water users protected. Additionally, 30 CFR § 816.42 states "discharges of water from areas disturbed by surface mining activities shall be made in compliance with all applicable State and Federal water quality laws and regulations and with the effluent limitations for coal mining promulgated by the United States Environmental Protection Agency (USEPA) set forth in 40 CFR part 434." Discharges of disturbed area runoff at the Navajo Tribal Coal Lease are conducted in accordance with the terms and conditions of a National Pollutant Discharge Elimination System (NPDES) permit issued by the USEPA and certified by the Navajo Nation and Hopi Tribe under the Clean Water Act (CWA).

OSMRE considered USEPA approved surface water quality standards for the Navajo Nation Environmental Protection Agency (NNEPA) as part of this assessment. Protection of existing and foreseeable water uses within the various delineated cumulative impact areas was a focus of this assessment. Additionally, potential impacts associated with the historic disposal of coal combustion by-products (CCB) at the Navajo Mine were specifically evaluated. Additional data and analysis of CCB impacts associated with the Four Corners Power Plant (FCPP) are available in the FCPP and Navajo Mine Energy Project Environmental Impact Statement (EIS) (OSMRE 2015, Sect. 4.15). The original CHIA was written in February, 1984 (Kaman Temp 1984), and addendum to the 1984 CHIA in 1989 (OSMRE 1989), and significantly updated in 2012. This 2015 CHIA supersedes the previous CHIA's and continues to evaluate all mining activities in the lease area, which are currently the Navajo Mine Permit Area, and the Pinabete Permit Area. Findings with regard to material damage of these operations are summarized below (Table 1).

Table 1: Navajo Mine and Pinabete Permit Area – Material Damage Summary

Water Resource	Assessment Approach	Hydrologic Balance Threshold Reached	Material Damage Limit Reached	Measures to Minimize Impact	Adequate Monitoring Program
Fruitland & PCS Quantity	Evaluation of potentiometric surface contour maps	No	No	Contemporaneous Reclamation	Yes
Alluvial Quantity	Comparison of water levels at individual wells over-time	No	No	Contemporaneous Reclamation; mining limited to ephemeral channels; stream buffer zones	Yes
Surface Water Quantity	SEDCAD modeling-assessment of pre- and post-mining impacts; Percent of HUC12 Watersheds controlled with impoundments	**Yes**	No		Yes
Fruitland & PCS Quality	Comparison of baseline water quality to potentially impacted or non-baseline wells, including spoil and CCB wells	No	No	Contemporaneous Reclamation; mixing of overburden/ backfill materials	Yes
Alluvial Quality	Comparison baseline (upstream/pre-mining) water quality to non-baseline (post-mining/downstream) water quality	**Yes**	No	Contemporaneous Reclamation; mining limited to ephemeral channels; stream buffer zones	Yes
Surface Water Quality		No	No	Contemporaneous Reclamation; mining limited to ephemeral channels; stream buffer zones; Sedimentation Ponds	Yes

The finding that the mining operation is designed to prevent material damage to the hydrologic balance outside the permit area is supported by the following chapters. The CHIA is organized as follows:

- Chapter 1 describes the regulatory environment and general background of the assessment area.
- Chapter 2
    - Assesses the cumulative impact potential with historical and active coal mines.
    - Delineates the surface water CIA.
    - Delineates the groundwater CIA.
- Chapter 3 identifies water resource uses and water use designations within the CIAs.

- Chapter 4 provides a description of baseline surface and groundwater quantity and quality within the CIAs.

- Chapter 5 contains an impact assessment of the NTEC operation on surface and groundwater quantity and quality, and includes a determination of:
    - The minimization of impacts within the lease area; and,
    - The adequacy of the monitoring program to assess potential impacts.

- Chapter 6
    - Establishes hydrologic balance thresholds and material damage limits; and,
    - Contains the summary CHIA findings statement.

1.1 Regulatory Environment

Surface coal operations within the Navajo Nation are managed through the coordinated collaboration of several regulatory agencies. Depending on the permitting action, several regulatory agencies may be involved in the review, comment, and public participation process. Regulatory agencies that may have a permitting action on the Navajo Tribal Coal Lease include:

- OSMRE (regulatory authority for coal mining operations within the Navajo Nation)
- Bureau of Indian Affairs (protect and improve trust assets of the Tribes)
- Navajo Nation Environmental Protection Agency (NNEPA) (develop and administer water quality standards)
- Navajo Nation Minerals Department (represent Tribal mineral interests)
- Navajo Nation Water Management Branch (implement Navajo Nation's Water Code)
- USEPA (issue and administer NPDES permits)
- U.S. Fish and Wildlife Service (ensure protection of threatened and endangered species)
- Bureau of Land Management (ensures maximum resource recovery)
- U.S. Army Corps of Engineers (issue permits and associated impact assessments for the discharge of fill material into waters of the United States, including wetlands under section 404 of the CWA)

The 2012 Navajo Mine CHIA was peer reviewed by the Bureau of Indian Affairs (BIA), Navajo Nation Environmental Protection Agency (NNEPA), Navajo Nation Minerals Department (NNMD), U.S. Army Corps of Engineers (USACE), and OSMRE technical staff. Additionally, separate face-to-face discussions were conducted with the aforementioned organizations to review the assessment approach, and to identify any potential major concerns prior to finalization of the assessment. BIA, NNMD, and USACE concurred that the assessment approach for the 2012 Navajo Mine CHIA was reasonable, and the conclusions were appropriate. NNEPA found that the process used to determine water quantity impact was appropriate and that comparison between baseline and post-mining results was acceptable.

OSMRE developed a use impact assessment approach, specific to the evaluation of potential impacts from NTEC operations. This approach developed by OSMRE in part referenced and used NNEPA water quality standards for comparison and also considered Baseline (background) water quality as well as research supported water quality criteria for livestock. OSMRE did not use NNEPA guidance for assessing the quality of Navajo Nation surface waters to determine impairment because OSMRE has no authority to implement 303d impaired stream listing protocols. For this reason NNEPA cannot concur with OSMRE's conclusions without first assessing water quality impairment using NNEPA guidance. NNEPA has expressed future plans to conduct analysis on the available data set using NNEPA guidance.

The 2015 CHIA update is administrative in nature to reflect a change in permittee from BNCC to NTEC, and to clarify the assessment of two active mining areas (Navajo Mine Permit and Pinabete Permit) within the Navajo Tribal Coal Lease, which was completed during the 2012 CHIA update.

1.1.1 CHIA Revision Rationale

The CHIA is not updated at a specified interval. 30 CFR § 780.21(g)(2) states "an application for permit revision shall be reviewed by the regulatory authority to determine whether a new or updated CHIA shall be required." On May 3, 2013, OSMRE received and application from BNCC, to transfer Federal Permit NM0003F to NTEC. OSMRE provided conditional approval in letter to BNCC dated November 1, 2013. Additionally, OSMRE received a Permit Application Package (PAP) on March 30, 2012 to develop an approximately 5,600 acre new permit area to continue surface coal mining and reclamation operations post July 6, 2016 at the Navajo Mine (Navajo Tribal Coal Lease 14-20-603-2505). The application has since been updated by NTEC's mine manager BHP Mine Management Company (MMCo.) in response to OSMRE's ongoing technical evaluation. The application was updated on: December 13, 2013, January 27, 2014, March 6, 2014 and March 17, 2014. A Final FCPP and Navajo Mine Energy Project EIS is anticipated for publication May 2015. The factors below describe the major differences from the 2012 CHIA to the 2015 CHIA.

The 2015 CHIA for NTEC operations:

- Changes the permittee of Federal Permit NM0003F from BNCC to NTEC in text and PAP references,
- Clarifies the assessment of two active permit areas (Navajo Mine Permit NM-0003F and The Proposed Pinabete Permit NM-0042A) within the Navajo Tribal Coal Lease, which was completed during the 2012 CHIA update in anticipation of the Pinabete PAP,
- Updates illustrations, tables, and text to reflect the Navajo Mine and Pinabete Permit Areas,
- Updates ongoing revisions to the hydrologic monitoring program described at Section 5.2 and Appendix H of this document, and
- Updates references to locations in the electronic permit application packaged approved on June 30, 2014.

1.1.2 Cumulative Impact Area

A CIA is defined at 30 CFR § 701.5 as, ". . . the area, including the permit area, within which impacts resulting from the proposed operation may interact with the impacts of all anticipated mining on surface- and ground-water systems." The CIA is an area where impacts from the coal mining operation, in combination with additional coal mining operations, may cause material damage (OSMRE 2002). The size and location of a given CIA will depend on the surface water and groundwater system characteristics, the hydrologic resources of concern, and projected impacts from the operations included in the assessment (OSMRE 2007). For this CHIA, one surface water CIA and one groundwater CIA are delineated to assess impacts associated within these distinct hydrologic resource areas.

1.1.3 Material Damage to the Hydrologic Balance

Sections 507(b) (11) and 510(b) (3) of SMCRA, and 30 CFR § 780.21 (g) require OSMRE to determine if a mining and reclamation operation has been designed to prevent material damage to the hydrologic balance outside the permit area. "Hydrologic balance" is defined at 30 CFR § 701.5 as, "the relationship between the quality and quantity of water inflow to, water outflow from, and water storage in a hydrologic unit such as a drainage basin, aquifer, soil zone, lake or reservoir. It encompasses the dynamic relationships among precipitation, runoff, evaporation, and changes in ground and surface water storage."

"Material damage to the hydrologic balance" is not defined in SMCRA or at 30 CFR § 701.5. The intent of not developing a programmatic definition for "material damage to the hydrologic balance" was to provide the regulatory authority the ability to develop a definition based on regional environmental and regulatory conditions. Therefore, for the purpose of this CHIA;

> Material damage to the hydrologic balance outside the permit area means any quantifiable permanent adverse impact from surface coal mining and reclamation operations on the quality or quantity of surface water or groundwater that exceeds the identified material damage limits and that would preclude any existing or reasonably foreseeable use of surface water or groundwater outside the permit area.

SMCRA recognizes that coal mining will have some hydrologic impacts; therefore, differentiates between impacts within the permit area and outside the permit area. Disturbances to the hydrologic balance within the permit and adjacent area should be minimized, and material damage outside the permit area should be prevented (30 CFR 780.21). The 2015 CHIA evaluates the entire lease area (Figure 1). The lease area includes NTEC coal mining areas prior to the enactment of SMCRA north of the permit area, and includes lease areas IV south and V. In an effort to evaluate historical CCB disposal north of the permit area, and to include baseline information from areas IV south and V, the assessment includes the entire lease area.

1.1.4 Material Damage Criteria

Except for water quality standards and effluent limitations established at 30 CFR § 816.42, the determination of material damage criteria is the discretion of the regulatory authority (48 FR 43972-43973, 1983 and 48 FR 43956, 1983). Material damage criteria for both groundwater and surface water quality should be related to existing standards that generally are based on the maintenance and protection of specified water uses such as public and domestic water supply, agriculture, industry, aquatic life, and recreation (OSMRE, 1998). A CHIA also can include material damage standards for parameters of local significance to water use (OSMRE, 1998). The 2015CHIA includes hydrologic balance thresholds and material damage limits (Ch. 6).

1.2 Background

The Navajo Tribal Lease Area was originally under the operation of Utah International, beginning operation in 1963. Utah International was acquired by GE in 1977, and then by BHP in 1984. Navajo Mine operation became part of BHP Billiton with the merger of BHP and Billiton in 2001. Navajo Mine operates under Permit NM-0003(A-F). Permit NM-0003 was renewed in 1991, 1993, 1994, 1999, 2004, and 2010; pursuant to 30 CFR 774.15(c). On May 3, 2013, OSMRE received an application from BNCC, to transfer Federal Permit NM0003F to NTEC. OSMRE provided conditional approval in letter to BNCC dated November 1, 2013. Additionally, OSMRE received a Permit Application Package (PAP) on March 30, 2012 to develop an approximately 5,600 acre new permit area to continue surface coal mining and reclamation operations post July 6, 2016 at the Navajo Mine (Navajo Tribal Coal Lease 14-20-603-2505). The application has since been updated by NTEC's mine manager BHP Mine Management Company (MMCo.) in response to OSMRE's ongoing technical evaluation. The application was updated on: December 13, 2013, January 27, 2014, March 6, 2014 and March 17, 2014.

The Navajo Tribal Coal Lease is located 18.6 miles southwest of Farmington, New Mexico, on a contiguous lease within the northeastern portion of the Navajo Nation (Figure 2). The Navajo Tribal Coal Lease area is divided into five areas (I-V) (Figure 1) (USEPA n.d.). These lands are divided into Pre-Law, Interim, Termination of jurisdiction (TOJ), and Permanent Program land classifications (Figure 1) (NTEC 2013, Part 6 Sect. 40). NTEC is currently conducting surface coal mining operations in Areas III and IV North, and anticipates conducting surface coal mining operations in the Pinabete Permit Area, south of Area IV North, beginning in 2016.

The NTEC operations currently supply coal from the Navajo Mine to support the operations of Units 4 and 5 at the Four Corners Power Plant (FCPP). The operation of Units 1, 2, and 3 were discontinued after 2013, reducing FCPP coal consumption from approximately 8.5 million tons of coal per year to 5-6 million tons of coal per year. As such, FCPP has two operational units, producing approximately 1,500 megawatts of power annually. Coal from Navajo Mine will be used to support operation of the FCPP until July 2016. After July 2016, coal resources in the Pinabete Permit Area will be available to support operation of the FCPP until 2041. The Proposed Pinabete PAP indicates that 5.38 million tons will be produced annually, on average, for the 25-year life-of-mine (NTEC 2014, Sect. 20). MMCo. relies on strip mining as the primary mining method in the Navajo Tribal Coal Lease area for multiple coal seam mining. Strip mining involves the removal of overburden material covering the coal using blasting and large draglines. The coal is then removed by truck shovels or front-end loaders and transported to coal preparation facilities using haulage trucks. Coal seams are exposed in pits ranging in depth from 5 feet to 240 feet, mine pit lengths vary from 1,000 feet to 15,000 feet. After the coal is removed, the overburden material is regraded to the approved topography and drainages to support the approved post-mining land uses. Stockpiled topsoil and other suitable material are spread on top of the graded overburden material to support the re-establishment of approved post-mining vegetation (NTEC 2013, Part 3 Sect. 20). NTEC must then demonstrate the persistence of reestablished vegetative cover sufficient to support post-mining land use in accordance with 30 CFR 816.116.

1.2.1 Climate

The lease area ranges in elevation from 5,000 feet to 5,600 feet above sea level. The climate at Navajo Tribal Coal Lease varies from arid to semi-arid based on Navajo Mine precipitation records. Navajo Mine has collected climatological data from two onsite meteorological monitoring stations since 1991, designated Met Station I and II. Met Station I is located in Area I, and Met Station II is located at an area referred to as "the Neck" between Area II and Area III (NTEC 2013, Part 2 Sect. 12).

Temperatures at the Navajo Tribal Coal Lease are characterized by cold winters and warm summers, with wide variations in diurnal and annual temperature (URS 2009). Summer days are typically warm (90-95°F) and dry, while nights are cool (55-60°F). During the winter months of December and January, air temperatures commonly fall below 20°F in early morning, while daytime highs typically range from 35 to 45°F. The frost-free period averages 162 days from early May to mid-October (Smeal, et al. 2006).

The average relative humidity at the Navajo Tribal Coal Lease ranges from 33 percent in July to 65 percent in January, with an annual average of 45 percent relative humidity (NTEC 2013, Part 2 Sect. 12). The area receives precipitation during the summer months, when afternoon showers form as a result of moist air from the Gulf of Mexico moving over the area, and in the fall and winter, when cold fronts moving to the east and southeast from the Pacific Ocean create steady, usually light rain and snow showers across the area (URS 2009). The majority of precipitation occurs during monsoon season (July-October), when prevailing winds shift to the southwest and carry sub-tropical moisture into the area, resulting in localized, high intensity, short duration thunderstorms (NTEC 2013, Part 2 Sect. 12, Smeal, et al. 2006, URS 2009). However, considering the entire year, most precipitation events are of short duration and deposit less than 0.10 inch of rain per event (Smeal, et al. 2006). During the winter, snows are infrequent and light. Snow accumulations melt or sublimate within a few days, and snow depths greater than 6 inches are uncommon (Smeal, et al. 2006, URS 2009).

1.2.2 Regional Geology

The area of interest for this CHIA is within the Colorado Plateau physiographic province of the Western United States, geographically west of the 100th meridian west longitude (NTEC 2013, Part 2 Sect. 12). The Colorado Plateau covers approximately 130,000 square miles (mi^2) and includes parts of Arizona, Colorado, New Mexico, and Utah (Hereford, Webb and Graham 2005). The Navajo Tribal Coal Lease is located on the western flank of the San Juan Structural Basin in northwestern San Juan County approximately 15 miles southwest of Farmington, New Mexico (Figure 3). This basin is an asymmetric, structural basin with a northwest trending axis parallel to the Hogback Monocline in northwest New Mexico. The basin is bounded on the northwest by the Hogback Monocline and on the north by the San Juan Uplift. The eastern rim is formed by the Brazos Uplift and the Nacimiento Uplift. The Zuni Uplift and the Chaco Slope form the southern margin of the basin while the Defiance Uplift and Four Corners Platform complete the northwestern basin rim (Figure 3) (NTEC 2013, Part 2 Sect. 17). The San Juan Watershed lies on the eastern edge of the Colorado Plateau and extends from northwestern New Mexico into portions of northeastern Arizona along the New Mexico/Arizona border, southwestern Colorado, and the southeastern most corner of Utah. The San Juan Watershed is approximately 140 miles wide by 200 miles long, and covers a total area of 21,600 square miles (URS 2009).

The rock strata in the southern part of the lease area strike north-south while the strata in the northern part strike northeast-southwest (NTEC 2013, Part 2 Sect. 17). The geologic formation dips gently to the east toward the center of the San Juan Basin at an angle of one to two degrees, and steepens toward the outcrop areas where the fairly abrupt monocline (Hogback) can be observed (NTEC 2013, Part 2 Sect. 18). The stratigraphic section in the lease area reflects the Late Cretaceous transition of shallow marine depositional environment to a terrestrial fluvial depositional environment (NTEC 2013, Part 2 Sect. 17). During the late Cretaceous geologic period, the shoreline of a vast shallow inland sea shifted back and forth across the basin and ultimately receded, depositing alternating marine and nonmarine sediments (NTEC 2013, Appendix 18.O). The strata in the lease area have not been intensively folded, and faults in the strata have limited displacement and extent (NTEC 2013, Part 6 Sect. 41). The mine lease area surface, and adjacent areas, are comprised of the Lewis Shale, Pictured Cliffs Sandstone Formation, Fruitland Formation, Kirtland Shale and unconsolidated alluvial deposits in the valleys of the San Juan River, Chaco River, and the Chaco River tributaries (NTEC 2013, Part 2 Sect. 18). A generalized stratigraphic section and geologic map of the lease area are presented in Figures 4 and 5.

Legend

Mine Lease Boundary

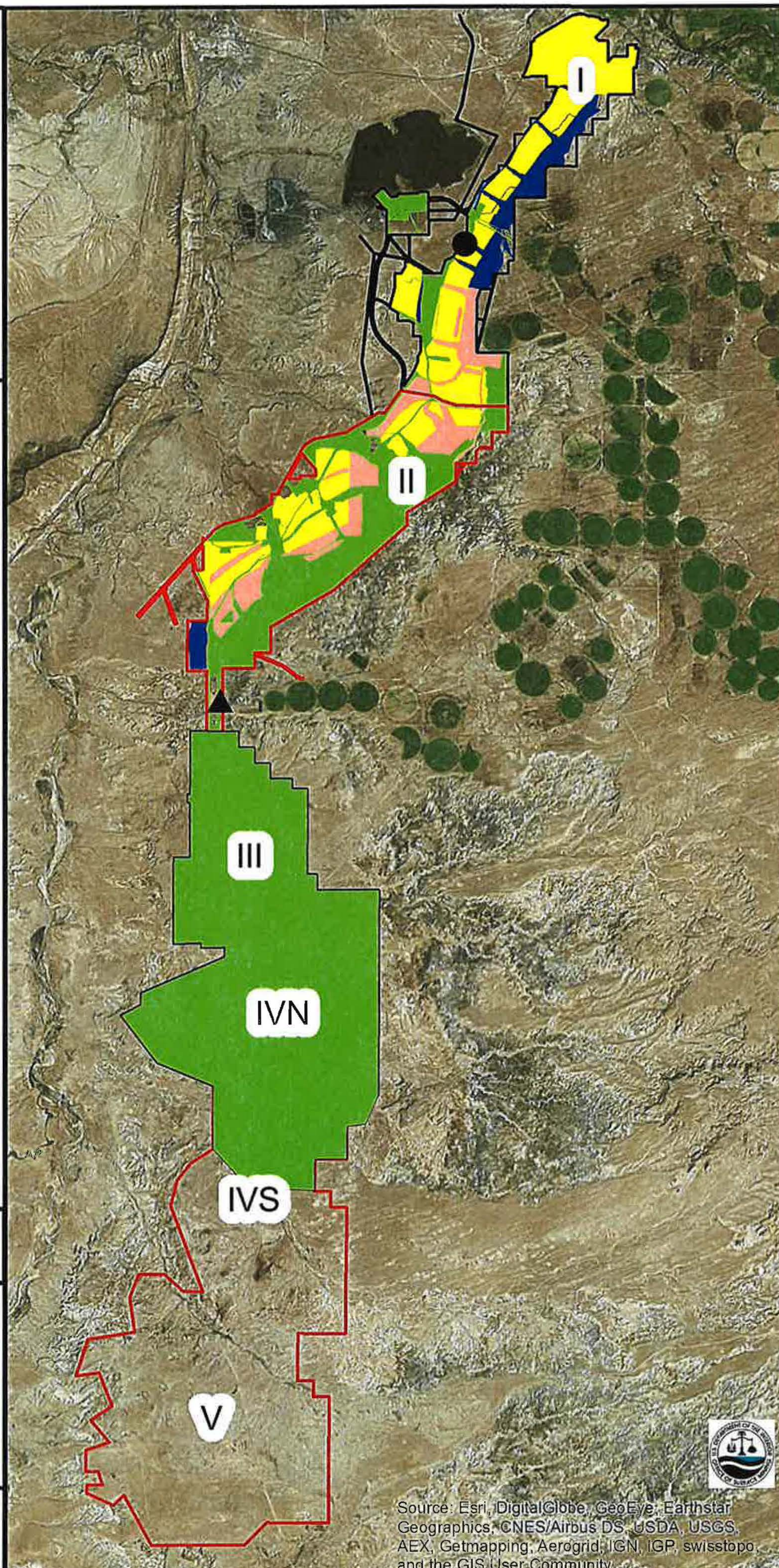
- Pre-Law
- Interim Program
- Permanent Program
- TOJ Lands

Meterological Station

- ● 1
- ▲ 2

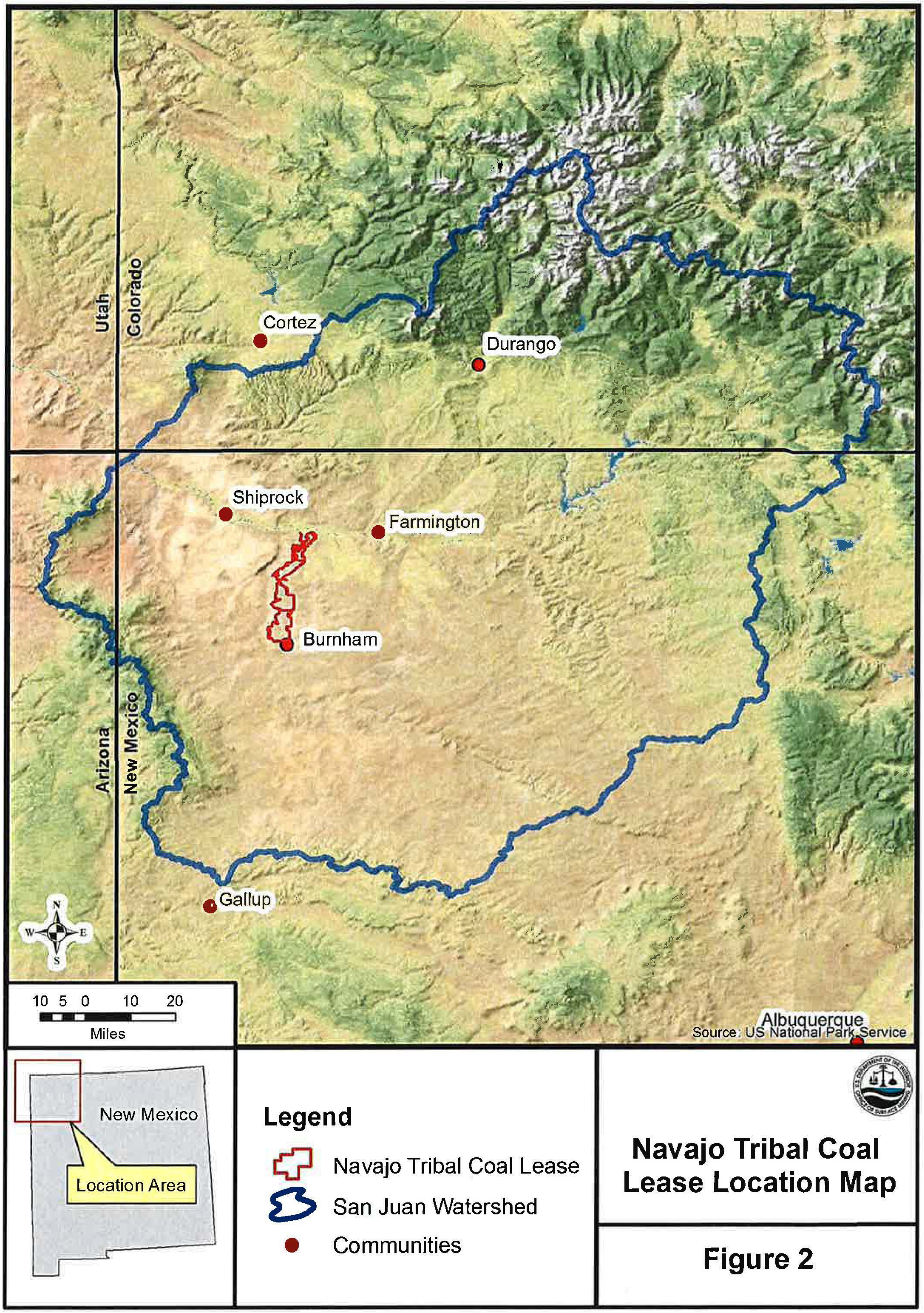
1 0.5 0
Miles

N



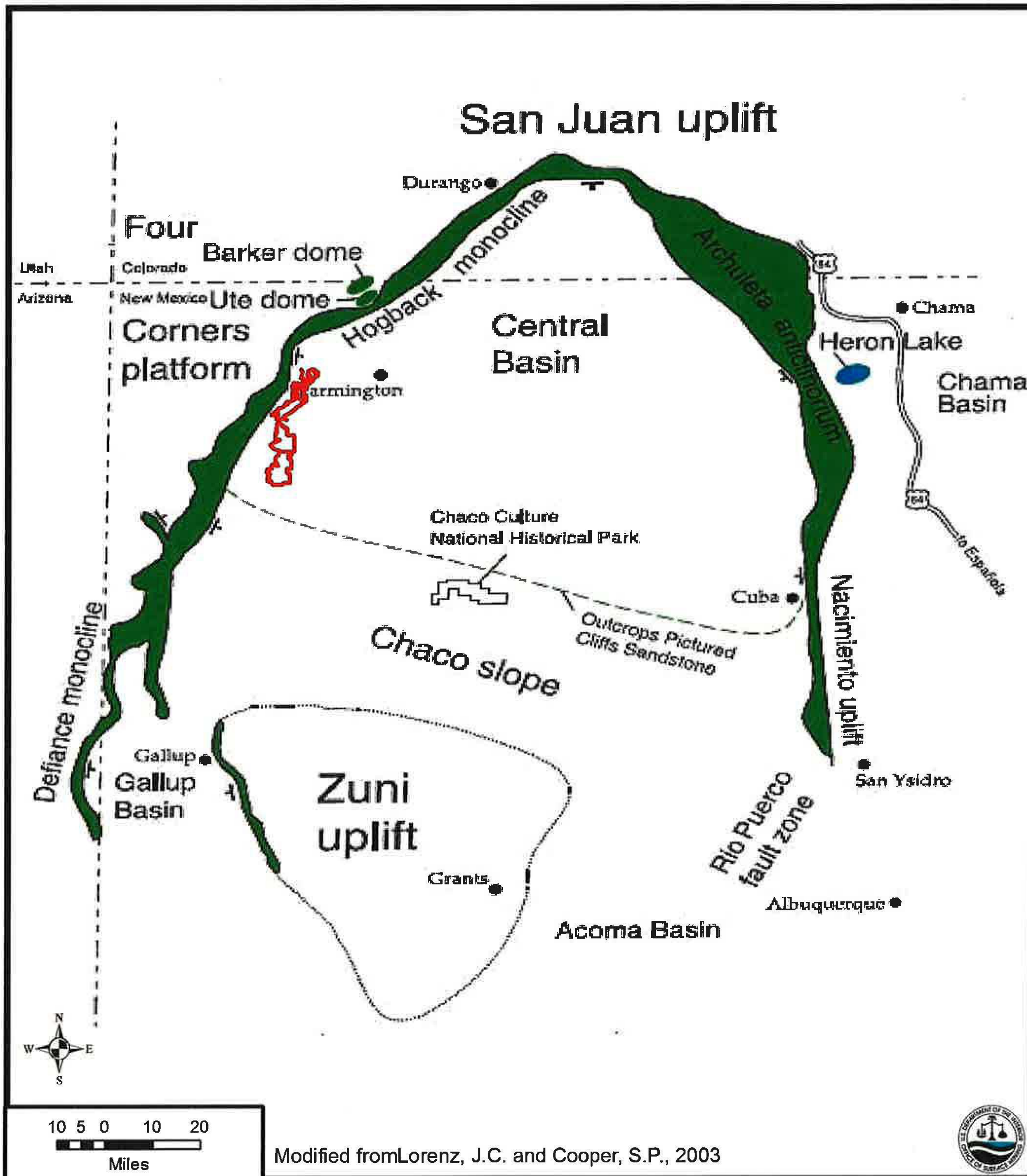
NTEC Navajo Mine and Pinabete Permit Areas

Figure 1



Navajo Tribal Coal Lease Location Map

Figure 2



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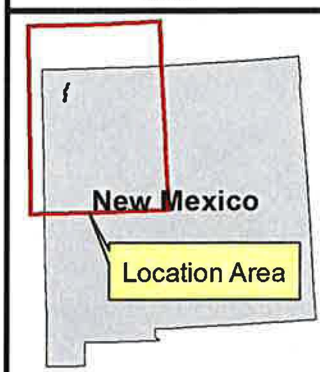


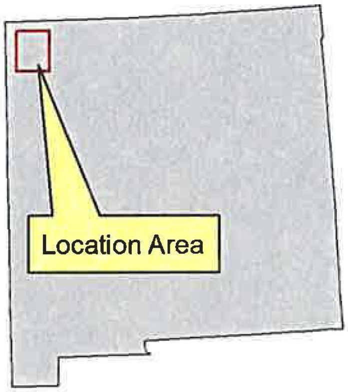
Legend

Navajo Tribal Coal Lease

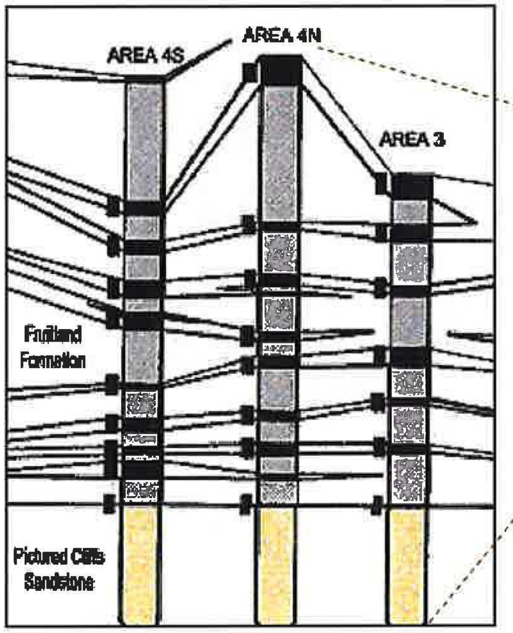
Areas of steep dip; strike and dip symbols show direction of dip

San Juan Watershed Structural Geology

Figure 3



Navajo Lease Area Lithology



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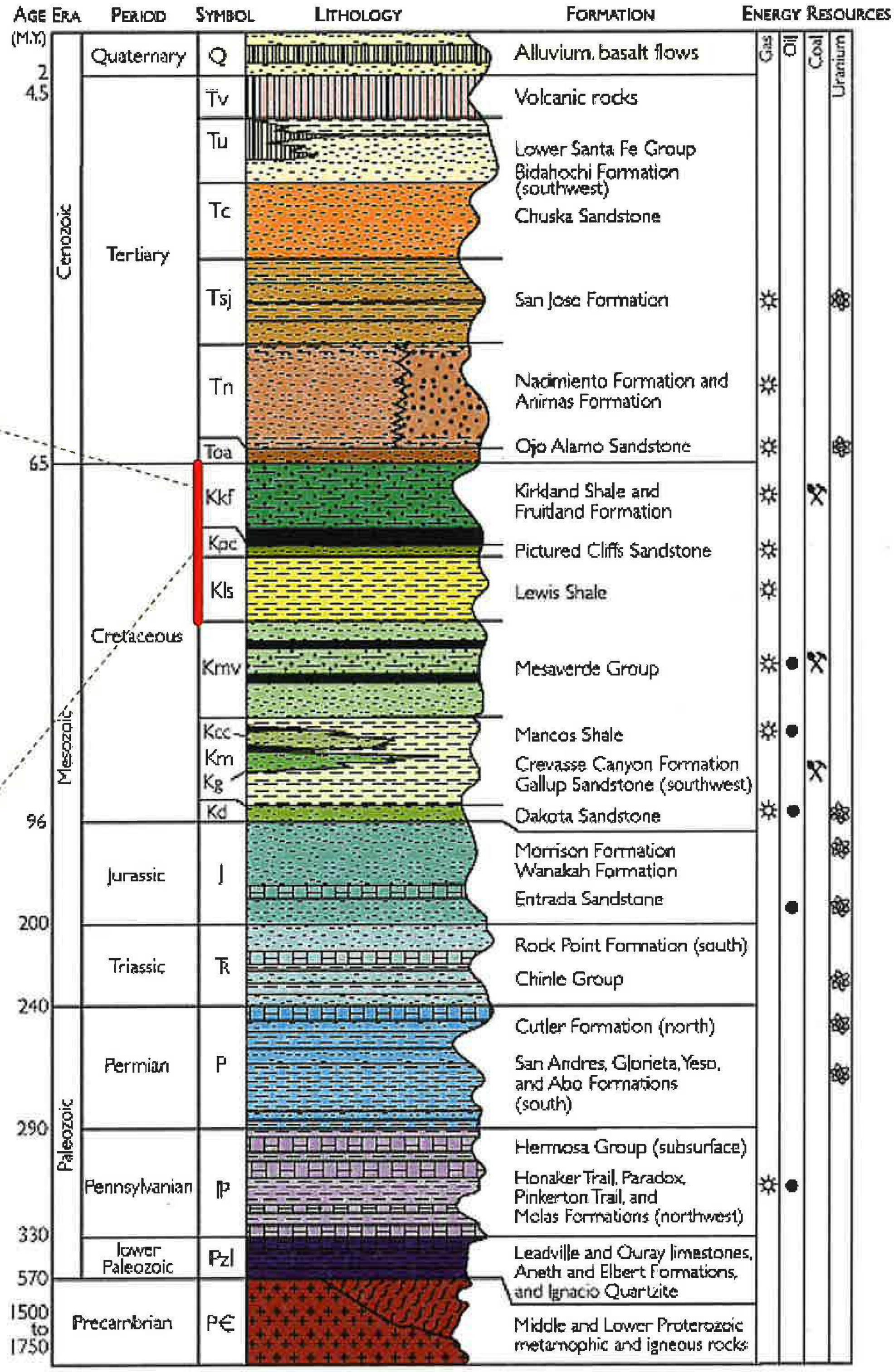
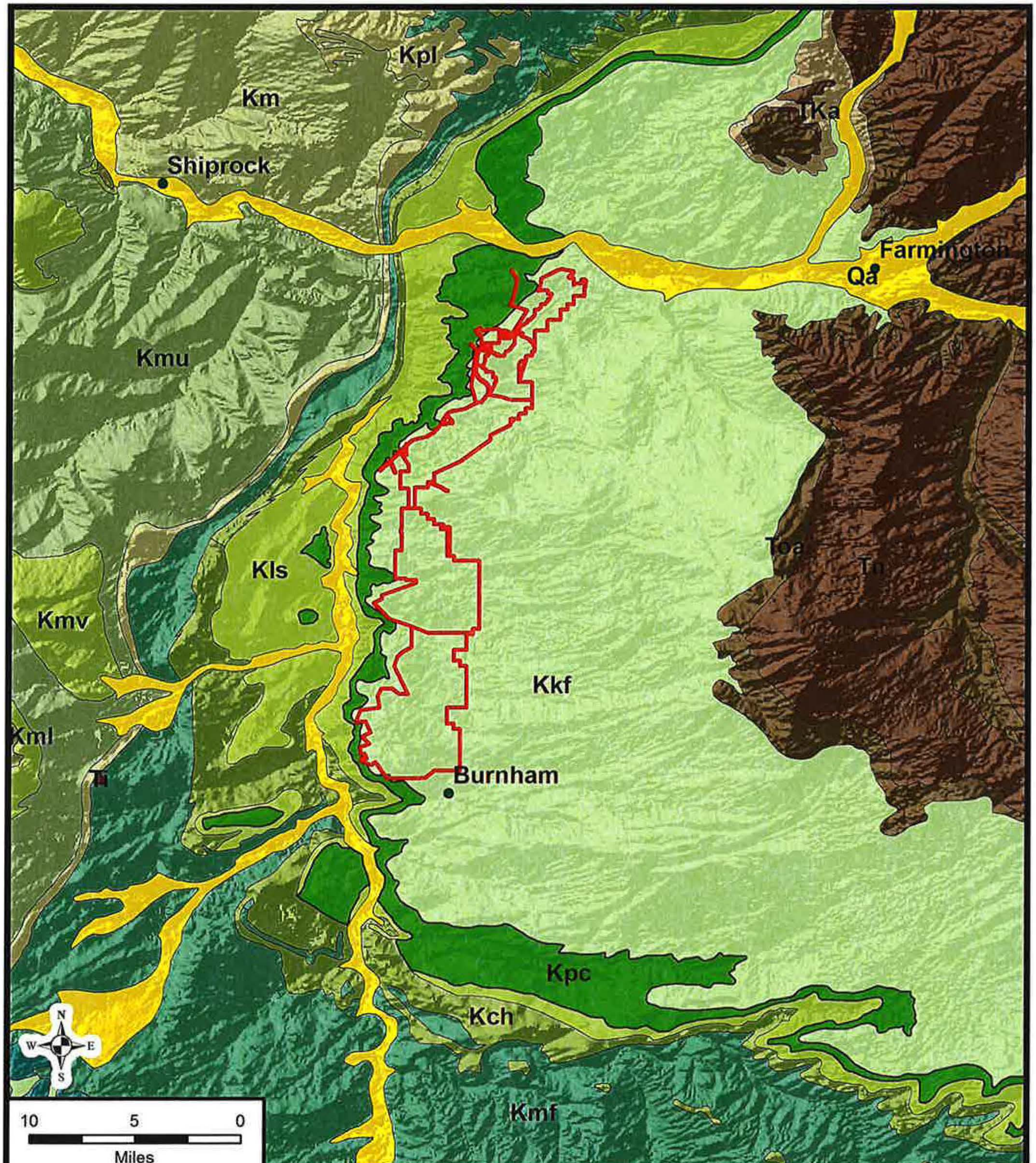
Fassett, J. E. (1977),
USGS Prof. Paper 1625-B



Navajo Tribal Coal Lease & Surrounding Area Stratigraphy

Figure 4

From: Brister, B. S. and Price, L. G., 2002



Legend

Navajo Coal Lease Boundary

Area Geology

Qa - Quaternary Alluvium

Kkf - Kirtland Shale - Fruitland fm.

Kpc - Pictured Cliffs Sandstone

Kls - Lewis Shale

Surface Geology Map NW New Mexico

Figure 5

2 DELINEATION OF CUMULATIVE IMPACT AREA

A CIA is defined in 30 CFR 701.5 as the area, including the permit area, within which impacts resulting from the proposed operation may interact with impacts of all anticipated mining on the surface and groundwater system. CIA delineation for the Navajo Tribal Coal Lease consists of both surface and ground water delineations, with specific impact areas delineated for both surface and ground waters based upon the resource extent and potential use impacts.

2.1 Surface Water Cumulative Impact Area

The Navajo Tribal Coal Lease covers all or part of the drainage areas of the Bitsui, Chinde, Hosteen, No Name, and Barber Washes, and the Neck, Lowe, Cottonwood, and Pinabete Arroyos (Figure 6).

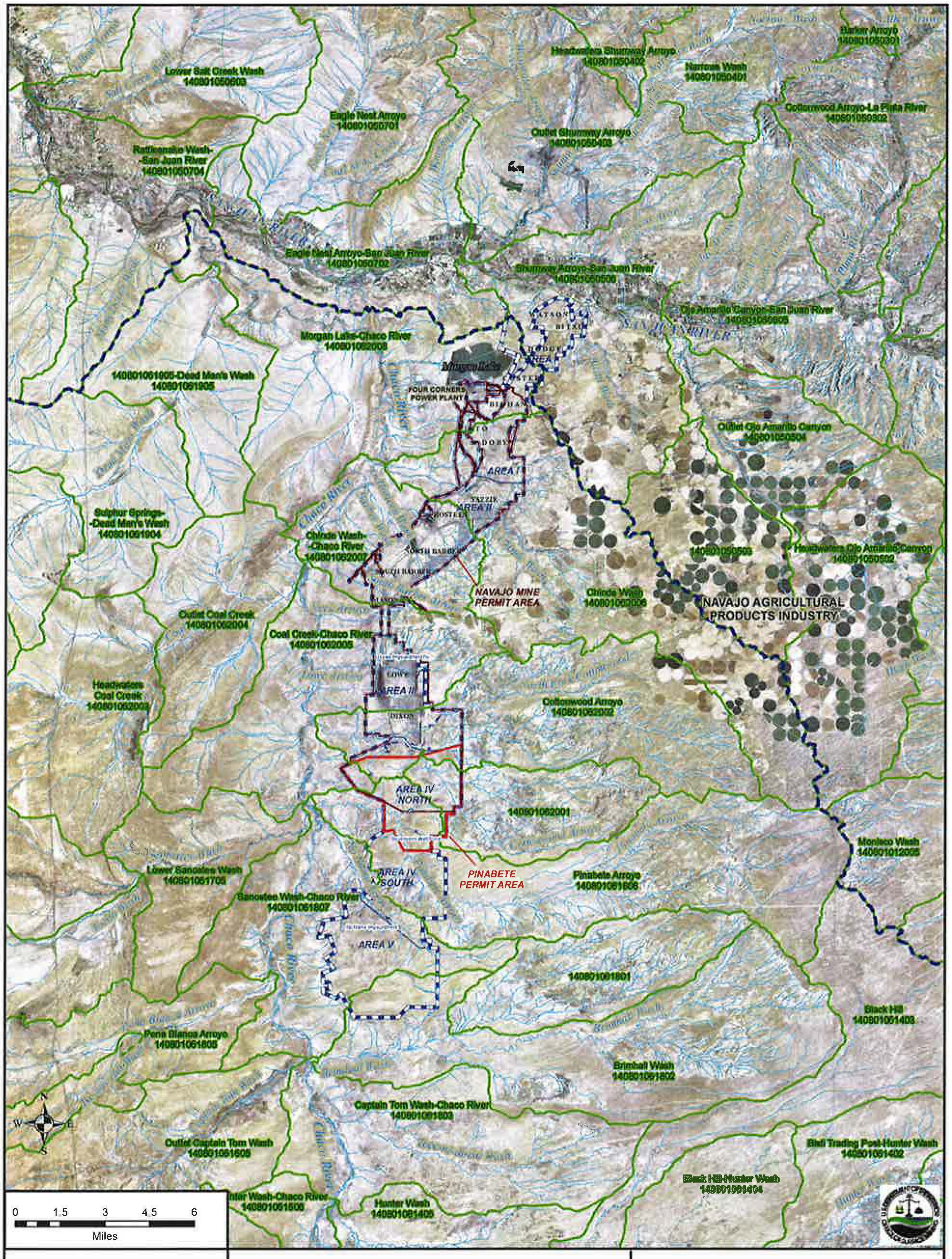
Since mining operations at the Navajo Tribal Coal Lease are the only SMCRA regulated operations in the above mentioned drainage basins, surface water impacts cannot be cumulative with other SMCRA operations unless the impacts extend farther downstream. Bitsui Wash discharges directly to the San Juan River, all other washes and arroyos discharge to the Chaco River, which in turn discharges to the San Juan River. The San Juan River and Chaco River channels and flood plains will not be directly impacted by active mining activities. Therefore, potential coal mining impact on these rivers would be through the discharge of surface or groundwater from the mine area or from reclaimed surface and backfill (NTEC 2013, Part 6 Sect. 41). OSMRE will assess (1) the cumulative surface water impact potential of all NTEC mining operations on the Chaco and San Juan watersheds, and (2) the potential for cumulative surface water quality and quantity impacts of the Navajo Mine and Pinabete Permit area on either the Chaco or San Juan Rivers.

2.1.1 Cumulative Surface Water Impact Potential

Surface coal mining and reclamation activities are required to minimize disturbance to the hydrologic balance within the permit and adjacent areas, prevent material damage to the hydrologic balance outside the permit area, to assure the protection or replacement of water rights, and to support approved post-mining land uses and conditions (30 CFR 816.41(a)). Surface water quality protection of the hydrologic balance is accomplished, to the extent possible, by using the best technology currently available to minimize acidic or toxic drainage and additional contribution of suspended solids to streamflow outside the permit area (30 CFR 816.41(d)(l)).

The 1984 Navajo Mine CHIA (with addendum in 1989) was prepared considering the entire San Juan Watershed as the CIA (Kaman Temp 1984, OSMRE 1989). Therefore, this delineation considers the cumulative surface water impact potential of all SMCRA regulated activities in the San Juan Watershed. The San Juan Watershed contains the following historical or existing coal mines: Chimney Rock Mine, Coal Gulch Mine, Carbon Junction Mine, Peacock Mine, National King Coal Mine, La Plata No. 1 Mine, Blue Flame Mine, La Plata Mine, Black Diamond Mine, San Juan Mine, Navajo Mine, Burnham Mine, De-Na-Zin Mine, Gateway Mine, El Segundo Mine, and the Pinabete Permit (Figure 7). Lee Ranch Mine, which began surface coal operations in 1984, is identified on Figure 7 for illustration purposes only. Existing and planned operations boarder but are not within the San Juan Watershed; therefore, Lee Ranch Mine will not be included in the potential cumulative impacts discussion at this time.

The Chimney Rock, Coal Gulch, Gateway, De-Na-Zin, and Black Diamond Mines were surface coal mines (Table 2). Mining was completed at each of these mines, as well as final bond release. The Blue Flame and La Plata No. 1 Mines were underground mines, which began operation in 1950 and 1905 respectively. Mining was completed at each in 1991 and 1988 respectively; final bond release occurred in 2008 and 2004 respectively. The Peacock Mine was on underground coal mine, which began mining in 1905, and reclamation was completed in 1996.



Legend

- HUC12 Watersheds[1]
- Ponds
- Natural Stream[1]
- Artificial Canal/Ditch[1]
- Surface Water CIA
- Pinabete Permit Area
- Navajo Mine Permit Area
- Coal Lease Area
- *RESOURCE AREAS*
- PIT NAMES

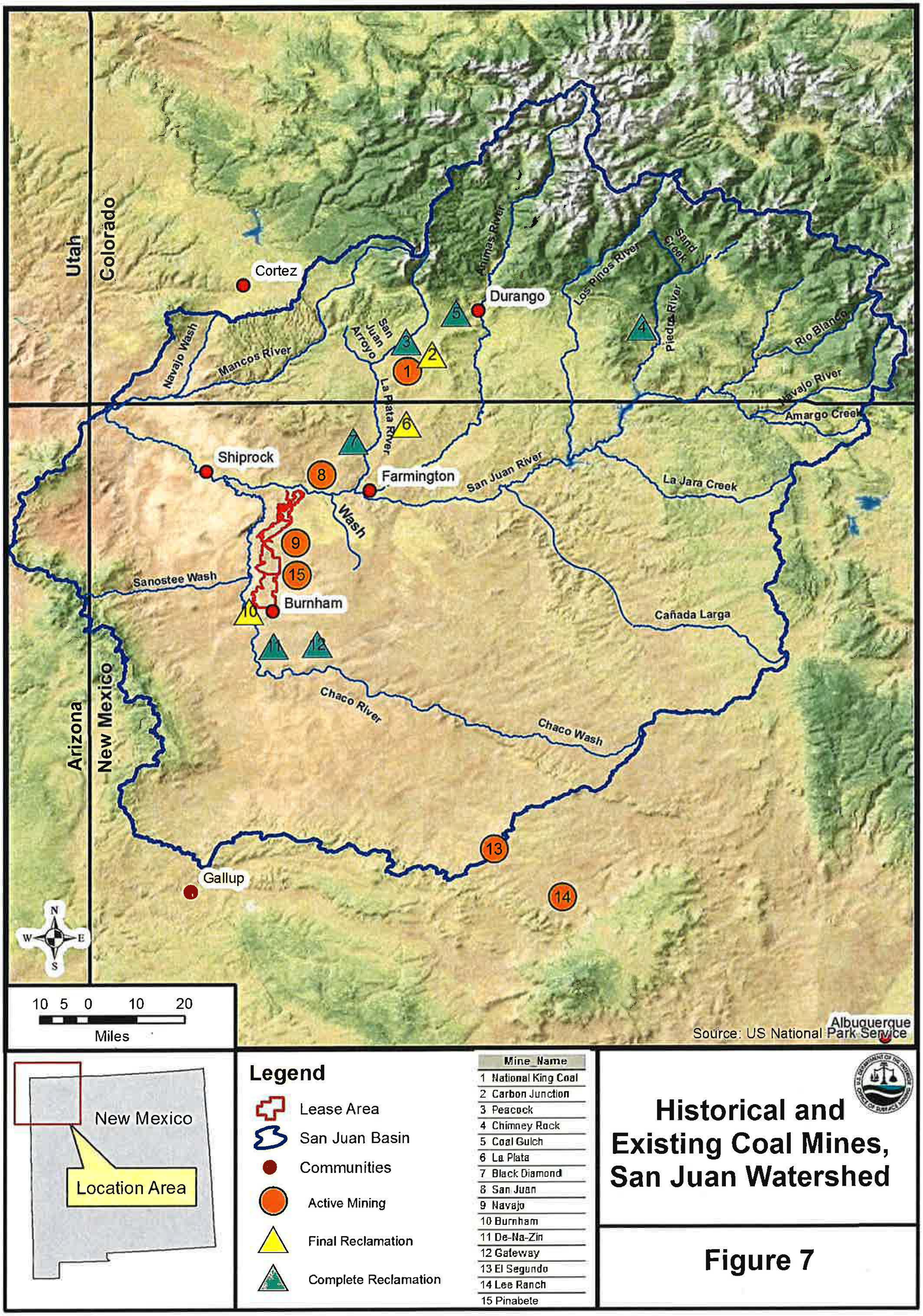
Data Sources:
Aerial Photography (San Juan County) 2009
[1] USGS National Hydrography Dataset

Coordinate System:
StatePlane New Mexico West
North American Datum 1927
Feet

1:200,000 (at 11" x17")

Navajo Tribal Coal Lease Primary Drainages and HUC 12 Watersheds

Figure 6



Historical and Existing Coal Mines, San Juan Watershed

Figure 7

The Carbon Junction, La Plata and Burnham mines are surface mines, which have not achieved final bond released. The Carbon Junction Mine achieved final reclamation in 2008. Phase II bond release was achieved for the entire La Plata Mine site, and the location is now in final reclamation. The Burnham Mine was conditionally approved for the initial seven years of operation; however, was never issued a permit under the Permanent Program, and the location is currently under reclamation. The King Coal Mine is an underground operation, which began in 1941, and is currently active. The San Juan Mine is both a surface and underground mine operation, which began in 1973 and 2000 respectively. Both the San Juan surface and underground mines are currently active. El Segundo Mine is a surface mine, which began in 2008, and is currently active. The Navajo Mine has operated since 1963, and is the subject of this assessment.

Table 2: Mining History in the San Juan Watershed

Mine	Type	Start of Mining	End of Mining	Status
Chimney Rock	Surface	1976	1985	Final Bond Release 2005
Coal Gulch	Surface	1978	1998	Final Bond Release 2010
Gateway	Surface	1982	1990	Final Bond Release 2004
De-Na-zin	Surface	1980	1992	Final Bond Release 2003
Black Diamond	Surface	1983	1993	Final Bond Release 2007
Blue Flame	Underground	1950	1991	Final Bond Release 2008
La Plata No. 1	Underground	1905	1988	Final Bond Release 2004
Peacock	Underground	1905	1981	Reclamation Completed 1996
Carbon Junction	Surface	1983	1990	Reclamation Completed 2008
La Plata	Surface	1986	2003	In Final Reclamation
Burnham	Surface	1980	1984	Under Reclamation
King Coal Mine	Underground	1941	NA	Active
San Juan Mine	Surface/Underground	1973/2000	NA	Active
El Segundo	Surface	2008	NA	Active
Navajo	Surface	1963	NA	Active

Generally, Phase I bond release requires submission and approval of all documentation for permanent drainage control structures. Phase II bond release generally requires documentation that the permittee or the landowner has provided for sound future maintenance of all approved permanent impoundments in accordance with 30 CFR 800.40(c)(2). Phase III bond release requires a demonstration in accordance to 30 CFR 816.41 that all surface mining and reclamation activities have been conducted to minimize disturbance of the hydrologic balance within the permit and adjacent areas, to prevent material damage to the hydrologic balance outside the lease area, to assure quantity and quality are suitable to support approved postmining land uses, the water rights of other users have been protected or replaced, and in accordance with terms and conditions of the approved permit.

All mines approved for final bond release are eliminated from the potential impact discussion since a determination has been made that material damage to the hydrologic balance has been prevented. Peacock mine is also excluded from the potential impact discussion, since reclamation has been completed to the satisfaction of the Colorado Department of Mining and Safety. Inactive operations, and permit areas currently under reclamation, especially those further along in the bond release process, will most likely not have a cumulative impact; however, they are considered in the potential impacts discussion. All currently active mines are also considered in the potential impact discussion. Therefore, mines which are considered in the potential impact discussion are Carbon Junction, La Plata, Burnham, King Coal, San Juan, El Segundo, Pinabete, and Navajo Mine.

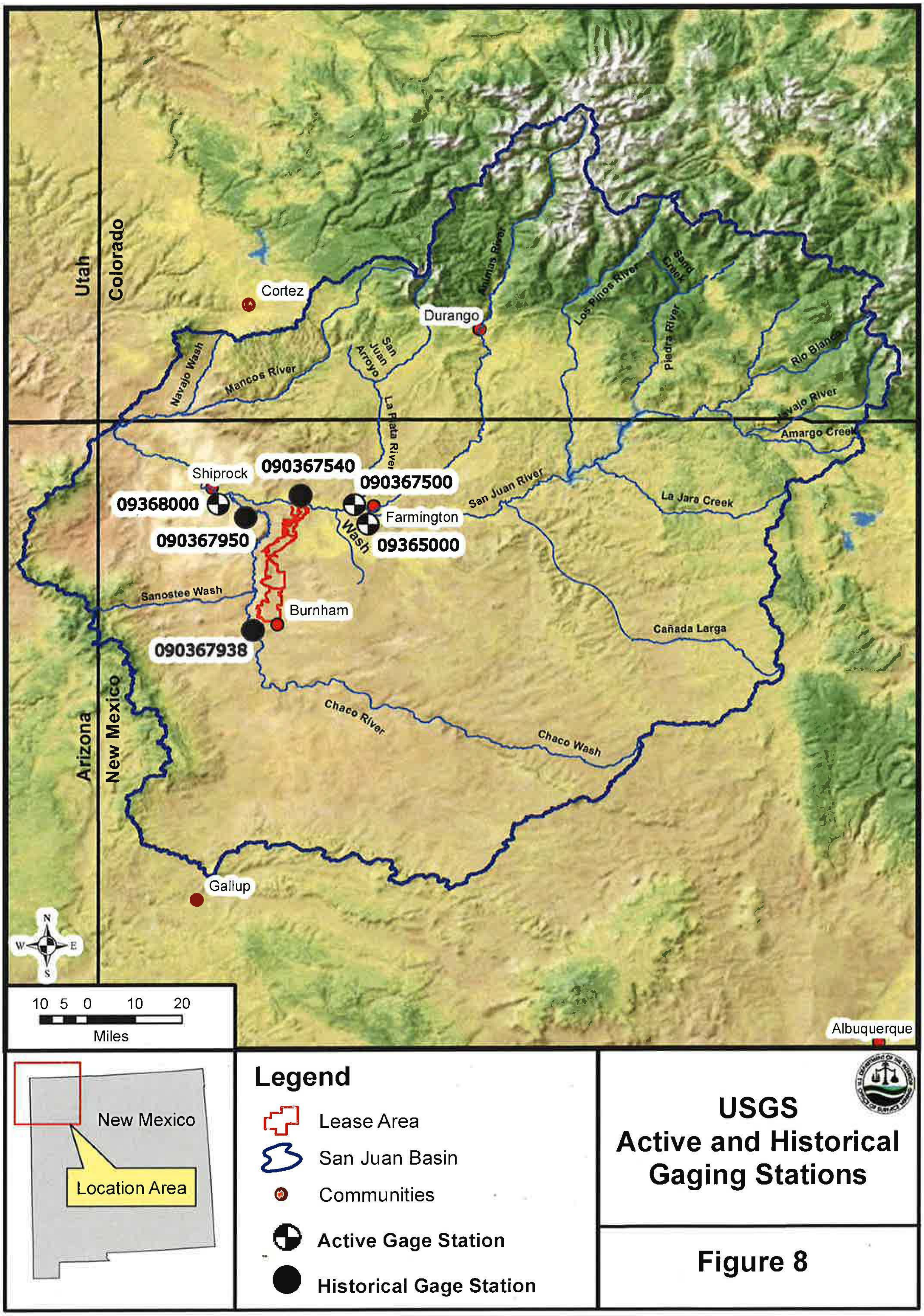
2.1.2 **Impact Potential to the San Juan River**

The San Juan River is a major tributary to the Colorado River, with a drainage area of 24,900 square miles. The San Juan River Watershed is within New Mexico, Arizona, Colorado, and Utah. Originating on the western slope of the Continental Divide in southwestern Colorado, the San Juan River flows perennially from the San Juan Mountains north of Pagosa Springs, Colorado, and enters northwestern New Mexico through the Navajo Reservoir in Rio Arriba County, west of the Jicarilla Apache Reservation and the Carson National Forest. The course of the San Juan River turns westward for approximately 140 miles through New Mexico and southern Utah to its confluence with the Colorado River.

The United States Geologic Survey (USGS) located three stream gaging stations along the San Juan River within the general area of the Navajo Mine (Figure 8). These stations were assigned the following site numbers by the USGS; 09368000, 09367540, and 09365000. Station 09368000 is active and located on the San Juan River approximately 0.9 miles south of Shiprock New Mexico, and 2 miles west of the Chaco River confluence. Station 09367540 is not active, and located approximately 0.4 miles west of Fruitland New Mexico, 13.8 miles east of the Chaco River confluence, and 8.3 miles west of the La Plata confluence. Station 09365000 is active, and located approximately 0.9 miles southwest of Farmington New Mexico, 1.7 miles southeast of the La Plata River confluence, and 0.7 miles northwest of the confluence with the Animas River (Figure 8).

The San Juan River is perennial, and part of its flow originates from groundwater discharge. The historic average mean annual flow at USGS station 09368000 near Shiprock is 2024 ft^3/sec, with a historical low of 657 ft3/sec in 2002. BNCC holds Surface Water Permit Number 2838, issued by the New Mexico Office of the State Engineer in October 1958, and supplies water to the Four Corners Generating Station, the San Juan Generating Station, and the Navajo Mine under this permit. Permit number 2838 provides BNCC a total diversionary right of 51,600 acre-feet annually (~71 ft3/second), with a consumptive right of 39,000 acre-feet annually (~54 ft3/second), for waters drawn from the San Juan River. BNCC typically diverts 825 acre feet per year (~1.14 ft3/second) for use at the Navajo Tribal Coal Lease (United States of America 2011, Table L-1), or less than 0.2% of the San Juan River historic low flow rate from 2002. Therefore, diversion from the San Juan River for use at Navajo Mine or Pinabete Mine is not expected to result in material damage to the surface water quantity of the San Juan River given the ratio of the diversion to the total flow of the San Juan River. Surface Water Permit Number 2828 may be transferred from BNCC to NTEC, but has not occurred at the time of the 2015 CHIA update.

The San Juan alluvial aquifer is estimated to have an average flow of approximately 30,000 ft^3/day, or approximately 0.02% of the historic average flow within the San Juan River. Approximately 1% of the alluvial aquifer flow, or 300 ft^3/day, is estimated to discharge from the backfilled mining areas to the San Juan River (NTEC 2013, Part 6 Sect. 41). Leaching studies from overburden and spoil sample analysis indicate that the chemical quality expected from backfill leachate would be similar to baseline quality in coal seams. Therefore, groundwater discharge from the mine area will have a negligible effect on the water quantity or quality of the San Juan River due to low discharge estimates and water quality analysis comparison.



USGS
Active and Historical Gaging Stations

Figure 8

Figure 9 illustrates discharge data collected by the USGS at three stations San Juan River gaging stations from 1931 to 2010. The data demonstrates there has been consistent flow variability along the San Juan, with a general decreasing flow trend for the period of record. Although flows initially increased upstream to downstream along the San Juan during the monitoring period, this trend reversed, such that downstream flows were less than upstream flows. Based on linear trend lines, the tipping point at which this occurred was around 1972. However, the general trend of decreasing flows, and the difference in the rate of decrease between the downstream and upstream stations, was apparent before mining, and appears unrelated to the changing mining activity in the San Juan Watershed.

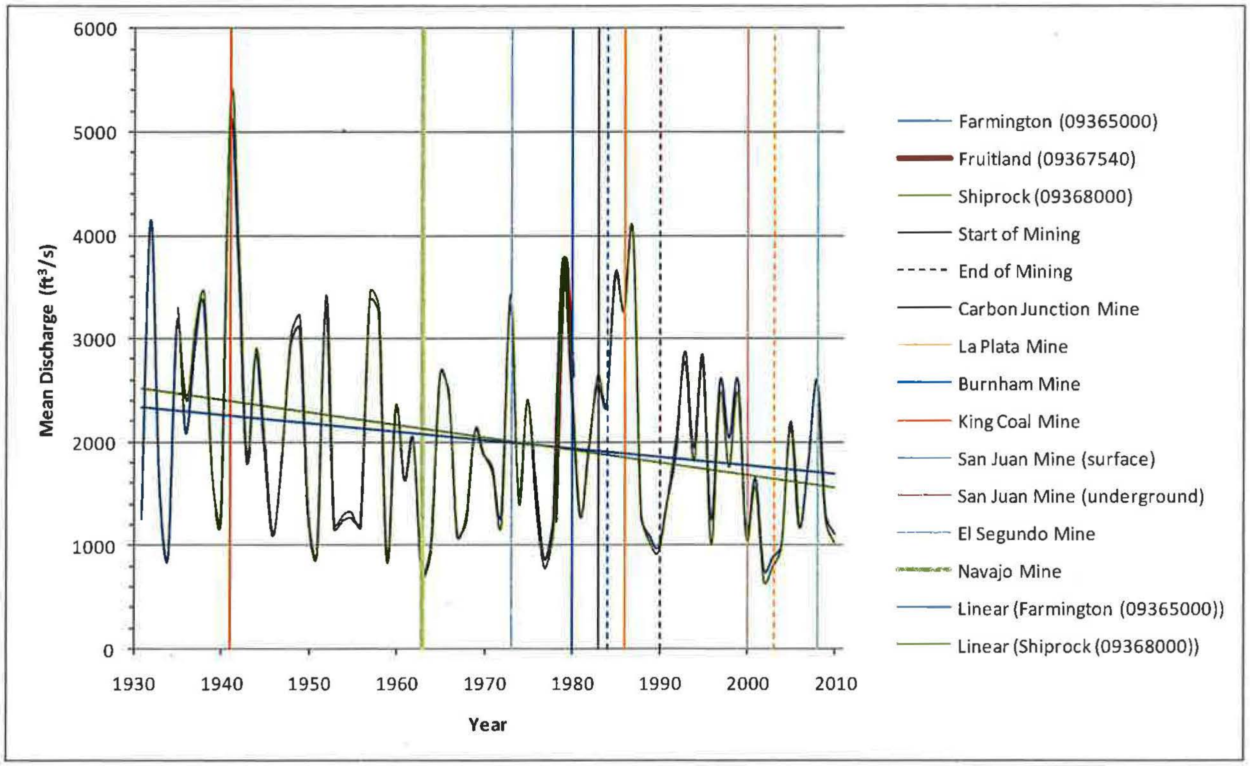


Figure 9: San Juan River Discharge and Mine Operational Period Comparison (1931-2010)

Historic data was analyzed for over 20 constituents collected by the USGS along the San Juan River at the three stations from 1958 to 2010 (Appendix A). Analysis indicates high variability, generally increasing pH, and generally decreasing or relatively unchanged concentrations in constituents of interest over time. Additionally, changes in data trends do not show correlation with mining activities.

For instance, the measured Total Dissolved Solids (TDS) concentrations indicate variability in concentrations along the San Juan River, with a general trend of decreasing concentration throughout the duration of monitoring. TDS increases from upstream to downstream along the San Juan River, and is consistently higher at downstream monitoring stations. Based on linear trend lines, TDS concentrations are decreasing at downstream locations, and the general trend appears to be unrelated to the changing mining activity in the San Juan Watershed (Figure 10).

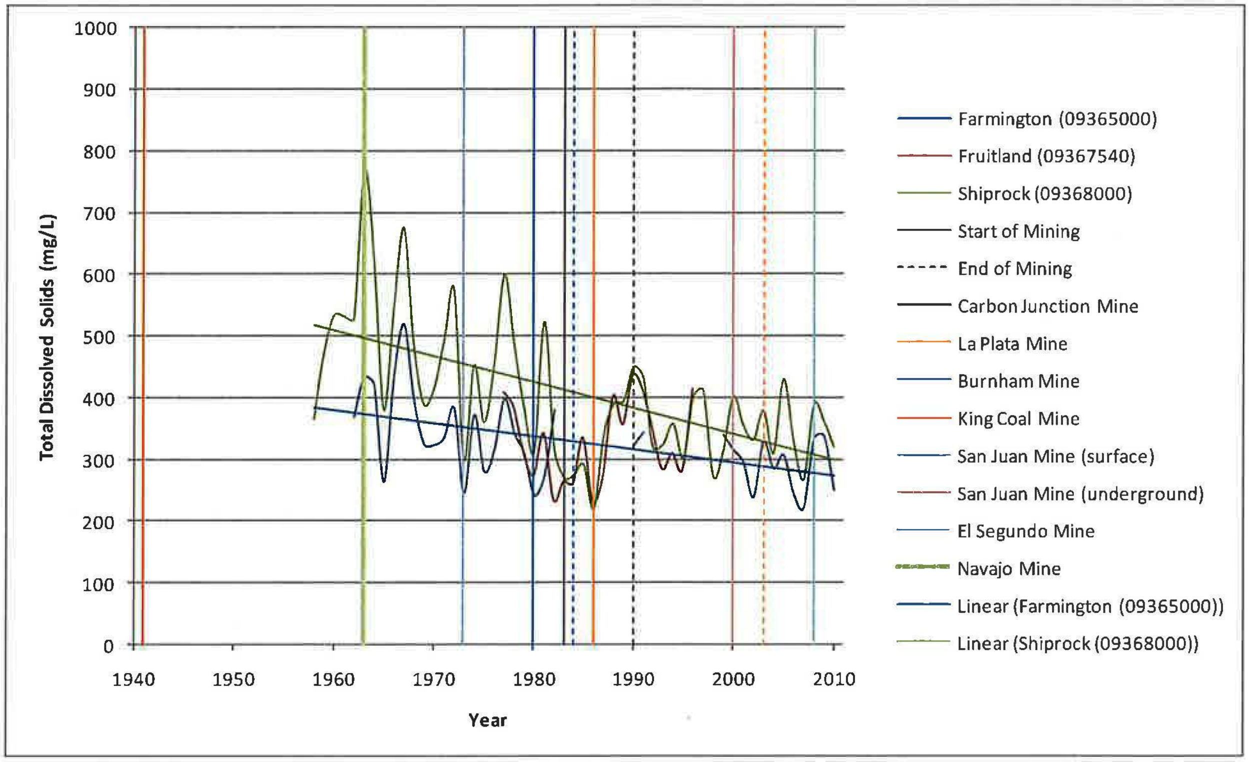


Figure 10: San Juan River TDS and Mine Operational Period Comparison (1957-2010)

Assessment of historic USGS data suggests that cumulative surface water quality impacts from mining are not distinguishable from baseline surface water quality for the San Juan River. All surface water drainages that traverse the Navajo Tribal Coal Lease discharge into the Chaco River, which in turn discharges into the San Juan River, except Bitsui Wash. Bitsui Wash is located near the northernmost portion of the lease area, flows intermittently, and discharges directly to the San Juan River (Figure 6). Bitsui Wash drains an area of 7,835 acres. Approximately 17.5% of the Bitsui watershed, or 1,371 acres, were disturbed by historical mining at Navajo Mine. All mining disturbance within the Bitsui watershed predates the establishment of SMCRA in 1977, and is consider pre-law (NTEC 2013, Part 2 Sect. 18). Bitsui receives drainage from pre-law jurisdictional lands on the northern area of the mine lease, but receives no drainage from the reclaimed areas from the Navajo Mine or Pinabete permanent program permit areas (NTEC 2013, Part 6 Sect. 41). Historically, Bitsui Wash would flow ephemerally in response to precipitation; however, the development of NAPI causes Bitsui Wash to flow intermittently. Surface water monitoring was conducted along the Bitsui Wash from 1986-1992. Comparison of median water quality monitoring data to the 2007 NNEPA numeric standards for designated uses indicated exceedances of the aquatic and wildlife standards for cadmium, chromium, and selenium. However, median concentrations are only slightly elevated, and impact to the hydrologic balance is not expected to be significant. The San Juan River is the closest surface water body which could be impacted by Bitsui Wash outside the lease area. Analysis of USGS data indicates concentrations of cadmium, chromium, and selenium have all been decreasing with time in the San Juan River. Therefore, material damage to the San Juan River uses is not expected. Since discharge from Bitsui Wash is not expected to result in material damage to the hydrologic balance, and since the Bitsui Wash area was mined and reclaimed prior to the jurisdiction of SMCRA, it is excluded from the surface water CIA.

Additionally, the Mining and Minerals Division of the New Mexico Energy, Minerals and Natural Resource Division (NMEMNRD) completed CHIAs for both the La Plata and San Juan Mines. La Plata CIA, as determined in the 1999 La Plata CHIA, was found to be entirely contained within the La Plata

Watershed, and potential impacts from the La Plata Mine were not found to extend to the San Juan River. The northern boundary of the La Plata mine CIA is the Colorado-New Mexico border, which is downstream of the King Coal Mine, indicating impacts were not found to be cumulative between the King Coal and La Plata mines along the La Plata River (NMEMNRD 1999). The 1999 San Juan Mine CIA includes the Shumway Arroyo and Stevens Arroyo, which are both tributaries to the San Juan River, but does not extend to the San Juan River (NMEMNRD 1999). Considered in conjunction with hydrologic assessments completed by the NMEMNRD, impacts from the King Coal, La Plata and San Juan mines will have a negligible cumulative potential with the Navajo Mine impacts.

Based on historical quantity and quality data along the San Juan River and CHIA analysis completed by the NMEMNRD, the San Juan River will not be included in the Navajo Mine surface water CIA.

2.1.3 Impact Potential to the Chaco River

The Chaco River has a watershed area of approximately 4,350 square miles, of which, the Navajo Tribal Coal Lease area occupies approximately 0.6-percent. The Chaco River lies to the west of the lease area, and flows north to the San Juan River, downstream of the lease area. Flow in the Chaco River is ephemeral except for the last 12.5 miles near the confluence of the Chaco and San Juan rivers. The surface expression of the Chaco River is approximately 0.1 mile wide. The Chaco River is subject to high sediment loadings. The Bureau of Land Management (BLM) Farmington Field Office estimated an average sediment yield from the Chaco watershed at 5.8 tons per acre per year (URS 2009). The only coal mining activities in the Chaco Watershed that have not achieved final bond release, other than Navajo Mine, are the Burnham Mine and the El Segundo Mine.

The Burnham Mine is located in Burnham, New Mexico approximately 15 miles east of U.S. Highway 491 on BIA Road 5 in San Juan County, New Mexico (Golder Associates Inc. 2008). In 1978, Consol proposed mining 6,831 acres at Burnham Mine. OSMRE conditionally approved Burnham Mine for 7 years, and mining operations commenced in 1980. However, the mine only produced coal for 4 years, and production ceased in 1984. Consol submitted an application under the permanent program as a result of the approval of the Federal Program for Indian Lands (30 CFR § 750) in 1984. However, prior to OSMRE completing review of the application, lease negotiations between Consol and the Navajo Nation failed resulting in lease termination in 1990. For this reason in 1991 OSMRE rejected the Permanent Program application, returned the application, and requested Consol reclaim the disturbed lands of about 140 acres. Consol submitted the "Plan for the Reclamation of the Burnham Mine" to OSMRE and it was approved in 1994 (Blake 1994).

The existing Burnham Mine site encompasses approximately 203 acres; containing a former pit area, reclamation areas, and the main facility. The main facility area contains an office building, abandoned guard house, abandoned trailer, and two 500 gallon above ground storage tanks (ASTs). In 1992 a release of diesel fuel was confirmed from an AST system that provided fuel to a generator. The product lines from two 8,000 gallon ASTs to the generator leaked an unknown volume of diesel fuel. The release affected the subsurface soil and shallow groundwater. The majority of soil contamination was present at the air-water interface between 16 and 26 feet below ground surface not exceeding four feet in thickness. The extent of soil contamination roughly mirrored the extent of non-aqueous phase liquid (NAPL) and was present south of the former ASTs and extended south to the office building. Results of groundwater monitoring indicated that dissolved phase contamination had not migrated extensively ahead of the NAPL contamination (Golder Associates Inc. 2013, Golder Associates Inc. 2008). In letter dated August 26, 2014 from NNEPA to Consol Energy, it is stated that "Downgradient groundwater monitoring wells were sampled in April 2013 and analyzed for diesel range organics. Results indicate that no diesel hydrocarbons were detected. Therefore, the excavation, landfarming and backfilling operations are judged to have been successful. Tiis Tsoh Sikaad Chapter has resolved that the remediation of the diesel contamination has been completed to their satisfaction. The decision has been approved by the chapter membership and set forth in the Chapter Resolution TTS-RES-14-05-067 dated 18th day of May, 2014. This site appears to no longer pose a current threat to human health and the environment" (NNEPA 2014). The nearest major surface water is the Chaco River located approximately seven miles west of the site, with the Brimhall Wash a tributary feature to the Chaco River located 0.5 miles south of the site. The impacts associated with Burnham mine will not be considered further in this surface water CIA.

There are two historic United States Geologic Survey (USGS) stream reach stations along the Chaco River. These stations were assigned the following site numbers by the USGS; 09367950 and 09367938. Station 09367950 is located on the Chaco River approximately 6 miles southwest of Waterflow New Mexico and 4.6 miles southeast of the San Juan River confluence. Station 09367938 is located on the Chaco River approximately 15 miles southwest of Burnham New Mexico and 0.7 miles north of the Brimhall Wash confluence. Discharge data was collected from 1977 to 1994, and water quality data was collected from 1969 to 1989. The period of record does not sufficiently cover the more recent mining activity in the watershed, and therefore cannot be used to rule out cumulative SMCRA related surface water impacts along the Chaco.

In addition to the USGS data, the Mining and Minerals Division of the NMEMNRD has completed a CHIA assessment for the El Segundo Mine. El Segundo coal mine is located in the eastern end of the Standing Rock Cleary Coal area which is located in the southern part of the San Juan Watershed in an area known as the Chaco Slope. The Chaco Slope is a broad, gently dipping part of the San Juan Watershed extending from the edge of the Zuni uplift on the south, northward to the central area of the basin. The proposed lease area straddles the continental divide at elevations approximating 7,000 feet above mean sea level (MSL) in an area that is crossed by several unnamed ephemeral, arroyos. The continental divide separates the lease area into two surface watersheds; only the western section is included as part of the Chaco watershed. There are no named drainages to the west of the continental divide within the proposed lease area. The main drainage through the western mine area has the National Hydrologic Database (NHD) reach code of (14080106000944) and is identified as ephemeral as it leaves the lease area. The drainage area for the main western drainage as it leaves the lease area is approximately 24.7 square miles of which about 6.1 square miles (25%) of the total watershed are proposed to be disturbed by mining (NMEMNRD 2005).

Cumulative surface water quantity and quality impacts from the Navajo Tribal Coal Lease with other mining operations in the Chaco River Watershed cannot be ruled out based solely on historical quantity and quality data along the Chaco River and analysis from the Mining and Minerals Division of the NMEMNRD.

2.1.4 Surface Water Impact Area

The Surface water CIA for assessing cumulative impacts of the permit areas on the Navajo Tribal Coal Lease and El Segundo Mine will be the entire Chaco River watershed (Figure 11). However, the NTEC lease area covers a relatively small percentage of the entire Chaco Watershed. Therefore to insure adequate protection of water uses adjacent to the lease impacts will also be assessed using smaller evaluation areas. Impact of surface water quality will be assessed for the Chaco River within the immediate vicinity of NTEC permits and the primary washes and arroyos traversing the lease area; Pinabete Arroyo, No Name Wash, Cottonwood Arroyo, and Chinde Wash, as these washes are representative of the water quality conditions of the lease area. Impacts on surface water quantity are analyzed using Hydrologic Unit Code (HUC) 12 watersheds. The USGS has divided and sub-divided the United States into successively smaller hydrologic units and assigned each a HUC number. HUC 12 watersheds are among the smallest of these hydrologic units and represent 6 levels of divisions (USGS 2012). HUC 12 watersheds are used rather than individual drainage basins in order to standardize the analysis as flow is impacted by watershed size which varies significantly between drainages. Impacts on surface water quantity were analyzed using the following HUC 12 watersheds; Morgan Lake-Chaco River

(140801062008), Chinde Wash (140801062006), Chinde Wash-Chaco River (140801062007), Coal Creek-Chaco River (140801062005), and Cottonwood Arroyo (140801062002)

2.2 Ground Water Cumulative Impact Area

Based on drilling and excavation activities, the Quaternary Alluvium, the coal seams and inter-bedded lithologic units of the Fruitland Formation, and the Pictured Cliffs Sandstone (PCS) bear appreciable amounts of water within the mine area. All coal seams at Navajo and Pinabete Mines are within the Fruitland Formation, and the majority of water within the Fruitland Formation is concentrated within these lenticular coal strata, therefore the Fruitland Formation will be assessed in this CHIA with an emphasis on the coal strata. The Kirtland Shale is relatively impermeable, contains no coal seams and was not found to contain appreciable amounts of water within the permit areas; therefore the Kirtland Shale is not considered for impact assessment in this CHIA (NTEC 2013, Part 2 Sect. 18). The potentiometric gradients in Fruitland Coal and in the PCS trend north to northwest towards the San Juan River (NTEC 2013, Appendix 18.O), with localized gradients toward the topographic lows along the Chaco tributaries. Ground water in the Fruitland coals and Pictured Cliffs Sandstone may discharge at a very low rate at some locations within the topographic lows along arroyos, where it is removed by evapotranspiration. These discharges are insufficient to sustain baseflow, although they may be sufficient to enhance localized vegetation growth (URS 2009). Alluvial groundwater will also be included in this groundwater CIA. Ground water recharge of the bedrock is thought to be enhanced along the select channels and at existing pond locations where water is available for recharge from storm runoff and pond storage. Recharge water, although limited, is thought to move predominantly downward through the overburden and coal units of the Fruitland Formation and into the PCS. For this reason the PCS will also be assessed in this CHIA. The Lewis Shale underlies the PCS; however, the Lewis Shale is relatively impermeable and does not receive significant discharge from the PCS and will not be considered for impact assessment in this CHIA. Therefore, potential groundwater quality and quantity affects on the Fruitland and Picture Cliffs Sandstone (PCS) Formations and valley alluvium in the permits and adjacent area will be evaluated in this CHIA.

2.2.1 Ground Water Impact Area

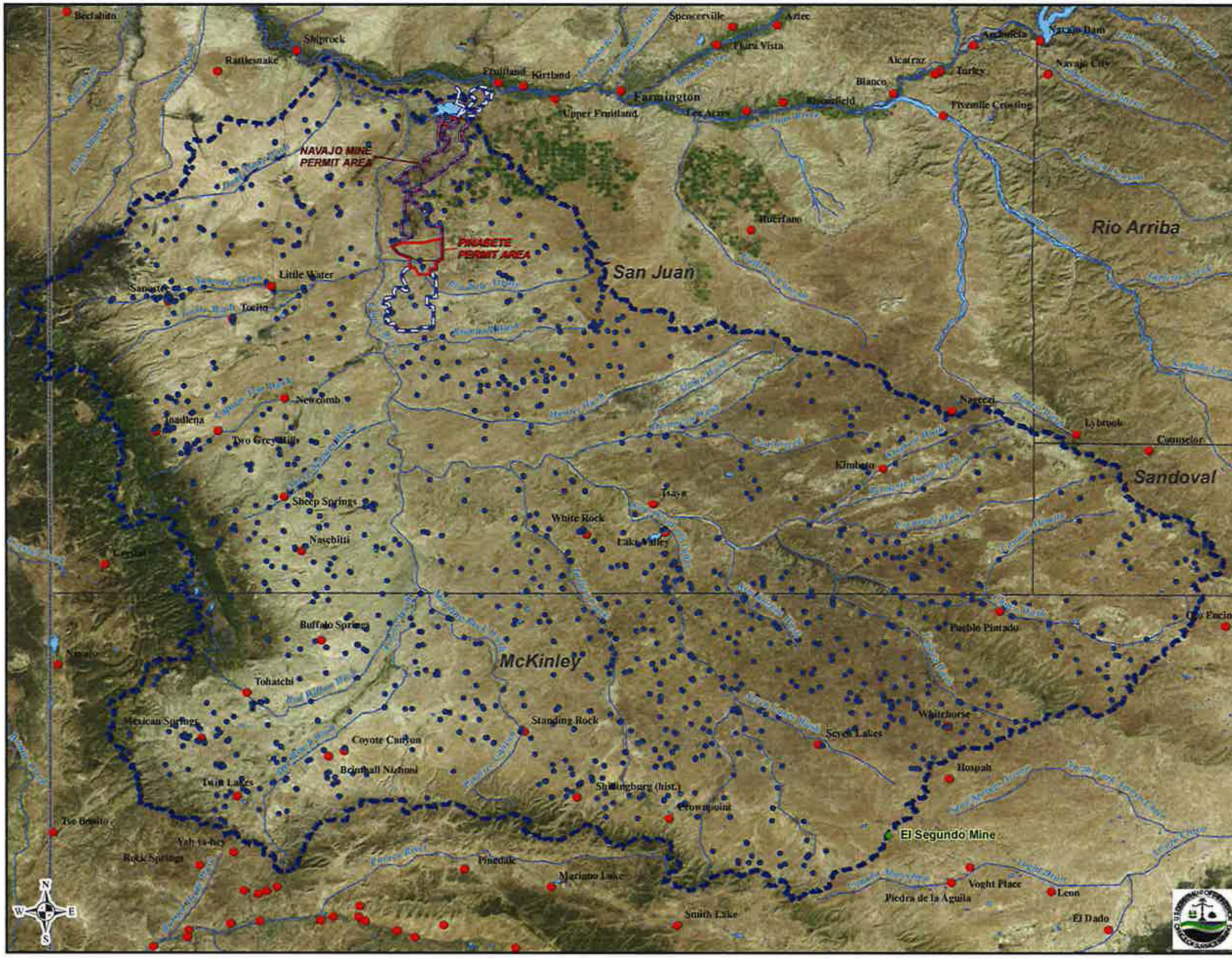
A single groundwater CIA will be used to encompass all three groundwater resources (Figure 12); Fruitland Formation, PCS and alluvium. The CIA will be bounded on the north by the San Juan River. Both the PCS and the Fruitland outcrop in the vicinity of the San Juan River, and given that the San Juan is perennial and receives groundwater baseflow, it is expected that the groundwater potentiometric elevation is close to the elevation of the San Juan River channel bottom. The San Juan River can therefore be assumed to act as a hydrologic barrier.

The San Juan alluvial aquifer is estimated to have an average flow of approximately 30,000 ft^3/day, of which 1% or 300 ft^3/day is estimated to be discharged from the backfilled mining areas (NTEC 2013, Part 6 Sect. 41). Leaching studies of overburden and spoils indicate that the chemical quality expected from backfill leachate would be very similar to baseline quality in coal seams (NTEC 2013, Part 2 Sect. 19). Consequently, groundwater discharge from the mine area will have a negligible effect on the water quantity or quality of the San Juan River alluvium.

Both the PCS and Lewis Shale outcrop to the west of the Lease area, serving as a physical barrier to groundwater impact for the PCS. In this area the PCS potentiometric surface is above the base of the coal layers and should therefore also serve as an impact boundary for the Fruitland formation. However, in order to address all potential impact to the alluvial system the western boundary of the CIA will be extended beyond the outcrop of the PCS/Lewis shale stratigraphic interface to the western boundary of the Chaco River alluvium.

Both the southern and eastern CIA boundaries are based on groundwater model boundaries developed by Norwest Corporation for NTEC, and presented in the PHC. Two distinct models were developed by Norwest one for the southern mine area (Areas IV and V) and one for the northern mine area (Area I). The southern CIA boundary is the southern boundary developed for the model of Areas IV and V. The eastern CIA boundary is a composite of the eastern boundaries of both models extended correspondingly north and south to their natural intersection. Current and historic water level monitoring data from wells, drainage and outcrop locations, and previously conducted studies in the area, were used to generate a potentiometric surface for the PCS. This potentiometric surface was then used to establish boundaries at a sufficient distance to the east and south of the coal lease where the required assumptions about hydrogeologic conditions at the boundary were expected to have minimal influence on the predicted changes in the groundwater system. The models represent the most comprehensive compilation and evaluation of geologic and hydrologic data in the area, and are therefore appropriate tools for assessing NTEC hydrologic impacts. Figure 12 illustrates the boundaries of the groundwater CIA for this CHIA.

It should be noted that this groundwater CIA extends south of the Burnham Mine. The depth to groundwater at Burnham Mine ranges from approximately 16 to 30 feet below ground surface. Hydrologic monitoring at Burnham Mine indicates groundwater is moving to the southeast away from the Navajo Tribal Coal Lease (Golder Associates Inc. 2008). Additionally, the area has a low hydraulic gradient and reclamation has been completed (Golder Associates Inc. 2013).. Therefore, the groundwater contamination at Burnham is not expected to result in cumulative groundwater affects with the Navajo Mine or Pinabete Permit areas, and the groundwater impacts associated with Burnham mine will not be considered further in this CHIA.



Legend

- Impoundments [1]
- Water Body [2]
- Streams [3]
- Navajo Mine Permit Area
- Pinabete Permit Area
- Coal Lease Area
- Surface Water CIA
- Counties
- El Segundo Mine
- Population Centers

Data Sources:
Aerial Photography (ESRI Mapping Service)
[1] Navajo Nation Hydrographic Survey (2010)
[2] USGS National Hydrography Dataset
[3] ESRI USA Base Data (2010)

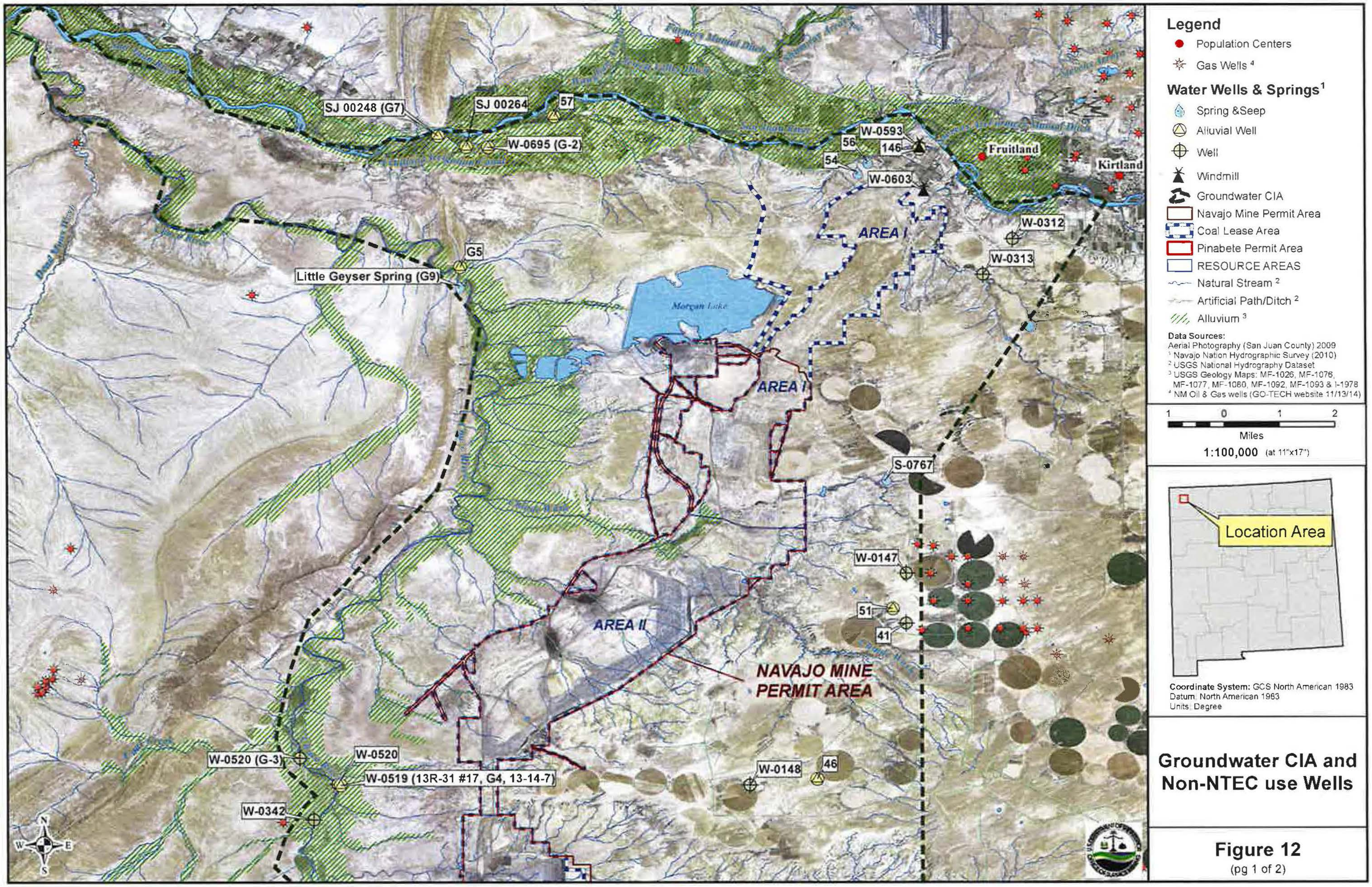
1:600,000 (at 11"x17")

5 0 5 10 15
Miles

Coordinate System: GCS North American 1983
Datum: North American 1983
Units: Degree

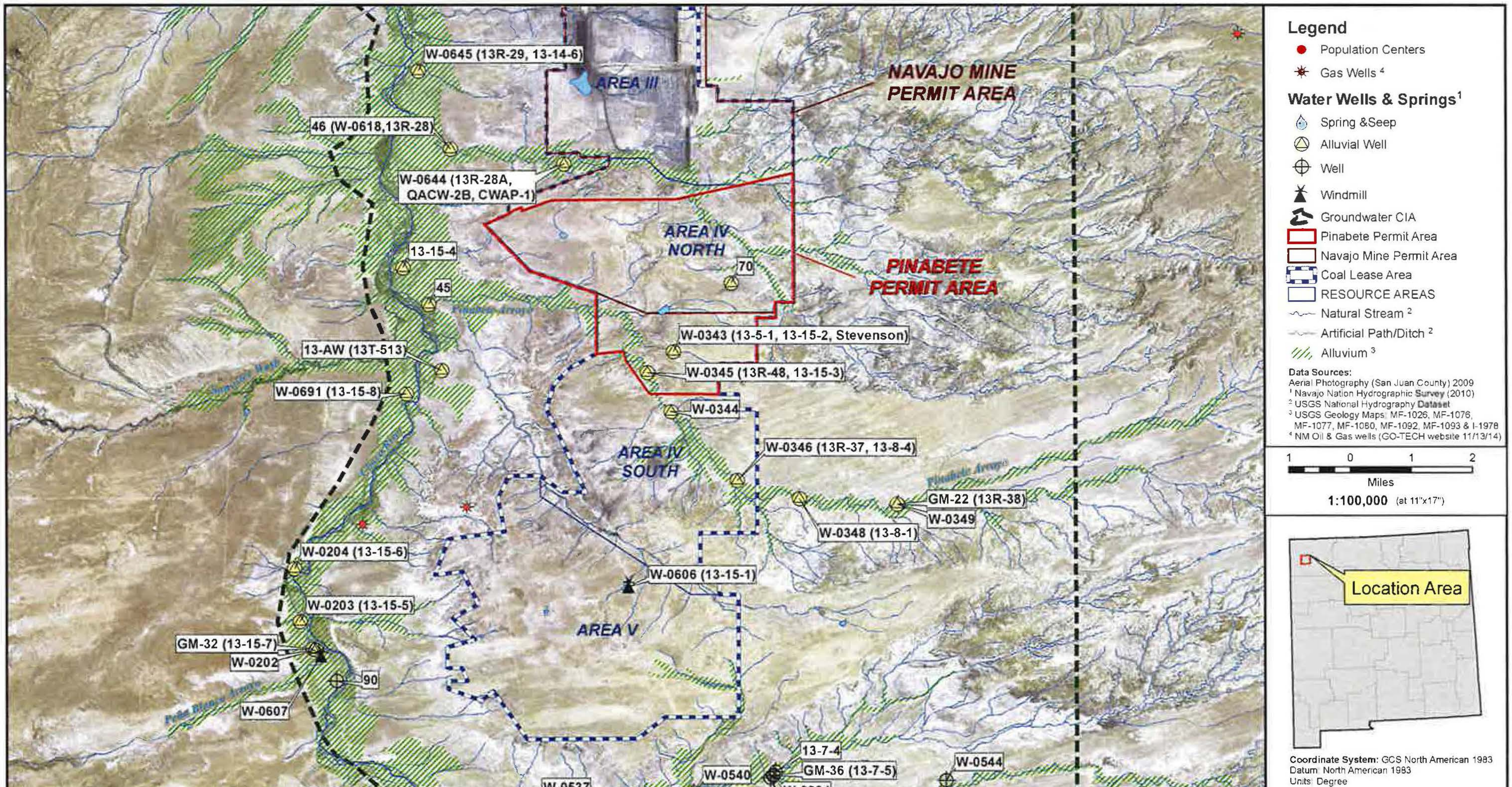
Surface Water CIA and Non-NTEC Surface Water Impoundments

Figure 11



Groundwater CIA and Non-NTEC use Wells

Figure 12
(pg 1 of 2)



Groundwater CIA and Non-NTEC use Wells

Figure 12
(pg 2 of 2)

3 WATER RESOURCE USES AND DESIGNATIONS

As the regulatory authority, OSMRE has the responsibility of assessing the potential impacts of the mining operation on the hydrologic balance, and to provide a determination for the potential to materially damage the hydrologic balance outside the lease area. Material damage implies that a quantifiable adverse degradation or reduction of surface or ground waters outside the permit area has occurred, resulting in the inability to utilize water resources for existing and foreseeable uses. Therefore, it is necessary to identify the existing and foreseeable water uses within the CIA's.

Surface and ground water within the CIA's will be evaluated for the following existing and foreseeable uses:

- Direct human use (including domestic and municipal water supply),
- Industrial water supply,
- Irrigation supply water,
- Livestock watering, and
- Aquatic and wildlife habitat

Multiple uses may be present at some locations. Tables summarizing use information within the surface Water and groundwater CIA's can be found in Appendix B, additionally Figure 12 shows all groundwater wells identified in the groundwater CIA and Figure 11 shows all surface water impoundments identified in the surface water CIA.

3.1 Direct Human Use

Within the surface water CIA Morgan Lake and the Chaco River from its mouth to the mouth of Dead Man's Wash are the only water bodies designated by the NNEPA for Primary Human Contact; all surface waters within the CIA are designated by the NNEPA for Secondary Human Contact. Primary Human Contact means use of water that causes the human body to come into direct contact with the water, typically to the point of submergence in the water body, or probable ingestion of the water, or contact by the water with membrane material of the body. Examples include ceremonial uses, swimming and water-skiing. Secondary Human Contact means the use of water which may cause the water to come into direct contact with the skin of the body but normally not to the point of submergence, ingestion of the water, or contact of the water with membrane material of the body, such contact would occur incidentally and infrequently, examples include boating and fishing (NNEPA 2007). Both Primary and Secondary Human Contact may occur during ceremonial or other cultural uses. Based on currently available information no cultural use waters have been identified within the vicinity of the Navajo Tribal Coal Lease.

The Chaco River and all tributaries including the Chinde Wash and Cottonwood Arroyo are designated by the NNEPA for Fish Consumption. Fish Consumption means the use of water by humans for harvesting aquatic organisms for consumption. Harvestable aquatic organisms include, but are not limited to, fish, shell-fish, turtles, crayfish, and frogs. The lease does not contain any streams or ponds with fish, and Morgan Lake is the closest water body within the surface water CIA that provides a fishing habitat.

The closest surface water body to the mine designated by the NNEPA for domestic water supply is the San Juan River, which is outside of the surface water CIA. There are no surface water sources for municipal supply water within the CIA, however, the San Juan River, downstream of the Navajo Tribal Coal Lease, is used as a municipal water source for Shiprock, NM. A hydrographic survey was conducted as part of an ongoing water rights settlement agreement between the State of New Mexico, the United States Federal Government, and the Navajo Nation. The survey did not distinguish between historic and current uses. The survey identified 59 impoundments within the surface water CIA that are used for municipal waste water treatment. These impoundments are supplied by local sewer systems and used for waste settling. Of the 59 impoundments, 56 are west and/or south of the Chaco, and 3 are north of the Chaco and east of the Permit (United States of America 2011, Appendix D).

Within the groundwater CIA, the Burnham chapter was identified as a community whose water supply may be included for groundwater impact assessment. However, the Burnham Chapter used to get their water from a nearby well, but currently has water piped in from the Carson/Huerfano area to the east, outside of the groundwater CIA. Additionally, the water withdrawn from the Carson/Huerfano area is from the Ojo Alamo aquifer, located well above the Fruitland formation. Therefore, although the Burnham Chapter is within the groundwater cumulative impact area, a specific water quantity assessment related to Burnham water use is not warranted since water used at this location is derived from a source outside the CIA. Well #90 located west of Area V and the Chaco River (Figure 12) is completed in the PCS (NTEC 2013, Part 6 Sect. 41). The hydrographic survey identified W-0312 east of the permit just south of the San Juan River, it is owned by the Navajo Tribal Utility Authority and W-0349 east of Area IV South along the Pinabete Arroyo (United States of America 2011, Appendix D). New Mexico State Engineer's Office Records and the USGS have identified SJ 00248 (G7, #6) in the alluvium of the San Juan River Northwest of the NTEC lease (Thorn 1993). NTEC also provides the community potable water at two locations, one near the Navajo North facilities and the other near the Area III facilities (NTEC 2013, Exhibit 41-2).

3.2 Industrial Supply Water

The Arizona Public Service (APS) Four Corners Power Plant (FCPP) and NTEC are the primary industrial water users within the CIA's. In addition to APS and NTEC, significant oil and gas extraction occurs within the San Juan Basin, including the Chaco Watershed. Oil and Gas extraction wells use groundwater resources within the vicinity of the permit areas. A few gas wells were identified within the GW CIA just north and east of the NTEC permits. Gas extraction is the only industrial use of groundwater within the groundwater CIA beyond water required for operation of the FCPP and NTEC mining and reclamation activities.

San Juan River surface water is used at the FCPP and by NTEC through the use of Surface Permit Number 2838 issued by the New Mexico Office of the State Engineer in October 1958. This permit provides a total diversionary right of 51,600 acre-feet annually (~71 ft3/second), with a consumptive right of 39,000 acre-feet annually (~54 ft3/second), for waters drawn from the San Juan River (United States of America 2011, Table L-1).

Water diverted from the San Juan River is diverted to Morgan Lake [P-0016] (Figure13), which is the primary source of industrial water in the area, and is used by both NTEC and APS. NNEPA has designated Morgan Lake for primary and secondary human contact, fish consumption, aquatic wildlife and habitat, and livestock watering. Morgan Lake is a manmade reservoir approximately 1.2 miles wide and 2.2 miles long; it has a maximum depth of about 100 feet and a surface area of 1,260 acres at its maximum storage. Built in 1961 and operated by APS, Morgan Lake holds approximately 39,200 acre-feet of water at normal storage and 42,800 acre-feet of water at maximum storage. Water from Morgan Lake is used as cooling water at the FCPP and also for use in dust suppression and reclamation irrigation activities associated with the NTEC Lease Area. APS uses an ultra-filtration system to purify the water before using it to cool the turbines, and diverts a small portion for drinking water within the plant.

APS manages 11 impoundments northwest of the Navajo Tribal Coal Lease area which are supplied by industrial water from the power plant and used for industrial purposes [P-0430 through P-0440]. There are an additional 3 impoundments supplied by industrial sources just south of Morgan Lake [P-0022 through P-0024] (United States of America 2011, Table K-1). NTEC manages several impoundments on the current lease area, as outlined in PAP Part 4 Section 26 and summarized in Appendix C, from which they extract water for use in dust suppression. In addition to impoundments operated by APS and NTEC, 6 impoundments supported by the Navajo Indian Irrigation Project (NIIP) irrigation channel are used as a fish hatchery east of the Neck section of Area II of the Navajo Mine permit [P-1430 through P-1435] (United States of America 2011, Table K-1). Although El Segundo Mine is partially within the surface water CIA, the water supply for the mine is from a groundwater well outside of the groundwater CIA. All of these impoundments within the immediate vicinity of the NTEC Lease Area can be seen on Figure 13.

3.3 Irrigation Supply Water

Groundwater is not used for irrigation within the groundwater CIA. However, there is significant use of surface water for irrigation within the surface water CIA. The closest surface water body to the Navajo Tribal Coal Lease to be designated by the NNEPA for agricultural water supply is the San Juan River. Water from the San Juan River is used for irrigation by NAPI, NTEC and Navajo Nation Fruitland-Cambridge irrigation projects within the vicinity of the lease area. The Fruitland-Cambridge project is just north of the lease area and has a diversion right of 18,180 acre feet per year and depletion right of 7,970 acre feet per year, however all fields on the southern edge of the San Juan drain into the San Juan and do not extend south into the Chaco watershed. Therefore, this project does not extend into the surface water CIA. NTEC operates an irrigation pipeline (initiated in 1975), which provides water from Morgan Lake for the irrigation of revegetation plots as part of the approved reclamation plan (NTEC 2013, Part 3 Sect. 22.3). NAPI withdrawals water from the Navajo Reservoir. The Navajo Reservoir is approximately 33 miles east of Farmington, NM and outside of the surface water CIA.

NAPI is part of the Navajo Indian Irrigation Project (NIIP). On June 13, 1962, Congress authorized the NIIP to furnish irrigation water to 110,630 acres of land with an average annual diversion of 508,000 acre feet of water. The initial 1962 project authorization allowed for development of 77,543 acres of land east and 33,087 acres west of the Chaco River. On September 25, 1970, following a reevaluation of the project, the site descriptions authorized by the original 1962 Act were amended to exclude the proposed irrigated lands west of the Chaco River and include additional townships east of the river such that all proposed irrigated 110,630 acres were east of the Chaco River (United States of America 2011). NAPI was created by the Navajo Tribal Council on April 16, 1970 (Moore 2006). NAPI has developed in stages and by blocks; eleven blocks of approximately 10,000 acres each were created (United States of America 2011). On April 10, 1976 Farm Block I received its first release of water (Moore 2006).

Today, the project is still under construction. Blocks 1 through 8 and the first six fields of Block 9 of NIIP have been completed and are operational. Since 1962, of the acres authorized for development, 79,760 acres have been developed and are subject to project irrigation. Blocks 1, 2 and 4 are east of Gallegos Canyon and outside of the surface water CIA. Block 3 is just east of Area I and II and well within the surface water CIA. Block 2 is just north and east of Block 3, and while part of it drains into the Bitsui watershed it is outside of the Chaco watershed (surface water CIA). Block 7 is just east of Block 3 and partially contained within the CIA. Block 8 and 9 are south of Block 7 and also partially contained in the CIA (United States of America 2011, Appendix E).

In addition to NAPI and NTEC impoundments, 77 impoundments are supplied by surface water sources, other than the San Juan River, which are used for irrigation within the surface water CIA. The 77 impoundments include diversions, in-channel impoundments, and off-channel impoundments. All 77 of these impoundments drain into the Chaco from the opposite side of the basin from NTEC and are located either west or south of the Chaco. Additionally there are 15 impoundments used for irrigation within the SW CIA that are supplied by groundwater or spring sources, all drain into the Chaco from the opposite side of the basin from NTEC and are located either west or south of the Chaco (United States of America 2011, Appendix F).

The hydrographic survey also identifies acreage associated with tributary irrigation project lands that utilize water from sources other than the Mainstem of the San Juan River (Figure 14). One project which irrigates by diversion of surface flows from the No Name Wash is just South of Area IV

North, and east of the Chaco River. Two projects which also irrigate by diversion of surface flows from the Teec-ni-di-tso Wash are southwest of Area V and east of the Chaco River. None of these tributary irrigation projects have associated impoundments. The fourth tributary irrigation project is the R.L. Tanner project located north of the Chaco River and southeast of the NTEC lease area in the Lower De-na-zin Wash HUC-12 Watershed. The project has an associated reservoir and irrigates by diversion of surface flows from the De-na-zin Wash. All other tributary irrigation project lands are located either west or south of the Chaco on the opposite side of the basin from the NTEC permit area (United States of America 2011, Appendix E).

3.4 Livestock Supply Water

Livestock grazing has been and is currently the largest land use on Navajo Lands. Within the San Juan Watershed a variety of water sources exist to meet the demands of livestock. Surface water from the mainstem of the San Juan River and its tributaries has been, and continues to be, used for livestock purposes. In addition, groundwater sources are also utilized to meet livestock demands. On Navajo Lands within the San Juan Watershed, there are 650 wells and 138 springs that have been identified as serving livestock purposes. Finally, on Navajo Land, stock impoundments have been built or maintained to create an additional source of water for livestock. These stock impoundments are supplied with water and are filled and refilled annually to the extent that water is available. The United States has identified that the reserved water right associated with livestock grazed on the lands held in trust for the Navajo Nation is 304 acre feet per year (afy) of depletion (486 afy diversion). Additionally, the Navajo Nation water rights associated with stock impoundments on trust lands amount to 12,693 acre-feet of storage with the associated right to fill and refill these stock impoundments as water is available (United States of America 2011).

NTEC has completed an inventory of wells and springs within the permit and adjacent area (NTEC 2013, Appendix 41.A). The inventory was extended beyond the Navajo Mine and Pinabete permit areas and includes wells completed in the alluvium of the Chaco River and the San Juan River. The hydrographic survey conducted as part of the ongoing water rights settlement agreement also identified wells and springs used for livestock watering within the groundwater CIA (United States of America 2011).

All together thirty-nine wells used for stock watering were identified within the groundwater CIA. Three wells are located along the San Juan River north of the NTEC lease, two of these are specifically identified as alluvial wells [W-0695 (G-2), SJ 00264 (#7)], and the other well [W-0593] does not have an identified completion level. There are fifteen wells along the Chaco, nine of which are identified to be alluvial [W-0202, W-0607, W-0203, W-0204, W-0519, W-0645, 13-AW, GM-32], one is identified to be in the PCS [#90], and the other four [W-0342, W-0520, W-0538, W-0539] have unidentified completion levels. Two wells are located along Bitsui Wash, one east [W-0313] and one north [W-0603] of the lease, both have unidentified completion levels. One improved spring [S-0767] is located adjacent to the Chinde Wash east of the lease area. Two wells used for stock watering are located west of the lease area within the Cottonwood Arroyo alluvium [W-0618, W-0644]. Seven wells are identified along Pinabete Arroyo, 4 within the lease area [W-0343, W-0345, W-0344, W-0346] and 3 west of the lease boundary [W-0348, W-0349, GM-22], six are identified to be in the alluvium, and one has no identified completion level. There is one well within the lease area along No Name Wash which has no identified completion level [W-0606]. Six wells have been identified as used for stock watering along Brimhall Wash, none of which have identified completion levels [W-0314, W-0537, W-0540, W-0544, W-0545, W-0624]. There are an additional seventeen wells identified within the groundwater CIA with no identified use. Livestock watering is the primary use of groundwater within the CIA. The location of all referenced wells can be found in Appendix B and Figure 12.

All surface waters within the CIA are designated by the NNEPA for livestock watering use, including Morgan Lake. Surface water flows are used opportunistically by sheep or other livestock which might be in the vicinity when the channels are carrying water. However, livestock normally use stock watering ponds which have been constructed to catch surface flows. Surface water use adjacent to the El Segundo mine is confined to opportunistic use by ranchers for livestock watering (NMEMNRD 2008).

NTEC has conducted an inventory of the stock watering ponds within the permit and adjacent area (NTEC 2013, Exhibit 16-3). The inventory found 11 pre-mine stock ponds, which have been disturbed, or will be disturbed by mining. NTEC also identified 4 ponds west of Area II, 3 east of Area II, 2 west of Area III, and 11 east of Area III.

The hydrographic survey conducted as part of the ongoing water rights settlement agreement also identified stock ponds within and adjacent to the lease area (United States of America 2011). One in-channel impoundment [P-5378] was indentified east of Area II slightly south of Area I. Five impoundments were identified east of the Chaco, west of the Areas II and III, three in Chaco tributaries north of the Cottonwood [P-5358, P-5354, P-5305], one in a Cottonwood tributary south of the main fork [P-5294], and one in a Chaco tributary south of Cottonwood [P-0384]. Fourteen in-channel stock impoundments were identified east of Area II and III, six in the Chinde [P-0365, P-1769, P-0366, P-5352, P-0367, P-0354], two in the north fork of Cottonwood [P-5306, P-5318], one in the South Barber Arroyo [P-5344], and five in Lowe Arroyo [P-5325, P-5324, P-5323, P-5320, P-5316]. All referenced impoundment locations can be found in Appendix B and page 1 of Figure 13.

Additionally, twelve in channel impoundments were identified east of Areas III and IV North, in Cottonwood Arroyo and Cottonwood Arroyo tributaries [P-5318, P-0382, P-0355, P-0356, P-5311, P-0695, P-0691, P-0690, P-5280, P-5357, P-0700, P-0692]. South of Area IV North, 41 stock impoundments were identified; sixteen in-channel impoundments are within Pinabete Arroyo and Pinabete Arroyo tributaries [P-5274, P-5261, P-5233, P-5232, P-0350, P-0349, P-0348, P-5241, P-0346, P-0345, P-5262, P-0685, P-0688, P-0687, P-5250, P-0689], two in No Name Wash [P-0332, P-0342], and 23 in Brimhall Wash and Brimhall Wash tributaries [P-0337, P-0339, P-5192, P-5184, P-0341, P-5187, P-5190, P-5209, P-0343, P-5213, P-0344, P-0813, P-5180, P-0608, P-5183, P-0610, P-0611, P-0594, P-0593, P-5195, P-5189, P-0593, P-0591] (United States of America 2011, Appendix M). All referenced impoundment locations can be found in Appendix B and Figure 13.

Outside of the permit and adjacent area, 242 stock impoundments were identified northeast of the Chaco River on the same side of the watershed as the Navajo Tribal Coal Lease; 205 are in-channel, two are off-channel, three are NIIP supplied, and one is a diversion. 791 stock impoundments were identified southwest of the Chaco River; 767 are in-channel, nine are off-channel, and fifteen are diversions (United States of America 2011, Appendix M). Additionally, NTEC provides water to local permitees in tanks for livestock use in areas around the lease, when requested (NTEC 2013, Part 6 Sect. 41). Given the total number of stock impoundments, it is evident that livestock watering is the primary use of surface water within the CIA.

3.5 Aquatic and Wildlife Habitat Water Supply

The Chaco River and all tributaries including the Chinde Wash and Cottonwood Arroyo are designated by the NNEPA for Aquatic & Wildlife Habitat use. The Aquatic and Wildlife Habitat designated use indicates that the water body supports use by animals, plants or other organisms, including salmonids and non-salmonids, and non-domestic animals (including migratory birds) for habitation, growth or propagation (NNEPA 2007).

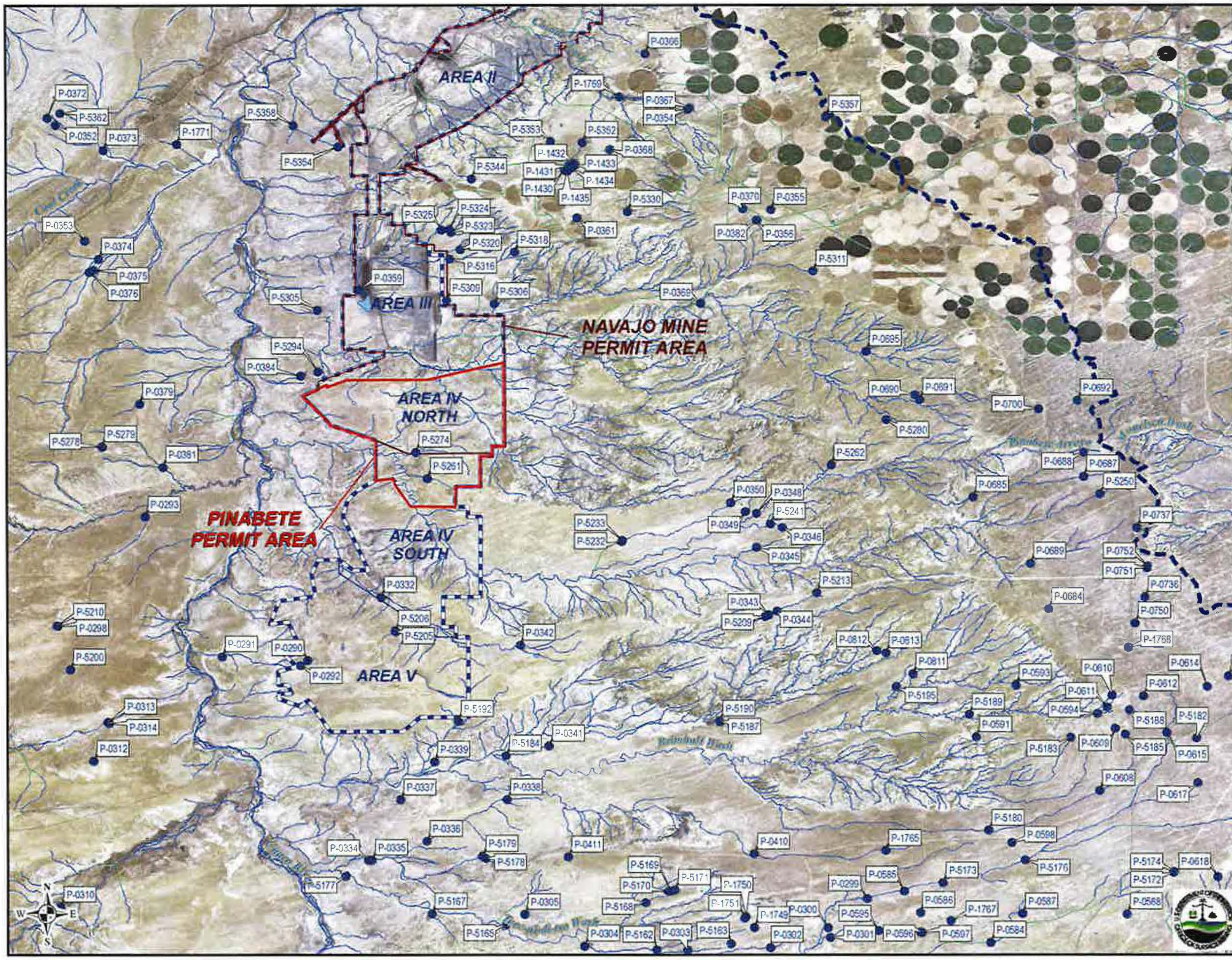
All water sources are considered wildlife habitats, particularly in the arid region within which the Navajo Tribal Coal Lease occurs. The vegetation around water sources may be more vigorous or comprised of different species than found in the surrounding area. The predominant wildlife water sources are ponds and impoundments on the lease and nearby areas. Of particular interest are three ponds located on pre-law lands at the french drain discharge point in Area II, based on observations the ponds appear to be permanent year long features. Other small ponds only contain water after precipitation events and are dry most of the time; off lease stock ponds depend on runoff for their water supply. Wildlife and their habitats on and adjacent to the Navajo Tribal Coal Lease have been surveyed during several studies conducted at various times since 1973 through 1987 and 1989. The lease does not contain any streams or ponds with fish, and Morgan Lake is the closet water body within the surface water CIA that provides fishing habitat. The scarcity of suitable water sources on the lease limits the potential habitat for amphibians. The lesser earless lizard, western whiptail, and sagebrush lizard were the most frequently observed reptiles on the lease (NTEC 2013, Part 2 Sect. 16).

Waterfowl in the area use water sources such as stock ponds and impoundments on the lease opportunistically as they migrate through the area. Morgan Lake, which is located off lease but within the surface water CIA, provides more suitable waterfowl habitat than is available on the lease. Horned larks are by far the most abundant passerine bird species throughout the year. Other common breeding birds are mourning doves and rough-winged swallows. Mourning doves were the most frequently observed game bird, and mourning dove and waterfowl hunting is provided at Morgan Lake. Blue-winged or cinnamon teal were the most common species observed using the small ponds. White-faced ibis migrate through the region and are occasionally observed at stock ponds or other water sources. Raptors nesting within the lease and adjacent buffer zone during 1987 were ferruginous hawk, red-tailed hawk, American kestrel, and burrowing owl. One active ferruginous hawk nest was located on the lease and several were located within approximately one-quarter mile of the lease boundary. Three red-tailed hawk nests were located on the lease during 1987. Burrowing owls nested on several of the active and abandoned prairie dog colonies on the lease. Additional raptors nesting beyond the one-quarter mile buffer include ferruginous hawk, red-tailed hawk, golden eagle, prairie falcon, and barn owl (NTEC 2013, Part 2 Sect. 16).

Mule deer are the only big game animal that has been reported on the lease, though they are infrequently observed. Deer mice and silky pocket mice are the most abundant small mammals throughout most of the habitats on the lease. Prairie dogs and kangaroo rats are relatively common on the upland habitats on the lease. Blacktailed jackrabbits and cottontails are common medium-sized mammals. Common predators include red fox, kit fox, coyote, and badger. The prairie dog colonies on the lease provide potential habitat for the endangered black-footed ferret, however, no black-footed ferret has been found during over 1000 hours of night spotlight surveys conducted on the lease. Other endangered species that may use the area are bald eagle and peregrine falcon. Neither of the species nests on the lease and no suitable nesting habitat for either of them occurs on the lease. Both species may occasionally use the area during the migration or winter periods. Other species of high interest that breed on the lease are ferruginous hawk and mountain plover (NTEC 2013, Part 2 Sect. 16).

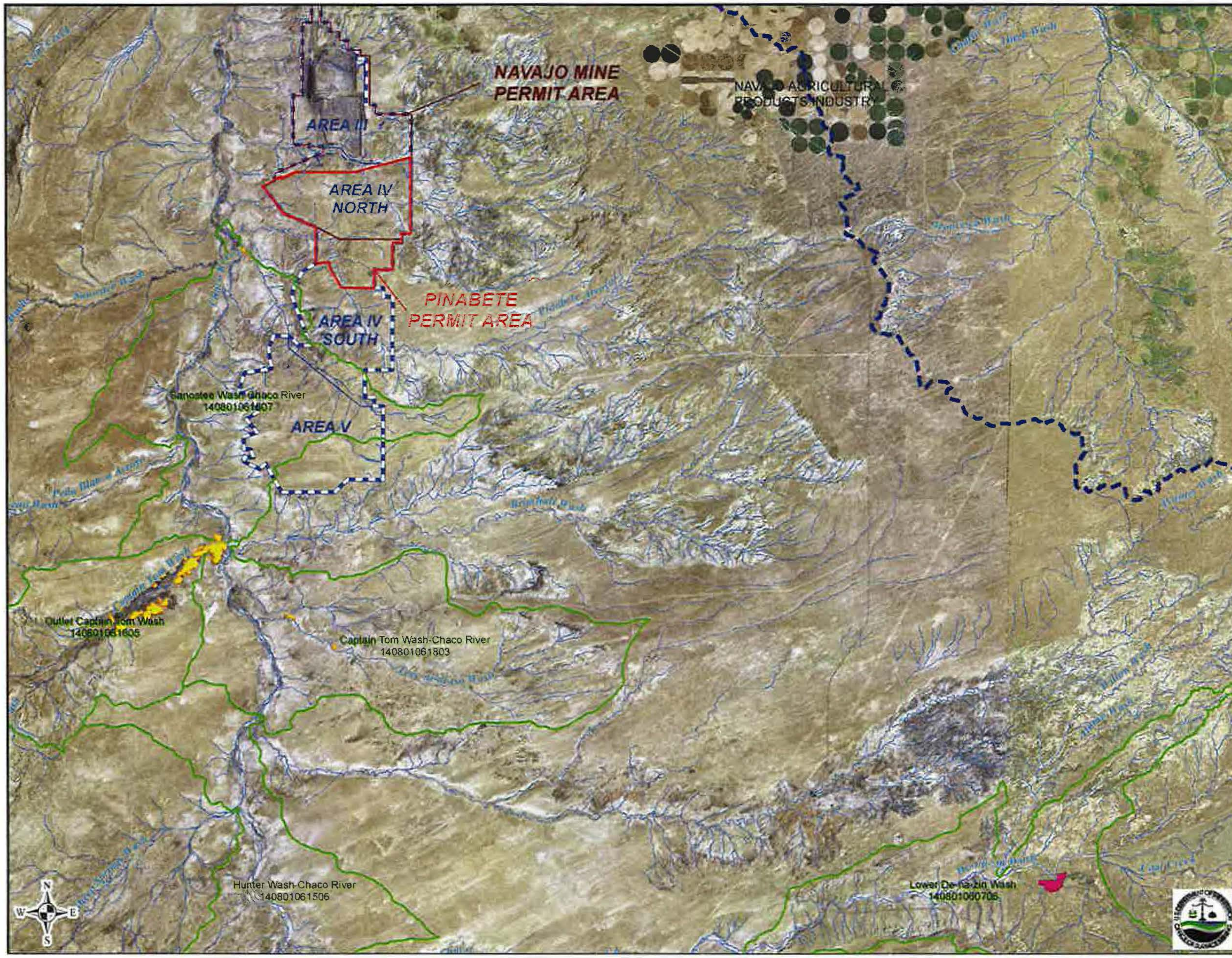
Non-NTEC Surface Water Impoundments within vicinity of Navajo Tribal Coal Lease

Figure 13
(pg 1 of 2)



Non-NTEC Surface Water Impoundments within vicinity of Navajo Tribal Coal Lease

Figure 13
(pg 2 of 2)



Legend

Irrigation Type:

- Diversion with Reservoir[1]
- Diversion[1]
- Floodwater[1]
- Ponds & Reservoirs
- Natural Stream [2]
- Artificial Path/Ditch [2]
- HUC12 Watersheds[2]
- Surface Water CIA
- Pinabete Permit Area
- Navajo Mine Permit Area
- Coal Lease Area
- *RESOURCE AREAS*

Data Sources:
Aerial Photography (San Juan County) 2009
& ESRI Mapping Service
[1] Navajo Nation Hydrographic Survey (2010)
[2] USGS National Hydrography Dataset

1 0 1 2 3 4
Miles
1:165,000 (at 11"x17")

Location Area

Coordinate System:
State Plane
North American Datum 1927
New Mexico West (FIPS 3003)
Feet

Select Tributary Irrigation Project Lands

Figure 14

4 BASELINE HYDROLOGIC CONDITIONS

The issuance of the Surface Mining Control and Reclamation Act of 1977 (SMCRA) established that surface coal mining operations are to be conducted as to protect the environment, and to assure that a balance between the protection of the environment and the production of coal as a source of energy is maintained (SMCRA, Section 102(d) and (f), 1977). Therefore, as presented in OSMRE's guidance document for the preparation of PHC's and CHIA's, the goals in establishment of baseline hydrologic conditions are to characterize the local hydrology, understand the regional hydrologic balance, and identify any water resource or water use that could be affected by the mining operation (US DOI, 2002). The guidance document is consistent with 30 CFR 780.21: Hydrologic Information. However, NTEC mining operations commenced prior to the issuance of SMCRA, making quantification of baseline conditions for impact assessment challenging for some hydrologic resources in the northern lease area due to the absence of pre-mining information since it was not required prior to 1977.

In compliance with the issuance of SMCRA, in the late 1970's an extensive hydrologic monitoring program was initiated documenting the interaction between the surface water system and alluvial and Fruitland ground water systems within the lease area. Although the majority of hydrologic information was collected after mining operations began, the data sets developed over the last 30 years of monitoring provide insight regarding baseline conditions based on water quality and quantity trend analysis. Assessment of predictive impacts from the 1984 CHIA, 2012 CHIA, and this 2015 CHIA are based on the available information in the approved PAP at time of publication. Information from data sets for the period of record is used and applied to understand baseline conditions and inform the evaluation of predictive impacts.

The general approach for hydrologic impact assessment is similar to the 1984 CHIA, and the same as the 2012 CHIA. Chapter 3 of this document identified the water resource uses and designations within the surface and ground water CIA's delineated in Chapter 2. The following discussion on the baseline hydrologic conditions will consider available surface and ground water information to characterize both regional and local hydrologic quantity and quality in the assessment areas. Chapter 5 will utilize the characterization of regional and local hydrologic quantity and quality to facilitate hydrologic impact analysis related to the existing and foreseeable water uses, and Chapter 6 make hydrologic determinations of the potential for the mining operation to result in material damage outside the lease area.

4.1 Surface Water

The drainages in the surface water CIAs are considered ephemeral, intermittent and perennial based on OSMRE definitions at 30 CFR 701.5. An ephemeral stream is when a stream flows only in direct response to precipitation in the immediate watershed or in response to the melting of a cover of snow and ice, and which has a channel bottom that is always above the local water table. An intermittent stream is considered a stream, or reach of a stream, that is below the water table for a least some part of the year, and obtains its flow from both surface runoff and groundwater discharge. OSMRE further defines intermittent at 30 CFR 701.5 as a stream, or reach of stream, that drains a watershed of a least one square mile. A perennial stream is defined as a stream or part of a stream that flows continuously during all of the calendar year as a result of ground-water discharge or surface runoff.

4.1.1 Surface Water Regulatory Requirements

Water Quality

Surface water runoff from areas disturbed by mining operations is required to be managed in a manner that prevents additional contribution of suspended solids to stream flow outside the lease area to the extent possible with the best technology currently available, and otherwise prevents surface water pollution (30 CFR 816.41(d)). NTEC ensures compliance of surface water protection by designing, constructing, and maintaining siltation structures, impoundments, diversions, and designating stream buffer zones within the lease area.

NTEC is required to submit a monthly report to the USEPA regarding NPDES Permit No. NN0028193. The NPDES monthly reports document the water quality and quantity of discharge to the washes when high runoff events exceed the storage capacity design of the structure and surface water discharge to the wash occurs. Additionally, NTEC may dewater ponds in order to ensure sufficient design capacity by either transferring water to nearby ponds with available capacity, or by discharging water into the downstream wash in accordance with the NPDES permit.

Water Quantity

NTEC is required to reclaim lands disturbed by mining so the lands may be returned to the appropriate land management agency in a condition compatible with and capable of supporting the approved post-mining land uses. Therefore, the reclamation plan has been designed by NTEC to produce lands which will be compatible with and will support livestock grazing. The approved post-mining land use is livestock grazing, which is consistent with the pre-mining land use. In order to support the livestock grazing post-mining land use, and after consultation with the Navajo Nation and the Bureau of Indian Affairs (BIA), NTEC proposed to replace the 11 livestock ponds impacted by mining as part of reclamation to ensure a greater viability of post-mining land use success. All the reconstructed ponds will be built to accommodate a similar volume to estimated pre-mining volumes and in the vicinity of the pre-mining locations. The reclamation plan has been previously agreed to by the BIA and the Navajo Nation.

4.1.2 Surface Water Regime

The surface water CIA flow regime is influenced by the duration, intensity, and extent of the precipitation events and the transmission loss rates to the alluvium along the channels. NTEC has conducted several field investigations to better understand these intricate influences of the surface water regime within the lease area. Additionally, the surface water monitoring program continues to provide information necessary for hydrologic evaluation and compliance with SMCRA regulatory requirements. The continued collection and analysis of hydrologic data is utilized to continually assess and update probable hydrologic consequences to the surface water regime.

4.1.3 El Segundo Mine

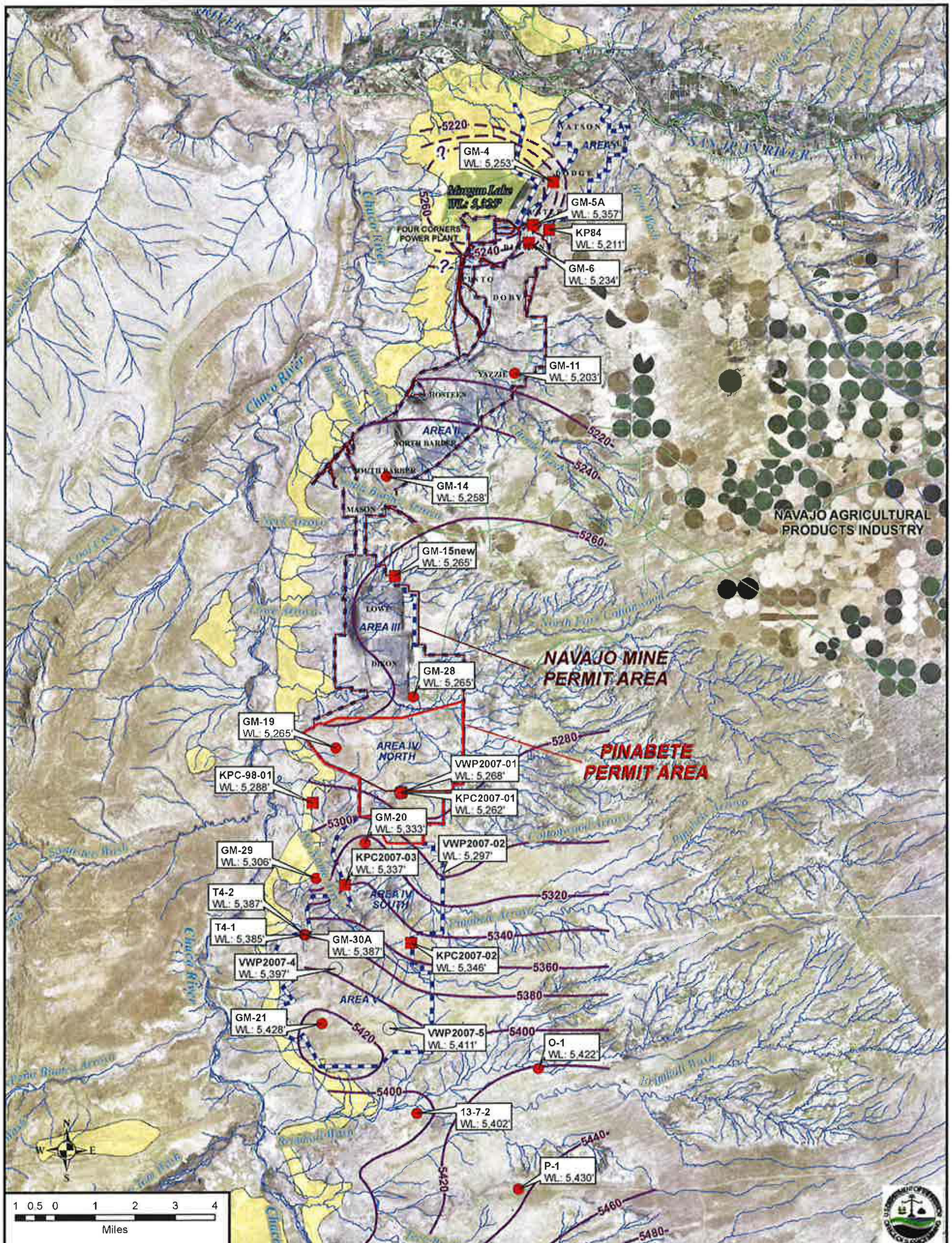
El Segundo coal mine is located approximately 70 miles southeast from the southern tip of the Navajo Tribal Coal Lease boundary. The proposed lease area is divided into two subwatersheds by the continental divide and is crossed by several unnamed ephemeral, arroyos. The western portion of the lease area drains into the Chaco River through an unnamed, ephemeral channel that drains to Laguna Castillo before flowing into a named drainage, Kim-me-ni-oli Wash, and into the Chaco River. The USGS maintained a gaging station on Kim-me-ni-oli wash from October 1981 to September of 1983. The utility of this station is questionable due to a baseflow discharge to the wash from the proposed Phillips Petroleum, Nose Rock Uranium Mine at that time period. The 2 year data set indicates that surface flows in the ephemeral channel are highly variable, ranging from zero to 1060 cfs. The ephemeral arroyos passing through the lease area flow only in direct response to storm events and have channel bottoms that are above the local water table. The drainage area for the main western drainage as it leaves the lease area is approximately 24.7 square miles of which about 6.1 square miles (25%) of the total watershed are proposed to be disturbed by mining (NMEMNRD 2008) . In the western unnamed Arroyo drainages bicarbonate is the dominant anion and calcium is the major cation followed by sodium. Additionally, total suspended solids and possibly aluminum concentrations exceed various New Mexico water quality standards under baseline conditions (NMEMNRD 2008).

4.1.4 Morgan Lake

Built in 1961, Morgan Lake is a manmade reservoir and perennial surface water body, west of Area I (Figure 15). It was constructed to supply water to mining and power generation activities in the area. Morgan Lake is approximately 1.2 miles wide and 2.2 miles long with a maximum depth of about 100 feet and a surface area of 1,260 acres at its maximum storage. Morgan Lake has a volume of approximately 39,200 acre-feet of water at normal storage and 42,800 acre-feet of water at maximum storage.

Morgan Lake has influence on baseline conditions of Navajo Mine areas I, II, and III. It has had a significant impact to baseline conditions with respect to both surface water quantity and groundwater quantity in the area. One of the principal impacts in which Morgan Lake has affected surface water is at its outflow point where it discharges into the Chaco River. Flow in the Chaco River is ephemeral except for the last 12.5 miles of the river, where perennial flow is the result of spillway overflows from Morgan Lake. It has also had an effect on the groundwater regime in the area, specifically within the PCS. The PCS potentiometric surface in Figure 15 shows how Morgan Lake has likely affected groundwater quantity around its perimeter and within the Navajo Tribal Coal Lease Area.

Water from the San Juan River is pumped to Morgan Lake for use as cooling water at the APS Four Corners Generating Station and also for use in dust suppression and reclamation irrigation activities associated with the NTEC Lease Area. Therefore, baseline water quality in Morgan Lake is most likely similar to that found in the San Juan River. The San Juan River has a better water quality compared to water within the Chaco River Watershed; specifically a comparison of water quality from USGS stations along the San Juan and Chaco Rivers shows that TDS concentrations within the Chaco River are approximately three times more than TDS concentration within the San Juan River. Morgan Lake is designated for the following uses by the NNEPA; livestock watering, aquatic and wildlife habitat, secondary and primary human contact and fish consumption (NNEPA 2007).



Legend

- Abandoned PCS Monitoring Well
- Existing PCS Monitoring Well
- Nested Vibrating Wire Piezometer
- PCS Potentiometric Contour
- PCSPotentiometric Contour - Inferred
- Pinabete Permit Area
- Navajo Mine Permit Area
- Coal Lease Area
- RESOURCE AREAS
- Natural Stream[1]
- Artificial Canal/Ditch[1]
- Pictured Cliffs Formation (Kpc)
- PIT NAMES

Data Sources:
Aerial Photography (San Juan County) 2009
[1] USGS National Hydrography Dataset

Coordinate System:
StatePlane New Mexico West
North American Datum 1927
Feet

1:150,000 (at 11"x17")

Pictured Cliffs Sandstone Potentiometric Surface and Outcrop Location

Figure 15

4.1.5 **Chaco River**

4.1.5.1 **Surface Water Quantity**

The Chaco River is an ephemeral drainage up until the last 12.5 miles of the stream where runoff from Morgan Lake has caused it to be perennial. All of the primary drainages of interest at the Navajo Tribal Coal Lease except for Bitsui Wash drain into the Chaco River. Water monitoring historically occurred at two USGS gage stations along the Chaco River, station #09367950 near Waterflow, NM and station #09367938 near Burnham, NM. The locations of these two water monitoring stations are illustrated in Figure 8. The stations were actively monitored for stream flow and select water quality parameters from 1977-1994 and from 1977-1982, respectively. Station #09367938 exhibits the original ephemeral nature of the Chaco River, which existed prior to the construction of Morgan Lake. USGS station #09367938 is considered to be representative of baseline conditions within the Chaco River relative to mining impacts as it is upstream of the Navajo Mine and Pinabete Permit areas. Flow at USGS station #09367938 is shown in Figure 16. All of the large flow events occur in response to precipitation.

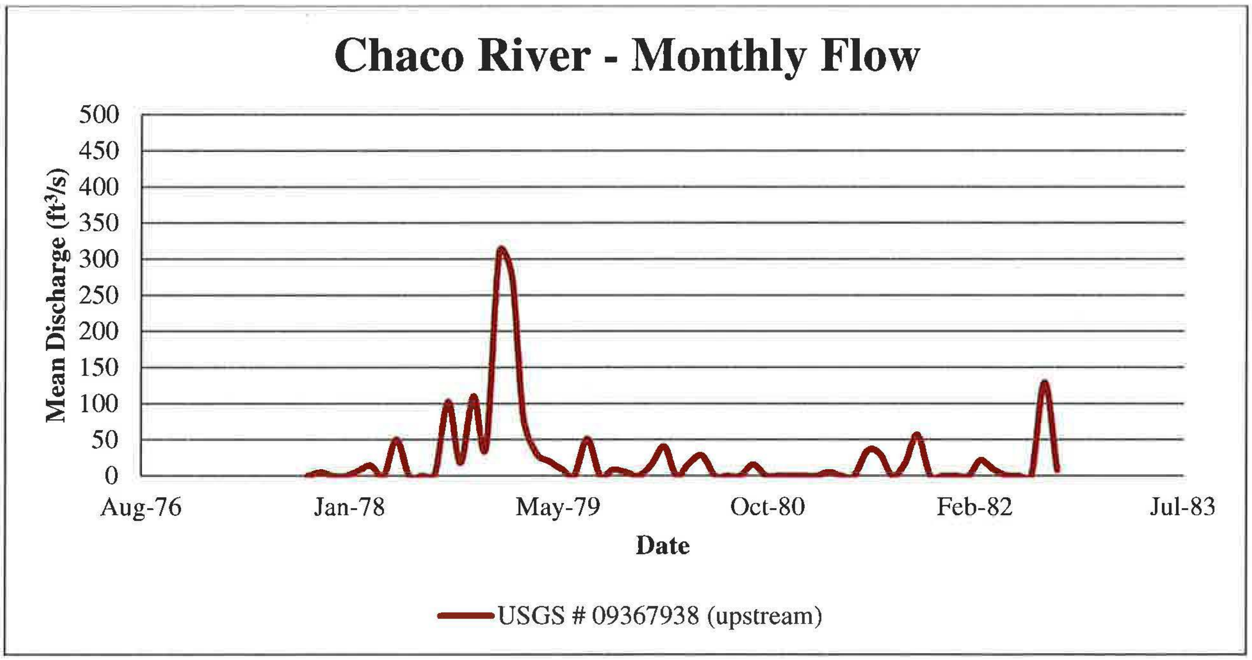


Figure 16: Baseline Monthly Flow along the Chaco River

4.1.5.2 **Surface Water Quality**

The Chaco River within the vicinity of the NTEC lease area is designated for the following uses by the NNEPA; livestock watering, aquatic and wildlife habitat, secondary human contact and fish consumption. Additionally, the Chaco River from its mouth to the mouth of Dead Man's Wash is designated by the NNEPA for Primary Human Contact (NNEPA 2007). The principal use of surface waters near the lease area is for stock watering ponds (NTEC 2013, Part 6 Sect. 41).

4.1.5.2.1 Methodology

Surface water quality analysis, where data was available, has been done for all constituents for which there are NNEPA criteria, as these constituents have been identified by NNEPA to have potential impact on use (NNEPA 2007). Additionally, analysis has been conducted on TDS, sulfate, chloride, and fluoride as these are generally considered to be harmful to livestock at elevated concentrations (Lardy, Stoltenow and Johnson 2008). Select surface water use criteria are presented in Table 3 below. Analysis was also conducted for dissolved iron based on the water quality definition referenced in SMCRA at 30 CFR §

816.42, which for western alkaline mining is defined in 40 CFR § 434.81 to be a drainage effluent maximum of 10mg/L. No manganese criteria is defined for western alkaline mining in 40 CFR § 434.81.

Table 3: Surface Water Criteria

Constituent	Livestock	Aquatic & Wildlife Habitat (Acute)	Aquatic & Wildlife Habitat (Chronic)	Secondary Human Contact	Fish Consumption
Aluminum	NNS	0.75	0.087	NNS	NNS
Arsenic	0.2	0.34	0.15	0.28	0.08
Barium	NNS	NNS	NNS	98	NNS
Boron	5	NNS	NNS	126	NNS
Cadmium[1]	0.05	.0041	.00041	0.47	0.008
Chloride	600**	NNS	NNS	NNS	NNS
Chromium (III+IV)	1	NNS	NNS	NNS	NNS
Chromium III	NNS	.00061	.035	1400	75
Chromium IV	NNS	.016	.011	2.8	0.15
Copper[1]	0.5	.027	.017	9.33	NNS
Fluoride	2*	NNS	NNS	56	NNS
Lead[1]	0.1	.14	.0056	0.015	NNS
Mercury	NNS	0.0024	0.000001	0.28	0.00015
Nitrate	500*	NNS	NNS	1493.33	NNS
pH	6.5-9.0	6.5-9.0	6.5-9.0	6.5-9.0	NNS
Radium 226+228	30	NNS	NNS	NNS	NNS
Selenium	0.05	0.033	0.002	4.67	0.67
Silver[1]	NNS	.012	NNS	4.67	8
Sulfate	1000*	NNS	NNS	NNS	NNS
TDS	3000*	NNS	NNS	NNS	NNS
Zinc[1]	25	.0375	.0378	280	5.1

Note all values are NNEPA 2007 criterion unless otherwise specified
NNS = No Numeric Standard
[1] Aquatic & Wildlife Criterion are hardness dependent and calculated for a hardness of 210 mg/L as CaCO3, which is the median across all surface water samples
*Lardy, Stoltenow and Johnson 2008
**NNEPA 2004 Criterion

Several statistical parameters were run during the analysis of surface water quality including, average and standard deviation, median and median absolute deviation (MAD), third quartile (Q3), and ninety-fifth percentile. Variability of surface water quality data in the area was found to be high with the Percent Relative Standard Deviation (%RSD) across all parameters at all sites ranging from 44% to 126% with a median of 85%. Therefore, given the high variability in the data, the use of medians and MAD as compared to other parameters was considered more appropriate for characterization, as it is a more robust measure of variability of a data set and more resilient to the influence of outliers (NIST 2010). The median and MAD are therefore used throughout the characterization of baseline within this CHIA; however, all statistical values can be found in Appendix D.

4.1.5.2.2 Analysis

Surface water quality data is available on the Chaco at two historic USGS monitoring stations, which bracket all Chaco River tributaries traversing the lease area; station 09367950 downstream of the Morgan Lake discharge point and station 09367938 upstream of No Name Wash confluence (Figure 8). USGS station 09367938 is considered representative of baseline conditions within the Chaco River since it is upstream of the Navajo Tribal Coal Lease. Water quality data was collected by the USGS at this site from July of 1977 to August of 1982.

Baseline data has a high variability, with a calculated median percent relative standard deviation for all constituents of 44 percent. There were no exceedances of NNEPA and other relevant livestock watering criteria or NNEPA secondary human contact criteria. However aluminum, cadmium, copper, mercury, selenium and zinc exceeded NNEPA chronic aquatic and wildlife habitat criteria for 50%, 100%, 57%, 100%, 67% and 17% of all samples respectively. Chromium, copper, mercury and zinc levels also exceeded NNEPA acute aquatic and wildlife criteria for 100%, 14%, 31%, and 17% of all samples respectively. Mercury also exceeded NNEPA fish consumption standards for 100% of all samples. Additionally, the median aluminum, cadmium, copper mercury and selenium values were 2, 1.2, 1.2, 2100, and 1.5 times greater than the NNEPA chronic aquatic and wildlife habitat standards. The median chromium value was 12 times the NNEPA acute aquatic and wildlife habitat standard. The median mercury value was also 14 times the NNEPA fish consumption criteria. Baseline surface water quality within the Chaco River as compared to NNEPA and other relevant criteria is appropriate for the designated post-mining land use of livestock grazing. However, elevated levels of aluminum, cadmium, chromium, copper, mercury, and selenium were found relative to aquatic and wildlife habitat and fish consumption NNEPA criteria. There were no exceedances of the SMCRA dissolved iron standard.

4.1.6 Historic Mining Area North of the Navajo and Pinabete Permit Areas

Prior to mining and before the development of up gradient agricultural lands, surface flows in channels traversing this area were predominantly ephemeral. The ephemeral surface flows carry high sediment loads. The increased application of surface water from NAPI has impacted the area hydrology and water quality. NAPI impacts in this area consist of indirect discharges from irrigation return flows. The indirect NAPI related discharges are a result of return flows caused by infiltrating irrigation water. The impacts of the NAPI activities on the baseline channel hydrologic balance are expressed as highly variable increases in flow and discharge. The indirect NAPI related discharges result in leaching of the unconfined geologic surface formations and soils. NAPI impacts increase the already highly variable hydrologic balance and further decrease the potential for changes to the hydrologic balance as a result of mining (NTEC 2013, Part 6 Sect. 41).

The historic mining area north of the NTEC permit areas include the Watson, Bitsui, Dodge, and Custer pits, of these only the Custer pit area is within the surface water CIA. The Custer Pit area is within the Morgan Lake-Chaco River HUC12 watershed along with the Bighan Pit area. The Bighan Pit area is within the Navajo Mine permit area therefore the characterization of the baseline water quantity for the Morgan Lake-Chaco River HUC12 watershed is included below in Section 4.1.2.1.5.1. There are no major tributaries to the Chaco River which traverse this area, and no baseline surface water data is available for this area within the surface water CIA.

4.1.7 Navajo Mine and Pinabete Permit Areas

4.1.7.1 Surface Water Baseline Quantity

Prior to mining and before the development of up gradient agricultural lands, surface flows in channels traversing the permit areas were predominantly ephemeral. The ephemeral surface flows carry high sediment loads. Stock watering ponds are the principal use of surface water on or near the lease area, and these are not located on the larger tributaries where pond embankments are susceptible to failure due to flash floods.

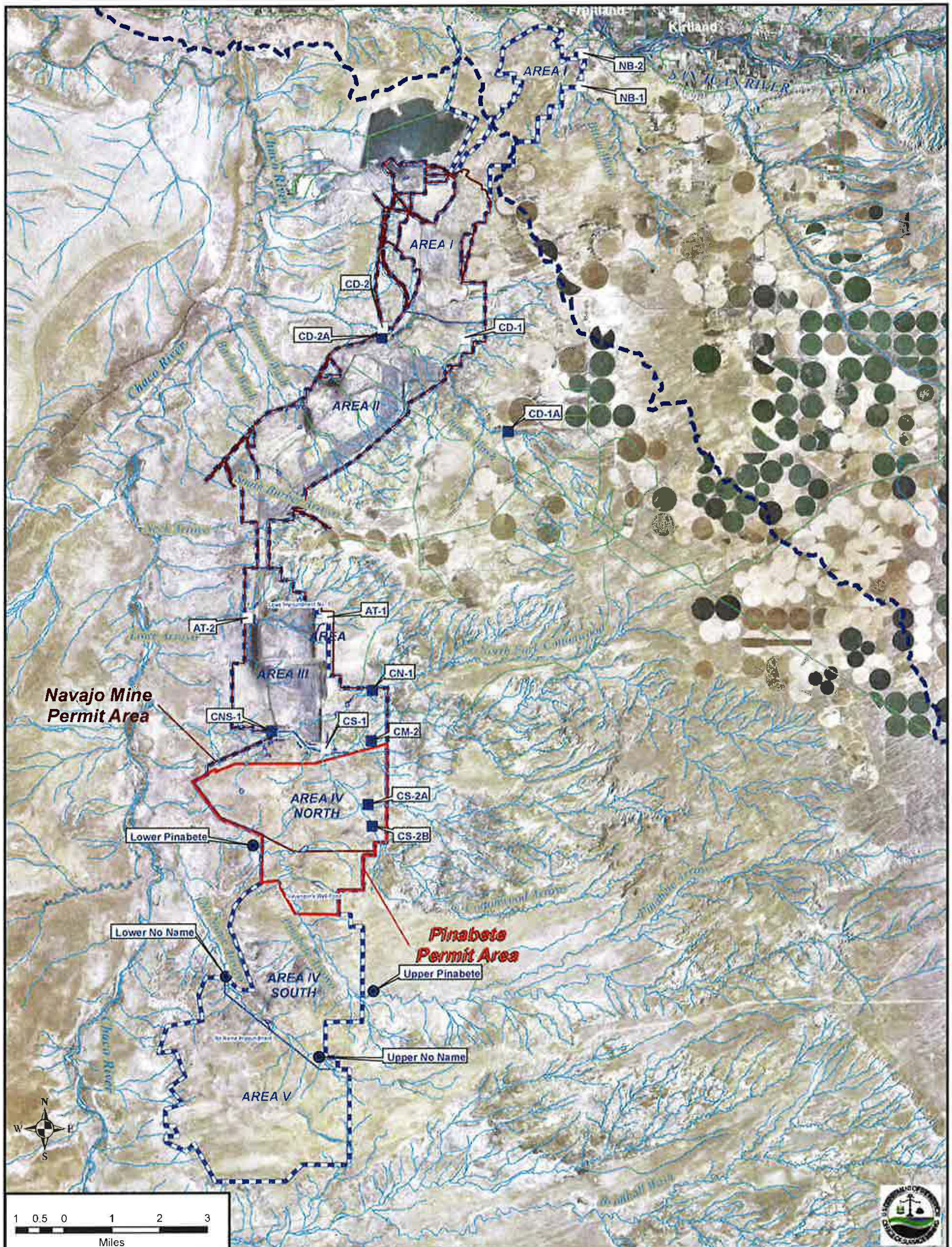
The increased application and discharge of surface water from NAPI has impacted the permit area hydrology. NAPI impacts include direct discharges of water from irrigation canals and indirect discharges from irrigation return flows. NAPI direct discharges are a result of an oversupply of water in the canal that is released directly to a wash. Discharge events for the streams are highly variable, occur quickly, and can last up to 12 hours causing significant erosion and sediment transport in the channel (NTEC 2013, Part 6 Sect. 41). The indirect NAPI related discharges are a result of return flows to the wash caused by the infiltrating irrigation water. The impacts of the NAPI activities on the baseline channel hydrologic balance are expressed as highly variable increases in flow and discharge.

The irrigation return waters have changed the Chinde Wash from ephemeral conditions to perennial conditions. Cottonwood Arroyo does not have perennial conditions. Water quantity impacts of NAPI activities on the baseline hydrologic balance of the Cottonwood Arroyo will be highly variable increases in the flow and discharge. Moreover these impacts increase the already highly variable hydrologic balance and further decrease the potential for post mining changes to the hydrologic balance as a result of mining.

Quantitative and qualitative data to characterize the NAPI impacts to these drainages is being collected as part of the surface water monitoring plan. Historically, nineteen surface water monitoring stations were established on drainages that pass through the Navajo Tribal Coal Lease area, of which seventeen are within the surface water CIA (Figure 17). The stations within the CIA cover the Chinde, and No Name Washes along with Lowe (only one sample was taken along this wash before the stations were abandoned), Cottonwood, and Pinabete Arroyos. All of the monitoring stations north of station CS-l have been impacted by irrigation activities derived from the NAPI project located to the east of the permit (NTEC 2013, Part 6 Sect. 41). There is little to no flow that passes through the lease area along Hosteen Wash, Barber Wash and Lowe Arroyo. The combination of upstream check dams, the present mining topography, and higher soil infiltration rates in the case of reclaimed areas causes surface water flow to be attenuated as it passes through the lease area along these drainages.

Mining and reclamation activities occur primarily within four HUC12 watersheds that either intersect or contain portions of the lease area (Figure 6). The watersheds include the Morgan Lake-Chaco River, Chinde Wash-Chaco River, Coal Creek-Chaco River, and Cottonwood Arroyo watersheds. Each major tributary to the Chaco River are described by watershed in the following sections.

Modeling using SEDCAD 4 was implemented to assess peak flows in response to the 10-year, 6-hour storm events within each HUC 12 watershed. NTEC developed SEDCAD models for all major drainages which traverse the lease area. The Chinde Wash and Cottonwood Arroyo Watersheds are both representative of HUC 12 range, as they were modeled directly in the PHC, and models have been reviewed by OSMRE; this modeling was not duplicated for purposes of this CHIA, rather results of NTEC models presented in the PHC are used. The PHC SEDCAD modeling only evaluated specific parts of the Coal Creek and Chinde-Chaco River HUC12 watersheds within the lease area where mining has occurred. Therefore for these HUC 12 watersheds information from the PHC on the pre-mining and post-mining SEDCAD inputs (curve numbers, runoff volumes, etc.) were integrated into simplified larger watershed scale models for the purpose of this evaluation. Excerpts from the OSMRE-generated SEDCAD models showing specific routing details, curve numbers, and other pertinent information are located in Appendix E. Figure 18 shows SEDCAD subwatersheds used in OSMRE modeled HUC 12 watersheds.



Legend

- Active Monitoring Station
- Historic Monitoring Station
- Non-SMCRA Surface Water Monitoring
- Surface Water CIA
- Ponds
- Natural Stream[1]
- Artificial Canal/Ditch[1]
- Pinabete Permit Area
- Navajo Mine Permit Area
- Coal Lease Area
- *RESOURCE AREAS*

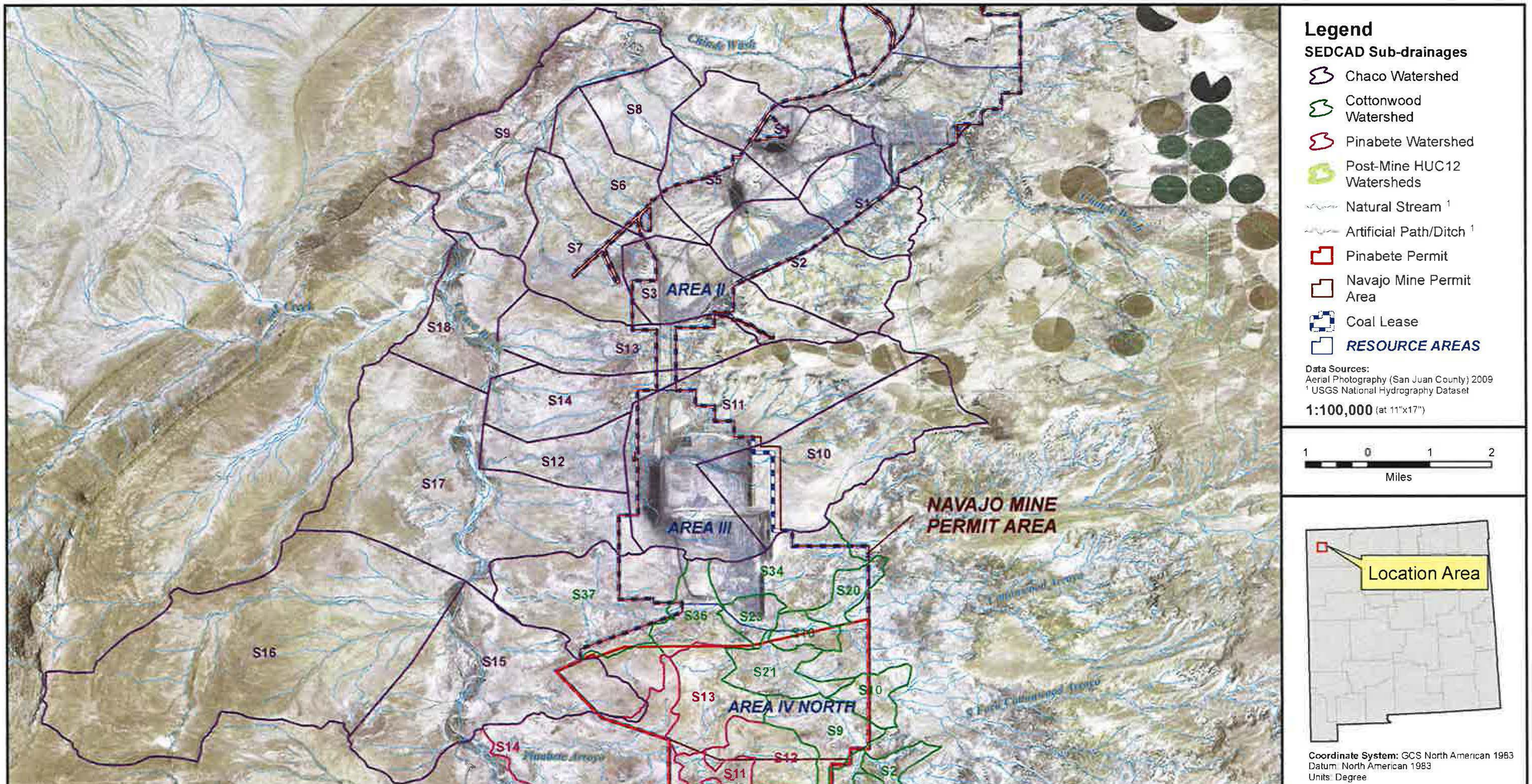
Data Sources:
Aerial Photography (San Juan County) 2009
[1] USGS National Hydrography Dataset

Coordinate System:
StatePlane New Mexico West
North American Datum 1927
Feet

1:125,000 (at 11" x17")

Surface Water Monitoring Locations

Figure 17



SEDCAD Modeled Sub-Drainages

Figure 18

4.1.7.1.1 Morgan Lake-Chaco River Watershed

The Morgan Lake-Chaco River Watershed (HUC 12 number 140801062008) is located north of the Chinde Wash and Chinde Wash-Chaco River watersheds and comprises part of the northern section of the Navajo Mine. The surface area of the entire watershed is about 32,600 acres, and about 1,400 acres of the Navajo Mine permit area is within this watershed. The entirety of the permitted area that overlaps with this watershed is in the Area I section of the mine. Conditions within this watershed are dominated by the presence of Morgan Lake, which has significantly altered baseline conditions from what they might have been before the mine. SEDCAD modeling was not implemented on the watershed due to the small contribution that activities within the permit area would have on the total watershed, because of the effect that contributing perennial flow to the watershed outfall (Chaco River) from Morgan Lake would have on the model, and because most of the permit area present in this watershed either predates SMCRA regulatory requirements or OSMRE has terminated jurisdiction.

4.1.7.1.2 Chinde Wash Watershed

Chinde Wash (HUC 12 number 140801062006) has been disturbed by mining since before SMCRA was passed in 1977, so it is difficult to estimate pre-mining conditions along the stream reach. Little data was collected prior to this time period that characterized pre-development conditions along the Chinde Wash. Therefore, advanced techniques involving iterative modeling (SEDCAD) were utilized in the approved PHC, to address pre-mining conditions. The present watershed area of Chinde Wash is about 27,130 acres. An area of an additional 7,000 acres initially contributed to the present Chinde watershed but was diverted by NAPIs Ojo Amarillo canal into Cottonwood Arroyo. The baseline estimate of peak runoff for the entire drainage from the 10 year, 6-hour precipitation event is 715 cubic feet per second. Model details including SEDCAD subwatersheds can be found in the PHC (NTEC 2013, Part 6 Sect. 41).

4.1.7.1.3 Chinde Wash-Chaco River Watershed

The Chinde Wash-Chaco River watershed (HUC 12 code 140801062007) is approximately 14,225 acres, of which the Navajo Mine permit area is 4,200 acres. It is composed of 3 principal sub-watersheds, namely Hosteen Wash, Barber Arroyo, and South Barber Arroyo. SEDCAD modeling was utilized to determine pre-mining estimates for peak flow from a 10 year, 6 hour storm event for the entire watershed. Figure 18 and Table 4 outline the details of the sub-watersheds for the area. Hosteen Wash is represented by the S1, S2, S4, and S5 sub-watersheds in the model and comprises a total of 5,860 acres, comparable to the 5,833 acres of the pre-mining area stated in the PHC model. South Barber Arroyo is represented by the S3 and S7 sub-watersheds and Barber Arroyo is represented as the S6 watershed. All of these watersheds collectively drain into the Chaco River, contributing runoff that is attenuated, to an extent, as it moves through each stream reach towards the ultimate discharge point in the HUC 12 watershed. The baseline estimate of peak discharge for the entire watershed is about 2,100 cubic feet per second for the 10 year, 6 hour rain event.

Table 4: Chinde-Wash Chaco River Sub-Watershed Details

Chinde Wash-Chaco River Watershed	
Subwatershed	Area (acres)
S1	1210
S2	2010
S3	1565
S4	1540
S5	1100
S6	1235
S7	1650
S8	980
S9	2930
Total	14220

4.1.7.1.4 Coal Creek-Chaco River Watershed

The total watershed area for Coal Creek-Chaco River Watershed (HUC 12 code 140801062005) is 28,235 acres; of which approximately 2,900 acres is Navajo Mine lease area. The lease area-portion of the watershed is comprised of 2 separate sub-watersheds, the Neck Arroyo and Lowe Arroyo. The Lowe Arroyo is the larger of the two, approximately 7,700 acres, and is represented in SEDCAD as S10, S11, and S12. The Neck Arroyo is smaller in comparison, about 1,700 acres, little of which is disturbed by mining related impacts. Both the Lowe and the Neck Arroyo drain into the Chaco River, which ultimately exits the watershed to the northwest of its tributaries. To determine peak flows from the pre-mining surface configuration in the Coal Creek Watershed, SEDCAD modeling was utilized using a 10 year, 6 hour storm event as a basis of comparison. The area of each subwatershed is displayed in Table 5. Although the surface area of this watershed is quite large, the peak flow for the 10 year 6 hour storm event at the exit point of the watershed was estimated to be about 1,720 cubic feet per second.

Table 5: Coal Creek Sub-Watershed Details

Coal Creek Watershed	
Subwatershed	Area (acres)
S10	2860
S11	3930
S12	940
S13	1740
S14	1280
S15	3530
S16	7300
S17	5060
S18	1590
Total	28230

4.1.7.1.5 Cottonwood Arroyo Watershed

Cottonwood Arroyo is a major sand bed ephemeral drainage that passes through the southern portion of the Navajo Mine permit area and eastern portion of the Pinabete permit area. The HUC 12 watershed number 140801062002 is 29,845 acres and the ultimate outlet of the watershed is from Cottonwood Arroyo itself just before it drains into the Chaco River. Approximately 10 percent of the drainage area of the Cottonwood Arroyo watershed lies within the lease area. The total drainage area of the watershed includes 7,000 acres of the Chinde Wash drainage that is diverted by the NAPI Ojo Amarillo canal into the Cottonwood drainage. About 49 percent of this watershed is occupied by badlands that account for the high discharge and flow intensities observed in this drainage.

The total watershed area that was modeled in the PHC includes the 7,000 acres diverted from the Chinde Watershed, the Cottonwood Arroyo HUC12 Watershed, and an additional unnamed HUC12 number 140801062001 watershed directly south of the Cottonwood Arroyo watershed. The total of these three areas, as modeled in the Navajo Mine PHC, is 51,269 acres.

The modeled flow response in Cottonwood Arroyo is characterized by a rapid increase in discharge from a dry channel to peak discharge, followed by a recession to a low discharge over several hours. The pre-mining estimate of peak flow in response to the 10-year, 6-hour storm event is 1,551 cubic feet per second. Model details including SEDCAD subwatersheds can be found in the PHC (NTEC 2013, Part 6 Sect. 41).

4.1.7.2 Surface Water Baseline Quality

All surface waters which cross the lease area are designated for the following uses by the NNEPA; livestock watering, aquatic and wildlife habitat, secondary human contact and fish consumption (NNEPA

2007). The principal use of surface waters on or near the lease area is for stock watering ponds (NTEC 2013, Part 6 Sect. 41). Surface water quality analysis, where data was available, has been done using the same methodology used for analysis of the Chaco River as described in Section 4.1.5.2.1 above.

Prior to mining and before the development of up gradient agricultural lands, surface flows in channels traversing the lease area were predominantly ephemeral. Under baseline conditions, these tributary channels carry very high concentrations of suspended solids and bed loads during storm runoff (NTEC 2013, Part 6 Sect. 41). Generally surface waters within the northern lease area, specifically Chinde watershed, are of the sodium sulfate type while surface waters in the southern lease area, specifically Cottonwood watershed, are of the sodium sulfate/sodium bicarbonate type. This difference might be explained by different salts being present in the soils of the different watersheds (NTEC 2013, Appendix 18-G).

Monitoring of tributaries to the Chaco River that traverse the lease area has revealed a range of surface water conditions that are considered representative of similar tributaries traversing the lease area, on which there has been no monitoring. Historically, fifteen surface water monitoring stations were established on drainages that pass through the Navajo Tribal Coal Lease area, of which thirteen are within the surface water CIA (Figure 17). The stations within the CIA cover the Chinde, and No Name Washes along with Lowe (only one sample was taken along this wash prior to the station being abandoned), Cottonwood, and Pinabete Arroyos. All of the monitoring stations north of station CS-l have been impacted by irrigation activities derived from the NAPI project located to the east of the permit (NTEC 2013, Part 6 Sect. 41). Since the effects of NAPI discharge are not attributable to the mine, the changes brought about by NAPI will be treated as baseline conditions. For this reason the baseline surface water quality discussion of Chaco River tributaries is divided into two sections: a discussion of baseline with NAPI impacts in the northern lease area, and a discussion of baseline without NAPI impacts in the southern lease area. Baseline water quality for the Chaco River and its major tributaries as they cross the lease area from north to south are described in the following sections. A complete summary of water quality data including tables and graphs can be found in Appendix D.

4.1.7.2.1 Baseline with NAPI

NAPI impacts include direct discharges of water from irrigation canals and indirect discharges from irrigation return flows. Direct discharge events are highly variable, occur quickly, and can last up to 12 hours causing significant erosion and sediment transport in the channel (NTEC 2013, Part 6 Sect. 41). The indirect NAPI related discharges result in leaching of the unconfined geologic surface formations and soils. NAPI impacts increase the already highly variable hydrologic balance and further decrease the potential for changes to the hydrologic balance as a result of mining. Quantitative data to characterize NAPI impacts is being collected as part of the surface water monitoring plan. For the purpose of this CHIA analysis, the results of NAPI discharges are taken into account when evaluating baseline surface water conditions for Chinde Wash and Cottonwood Arroyo.

A comparison of median baseline values at NAPI influenced stations on Chinde Wash and Cottonwood Arroyo to median baseline values at stations without NAPI influence on Pinabete Arroyo and No Name Wash showed that values were relatively consistent for aluminum, pH, and selenium. Aluminum and total iron values were relatively higher at non-NAPI influenced stations, whereas values were higher at NAPI influenced stations for barium, boron, cadmium, chloride, chromium, fluoride, lead, nitrate, silver, sulfate, TDS, zinc, conductivity, and manganese. Total Suspended Solids (TSS) was highest along Cottonwood Arroyo and lowest along Chinde Wash.

4.1.7.2.1.1 Chinde Wash

Surface water quality data is available on Chinde Wash at four monitoring stations which bracket the lease area; CD-2 and CD-2A downstream of the mine and CD-1 and CD-1A upstream of the mine (Figure

17). Water quality data was collected at CD-1 and CD-2 from 1986 to 1997 and at CD-1A and CD-2A from 1996 to present. There is no pre-mining data on Chinde Wash, however, CD-1 and CD-1A can be considered as baseline as they are upstream of the mine. It is important to note that while upstream of mining, CD-1 and CD-1A are both downstream of NAPI activities, and there is no pre-NAPI data on Chinde Wash. Chinde Wash is subject to both direct and indirect NAPI influences. Direct discharge events for the streams are highly variable, occur quickly, and can last up to 12 hours causing significant erosion and sediment transport in the channel. The indirect NAPI related discharges are a result of return flows to the wash caused by the infiltrating irrigation water, and most likely result in the continuous baseflow within Chinde Wash. TSS values are most likely lowest along Chinde Wash as some samples are taken during baseflow, whereas all TSS values for other drainages correspond to periodic high flow events. NAPI irrigation return waters leach the unconfined surface formations resulting in greater dissolved solids concentrations in base flow (NTEC 2013, Part 6 Section 41).

Baseline water quality data at CD-1 and CD-1A was found to have a relatively higher variability than that of Chaco River where the median percent relative standard deviation for all constituents was 85. Baseline water quality within Chinde Wash occasionally exceeded NNEPA and other relevant livestock watering criteria. Specifically fluoride, TDS, sulfate, lead, and selenium exceeded livestock criteria for 16%, 4%, 16%, 0.35%, and 0.29% of all samples respectively. Cadmium, chromium, lead, selenium, silver and zinc exceeded NNEPA acute aquatic and wildlife habitat standards for 4, 100, 0.3, 1, 2, and 64 percent of all samples respectively. Aluminum, cadmium, chromium, lead, selenium, and zinc exceeded NNEPA chronic aquatic and wildlife habitat standards for 27, 100, 2, 65, 76, and 64 percent of all samples respectively. Lead exceeded NNEPA secondary human contact criteria for 4% of all samples and arsenic exceeded NNEPA fish consumption criteria for 35% of all samples. Median cadmium, lead, selenium and zinc concentrations were 6, 2, 1.4, and 2 times greater than NNEPA chronic aquatic and wildlife habitat criteria. Median chromium and zinc concentrations were 16 and 2 times greater than NNEPA acute aquatic and wildlife habitat criteria. Arsenic, aluminum and selenium median values are below all criteria indicating that the criteria exceedances are generally more characteristic of the high variability in the data set as compared to the general water quality. Therefore baseline surface water quality within the Chinde Wash as compared to NNEPA and other relevant criteria is considered generally appropriate for the designated post-mining land use of livestock grazing. However, elevated levels of cadmium, chromium, lead, and zinc were found relative to aquatic and wildlife habitat and fish consumption NNEPA criteria. One sample or approximately 0.5 percent of all samples exceeded the SMCRA dissolved iron standard; however, the median dissolved iron concentration of 0.2 mg/L is fifty times smaller than the criterion.

4.1.7.2.1.2 Cottonwood Arroyo

Surface water quality data was collected on the Cottonwood Arroyo from 1990 to 1999 at three monitoring stations CN-1 along the North Fork upstream of the mine, CNS-1 downstream of mining, and CS-1 along the main stem within the mine lease area (Figure 17). All data was collected prior to mining in the area. It is important to note that while data is pre-mining there is no pre-NAPI data along the Cottonwood Arroyo. Cottonwood Arroyo is not subject to indirect NAPI irrigation return flows, but NAPI does directly discharge from irrigation canals into the North Fork, therefore monitoring station CN-1 and the downstream monitoring station CNS-1 are both influenced by NAPI, whereas station CS-1 is not. Direct discharge events are highly variable, occur quickly, and can last up to 12 hours causing significant erosion and sediment transport in the channel. These recurrent higher flow NAPI discharges could be the cause of higher TSS levels in Cottonwood Arroyo as compared to non-NAPI influenced drainages to the south. The Cottonwood Arroyo is geochemically impacted by NAPI as evident through the increased mineralization deposited on the stream banks as a result of seeps in the upper reaches, resulting in highly variable increases in water quality parameter concentrations.

Baseline data at CN-1, CNS-1, and CS-1 was found to have a relatively higher variability than that of the Chaco River or Chinde Wash where the median percent relative standard deviation for all constituents was 108. Baseline water quality pH within Cottonwood Arroyo dropped below the NNEPA criteria range once at both CN-1 and CNS-1. Arsenic exceeded NNEPA criteria for all five categories for 0.5% of all samples. Cadmium exceeded NNEPA fish consumption criteria for 0.4% of all samples, and lead exceeded NNEPA livestock and secondary human contact criteria for 0.3% and 20% of all samples respectively. Additionally, nitrate, sulfate and TDS exceeded livestock criteria for 38%, 3%, and 4% of all samples respectively. NNEPA acute aquatic and wildlife habitat criteria where exceeded for arsenic, cadmium, chromium, lead, silver, and zinc for 0.5, 2, 100, 1, 1, and 77 percent of all samples respectively. NNEPA chronic aquatic and wildlife habitat criteria where exceeded for arsenic, cadmium, chromium, lead, selenium, and zinc for 0.5, 100, 5, 78, 64, and 77 percent of all samples respectively. Median concentrations for chromium and zinc were 16 and 3 times greater respectively than NNEPA acute aquatic and wildlife habitat criteria. Median concentrations for cadmium, lead, selenium and zinc were 6, 2, 1.25, and 3 times greater respectively than NNEPA chronic aquatic and wildlife habitat criteria. All other median values are below all criteria indicating that the criteria exceedances are generally more characteristic of the high variability in the data set as compared to the general water quality. Therefore baseline surface water quality within the Cottonwood Arroyo, as compared to NNEPA and other relevant criteria, is considered generally appropriate for the designated post-mining land use of livestock grazing. However, elevated levels of cadmium, chromium, lead, selenium and zinc were found relative to aquatic and wildlife habitat NNEPA criteria. Thirty samples or approximately 15 percent of all samples exceeded the SMCRA dissolved iron standard; however, the median dissolved iron concentration of 0.5 mg/L is twenty times smaller than the criterion.

Comparison of median concentrations at each station showed that barium, cadmium, chromium, lead, nitrate, pH, selenium, silver, zinc and manganese concentrations were approximately equal across all stations. Arsenic, boron and total iron were all lowest on the North Fork (CN-1). Arsenic was approximately equal on the main fork within the mine lease (CS-1) and downstream of the lease area (CNS-1), boron was highest downstream of mining (CNS-1), and iron was highest along the main fork within the lease area (CS-1). Chloride, sulfate, TDS, TSS and conductivity were all highest along the North Fork (CN-1) upstream of the lease area.

4.1.7.2.2 Baseline without NAPI

Surface water quality data was collected on Pinabete Arroyo and No Name Wash at upper and lower stations in 1998 and from 2007 to 2008, where all stations are within the mine lease area (Figure 17). All data is pre-mining in the area and neither drainage is impacted by NAPI activities. Baseline data on Pinabete and No Name was found to have a relatively higher variability than that of the Chaco River where the median percent relative standard deviation for all constituents was 86 for Pinabete Arroyo and 77 percent for No Name Wash. This places Pinabete Arroyo at roughly the same variability as Chinde Wash and No Name Wash at a relatively lower variability. Both Pinabete Arroyo and No Name Wash express less variability in water quality than Cottonwood Arroyo.

There were no exceedances of NNEPA secondary human contact criteria. Aluminum, cadmium, copper, lead, mercury, selenium and zinc exceeded NNEPA chronic aquatic and wildlife habitat criteria for 41, 23, 7, 3, 100, 56, and 7 percent of all samples respectively. Aluminum, cadmium, chromium, and zinc exceeded NNEPA acute aquatic and wildlife criteria for 7, 8, 46, and 7 percent of all samples respectively. Cadmium and zinc NNEPA fish consumption standards were also exceeded for 8% and 3% of all samples respectively. Cadmium also exceeded NNEPA livestock criteria for 4% of all samples and TDS exceeded criteria for 7% of all samples. Median concentrations for mercury and selenium were 100 and 1.25 times greater respectively than NNEPA chronic aquatic and wildlife habitat criteria. All other median values are below all criteria indicating that the criteria exceedances for these parameters are generally more characteristic of the high variability in the data set as compared to the general water quality. Therefore baseline surface water quality within Pinabete and No Name as compared to NNEPA and other relevant criteria is considered generally appropriate for the designated post-mining land use of livestock grazing. However, elevated levels of mercury and selenium were found relative to aquatic and wildlife habitat NNEPA criteria. There were no exceedances of the SMCRA dissolved iron standard along No Name Wash. One sample along Pinabete Arroyo or approximately 4 percent of all samples exceeded the SMCRA dissolved iron standard; however, the median dissolved iron concentration of 0.12 mg/L is 80 times smaller than the criterion.

Cadmium, pH, and selenium were relatively consistent across Pinabete Arroyo. Chloride and pH were relatively consistent across No Name Wash. Aluminum and copper median values were higher at upper stations, whereas barium, boron, lead and manganese median values were all higher at lower stations for both Pinabete Arroyo and No Name Wash. Along Pinabete Arroyo arsenic, chloride, fluoride, nitrate, sulfate, TDS, TSS and conductivity median values were higher at upper stations; whereas chromium, silver, zinc and iron median values were all higher at lower stations. Along No Name Wash cadmium, chromium, silver, zinc, and iron median values were higher at upper stations; whereas arsenic, fluoride, nitrate, selenium, sulfate, TDS, TSS and conductivity median values were all higher at lower stations.

4.2 Ground Water

Since mining at the Navajo Tribal Coal Lease started in 1963, before SMCRA became law in 1977, baseline hydrologic monitoring data generally does not exist for Area I and portions of Area II of the Navajo Mine. Nevertheless, the "GM-" monitoring wells installed in the late 70's provide baseline information for Areas III, IV, V, and portions of Area II. Many of the GM wells have been mined through or reclaimed and additional monitoring wells were installed during the mid 80's. Monitoring wells were installed in 1998 and in 2007 for baseline characterization of Areas IV South and V. Groundwater monitoring locations can be seen on Figure 19.

4.2.1 Ground Water Regulatory Requirements

30 CFR 816.41(h) states that a water supply of an owner of interest used for domestic, agricultural, industrial, or for other legitimate use that is adversely impacted by contamination, diminution, or interruption proximately resulting from surface mining activities shall be replaced. The Fruitland and PCS formations are utilized in oil production west of the lease area, and the alluvial aquifer has limited use as a livestock watering supply.

4.2.2 Chaco River Alluvium

Data was collected along the Chaco River alluvium from 1974 to 1977 at GM-24 located between the No-Name and Pinabete confluences, GM-25 located upstream of No Name Wash, and GM-34 located upstream of the NTEC lease. The Chaco River alluvium is mostly saturated across the length of the lease area and provides limited stock water supply at several dug wells as shown in Figure 12. The Chaco River alluvium had water for all sampling events at GM-34 upstream of the lease area, for 67% of all sampling events downstream of No Name Wash, and for 87.5% of sampling events at GM-24 between No Name Wash and Pinabete Arroyo. The characterization of Chaco River alluvial quantity was limited to the percent of dry sampling events as no water elevation data was available.

Groundwater use in the groundwater CIA is limited in extent and is mostly derived from wells completed within surficial valley-fill deposits of Quaternary age, or alluvium. Water derived from alluvial wells is predominantly used for livestock watering. Given the predominant use of alluvial waters for livestock watering and the designated post-mining land use of livestock grazing, alluvial baseline quality will be evaluated in part by comparison to applicable livestock watering criteria (Table 3). The criteria are not enforceable standards with respect to groundwater and are included only as a reference for the suitability of the groundwater quality for livestock use.

Baseline alluvial quality data was found to have a higher variability compared to surface water quality where the median %RSD for all constituents was 127 or 2.9 times greater than the surface water %RSD. A general comparison of median concentrations across different wells within the alluvial systems showed the following. The Chaco River alluvium pH was relatively consistent across all sites. Moving downstream along the Chaco River, selenium and nitrate tended to increase while arsenic, copper, mercury and zinc tended to decrease, and other constituents did not show any apparent trend.

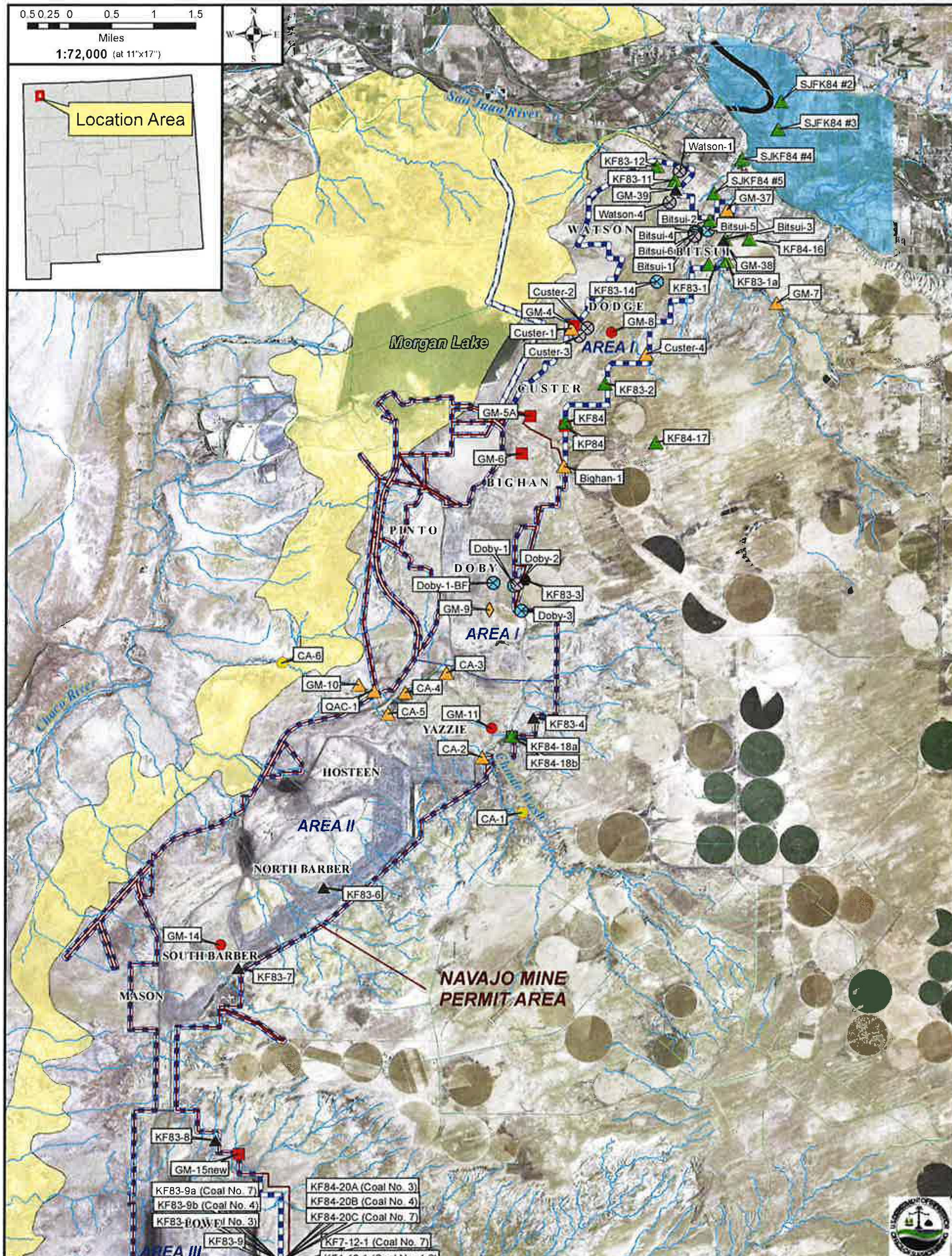
All pH values for all other Chaco River alluvial samples were within the appropriate range. Arsenic, lead, selenium, chloride, fluoride, sulfate, and TDS exceeded livestock criteria for the Chaco River for 21%, 5%, 16%, 11%, 6%, 67% and 72% of all samples respectively. Median values for arsenic, lead, selenium, chloride, and fluoride were below the criteria indicating that the criteria exceedances are generally more characteristic of the high variability in the data set as compared to the general water quality. Median sulfate and TDS values exceed the livestock criteria. Based on these relevant use criteria, the water in the alluvium systems is a poor source of supply for livestock watering use. This is especially apparent when considering sulfate and TDS concentrations. These water quality parameters often exceed relevant criteria for livestock use, although the alluvium has been historically and is currently used for this purpose.

4.2.3 **Historic Mining Area North of Navajo Mine and Pinabete Permit Areas**

Two alluvial wells exist along drainages that are tributary to Morgan Lake; data was collected from 1996 to 2000 at Custer-1 located along the western lease boundary, and Custer-4 located within the NTEC lease area close to the eastern lease boundary. The Custer wells were not monitored prior to mining impact in the area and can therefore not be used for baseline characterization. Two additional alluvial wells exist along Bitsui Wash; data was collected from GM-7 from 1975 to 1976 and no data is available at GM-37. GM-7 is located upstream of mining and can therefore be used for baseline characterization. The Bitsui Wash alluvium had water for all sampling events at GM-7 upstream of the lease area. No water elevation data was available for characterization of Bitsui Wash alluvial quantity.

Only four samples were collected at GM-7 from 1975 to 1976. Baseline alluvial quality data was found to have a lower variability compared to surface water quality where the median %RSD for all constituents was 70% less than the surface water %RSD. All pH values for all other Bitsui Wash alluvial samples were within the appropriate range. Arsenic, selenium, chloride, fluoride, sulfate, and TDS exceeded livestock criteria for the Chaco River for 25%, 25%, 25%, 100%, 75% and 25% of all samples respectively. Median values for arsenic, selenium, chloride, and TDS were below the criteria indicating that the criteria exceedances are generally more characteristic of the high variability in the data set as compared to the general water quality. Median fluoride and sulfate values exceed the livestock criteria. Based on these relevant use criteria, the water in the alluvium systems is a poor source of supply for livestock watering use. This is especially apparent when considering fluoride and sulfate concentrations. These water quality parameters often exceed relevant criteria for livestock use, although the alluvium has been historically used for this purpose.

No pre-mining Fruitland data is available in this area. However, there is post-mining data for the #8 coal seam. The Fruitland formation outcrop is located to the north of this area and this is the point of discharge to the San Juan alluvium. No pre-mining PCS data is available in this area. However, there is limited post-mining data for the PCS. Post-mining data along with modeling efforts has been made by the coal operator and OSMRE to assess post-mining conditions and impact potential for this area. This analysis is completed in section 5.3.5



Legend

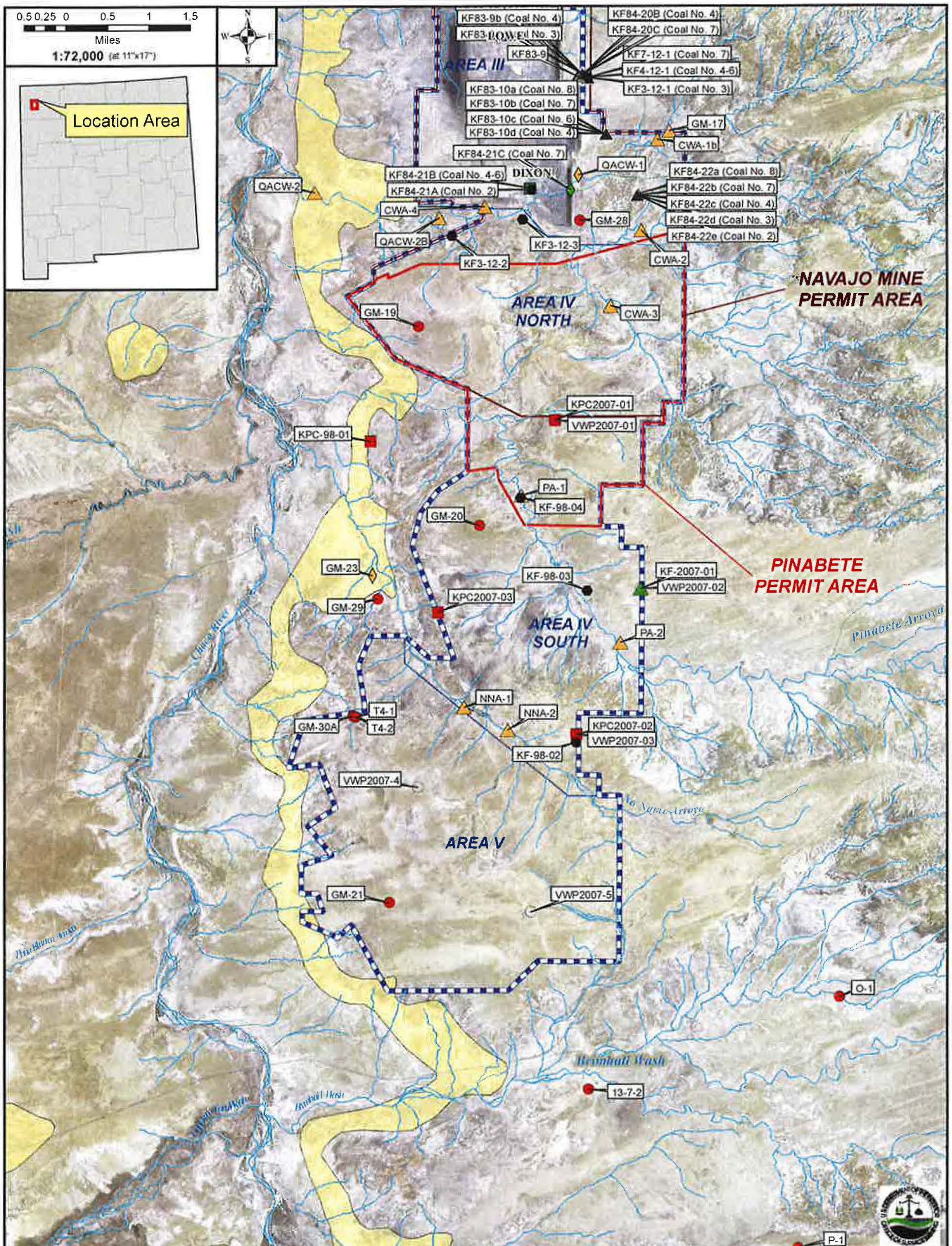
- San Juan Alluvium above Fruitland Formation Outcrop
- Approximate Coal Subcrop[2]
- Pictured Cliffs Formation (Kpc)
- Proposed Monitoring Well
- Abandoned Alluvial Monitoring Well
- Existing Alluvial Monitoring Well
- No. 2 Coal Monitoring Well
- No 3. Coal Monitoring Well
- No. 4 Coal Monitoring Well
- No. 4 - 6 Coal Monitoring Well
- No. 6 Coal Monitoring Well
- No. 7 Coal Monitoring Well
- No. 8 Coal Monitoring Well
- Fruitland Well or Nested Wells
- Abandoned PCS Monitoring Well
- Existing PCS Monitoring Well
- Backfill Monitoring Well
- CCB Monitoring Well
- Nested Vibrating Wire Piezometer
- Pinabete Permit Area
- Navajo Mine Permit Area
- Coal Lease Area
- *RESOURCE AREAS*
- Natural Stream[1]
- Artificial Canal/Ditch[1]
- PIT NAMES

Data Sources:
Aerial Photography (San Juan County) 2009
[1] USGS National Hydrography Dataset
[2] NMBMMR RM-19 Beaumont 1998

Coordinate System:
StatePlane New Mexico West
North America Datum 927
Feet

Groundwater Monitoring Locations

Figure 19
(pg 1 of 2)



Legend

- San Juan Alluvium above Fruitland Formation Outcrop
- Approximate Coal Subcrop[2]
- Pictured Cliffs Formation (Kpc)
- Proposed Monitoring Well
- Abandoned Alluvial Monitoring Well
- Existing Alluvial Monitoring Well
- No. 2 Coal Monitoring Well
- No 3. Coal Monitoring Well
- No. 4 Coal Monitoring Well
- No. 4 - 6 Coal Monitoring Well
- No. 6 Coal Monitoring Well
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PIT NAMES

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Coordinate System:
StatePlane New Mexico West
North America Datum 927
Feet

Groundwater Monitoring Locations

Figure 19
(pg 2 of 2)

4.2.4 **Navajo Mine and Pinabete Permit Areas**

4.2.4.1 **Alluvial Baseline Quantity**

Alluvial quantity was assessed using two methods, the percent of all sampling events which were dry and the water elevation in feet above Mean Sea Level (MSL). Water elevation was not collected for all samples; however, inference of water presence was based on the presence of water quality data. Therefore the total number of samples used to calculate the percent of dry sampling events is often higher than the number of samples used for the water elevation comparisons. Given data availability baseline quantity could only be characterized for the Chaco River, No Name Wash, Pinabete Arroyo and Cottonwood Arroyo.

One alluvial well, Bighan-1, exists along drainages that are tributary to Morgan Lake within the permit area; data was collected from 1995 to 2001 at this location along the eastern lease boundary just south of the permit boundary. The location of Bighan-1 along the eastern mine permit boundary suggests that the well would be representative of baseline; however, it was installed after mining impact in the area. For these reasons it is unclear if this well should be included as baseline, and it will be analyzed in Ch. 5 of this CHIA assessment.

Along Chinde Wash alluvial data was collected from 1979 to 1980 at GM-9 within the Navajo Tribal Coal Lease, from 1985 to present at QAC-1 at the western mine lease boundary, and from 1975 to 1982 at GM-10 just downstream of QAC-1. Wells along Chinde Wash were not monitored prior to mining impact in the area and can therefore not be used for baseline characterization.

Alluvial data was collected along Cottonwood Arroyo, from 1975 to 1982 at GM-17 along the North Fork at the eastern lease boundary, from 1985 to 1998 at QAC-1 along the North Fork downstream of GM-17 in Area III, during 1975 at GM-16 along the North Fork just upstream of the confluence with the Main Fork, from 1986 to 1999 at QACW-2B just downstream of the western lease boundary, and from 1974 to 2008 at QACW-2 downstream of QACW-2B. Cottonwood Arroyo alluvium was found to be variably saturated, and is known to provide limited stock water supply at wells shown in Figure 12, specifically W-0644 (QACW-2B), which is not owned by NTEC and has been used for stock water supply. QACW-2B and GM-17 had water for all sampling events, QACW-2, QACW-1, and GM-16 had water for 66%, 54%, and 50% of all sampling events.

Data was collected along No Name Wash alluvium during 1975 at GM-23 located just upstream of the Chaco River confluence, and during 1998, 2007 and 2008 at NNA-1 and NNA-2 located within the NTEC lease where NNA-1 is downstream of NNA-2. No Name Wash alluvium was found to be mostly dry where both NNA-2 was found to be dry for all sampling events; however, NNA-1 had water for 27% of all sampling events.

Along Pinabete alluvial data was collected from 1974 to 1977 at GM-22 located upstream of the NTEC lease, and during 1998, 2004, 2007 and 2008 at PA-2 located just west of the eastern lease boundary, and PA-1 located within the lease downstream of PA-2. Pinabete alluvium was found to be mostly saturated, and is known to provide limited stock water supply at wells shown in Figure 12. PA-2 and GM-22 had water for all sampling events and PA-1 had water for 96% of all sampling events. Estimated hydraulic conductivities based on aquifer test results for the Pinabete Arroyo alluvium are 51.3 ft per day (ft/day) (1.8 x 10-2 cm per second (cm/sec)) at PA-1 and 10.7 ft/day (3.8 x 10-3 cm/sec) at PA-2. Both are within the range expected for clean sand and considerably higher than the bedrock values in the area. Well yields from the alluvium, however, are limited by a very low saturated thickness of about 5 ft or less (NTEC 2013, Appendix 18.N).

Water elevation data was available for Cottonwood Arroyo, Pinabete Arroyo and No Name Wash, although not at any of the GM historic monitoring locations. The percent relative standard deviation for water elevation data showed that Cottonwood had the highest variability where the %RSD was 6 times greater than that of No Name and 2.5 times greater than that of Pinabete. The relatively higher variability of water elevation levels in Cottonwood Arroyo may in part be due to NAPI discharges which have generated high variability in surface water flows. Under baseline conditions the alluvial systems of both Cottonwood and Pinabete Arroyos have decreasing water levels as you move downstream. No Name however, had no water for any sampling events for the upstream well but had water for 27% of sampling events at the downstream well. This could in part be due to the influence of tributary drainages which confluence with the main channel in between the two wells. More detailed alluvial quantity data including graphs and tables can be found in Appendix F.

4.2.4.2 **Alluvial Baseline Quality**

Groundwater use in the vicinity of the Navajo Tribal Coal Lease is limited in extent and is mostly derived from wells completed within surficial valley-fill deposits of Quaternary age, or alluvium. Water derived from alluvial wells is predominantly used for livestock watering. Given the predominant use of alluvial waters for livestock watering and the designated post-mining land use of livestock grazing, alluvial baseline quality will be evaluated in part by comparison to applicable livestock watering criteria (Table 3). The criteria are not enforceable standards with respect to groundwater and are included only as a reference for the suitability of the groundwater quality for livestock use. Alluvial quality data was not collected at GM-23 and NNA-2 along No Name Wash and at GM-16 and QACW-1 along Cottonwood Arroyo as they were either dry or had insufficient water for sampling during baseline monitoring. Generally the alluvial systems are of sodium-sulfate type with variable TDS concentrations.

Baseline alluvial quality data was found to have a higher variability compared to surface water quality for all drainages except No Name Wash, where the median relative percent standard deviations for all constituents was 142, and 121 for the Pinabete Arroyo and Cottonwood Arroyo respectively or 1.7, and 1.1 times greater than their respective surface water %RSDs. The median %RSD for all constituents for No Name Wash alluvium was 68 or roughly 10% less than the respective surface water %RSD. A general comparison of median concentrations across different wells within the alluvial systems showed the following. The Pinabete Arroyo alluvium pH was relatively consistent across all sites. Moving downstream along Pinabete Arroyo, iron and mercury tended to increase while arsenic, boron, cadmium, copper, lead, selenium, zinc, and nitrate tended to decrease, and other constituents did not show any apparent trend. Moving downstream along the Cottonwood Arroyo alluvium pH, selenium, and fluoride tended to increase while boron, manganese, mercury, nitrate, sulfate and TDS tended to decrease, and other constituents did not show any apparent trend. No comparison was made along the No Name Wash alluvium as only one well had sufficient water for sampling.

Baseline water quality pH within the Cottonwood Arroyo alluvium dropped below the livestock criteria range once at GM-17, however, all other pH values for all other alluvial samples were within the appropriate range. Arsenic, selenium, chloride, fluoride, sulfate and TDS exceeded livestock criteria for the Cottonwood Arroyo alluvium for 6%, 4%, 3%, 26%, 91% and 55% of all samples respectively. All median values for arsenic, selenium, chloride and fluoride were below the criteria indicating that the criteria exceedances are generally more characteristic of the high variability in the data set as compared to the general water quality. The median sulfate and TDS values exceed the livestock criteria. Based on these relevant use criteria, the water in the Cottonwood Arroyo alluvium system is a poor source of supply for livestock watering use. This is especially apparent when considering sulfate and TDS concentrations. These water quality parameters often exceed relevant criteria for livestock use, although the alluvium has been historically and is currently used for this purpose.

All pH values for all samples within the Pinabete Arroyo alluvium were within the appropriate range. Arsenic, selenium, chloride, fluoride, sulfate and TDS exceeded livestock criteria for the Pinabete Arroyo alluvium for 5%, 4%, 4%, 86%, 75% and 46% of all samples respectively. All median values for arsenic, selenium, and chloride were below the criteria indicating that the criteria exceedances are generally more characteristic of the high variability in the data set as compared to the general water quality. The median fluoride, sulfate and TDS values exceed the livestock criteria. Based on these relevant use criteria, the water in the Pinabete Arroyo alluvium system is a poor source of supply for livestock watering use. This is especially apparent when considering fluoride, sulfate and TDS concentrations. These water quality parameters often exceed relevant criteria for livestock use, although the alluvium has been historically and is currently used for this purpose.

All pH values for all samples within the No Name Wash alluvium were within the appropriate range. Sulfate and TDS exceeded livestock criteria for the No Name Wash alluvium for 100% and 100% of all samples respectively. The median sulfate and TDS values exceed the livestock criteria. Based on these relevant use criteria, the water in the No Name alluvium system is a poor source of supply for livestock watering use. This is especially apparent when considering sulfate and TDS concentrations. These water quality parameters often exceed relevant criteria for livestock use, although the alluvium has been historically and is currently used for this purpose.

4.2.4.3 **Fruitland Formation Baseline Quantity**

Only a small amount of groundwater is found in the coal units of the Fruitland Formation and in the PCS, which underlies the Fruitland Formation at the Navajo Mine site. The geologic strata within the permit and adjacent area dip gently to the east toward the center of the San Juan Watershed at an angle of 1 to 2 degrees. Based on both regional and site-specific information, the Fruitland Formation and associated coal units, and the PCS are unsaturated or partially saturated near the outcrop of these units on the western side of the Navajo Tribal Coal Lease area but become saturated to the east and down dip of the outcrop.

The Fruitland Formation has been mined extensively throughout the history of the Navajo Mine. Most of the wells that were present at one time or another have been mined through or abandoned, making the monitoring program inconclusive with respect to the finer details of how groundwater flow has been affected at the mine site. Modeling efforts and other estimates have been made by the coal operator to determine (1) what the pre-mining groundwater flow conditions were like in the Fruitland Formation and (2) what the post-mining conditions will likely be for this aquifer.

Based on baseline information obtained from water level elevations measured in the wells and piezometers, the general groundwater flow directions in the Fruitland Formation within Areas III, IV and V of the NTEC coal lease are vertically downward through the interbedded shale and coal units of the Fruitland Formation and into the PCS and laterally within individual coal seams toward the north-northeast with some localized flow toward the topographic lows along Cottonwood and Pinabete Arroyos (NTEC 2013, Appendix 18-E).

Direct recharge rates measured by chloride mass balance methods on undisturbed areas of the lease area ranged from 0.002 to 0.09 in/yr (Stone, Phase-III Recharge Study at the Navajo Mine - Impact of Mining on Recharge 1987). The highest recharge rate of 0.09 in/yr was for valley terraces while the lowest recharge rate of 0.002 in/yr was for badland areas. Recharge from upland flats averaged 0.03 in/yr. Recharge is expected to be higher from saturated alluvium and surface water impoundments. Although Stone's research (1986 and 1987) did not include recharge estimates for surface impoundments, it does provide an estimate of an average recharge rate of 0.16 in/yr from depressions within reclaimed mine areas at the Navajo Mine (NTEC 2013, Appendix 18-E).

Baseline potentiometric elevations measured in the wells in Areas IV and V were recorded by NTEC. The potentiometric surface for the No. 3 coal seam is provided in Figure 20. This potentiometric surface was constructed from the baseline potentiometric elevations for the No. 3 coal seam presented in Navajo Mine and Pinabete PAP's and the July 1989 baseline potentiometric elevations measured in the No. 3 coal wells located within Area III. The modeled baseline potentiometric surface for the No. 3 coal was also used to estimate the potentiometric contours beyond the limits of the monitoring data. The potentiometric gradient in the No. 3 coal seam indicates groundwater flow components toward the north-northeast with local gradients toward Pinabete Arroyo and Cottonwood Arroyo. The lower coal seams pinch out and do not extend north of Area III. The groundwater moving perpendicular to the potentiometric gradients to the northeast flows through the undifferentiated Fruitland Formation into either the upper coal units or into the underlying PCS (NTEC 2013, Appendix 18.E).

Potentiometric gradients in the other coal seams within Areas III, IV, and V of the coal lease area are expected to be generally toward the northeast, similar to the gradients shown for No. 3 coal. However, the upper coal seams (No. 6, No. 7, and No. 8) outcrop to a greater extent within the valleys of Pinabete Arroyo, No Name Wash, and Cottonwood Arroyo within the coal lease area. The groundwater associated with these upper coal seams is expected to show greater local influence from the topographic lower elevations along the arroyos. The local influence of topography on potentiometric gradients was greatest for the shallowest coal, the No. 8 seam. Field observations of salt deposits and enhanced vegetation production also indicate that local discharge may occur from the No. 8 coal at the coal outcrop along Pinabete Arroyo. Baseline groundwater model simulations and potentiometric elevations at wells within the No. 8 coal seam were used to prepare the potentiometric surface in Figure 21. The modeled baseline potentiometric surface for the No. 8 coal was also used to estimate the potentiometric contours beyond the limits of the monitoring data. Higher hydraulic conductivities are characteristic of the higher coal units (No. 7 and No. 8) relative to the lower coal units (No. 2, No. 3, and No. 4-6) (NTEC 2013, Appendix 18-E).

4.2.4.4 **Fruitland Formation Baseline Quality**

Groundwater use in CIA is limited in extent, and water derived from the Fruitland formation has no known use within the vicinity of the coal lease area other than for oil and gas extraction to the west of the coal lease area. This is in part due to the very low well yields within the Fruitland system within the general area of the mine lease, which do not tend to support beneficial use. However, given the designated post-mining land use of livestock grazing, Fruitland baseline quality will be evaluated in part by comparison to livestock watering criteria (Table 3). The criteria are not enforceable standards with respect to groundwater and are included only as a reference for the suitability of the groundwater quality for livestock use. Fruitland water quality will only be evaluated for pH, conductivity, boron, total iron, manganese, selenium, chloride, fluoride sulfate, and TDS, as these parameters most generally define water quality and tend to be of concern within the region as evident in both the surface water and alluvial analysis. Generally water quality monitoring data from Fruitland Formation coal wells show that baseline groundwater in the coals is very saline (NTEC 2013, Appendix 18-E).

Fruitland water quality data has been collected at several historic and current locations as seen on Figure 19. All data collected from Areas IV and V and all data collected prior to 2001 within Area III and II is considered to be baseline relative to quality because during mining gradients within the Fruitland were towards the mine pits therefore impact to water quality would be minimal. This data used to characterize baseline Fruitland quality within the lease area consists of samples collected at 12 well locations from 1984 to 2008 as follows; KF2007-01 from 2007 to 2008, KF98-02 from 1998 to 2008; KF84-21A, KF84-22B, and KF84-20A from 1984 to 2001; KF84-21C, KF84-22D, and KF84-22E during 1984; KF84-22A from 1991 to 2001; KF84-20C and KF84-18A from 1985 to 2001; KF84-18B from 1984 to 2000.

Baseline Fruitland quality data was found to have a lower variability compared to alluvial water quality, and the median relative percent standard deviations for all constituents was 58 for the baseline coals within the lease area. Comparison of median concentrations across wells within the Fruitland baseline within the lease area showed a general trend where moving towards the northeast from Area V to II; conductivity, TDS, chloride, manganese and iron tended to increase, whereas sulfate, fluoride, selenium, and pH tended to decrease. The TDS concentrations in the coal units at the Navajo Tribal Coal Lease also typically increase from shallow to deep, whereas sulfate tends to decrease from shallow to deep, which could in part due to sulfate reduction in the groundwater (NTEC 2013, Appendix 18-E).

Baseline Fruitland water quality within the lease area showed that pH, fluoride, and sulfate were not within the range of acceptable criteria for 4%, 16%, and 11% of all samples respectively. Baseline Fruitland quality exceeded the chloride and TDS criteria for 85% and 88% of all samples respectively, where the median concentration for chloride and TDS were 6 times and 2.5 times greater than the criteria, respectively. Based on comparison to livestock criteria, the water in the Fruitland systems would be a very poor source of supply for livestock watering use, specifically because of elevated chloride and TDS concentrations, which are well above livestock criteria.

4.2.4.5 **Pictured Cliffs Sandstone Aquifer Baseline Quantity**

The PCS is a well-cemented, low-permeability, marine sand and is the first water-bearing unit below the Fruitland Formation. The PCS is approximately 110 to 120 ft thick and follows the structure of the Fruitland Formation, dipping to the east at approximately 2 degrees, although the structure varies locally. The PCS conformably overlies the Lewis Shale, with the contact marked by a zone of interbedded sandstones and mudstones in the lower part of the PCS (Stone, Hydrogeology and Water Resources of San Juan Basin, New Mexico 1983). It outcrops just west of the mine lease and east of the Chaco River. The PCS is a marginal water resource due to low permeability, poor water quality, gas production, and low yields. The PCS is also a natural gas reservoir in the San Juan Watershed. Stone et al. (1983) state that the PCS cannot be considered a major aquifer and it is important only because it is the water-bearing horizon immediately underlying the coals in the Fruitland Formation.

The PCS has neither been used as a groundwater source nor has it been extensively affected by the mining activities at the Navajo Mine. NTEC modeled the potentiometric surface and came to some conclusions regarding both baseline and mine-impacted conditions within the PCS. Although the modeling done by NTEC focuses primarily on the areas proposed for mining associated with the Pinabete PAP, the baseline quantity information for the PCS aquifer in this area sufficiently reflects prevalent conditions in other areas of the Navajo Mine.

Well KPC-98-01 was installed in 1998 near the PCS outcrop at the location shown in Figure 19. In 2007, wells KPC2007-01, KPC2007-02, and KPC2007-03 were completed in the PCS at locations around the perimeter of Area IV South. Vibrating Wire Piezometers (VWPs) were installed in the PCS at four of the five locations as shown in Figure 19. A VWP was not installed in the PCS at the VWP2007-03 location because monitoring well KPC2007-02 was installed in the PCS at this location.

The modeled baseline potentiometric surface for the PCS together with the baseline potentiometric elevations from the PCS wells and VWPs were used to prepare the PCS potentiometric surface provided in Figures 15. The measurements of the baseline potentiometric elevations for the abandoned GM wells were obtained in June 1989. The potentiometric surface for the PCS shows overall gradients to the north. The highest potentiometric elevations for the PCS correspond with a structural high in the PCS located within the southeast portion of Area V of the Navajo Tribal Coal Lease. There are also local gradients toward the topographic lows along No Name Wash, Pinabete Arroyo and Cottonwood Arroyo.

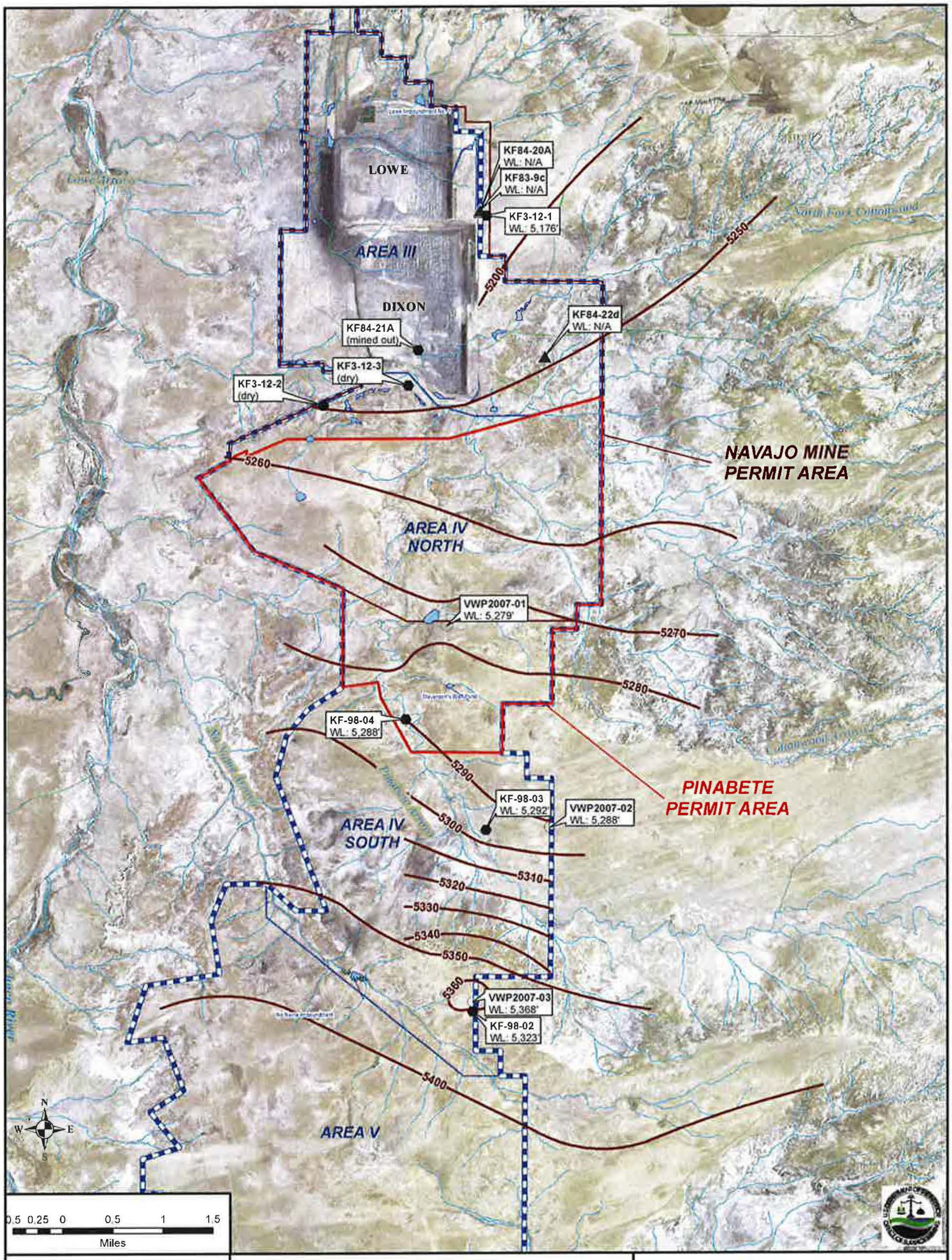
Water yields are quite low from the PCS monitoring wells completed around Navajo Tribal Coal Lease Area IV South. Two of the PCS wells were quickly pumped or bailed dry during conventional sampling. The yield from one of the PCS wells was sufficient to sustain a rate of about 0.4 gallons per minute (gpm) during a constant rate pumping test. The fourth PCS monitoring well was pumped dry after about 140 minutes during a constant-rate pumping test at a rate of about 1 gpm.

4.2.4.6 **Pictured Cliffs Sandstone Aquifer Baseline Quality**

Groundwater use in the vicinity of the Navajo Tribal Coal Lease area is limited in extent, and water derived from the PCS has no known use within the vicinity of NTEC mining operations other than for oil and gas extraction to the north and west of the lease area. This is in part due to the very low well yields within the PCS system within the general area of the mine lease, which do not tend to support beneficial use. However, given the designated post-mining land use of livestock grazing, PCS baseline quality will be evaluated in part by comparison to livestock watering criteria (Table 3). The criteria are not enforceable standards with respect to groundwater and are included only as a reference for the suitability of the groundwater quality for livestock use. PCS water quality will only be evaluated for pH, conductivity, boron, total iron, manganese, selenium, chloride, fluoride sulfate, and TDS, as these parameters most generally define water quality and tend to be of concern within the region as evident in both the surface water and alluvial analysis. Generally water quality monitoring data from PCS show that baseline groundwater is sodium-sulfate type with high TDS concentrations (NTEC 2013, Appendix 18-E).

PCS water quality data has been collected at several historic and current locations as seen on Figure 19. All data collected from Areas IV and V and all data collected during the mid-1970s from the GM series of wells is considered to be baseline relative to quality. This data used to characterize baseline PCS quality within the lease area consists of samples collected at 13 well locations from 1974 to 2008 as follows; KPC-2007-01 from 2007 to 2008, KPC-98-01 in 1998,2007, and 2008; GM-14, GM-15, and GM-8 from 1975 to 1976; GM-19, GM-20, and GM-21 from 1974 to 1979; GM-11 and GM-5 from 1975 to 1977; GM-6 from 1976 to 1977; GM-28 from 1974 to 1976; GM-30A from 1976 to1979. Baseline PCS quality data was found to have a lower variability compared to alluvial water quality, and a higher variability compared to Fruitland water quality, where the median relative percent standard deviations for all constituents was 76.

Comparison of median concentrations across wells within the PCS baseline showed that pH and TDS were relatively consistent across the lease area, other constituents were much more variable, and fluoride and boron tended to increase moving towards the northeast from Area III to I. Baseline PCS water quality showed that pH, boron, selenium, chloride, fluoride, sulfate and TDS were not within the range of acceptable criteria for 19%, 2%, 12%, 61%, 23%, 82% and 98% of all samples respectively. Additionally the median concentration for chloride, sulfate and TDS were 1.6, 2.5 and 2 times greater than the criteria, respectively. Based on comparison to livestock criteria, the water in the PCS would be a very poor source of supply for livestock watering use, specifically because of elevated chloride, sulfate and TDS concentrations, which are well above livestock criteria.



Legend

- Coal 3 Potentiometric Contour
- No 3. Coal Monitoring Well
- Fruitland Well or Nested Wells
- Nested Vibrating Wire Piezometer
- Pinabete Permit Area
- Navajo Mine Permit Area
- Coal Lease Area
- *RESOURCE AREAS*
- Ponds
- Natural Stream[1]
- Artificial Canal/Ditch[1]
- PIT NAMES

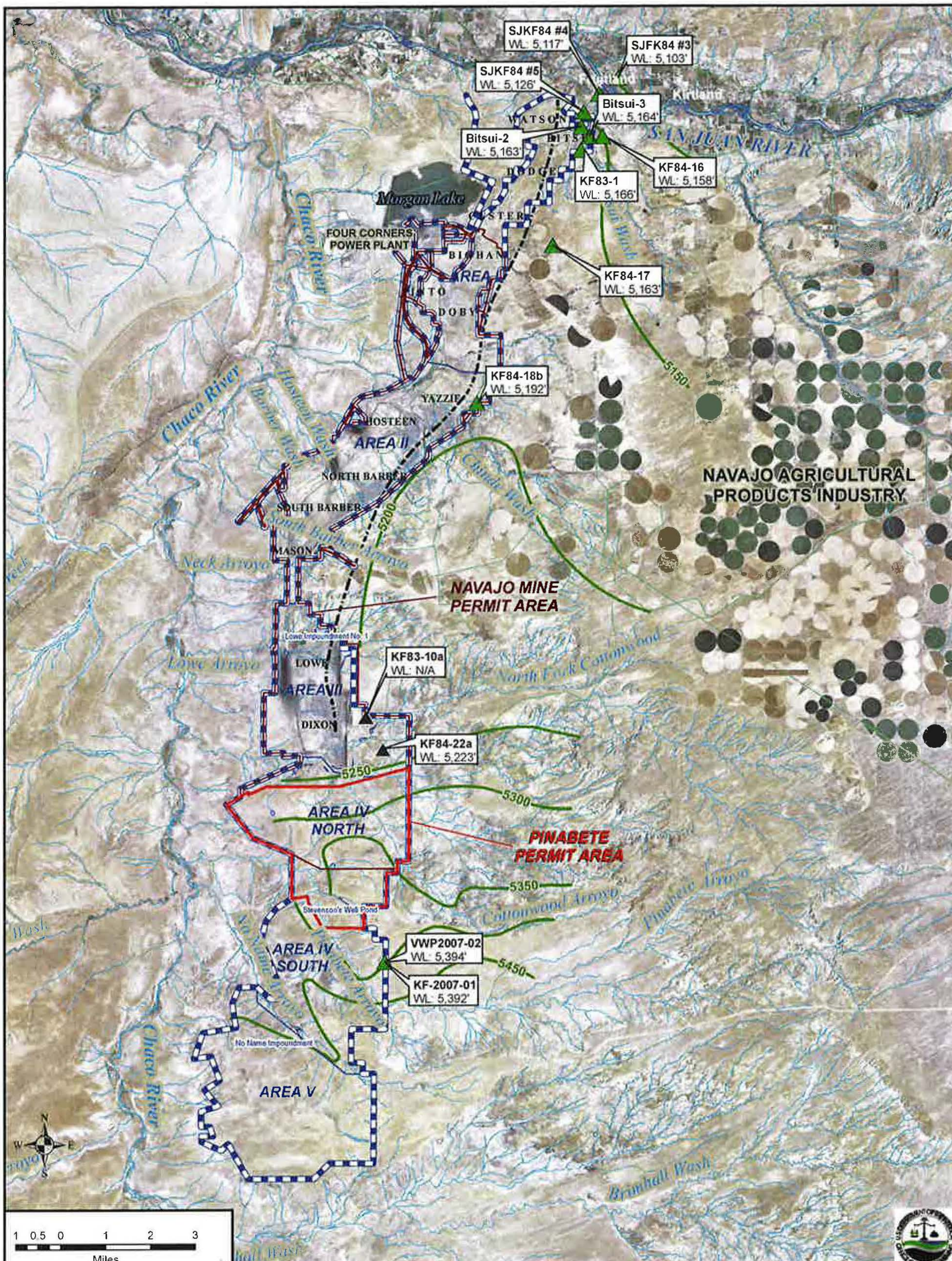
Data Sources:
Aerial Photography (San Juan County) 2009
[1] USGS National Hydrography Dataset

Coordinate System:
StatePlane New Mexico West
North America Datum 927
Feet

1:60,000 (at 11"x17")

No. 3 Coal Seam Potentiometric Surface

Figure 20



Legend

- No. 8 Coal Monitoring Well
- Fruitland Well or Nested Wells
- Nested Vibrating Wire Piezometer
- Coal 8 Potentiometric Contour
- Coal 8 Potentiometric Contour - Inferred
- Saturated/Unsaturated Boundary
- Pinabete Permit Area
- Navajo Mine Permit Area
- Coal Lease Area
- *RESOURCE AREAS*
- Ponds
- Natural Stream[1]
- Artificial Canal/Ditch[1]
- PIT NAMES

Data Sources:
Aerial Photography (San Juan County) 2009
[1] USGS National Hydrography Dataset

Coordinate System:
StatePlane New Mexico West
North America Datum 927
Feet

1:135,000 (at 11"x17")

No. 8 Coal Seam Potentiometric Surface

Figure 21

5 HYDROLOGIC IMPACT ASSESSMENTS

Required by 30 CFR 780.21(g), as the regulatory authority, OSMRE shall provide an assessment of the probable cumulative hydrologic impacts of the mining operation upon surface water and groundwater systems in the cumulative impact area. OSMRE must make a determination that the NTEC operation has been designed to minimize impact within the permit area and prevent material damage outside the permit area. OSMRE must also evaluate that the monitoring program has been appropriately designed to provide the surface water quantity and quality information necessary to assess potential impacts per 30 CFR 780.21(g).

5.1 Minimization of Impact

NTEC outlines impact minimization procedures in the Hydrologic Reclamation Plan of the PAP (NTEC 2013, Part 5 Sect. 35). Minimization of impacts to the hydrologic balance is focused on reducing the disturbance footprint to the extent practical via contemporaneous reclamation. Additionally, local areas of acid forming material are managed through proper chemical characterization and placement, including blending and mixing, of overburden materials. The amount of upgradient surface water commingled with disturbed area drainage is limited utilizing best management practices (BMPs) to contain or divert upgradient flows. Upgradient flows diverted around active mining pits and into downgradient natural channels or upgradient impoundments have been established to contain upstream water runoff. Migration of sediment during storm events is limited utilizing BMPs to contain or treat flows via impoundments downgradient of the mine site. NTEC also minimizes potential effects to the surface water and alluvial groundwater quantity by instituting stream buffer zones when practical to limit disturbances in channel reaches unaffected by mining. These measures are reviewed and approved during the permit application and revision process. The measures provide the highest degree of water management and treatment practicable to maintain designated uses and existing water quality. Additionally, discharges of water from areas disturbed by surface mining activities comply with water quality-based effluent limitations administered through NPDES Permit No. NN0028193. OSMRE finds that the mining operations are designed to minimize impacts within the Navajo Mine and Pinabete Permit areas.

5.2 Monitoring Program

A surface water monitoring plan is provided in the PAP; Section 42. NTEC's surface water monitoring programs are established to monitor surface water quantity and quality at locations where major watercourses enter and leave the permit areas. The monitoring provides the basis for assessment of the impact of mining on the surface water resource and has been developed to collect water quantity and quality information for use in the identification of potential impacts to the prevailing hydrologic regime. The plan identifies the parameters to be monitored, sampling frequency, and site locations. The permit application also complies with NPDES Permit No. NN0028193 (NTEC 2013, Part 6 Sect. 42). Current surface monitoring locations can be seen on Figure 17. A list of surface water sampling parameters is located in the PAPs at Section 42, Table 42.1-2, and includes pH, TDS, TSS, conductivity, settleable solids, total sediment, aluminum, arsenic, boron, calcium, cadmium, chloride, fluoride, total and dissolved iron, lead, total and dissolved manganese, nitrate, potassium, selenium, sulfate, sodium, bicarbonate, and carbonate (NTEC 2013). Additionally, each sample is accompanied with a cation/anion balance for quality assurance. OSMRE finds that the surface water monitoring program has supplied sufficient information to support the required evaluation for material damage potential in this CHIA.

A groundwater monitoring plan is provided in the Navajo Mine PAP; Section42. The groundwater monitoring program was established to monitor groundwater quantity and quality in alluvial systems, the Fruitland formation, and the PCS. The monitoring program provides the basis for assessment of mining impact on groundwater resources and has been developed to collect water quantity and quality information for use in the identification of potential impacts to the prevailing hydrologic regime. The plan identifies the parameters to be monitored, sampling frequency, and site locations (NTEC 2013, Part 6 Sect. 42). Current groundwater monitoring locations are illustrated on Figure 19. A list of groundwater sampling parameters is located in the PAPs at Section 42, Table 42.2-3, and includes TDS, conductivity, pH, water level, calcium, magnesium, sodium, potassium, carbonate, bicarbonate, sulfate, chloride, fluoride, and selenium. **Additionally, each sample is accompanied with a cation/anion balance for quality assurance.** Additional monitoring parameters, are only used if the reference criteria are exceeded, and are found in the Navajo Mine PAP, Chapter 6, Section 6.6.13.2 and footnote 1 of Table 6.5 Additional monitoring parameters include iron, manganese, nitrate, and boron. Table 6.5 lists the reference criteria. **OSMRE finds that the groundwater monitoring program has supplied sufficient information to support the required evaluation for material damage potential in this CHIA.**

5.2.1.1 Monitoring Program Updates

Monitoring programs are periodically updated to enhance the available data sets for predictive analysis. OSMRE approved enhancements to the hydrologic monitoring program in 2012 proposed by BNCC. Monitoring program enhancements are provided in Appendix H and summarized below along with implementation status as of March 2015 (BNCC 2012, MMCo. 2015):

Surface Water:

1. Chinde Wash
    a. One continuous flow gauge will be installed upstream, off lease in the proximity of agricultural fields.
    b. One continuous flow gauge will be installed on-lease, downstream of the "big fill"

    Status: Upstream location CD-1A and downstream location CD-2A have been implemented. Quarterly water quality monitoring is ongoing.
2. Cottonwood Arroyo
    a. Four upstream flow gauges will be installed (one each) along the North Fork, Middle Fork and two branches of the South Fork
        i. Above mentioned upstream gauges will be installed at the outfall of culverts along the proposed Burnham Road re-route
    b. One downstream flow gauge will be installed on an already existing cable structure across the channel; periodic channel surveys will confirm accurate channel cross section
    c. All stations will consist of flow meters to sample flow quantity and water samplers for water quality analysis

    Status: Upstream locations CN-2, CM-2, CS-2A, CS-2B and downstream location CNS-1 have been implemented. Quarterly water quality monitoring is ongoing and flow meters have been installed.

Groundwater:

1. Bitsui Area – used on part to evaluate the Area I groundwater model
    a. Existing well Bitsui-2 will be used for #8 seam groundwater level monitoring and for groundwater sampling.
    b. Existing wells KF84-16 and KF83-1 will be used for monitoring #8 seam groundwater levels.

    Status: Quarterly water quality and water level monitoring at Bitsui-2, and quarterly water levels at KF84-16 and KF83-1 were reinstated in 2012. Monitoring is ongoing.
2. Chinde Wash Area
    a. One off-lease, upstream pre-packed well (CA-1) will be installed via hand augur
    b. CA-2 will be installed near the lease boundary as a well to monitor water quality of Chinde Arroyo up gradient of mining activities.
    c. One off-lease, downstream pre-packed well (CA-6) may be installed via hand augur; this will be replaced by a drilled well once final approvals have been acquired
    d. Three piezometers (CA-3, CA-4, CA-5) will be installed in the "big fill" wetland area

e. All Chinde wells and piezometers will be monitored quarterly for a period of two years, followed by an assessment of continued monitoring frequency.
Status: Proposed locations CA-1 and CA-6 are located off-lease and are currently awaiting Navajo Nation approval for implementation. CA-2 through CA-5 and QAC-1 on Chinde Arroyo have neen implemented and quarterly water level and water quality monitoring is ongoing.

3. Cottonwood Arroyo Area
   a. A new alluvial well (proposed CWA-4) will be installed to replace the hand-dug, dry well QACW-2B along the main Cottonwood Arroyo just south of Dixon.
   b. A new alluvial well (proposed CWA-1) will be installed to replace the abandoned well GM-17 along the North Fork of the Cottonwood Arroyo just inside the lease boundary.
   c. Two new alluvial wells (proposed CWA-2 and CWA-3) will be installed along the Main Fork and South Fork, respectively, of the Cottonwood Arroyo near the lease boundary.
   d. Two new Fruitland wells (proposed KF-1 #3 and KF-1 #8) will be installed on the northwest side of Area IV North near the lease boundary. These will be used to evaluate Area IV north groundwater model predictions of drawdown, recharge and TDS transport. Monitoring of the No. 3 and No. 8 coal seam should provide information about potential impacts prior to influences on the alluvial water system, which will be protective of downstream alluvial users on the Cottonwood and Chaco.

   Status: Proposed locations CWA-1b, CWA-2, CWA-3, and CWA-4 were implemented for groundwater monitoring on the Cottonwood Arroyo, and quarterly water quality and water level monitoring is ongoing at these locations. Additionally, groundwater monitoring wells KF3-12-1, KF4-12-1, and KF7-12-1 were implemented for annual monitoring.
4. Groundwater Reference Criteria
   a. Criteria will be based on the entire set of baseline data from *10/17/2011*
   b. Reference criteria will be established for QACW-2, which is currently awaiting Navajo Nation approval for implementation.
   c. QACW-2B is a dry, unsuitable hand-dug well and will be replaced by well CWA-4; new reference criteria will be developed for well CWA-4
   d. GM-17 well will be replaced by proposed well CWA-1; local variation in natural soil properties precludes comparing these two wells as being chemically equivalent so new reference criteria will be developed for CWA-1
   e. Reference criteria are based on the median + 2 median absolute deviations for the baseline monitoring data through year 2001; detection values are calculated as the product of 0.5 and the detection limit
   f. Reference Criteria have been established for well QACW-2 as requested; detection values were calculated as the product of 0.5 and the detection limit.

Modifications to the Chinde alluvial monitoring are particularly important in light of the potential mining related impacts to this system discussed in section 5.3.7.1.2.2. The objective of these new monitoring locations is to characterize and monitor hydrogeologic conditions of the Chinde Alluvium as follows:

The first monitoring location would be a drive point well that would be installed down-gradient of the NAPI fields and up-gradient of the wetland east of the mine lease. The purpose of this monitoring location would be to assess the groundwater quality immediately down-gradient of NAPI.

- The second monitoring location would be a well installed adjacent to the wetland east and up-gradient of the mining activities. The purpose of this well would be to monitor water quality immediately up-gradient of mining activities.
- The third monitoring location would be a well installed in the Chinde Wash down-gradient of existing well QAC-1. The purpose of this well would be to monitor water quality down-gradient

of the mine. Since this monitoring location is located off-lease installation has been delayed due to the approvals that must be obtained.

- Three new monitoring locations have been installed in the wetland immediately up-gradient of the Big Fill. The purpose of these is to monitor potential impacts of the wetland on alluvial water quality, and to monitor groundwater elevations and enable groundwater flow direction to be determined.

Proposed and implemented additions are outlined in Table 6 and approximate locations are shown in Figure 22.

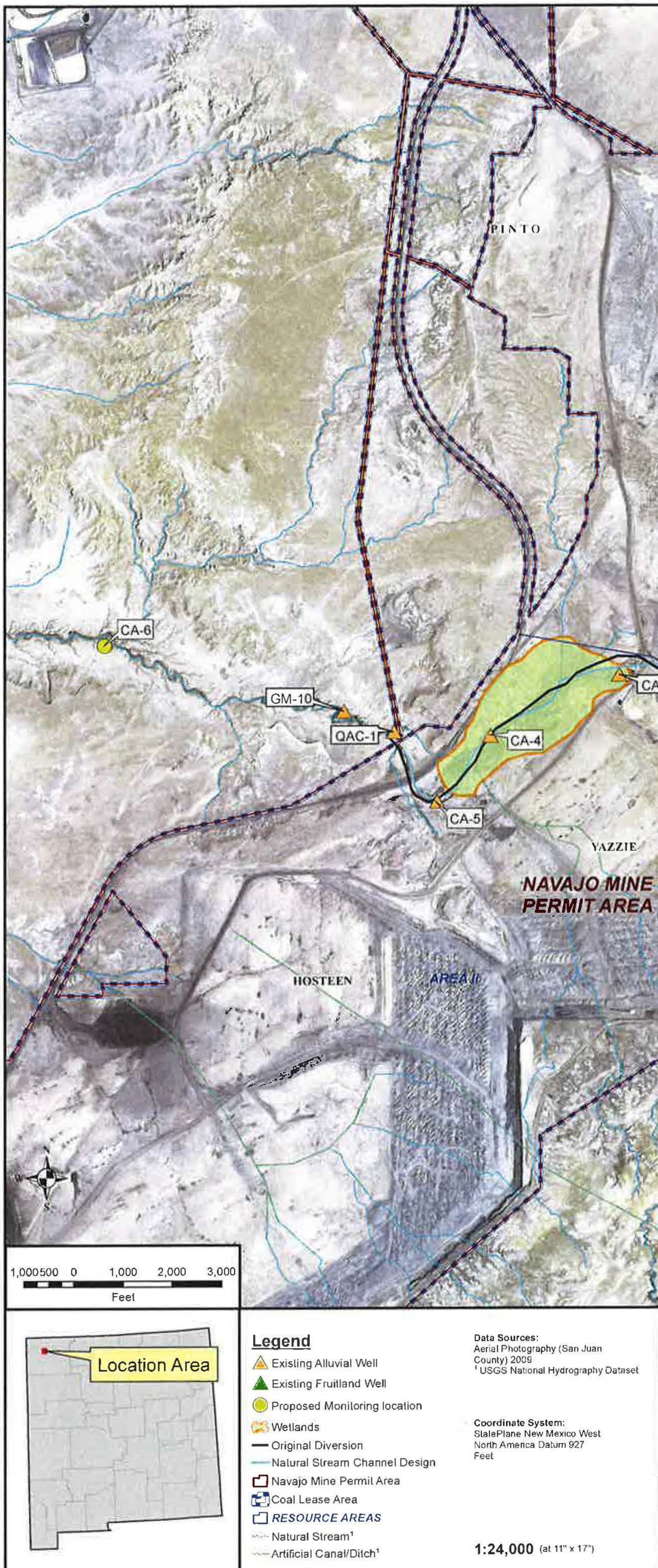
Table 6: Chinde Alluvium Monitoring Approach (BNCC 2012, MMCo. 2015)

<table>
<tr><th>Target Unit</th><th>Well Designation</th><th>General Location</th><th>Monitoring Type</th><th>Screen Interval</th><th>Sampling Frequency</th></tr>
<tr><td>Top of competent bedrock</td><td>CA-1</td><td>Chinde Wash – downgradient of NAPI</td><td>Drive Point</td><td>Dependent on refusal</td><td rowspan="6">Quarterly</td></tr>
<tr><td rowspan="5">Alluvium</td><td>CA-2</td><td>Chinde Wash – adjacent to wetland east of mine lease</td><td rowspan="4">Monitoring Well</td><td rowspan="4">Varies – 5' above the water table plus thickness of aquifer</td></tr>
<tr><td>CA-3*</td><td rowspan="3">Chinde Wash – wetland on lease</td></tr>
<tr><td>CA-4*</td></tr>
<tr><td>CA-5*</td></tr>
<tr><td>CA-6</td><td>Chinde Wash – downgradient of mine lease</td><td>Drivepoint/ Monitoring well</td><td>Dependent on refusal/ Varies – 5' above the water table plus thickness of aquifer</td></tr>
</table>

*Water level measurements only

5.3 Impact Assessment

The assessment presented in Chapter 5 of this document considers available quantity and quality information related to surface water and groundwater potentially affected by NTEC operations. The assessment approach used for each resource is outlined in Table 7. Impact assessment relied upon analysis of monitoring data, several models, relevant published and unpublished reports and papers, experience from past mining and reclamation operations at the Navajo Tribal Coal Lease and other mines located along the western rim of the San Juan Watershed, as well as observations made by mine personal and OSMRE staff during the day-to-day operations and regulation of the mine. Impacts are designated as negligible, minor, moderate or major as defined in Table 7. Table 7 also outlines current mitigation techniques and updates to the NTEC monitoring program.



Chinde Diversion and Monitoring Locations

Figure 22

Table 7: Impact Assessment and Designation Methodology

Water Resource		Fruitland & PCS Quantity	Alluvial Quantity	Surface Water Quantity	Fruitland & PCS Quality	Alluvial Quality	Surface Water Quality
Assessment Approach		Evaluation of potentiometric surface contour maps	Comparison of water levels at individual wells over-time	SEDCAD modeling- pre- and post-mining; Percent of HUC12 Watersheds controlled with impoundments	Comparison of baseline water quality to potentially impacted or non-baseline wells, including spoil and CCB wells	Comparison baseline (upstream/pre-mining) water quality to non-baseline (during and post-mining/downstream) water quality and comparison to applicable Water Quality Standards	
Impact Designation	**Major**	Changes in water level contours that are significantly less than baseline levels	Changes in water levels that are consistently (>60% of the time) below baseline fluctuations as Characterized by the Median minus 2 MAD	Impounded areas relative to HUC 12 watersheds or change in peak flows relative to baseline are >60%	Changes in water quality that consistently (>60%) exceed baseline fluctuations as Characterized by the Median plus 2 MAD		
	Moderate	Changes in water level contours that are moderately less than baseline levels	Changes in water levels that are regularly (30%-60%) below baseline fluctuations as Characterized by the Median minus 2 MAD	Impounded areas relative to HUC 12 watersheds or change in peak flows relative to baseline are between 30% and 60%	Changes in water quality that regularly (30-60%) exceed baseline fluctuations as Characterized by the Median plus 2 MAD		
	Minor	Changes in water level contours that are slightly less than baseline levels	Changes in water levels that are occasionally (10%-30%) below baseline fluctuations as Characterized by the Median minus 2 MAD	Impounded areas relative to HUC 12 watersheds or change in peak flows relative to baseline are between 10% and 30%	Changes in water quality that occasionally (10%-30%) exceed baseline fluctuations as Characterized by the Median plus 2 MAD		
	Negligible	Impacts to Groundwater that is not capable of providing a sustainable water supply for use or that are similar to baseline fluctuations		Impounded areas relative to HUC 12 watersheds or change in peak flows are <10% (considered within baseline)	Impacts to water quality that are within baseline fluctuations (<10%) as Characterized by the Median plus 2 MAD or Impacts to Groundwater that is not capable of providing a sustainable water supply for use or that are similar to baseline fluctuations		
Impact Mitigation		Contemporaneous Reclamation	Contemporaneous Reclamation; reclamation of approximate original contour (AOC); mining limited to ephemeral channels; stream buffer zones		Contemporaneous Reclamation; mixing of overburden/ backfill materials; material classification and handling procedures	Contemporaneous Reclamation; mining limited to ephemeral channels; stream buffer zones	Contemporaneous Reclamation; mining limited to ephemeral channels; stream buffer zones; Sedimentation Ponds
Monitoring Program Updates		Submittal of 5 yr Potentiometric Surface Contour Maps	Addition of new monitoring stations	Addition of new monitoring stations	Additional coal seam well in area IV north	Addition of new monitoring stations	Addition of new monitoring stations

5.3.1 Potential Cumulative Impact between NTEC operations and El Segundo Mine

El Segundo coal mine is located approximately 70 miles southeast from the southern tip of the Navajo Mine lease boundary. The proposed lease area is divided into two subwatersheds by the continental divide, and is crossed by several unnamed ephemeral arroyos. The western portion of the lease area ultimately drains into the Chaco River through an unnamed, ephemeral channel that drains to Laguna Castillo before flowing into a named drainage, Kim-me-ni-oli Wash, and into the Chaco River. The ephemeral arroyos passing through the lease area flow only in direct response to storm events, or discharges derived from NAPI. The drainage area for the main western drainage as it leaves the lease area is approximately 24.7 square miles of which about 6.1 square miles (25%) of the total watershed are proposed to be disturbed by mining. The effects of mining relative to surface water quantity is limited to the interception of surface flows, which has potential to impact the stock watering capability of rangelands (NMEMNRD 2008).

The El Segundo mine lies approximately 70 miles away from the Navajo Tribal Coal Lease and the Chaco River is an ephemeral, losing stream. Therefore, only under tremendous regional storm conditions is it possible for surface water flows from the El Segundo Mine to reach the Chaco River in the vicinity of the Navajo Tribal Coal Lease and comingle with surface waters that cross the NTEC permit areas. Overall, El Segundo Mine covers less than one percent of the total Chaco Watershed. The surface water runoff generated from the small percentage of the Chaco Watershed is imperceptible relative to the total runoff volume generated from the entire Chaco Watershed. Therefore, OSMRE concludes that surface water cumulative impacts to the Chaco River from the El Segundo Mine are negligible.

5.3.2 Potential Impact of NTEC Operations on NAPI

NAPI uses surface water sourced from the San Juan River upstream of NTEC mining operations. Additionally, NAPI operations are located upstream of NTEC operations. Therefore, given the surface water flow directions, NTEC operations are determined to have negligible surface water impacts on NAPI operations.

However, NAPI operations have been documented to have significant impact on NTEC operations. NAPI impacts include direct discharges of water from irrigation canals and indirect discharges from irrigation return flows. NAPI direct discharges are a result of an oversupply of water in the canal that is released directly to a wash. Discharge events for the streams are highly variable, occur quickly, and can last up to 12 hours causing significant erosion and sediment transport in the channel (NTEC 2013, Part 6 Sect. 41). The indirect NAPI related discharges are a result of return flows to the wash caused by the infiltrating irrigation water. The indirect NAPI related discharges result in leaching of the unconfined geologic surface formations and soils. The impacts of the NAPI activities on the baseline channel hydrologic balance are expressed as highly variable increases in flow and discharge.

5.3.3 Potential Impact of NTEC Operations on Morgan Lake and APS

Water from the San Juan River is pumped to Morgan Lake for use as cooling water at the Four Corners Generating Station and also for use in dust suppression and reclamation irrigation activities in the permit area. Approximately 825 acre-feet annually is diverted and consumed annually for mining and reclamation activities; Approximately 35,421acre-feet is diverted annually for power plant operations of which 28,611 acre-feet is consumed annually (United States of America 2011, Table L-1). The total volume of water in Morgan Lake is approximately 39,200 acre-feet at normal storage and 42,800 acre-feet at maximum storage. Variation between normal storage and maximum storage in Morgan Lake encompasses a difference of 3,600 acre-feet, or 10% of the normal storage. A comparison of total (power plant and mine permit area) diversion and consumption to the Morgan Lake volume shows that at normal storage roughly 90% of the Morgan Lake volume is diverted every year, of which roughly 75% is consumed. Of these total diversion and consumption percentages only 2% is attributed to mining operations. NTEC annual diversion and consumption from Morgan Lake is less than the difference between normal and maximum storage of Morgan Lake, therefore, the impact of NTEC operations on Morgan Lake water quantity is negligible. The contribution to Morgan Lake from tributaries which traverse the NTEC permit is also considered to be negligible.

Given the total (power plant and mine permit area) diversion rate from the San Juan River into Morgan Lake, which results in approximately 90% of the normal storage volume being replaced on an annual basis, and the negligible flow contribution to Morgan Lake from tributaries which traverse the NTEC permit area, quality impacts associated with these tributaries are considered to be negligible. NTEC diversion and consumption is roughly 2% of the total power plant diversion and 3% of the total power plant consumption, therefore NTEC operations are not expected to adversely impact the water availability for power plant operations. Quality impacts to Morgan Lake associated with NTEC operations are considered to be negligible, and NTEC operations should not impact Morgan Lake water quality, such that, it would not be suitable for power plant operation use.

5.3.4 **Chaco River**

There are periods when precipitation runoff from the drainages that normally flow across the areas intersected by mining will not make it to the Chaco River during operations, but will either be intercepted by the mine pits or captured in temporary pit protection ponds (highwall impoundments) located up gradient of mining. Once reclamation is completed within the mining area, precipitation runoff from these reclaimed areas will flow through channels in the reconstructed topography and then to the Chaco River.

5.3.4.1 **Surface Water Quantity**

The Chaco River is an ephemeral drainage up until the last 12.5 miles of the stream where runoff from Morgan Lake create perennial conditions. All of the primary drainages crossing the lease area, except for Bitsui Wash flowing into the San Juan River, drain into the Chaco River. Water monitoring historically occurred along two USGS gage stations along the Chaco River, station #09367950 near Waterflow, NM and station #09367938 near Burnham, NM. The locations of these two water monitoring stations are illustrated in Figure 8. The stations were actively monitored for stream flow and select water quality parameters from 1977-1994 and from 1977-1982, respectively. Station #09367938 exhibits the original ephemeral nature of the Chaco River, which existed prior to the construction of Morgan Lake, whereas Station #09367950 is downstream of the confluence with the Morgan Lake drainage where the river flows perennially. USGS station 09367938 is considered to be representative of baseline conditions within the Chaco River as it is upstream of the Navajo Tribal Coal Lease.

Precipitation runoff from reclaimed areas may be reduced somewhat from pre-mine levels due to any of the following factors: lower slopes, enhanced vegetative growth, engineered traditional or geomorphic drainage designs, and the use of sediment-control BMPs that operate to retain water in the reclaimed areas reducing storm-water runoff to the channels. Although some perennial flow occurs along the lower reach of the Chaco, all of the large flow events occur in response to precipitation. Figure 23 indicates that flow in response to heavy precipitation events increases moving downstream. Therefore, there is not a substantial loss in surface water flows within the Chaco River downstream of mining, and impacts of the NTEC mining operations on Chaco River surface water quantity considered negligible.

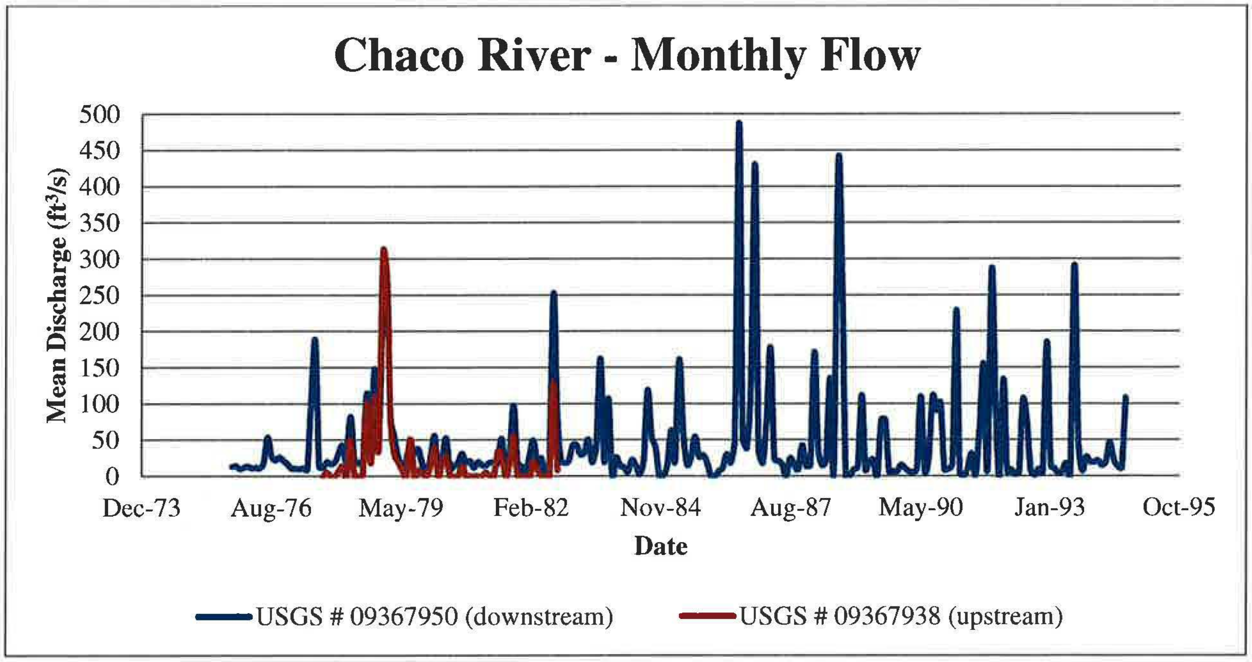


Figure 23: Monthly Flow along the Chaco River

5.3.4.2 Surface Water Quality

Surface water quality data is available on the Chaco at two historic USGS monitoring stations which bracket all Chaco River tributaries traversing the lease area; 09367950 downstream of the Morgan Lake discharge point and 09367938 upstream of No Name Wash confluence (Figure 8). USGS station 09367938 is considered to be representative of baseline conditions within the Chaco River as it is upstream of the Navajo Tribal Coal Lease. Water quality data was collected by the USGS at 09367938 from July of 1977 to August of 1982.

USGS station 09367950 is used to assess the non-baseline or downstream, conditions within the Chaco River as it is downstream of the Navajo Tribal Coal Lease, however it is not necessarily considered to be representative of mining impacts as it is also downstream of the Morgan Lake discharge point, which affects the Chaco River quantity by changing the normally ephemeral drainage into a perennial drainage at this point. Additionally, between two USGS stations, the Chaco river changes from flowing over Quaternary Alluvium Deposit to flowing over the outcrop of the Mesa Verde Aquifer (Cliff House Sandstone, Menefee Formation, Point Lookout Sandstone formation) before discharging into the San Juan River (Figure 5). The Chaco River is a discharge area for the Mesa Verde Aquifer within the San Juan Watershed. Water quality data for this aquifer in the San Juan Watershed is sparse, specifically within the discharge zone to the Chaco River adjacent to the Navajo Tribal Coal Lease. However, the data available to the west of the Navajo Tribal Coal Lease indicate that the dissolved-solids concentration ranges from about 1,000 to over 4,000 milligrams per liter (Robson and Banta 1995). Despite these potential non-mining impacts, Chaco River data from USGS 09367950 will be used for the assessment. Water quality data was collected by the USGS at 09367950 from October of 1969 to August of 1989.

Although USGS 09367950 is downstream of the NTEC permit areas, it is also downstream of the power plant operations and the Morgan Lake discharge; therefore it is not possible to completely differentiate mining impact from these other potential sources with the available information. Nevertheless, analysis will be done using data from this station as data collected upstream of the power plant operation and Morgan Lake discharge is not available.

Review of downstream data indicates high variability relative to baseline data where the median percent relative standard deviation for all constituents was 96 percent as compared to 44 percent for baseline data. The NNEPA criterion for pH was exceeded for 1 sample where the pH was 11.3. Mercury exceeded the NNEPA fish consumption criteria for 85 percent of all samples. Cadmium exceeded NNEPA secondary human contact, fish consumption, and livestock criteria for 8 percent of all samples. NNEPA acute aquatic and wildlife habitat criteria were exceeded for cadmium, chromium, copper, mercury, selenium, and zinc for 8, 100, 25, 17, 8, and 8 percent of all samples respectively. NNEPA chronic aquatic and wildlife habitat criteria were exceeded for cadmium, copper, mercury, selenium, and zinc for 100, 25, 100, 85, and 8 percent of all samples respectively. Livestock criteria for boron, chloride, fluoride, sulfate and TDS were exceeded for 23, 1, 46, 24, and 5 percent of all samples. The median cadmium, mercury and selenium concentrations were 1.2, 300, and 3 times greater than NNEPA chronic aquatic and wildlife habitat standards. The median chromium concentration was 1.6 times greater than NNEPA acute aquatic and wildlife habitat standards. The median mercury value also exceeds the NNEPA fish consumption criteria. All other median values are below all criteria indicating that the criteria exceedances are generally more characteristic of the high variability in the data set as compared to the general water quality. Therefore surface water quality within the Chaco River as compared to NNEPA and other relevant criteria is appropriate for the designated post-mining land use of livestock grazing. However, elevated levels of cadmium, chromium, mercury, and selenium were found relative to aquatic and wildlife habitat and fish consumption NNEPA criteria. There were no exceedances of the SMCRA dissolved iron standard.

The comparison to baseline median plus 2 MAD from the upstream station USGS 09367938 showed the following; minor impacts for manganese where 15% of all samples exceeded baseline; moderate impacts for barium, cadmium, fluoride, radium, and selenium where 35, 31, 54, 1, 38, and 58 percent of all samples exceeded baseline; major impacts for boron, sulfate, TDS and conductivity where 96, 94, 100, and 96 percent of all samples exceeded baseline. Of these the median concentrations of boron, chloride, fluoride, nitrate, selenium, sulfate, TDS, and conductivity all exceeded the baseline median plus 2 MAD. The median concentrations for all of these criteria except selenium and nitrate, however, were below the relevant use criteria. Impacts for all other constituents were determined to be negligible. Therefore while the impact designation can be considerable for certain constituents it does not appear to transfer to a significant impairment of use. Surface water quality within the Chaco River is generally appropriate for the designated post-mining land use of livestock grazing, except for possible concerns over nitrate concentrations. Additional potential concerns exist regarding selenium concentrations relative to aquatic and wildlife habitat use.

5.3.4.3 Chaco River Alluvium

Groundwater use in the groundwater CIA is limited in extent and is mostly derived from wells completed within surficial valley-fill deposits of Quaternary age, or alluvium. Water derived from alluvial wells is predominantly used for livestock watering. Baseline alluvial water quality was found to be a poor source for livestock watering use. This is especially apparent when considering sulfate and TDS concentrations. No downstream alluvial data is available for comparison.

5.3.5 Historic Mining Area North of the NTEC Permit Areas

5.3.5.1 Surface Water

The increased application of surface water from NAPI has affected the area hydrology and water quality. NAPI effect in this area consist of indirect discharges from irrigation return flows. The indirect NAPI related discharges are a result of return flows caused by infiltrating irrigation water. The effects of the NAPI activities on the baseline channel hydrologic balance are expressed as highly variable increases in flow and discharge. The indirect NAPI related discharges result in mobilization of chemical constituents from the unconfined geologic surface formations and soils. NAPI effects increase the already highly variable hydrologic balance and further decrease the potential for changes to the hydrologic balance as a result of mining (NTEC 2013, Part 6 Sect. 41).

The historic coal mining area north of the NTEC permit area includes the Watson, Bitsui, Dodge, and Custer pits. Only the Custer pit area is within the surface water CIA, and is within the Morgan Lake-Chaco River HUC12 watershed along with the Bighan Pit area. The Bighan Pit area is within the NTEC permit area therefore the characterization of impact to water quantity for the Morgan Lake-Chaco River HUC12 watershed is included below in Section 5.3.7.1.1. There are no major tributaries to the Chaco River which traverse this area, and no surface water data is available for this area within the surface water CIA.

5.3.5.2 **Alluvium**

There are no current uses of the alluvium in this area; however, historic uses of alluvium in the area have been attempted for livestock watering (NTEC 2013, Part 6 Sect. 41). Two alluvial wells exist along drainages that are tributary to Morgan Lake; water quantity data was collected from 1996 to 2000 at Custer-1 located along the western lease boundary, and Custer-4 located within the Navajo Tribal Coal Lease close to the eastern lease boundary. Two additional alluvial wells exist along Bitsui Wash; data was collected from GM-7 from 1975 to 1976 and no data is available at GM-37. Data collected at GM-7 represents the only alluvial quality data available for this area, however, it is located upstream of mining and was used for baseline characterization. Therefore no assessment of alluvial quality is presented in this discussion.

The Custer wells were not monitored prior to mining impacts in the area, therefore, not used for baseline characterization. Therefore, alluvial quantity assessment at these locations cannot rely upon comparison of pre to post mining conditions. Alluvial quantity was assessed using two metrics: the percent of all sampling events which were dry and the water elevation in feet above Mean Sea Level (MSL). Water elevation was not collected for all samples; however, inference of water presence was based on the presence of water quality data. Therefore the total number of samples used to calculate the percent of dry sampling events is often higher than the number of samples used for the water elevation comparisons. Alluvium at Custer-1 and 4 was found to be dry for 75% of all sampling events, and only two water elevation data points are available for each well as shown in Figure 24. Although data in the area is limited, hydrology, geologic, and climatological information indicate that changes in groundwater levels will not preclude use as they are steadily increasing over time, and potential mining related impact considered negligible.

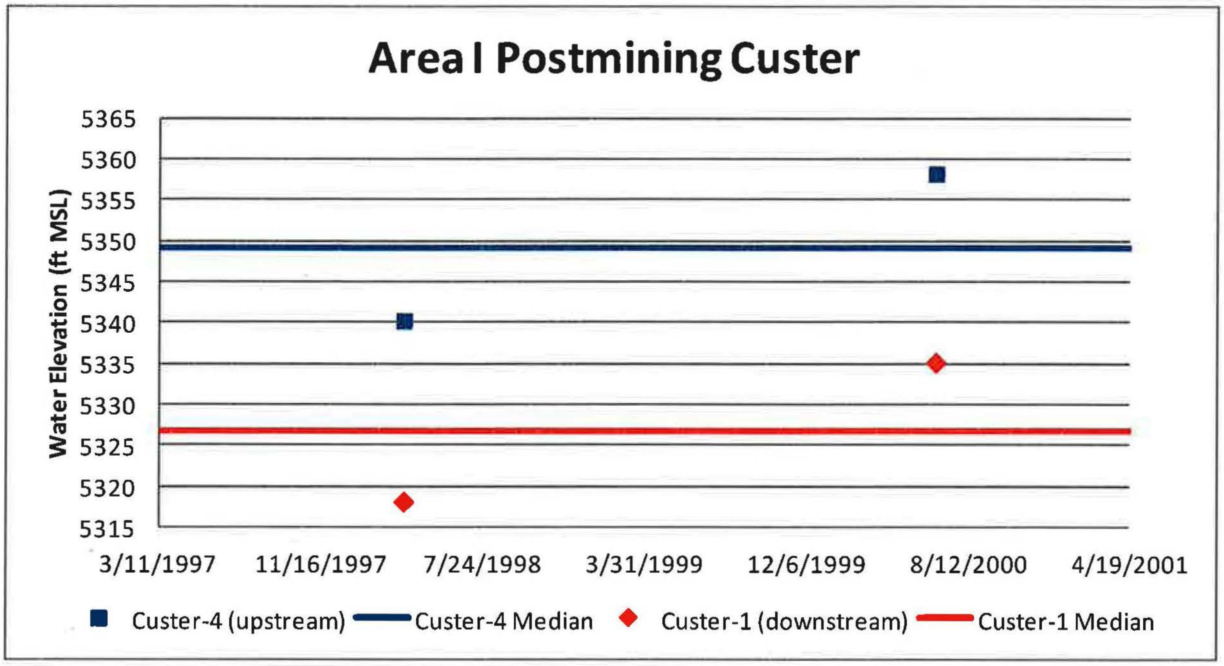


Figure 24: Custer Water Elevations

5.3.5.3 Fruitland Formation and PCS

The mine pits remain dry except on occasions when surface flows from precipitation events are captured. Groundwater seeps observed along highwalls, Fruitland overburden, and coals are typically consumed by evaporation (NTEC 2013). The few seeps observed during mining were at locations where the highwall was near NAPI irrigation plots. The projected and observed impacts to the water quantity within the Fruitland Formation and the coal seam aquifers resulting from coal mining have been minimal to date. There are no current uses for the Fruitland formation in or adjacent to this area and no foreseeable uses other than oil and gas extraction, therefore impacts to the Fruitland formation resulting from the historic mining activity are not expected to interrupt existing or foreseeable water users. Additionally, the observed impacts to the Fruitland do not extend outside of the immediate areas surrounding the mine pits and subsequent reclaimed areas and the unit is generally not capable of providing a sustainable water supply (NTEC 2013, Part 6 Sect. 41). Therefore for the purpose of this assessment, the impacts to the Fruitland groundwater quantity are considered to be negligible.

Laboratory spoil leaching tests were performed in support of the PHC assessment for the Navajo Mine and Pinabete permit areas. The spoil leaching test results indicate a considerable range in concentrations of TDS and sulfate, which are constituents of concern with respect to spoil leachate. The leaching test results are similar with the results for the Bitsui #5 spoil well completed in the mine spoils in the Bitsui Pit, located in the pre-SMCRA mining areas. The Bitsui Pit was backfilled in the 1980s and is the only pit where saturation of mine spoils has been observed to date. Arsenic and selenium were below detection in most of the leaching test results and in the Bitsui 5 spoil well. Fluoride is also lower in the spoil water leachate than in the coal water and is attenuated in flow through mine spoil. Boron and manganese concentrations are also elevated in mine spoil water (NTEC 2013, Part 6 Sect. 41). A post-reclamation increase in TDS and sulfate concentrations in mine spoil backfill may result in increased TDS and sulfate concentrations in the coal seams adjacent to the historic mining areas. Spoil leaching test results found an increase in TDS concentrations in spoil water leachate ranging from 400 to 2,700 mg/l and an increase in sulfate concentrations in spoil water leachate ranging from 630 to 2,580 mg/l (NTEC 2013, Appendix 41-B). Spoil data within this area is generally consistent with spoil data within the NTEC permit area, for a detailed assessment of spoil data relative to baseline within the permit area see Section 5.3.7.2.2.

The PCS is a well-cemented, low-permeability, marine sand and is the first water-bearing unit below the Fruitland Formation. The PCS is approximately 110 to 120 ft thick and follows the structure of the Fruitland Formation, dipping to the east at approximately 2 degrees, although the structure varies locally. The PCS conformably overlies the Lewis Shale, with the contact marked by a zone of interbedded sandstones and mudstones in the lower part of the PCS (Stone, Hydrogeology and Water Resources of San Juan Basin, New Mexico 1983). It outcrops just west of the Navajo Tribal Coal Lease and east of the Chaco River. The PCS is a marginal water resource due to low permeability, poor water quality, gas production, and low yields. The PCS is also a natural gas reservoir in the San Juan Watershed. Stone et al. (1983) state that the PCS cannot be considered a major aquifer and it is important only because it is the water-bearing horizon immediately underlying the coals in the Fruitland Formation. There is no non-baseline PCS data available in the area; therefore there will be no comparison of non-baseline PCS quality to baseline conditions.

Since there are no current uses for the Fruitland or PCS formations in or adjacent to this historic mining area and no foreseeable uses other than oil and gas extraction, mining related impacts are not anticipated to interrupt the existing or foreseeable water uses. Potential impacts are localized and are not anticipated to extend outside of the immediate areas surrounding the reclaimed areas. Additionally, the geologic units are generally not capable of providing sustainable water supply (NTEC 2013, Part 6 Sect. 41). Therefore for the purpose of this assessment, the impacts to the Fruitland groundwater quantity are considered to be negligible.

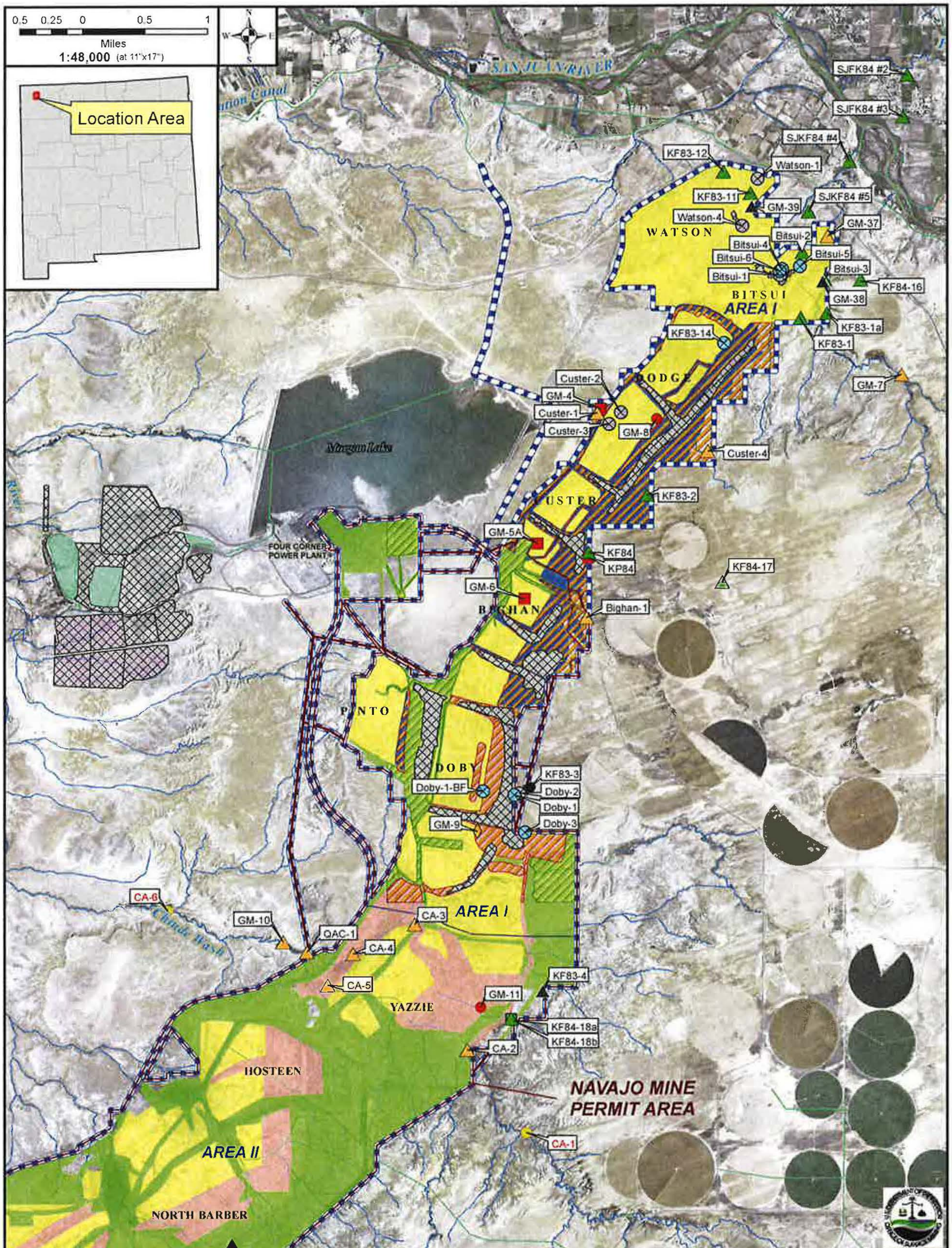
5.3.5.3.1 CCB Disposal

Navajo Mine accepted CCBs from the Four Corners Power Plant units 4 and 5 for disposal in final pits and ramps from 1971 to 2008. CCBs disposed of at Navajo Mine included: fly ash, scrubber sludge, and bottom ash. CCBs from the Four Corners Power Plant were placed in mined-out pits and ramps of the Navajo Mine to help achieve approximate original contours (AOC) (NTEC 2013, Part 6 Sect. 41). The CCB disposal designs considered the natural conditions prevalent in the area and targeted for placement above water table conditions to limit mobility of dissolved constituents.

CCB disposal predominantly occurred within this historic mining area north of the active NTEC permit areas, and can be seen on Figure 25. Additionally, the only saturated CCB area, Bitsui, is located within this pre-SMCRA historic area. No baseline Fruitland coal data is available for this area, however, baseline Fruitland data from upgradient wells located within the NTEC permit areas is available for comparison.

The variability of CCB data is relatively similar to that of the baseline Fruitland coal within the permit where the median %RSDs was 46. A comparison of CCB wells to the Median + 2MAD for baseline Fruitland coals within the Navajo Tribal Coal Lease showed the following; negligible impact for chloride; minor impacts for conductivity and manganese where 20 and 26 percent of all samples exceeded baseline respectively; moderate impacts for total iron and TDS where 40 and 59 percent of all samples exceeded baseline respectively; major impacts for pH, boron, selenium, fluoride and sulfate were 70, 100, 82, 63 and 100 percent of all samples exceeded baseline respectively. Of these the median concentrations for boron, selenium, fluoride, sulfate, and TDS exceeded the baseline Median + 2MAD where they were 13, 4, 1.1, 150 and 1.25 times larger respectively. Median pH was within the livestock criteria range, and no individual sample was below 6.5. However, 16 percent of pH samples were above 9. The median concentrations for selenium were below the livestock criteria; however, median concentrations for boron, fluoride, sulfate, and TDS exceeded livestock criteria where they were 2, 1.3, 6 and 5 times larger respectively. Therefore, within CCB disposal areas boron, fluoride, sulfate and TDS are all considered to be of concern relative to baseline and livestock criteria.

Although elevated levels of constituents of concern exist within the CCB wells in the historic mining area, there are no current uses for the Fruitland formation in or adjacent to this area and no foreseeable uses other than oil and gas extraction. Therefore in order for the historic CCB disposal to have significant impact to use, CCB leachate would need to have sufficient mobility to reach alluvial users within the vicinity of the historic disposal sites at significant concentrations. Modeling was conducted by OSMRE and NTEC to assess the impact of historic CCB placement relative to nearby alluvial systems, which could have impact to current and reasonably foreseeable uses. Modeling results indicated slow groundwater movement and the attenuation of contaminants of concern as they migrate through the subsurface. Detailed CCB analysis can be found in Appendix G, including CCB placement locations, CCB leachate studies and groundwater modeling. Based on analysis found in Appendix G, OSMRE concludes that potential impacts to water users from CCB disposal at the Navajo Mine permit area are negligible. Placement of CCBs is not proposed in the Pinabete Permit Area.



Mine Areas

- CCB Placement [1][2][4]
- Future CCB Placement [4]
- Interim [2]
- Permanent Program [2]
- Interim [3]
- Permanent Program [3]
- Pre-Law [3]
- TOJ [3]
- FCCP Ponds [4]

- Navajo Mine Permit Area
- Coal Lease Area
- *RESOURCE AREAS*
- Natural Stream[1]
- Artificial Canal/Ditch[1]
- PIT NAMES

- Abandoned Alluvial Monitoring Well
- Existing Alluvial Monitoring Well
- No 3. Coal Monitoring Well
- No. 4 - 6 Coal Monitoring Well
- No. 8 Coal Monitoring Well
- Fruitland Well or Nested Wells
- Abandoned PCS Monitoring Well
- Existing PCS Monitoring Well
- Backfill Monitoring Well
- CCB Monitoring Well
- Proposed Monitoring Well

[1] Bitsui and Watson CCB disposal.docx
[2] EXH 11-149 CCB Placement_032008.pdf
[3] Fig2_BNCC Navajo Mine Areas.pdf
[4] 2014-05DEISVol1_Fig3-2FCPPAshDisposal.pdf

Data Sources:
Aerial Photography (San Juan County) 2009
[1] USGS National Hydrography Dataset

Approximate pre-2008 Coal Combustion By-Product (CCB) Placement Area

Figure 25

5.3.6 **Navajo Mine and Pinabete Permit Areas**

5.3.6.1 **Surface Water Quantity**

Changes in peak flows due containment berms, diversions and highwall impoundments, coupled with retention of water within pits and down gradient sediment ponds will reduce peak flows downgradient of the mine area during operations. As areas are reclaimed, there will be increased retention of surface water runoff within the Navajo Tribal Coal Lease area compared with pre-mining conditions, due to less steep slopes and the placement of topsoil materials with more permeable textures than occurred naturally in pre-mine conditions.

It is anticipated that post-mining flows will be ephemeral in all of the streams within the Navajo Mine and Pinabete Permit areas due to the limited precipitation regime, unless activity from the upgradient NAPI area generate sustained flow. NAPI influences have resulted in the perennial and intermittent flows in Chinde and Cottonwood respectively. Future development of NAPI operations may continue further east and south of existing development into the headwaters of Cottonwood (NTEC 2013). The expanded NAPI irrigation plots would be far removed from mining within Area III or Area IV North.

Precipitation runoff from drainages that normally flow across the active mine permit areas may be intercepted by the mine pits or captured in temporary pit protection ponds (highwall impoundments) located up gradient of mining. Precipitation runoff collected in the pits or in the pit protection ponds may be utilized for dust suppression, or will naturally diminish from evaporation and seepage. Once reclamation is completed within the mining area, precipitation runoff from these reclaimed areas will flow through channels in the reconstructed topography and then to the Chaco River. Precipitation runoff from reclaimed areas may be reduced somewhat from pre-mine levels due to any of the following factors: lower slopes, enhanced vegetative growth, engineered traditional or geomorphic drainage designs, and the use of sediment-control BMPs that operate to retain water in the reclaimed areas reducing storm-water runoff to the channels.

The PHC and CHIA analyses were developed with the support of site-specific data and modeling analysis. Surface water and sediment modeling was performed using SEDCAD to model peak flows. The Navajo Mine and Pinabete Permit Areas are primarily within four HUC12 watersheds that either intersect or contain portions of the lease area (Figure 6). The watersheds include the Morgan Lake-Chaco River, Chinde Wash-Chaco River, Coal Creek-Chaco River, and Cottonwood Arroyo watersheds. Each major tributary to the Chaco River are described by watershed in the following sections.

Surface water quantity impacts from the permit areas are measured according to percentages in which each watershed is affected according to two criteria:

1. Percentage of each watershed managed by surface water impoundments, diversions, and other mining related surface water management structures, and
2. The percentage that water management within the lease area affects the peak flows within each watershed (i.e. the difference between pre-mining and post-mining peak flow).

The Navajo Mine and Pinabete PAPs present detailed information on water management structures, and removal plan of temporary structures. A summary of these structures and general hydrologic information is provided in Appendix C.

Modeling using SEDCAD 4 was implemented to assess peak flows in response to the 10-year, 6-hour storm events within each HUC 12 watershed. NTEC developed SEDCAD models for all major drainages which traverse the Navajo Tribal Coal Lease. The Chinde Wash and Cottonwood Arroyo Watersheds are both representative of HUC 12 scale, provided in the approved PHCs, and results utilized in this CHIA assessment. The SEDCAD modeling evaluated only specific areas of the Coal Creek and Chinde-Chaco River HUC12 watersheds within the lease area where mining has occurred. Therefore, for these HUC 12 watersheds, information from the PHC on the pre-mining and post-mining SEDCAD inputs (curve numbers, runoff volumes, etc.) were integrated into simplified larger watershed scale models for the purpose of this evaluation. Excerpts from the OSMRE-generated SEDCAD models showing specific routing details, curve numbers, and other pertinent information are located in Appendix E. Figure 18 shows SEDCAD subwatersheds used in OSMRE modeled HUC 12 watersheds.

5.3.6.1.1 Morgan Lake-Chaco River Watershed

As discussed previously in section 4.1.5.2.1, the impact assessment of the Morgan Lake-Chaco River watershed does not include modeling of peak flow changes due to the small contribution that activities within the permit area would have on the total watershed, and due to the effect that contributing perennial flow to the watershed outfall (Chaco River) from Morgan Lake would have on the model, and because most of the permit area present in this watershed is either pre-SMCRA or area where OSMRE jurisdiction has been terminated. However, remaining mine-related impoundments in this watershed may potentially affect the hydrologic conditions.

The maximum percentage of the Morgan Lake-Chaco River watershed managed by surface impoundments at any given time is about 2 percent. Illustrated on Figure 26, no permanent post-mine impoundments will affect this particular watershed. All impoundments are projected to be removed by 2025. For the purpose of this assessment, the impacts from surface water impoundment water-management on the Morgan Lake-Chaco River watershed are negligible.

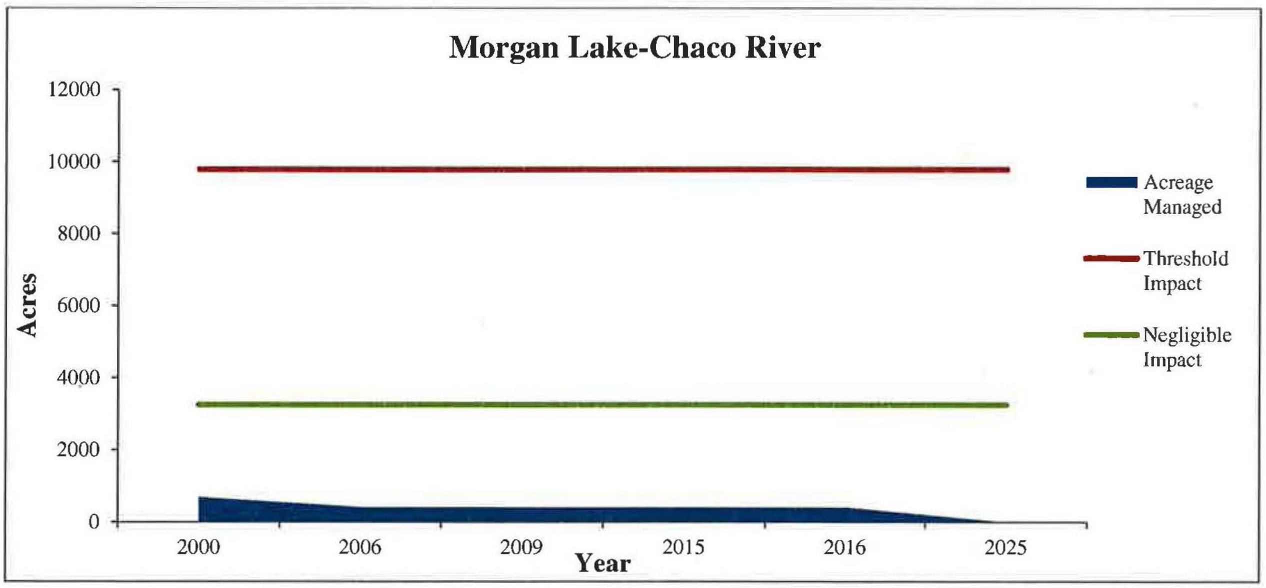


Figure 26: Percentage of the Morgan Lake-Chaco River Watershed Managed by Impoundments

5.3.6.1.2 Chinde Wash Watershed

Approximately 3,100 acres of the Chinde Wash drainage basin is disturbed by mining activities. The post-mining Chinde Wash watershed increases in size by 1,124 acres within the lease area primarily because of changes in the drainage divide between Hosteen Wash and Chinde Wash, and the drainage divide between Dodge Diversion and Chinde Wash.

The largest hydrologic change to Chinde Wash is in the Doby reclamation area to the north, where the westward drainages from the off-lease, undisturbed surface are diverted towards the south via a post-mine channel (Doby North Channel) that runs north to south along the eastern lease boundary. The pre-mine topography had no major channel; the surface sloped down towards the west with primarily sheet flow drainages and some small channels. The post-mine channel also collects surface runoff from a portion of the reclaimed surface to the west and diverts the flow into a tributary of the Chinde Diversion.

The peak flow resulting from a 10-yr 6-hr precipitation event was predicted to decrease from a pre-mining estimate of 715 cubic feet per second (cfs) to a post-mining estimate of 705 cfs for Chinde Wash at the exit point of the watershed (Table 8). For the purpose of this assessment, this decrease in peak flow constitutes a negligible impact.

There are no impoundments within the Chinde Wash watershed, therefore, impacts to the hydrologic balance concerning the percentage of the watershed managed by impoundments, are negligible. Although significant activity occurred on the Chinde Wash before SMCRA was established in 1977, which resulted in areas of sediment accumulation in the channel within the lease area. In 1973, the "Big Fill" was built for the rail crossing of the Chinde Wash. The area of sediment accumulation developed by the railroad crossing has developed into a productive wetland habitat. Surface and groundwater quality monitoring are in place to verify water conditions of the wetland habitat. The Chinde Wash Watershed has also experienced impacts from sources other than mining. Most notably in 1976 NAPI initiated commercial scale irrigation on lands adjacent to the Navajo Tribal Coal Lease (Moore 2006), and influences the hydrology of the Chinde Wash. Once an ephemeral arroyo, Chinde Wash now has perennial conditions due to NAPI irrigation return flows and releases of excess irrigation water. The irregular flow conditions are managed by development of two wetlands along the Chinde Wash. One of the wetlands is located up-gradient of the mine lease and the second is located on the mine lease, up-gradient of the Big Fill. The historic Chinde diversion and the new natural channel regrade can be seen in Figure 22.

Table 8: Comparison of Pre-Mine and Post-Mine Peak Flows in the Chinde Wash Watershed (NTEC 2013)

Sedcad 4.0 Watershed Designation		**Pre-Mine**		**Post Mine**		**Difference From Pre-Mine**	
Pre	Post	Area	Peak Flow (cfs)	Area	Peak Flow (cfs)	Area	Peak Flow (cfs)
S24	S24	27,130	715	28,254	705	1,124	-10
S17 SW1	S17 SW1	1,100	34	824	40	-276	6
S15 SW1	S15 SW1	595	43	600	26	5	-17
S11	S27	446	172	1,726	332	1,280	160
S18 SW1	S18 SW1	146	10	120	10	-26	0

5.3.6.1.3 Chinde-Chaco River Watershed

Notable changes to the watershed from the pre-mining model to the post-mining model occurred along Hosteen Wash, Barber Wash, and South Barber Wash. The surface area within Hosteen Wash decreased by approximately 1300 acres from the pre-mining to the post-mining scenario due to diversion of surface water into the adjacent Chinde Watershed. Curve numbers used in SEDCAD modeling for certain areas within Hosteen wash were significantly reduced to reflect the impact of mining impoundments and higher infiltration rates on the area. The total peak flow reduction from a pre-mining to a post-mining scenario along Hosteen Wash resulted in approximately 850 cfs. Impacts along North and South Barber wash were also integrated into the assessment. South Barber Wash decreased approximately 850 acres in its sub watershed. The decreased area from South Barber was subsequently added to the North Barber sub watershed through a diversion. Detailed assessment and modeling of the individual drainages can be found in the PHC (NTEC 2013, Part 6 Sect. 41). For purposes of this CHIA analysis and modeling was conducted on HUC 12 watersheds. Although peak flow to South Barber Wash is thought to be reduced by about 120 cfs after mining is completed, minimal effects to the entire HUC12 watershed occurred through the changes in the Barber and South Barber Washes. A summary of this information is presented in Table 9.

The peak flow resulting from a 10-yr 6-hr precipitation event at the watershed outlet is simulated to decrease from a pre-mining estimate of 2,096 cfs to a post-mining estimate 1,331 cfs. The total peak flow reduction for the entire HUC12 watershed, pre-mining to post-mining, is approximately 36 percent. For the purpose of this assessment, this decrease in flow represents a moderate impact.

Table 9: Comparison of Pre-Mine and Post-Mine Peak Flows in Chinde-Chaco River Watershed

Sedcad Watershed Designation	Pre-Mine		Post-Mine		Decrease in Peak Flow
	Total Contributing Area	Peak Discharge	Total Contributing Area	Peak Discharge	
	(ae)	(cfs)	(ac)	(cfs)	Percent
#2	2,010.00	680.13	1,650,000	81.38	88
#5	3,110.00	929.94	2,400,000	262.42	72
#1	1,210.00	298.3	850,000	32.21	89
#4	2,750.00	609.87	2,100.00	307.04	50
#8	6,840.00	1,408.08	5,480,000	575.42	59
#3	1,565.00	221.37	1,140,000	161.25	27
#7	3,215.00	444.33	2,365,000	326.8	26
#6	1,235.00	253.21	1,985,000	406.98	-61
#9 (Outlet)	14,220.00	2,096.39	12,760.00	1,331.61	36

The maximum percentage of the Chinde-Chaco River watershed managed by surface impoundments at any given time is approximately 8.2 percent. Illustrated Figure 27, no permanent post-mine impoundments will affect this particular watershed based on impact thresholds. All impoundments are projected to be removed by 2025. For the purpose of this assessment, the impacts from surface water impoundment water-management on the Chinde-Chaco River watershed are negligible.

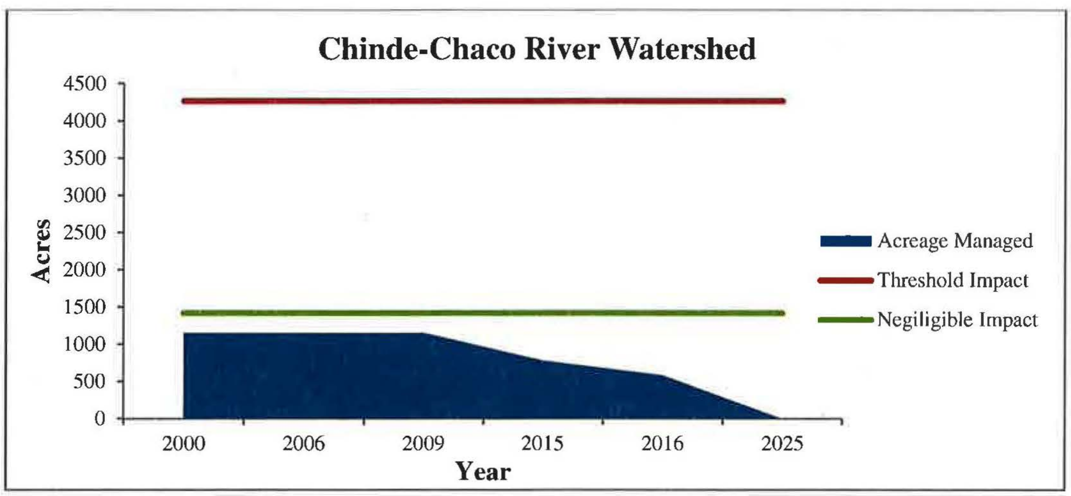


Figure 27: Percentage of the Chinde-Chaco River Watershed Managed by Impoundments

5.3.6.1.4 Coal Creek-Chaco River Watershed

The total peak flow reduction to the Coal Creek Watershed is much lower, as a percentage, compared to the Chinde-Chaco River Watershed. Although much of the runoff within the watershed area is generated in Lowe Arroyo due to the steeper slopes present in this area, the total impacts to the watershed are mitigated by the large geographical area of which it is comprised. Curve numbers used in SEDCAD modeling were lowered in order to model the post-mining changes along Lowe Arroyo. Detailed assessment and modeling of individual drainages can be found in the PHC (NTEC 2013, Part 6 Sect. 41). For purposes of this CHIA analysis and modeling was conducted on HUC 12 watersheds.

The estimated pre-mining peak flow for the watershed, in response to the 10-year 6-hour rain event, is 1,719 cfs and the post-mining peak flow is 1335 cfs. The total peak flow reduction for the entire HUC12 watershed, pre-mining to post-mining, is approximately 22 percent. Results are presented in Table 10. For the purpose of this assessment, this decrease in flow represents a minor impact.

Table 10: Comparison of Pre-Mine and Post-Mine Peak Flows in Chinde-Chaco River Watershed

Sedcad Watershed Designation	Pre-Mine		Post-Mine		Decrease in Peak Flow
	Total Contributing Area	Peak Discharge	Total Contributing Area	Peak Discharge	
	(acres)	(cfs)	(acres)	(cfs)	Percent
#16	7300	467.26	7300	467.26	0
#15	3530	388.14	3530	388.14	0
#10	2860	370.9	2860	240.25	35
#11	6790	898.5	6790	500.47	44
#12	7730	933.82	7730	523.35	44
#17	23620	1827.86	23620	1471.57	19
#14	1280	261.33	1280	261.33	0
#13	1762	250.23	1762	250.23	0
#18	28252	1757.7	28252	1383.23	21
#19 (Outlet)	28252	1719.96	28252	1335.69	22

The maximum percentage of the Coal Creek-Chaco River watershed managed by surface impoundments at any given time is about 9.3%. Illustrated on Figure 28, permanent post-mine impoundments will affect 1,624 acres for this particular watershed under the current mine plan. For the purpose of this assessment, the impacts from surface water impoundment water-management on the Chinde-Chaco River watershed are negligible.

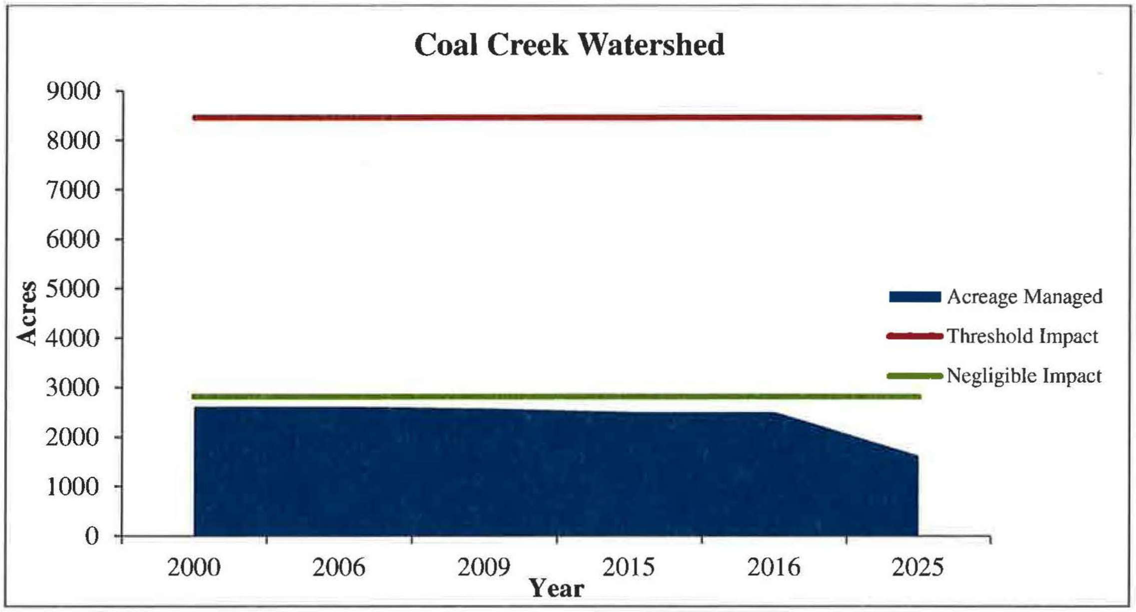


Figure 28: Percentage of the Coal Creek Watershed Managed by Impoundments

5.3.6.1.5 Cottonwood Arroyo Watershed

The primary hydrologic change to the Cottonwood Arroyo watershed is the disturbance of the North Fork of Cottonwood Arroyo. Approximately 10,662 feet of the North Fork will be permanently realigned from the pre-mine orientation due to reclamation (NTEC 2013). As noted in the discussion of Lowe Arroyo, the Cottonwood Arroyo watershed will slightly increase from the pre-mine scenario, but this increase will yield no appreciable hydrologic effects with respect to the evaluation method used in this CHIA.

Table 11 provides comparison of peak flow for the 10-yr 6-hr precipitation event for the portions of Cottonwood tributaries that drain the Area 4 North mine area. These results reflect disturbance conditions for the entire sub-watershed even though proposed mining affects only a portion of the sub-watershed. The differences in peak flow are negligible between pre and post-mining at the lease boundary. The incrementally small change in peak flow reflects the small acreage of mining disturbance in the Cottonwood watershed as a whole.

The peak flow resulting from a 10-yr 6-hr precipitation event at the lease boundary is predicted to slightly increase from a pre-mining estimate of 2,879 cfs to a post-mining estimate 2,903 cfs. For the purpose of this assessment, this is considered a negligible impact.

Table 11: Comparison of Pre-mine and Post-Mine Peak Flows in the Cottonwood Arroyo Watershed (NTEC 2013)

SEDCAD 4.0 WATERSHED DESIGNATION		Pre-Mine		Post-Mine		Difference From Pre-Mine	
Pre	Post	Area (acres)	Peak Flow (cfs)	Area (acres)	Peak Flow (cfs)	Area (acres)	Peak Flow (cfs)
S21	S21	13,492	1,551	13,532	1,546	40	-5
S34	S34	18,191	674	18,279	665	88	-9
S36 (lease line)	S36	49,060	2,879	49,184	2,903	124	24
S37(O utlet)	S37	51,269	2,842	51,477	2,855	208	13

The maximum percentage of the Cottonwood Arroyo watershed managed by surface impoundments at any given time is approximately 6.6 percent. Illustrated on Figure 29, permanent post-mine impoundments will affect 561 acres for this particular watershed under the current mine plan. For the purpose of this assessment, the impacts from surface water impoundment water-management on the Cottonwood watershed are negligible.

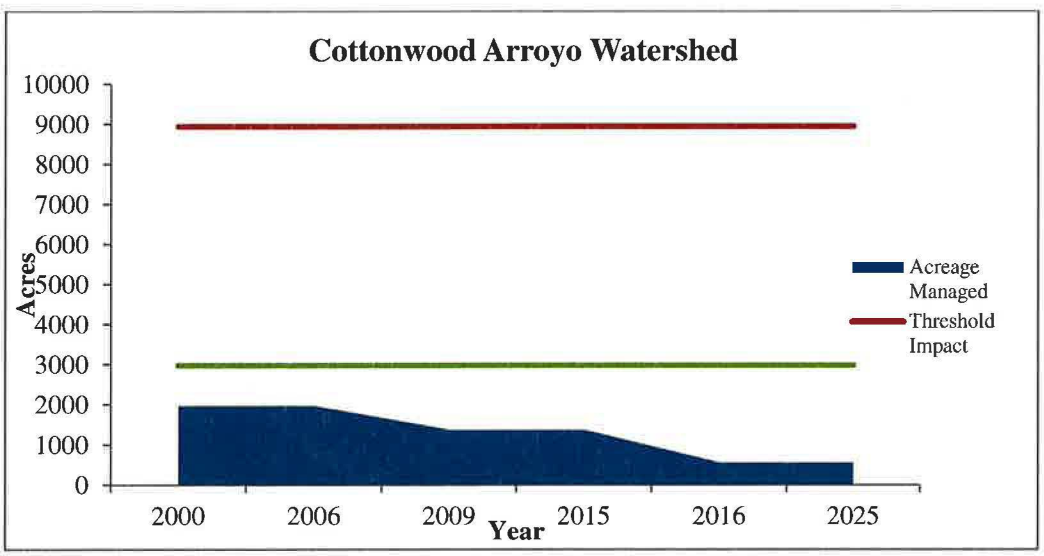


Figure 29: Percentage of the Cottonwood Arroyo Watershed Managed by Impoundments

5.3.6.2 Surface Water Quality

Several recharge mechanisms influence surface water quality within the permit and adjacent area. Precipitation and NAPI discharges generate runoff in the ephemeral washes, entraining sands, silts, and clays, inducing elevated concentrations of TSS. The elevated TSS concentrations influence the cation exchange capacity, and ultimately the chemical composition of the surface water. Recharge also occurs from baseflow in areas where NAPI has resulted in intermittent and perennial flows and rising of local groundwater tables increasing hydrologic communication between the Fruitland Formation and alluvial systems. The effect of runoff on spoil surface area influences the surface water quality. During mining and through bond release, surface water impoundments capture surface water runoff that was in contact with spoil material. The impounded surface water may discharge over the spillway during precipitation events exceeding the design capacity, or infiltrate through the bottom of the impoundments, entering the Fruitland Formation and alluvial and surface water systems.

Surface water quality impact assessment is conducted via comparison of upstream/pre-mining or baseline water quality to downstream or non-baseline water quality collected during and post-mining. This assessment is conducted on the primary drainages which traverse the NTEC permit area. As part of the ongoing NTEC surface water monitoring program, water quality has been assessed along the Chinde, Cottonwood, Pinabete, and No Name drainages at the location shown in Figure 17. The only drainage for which non-baseline surface water quality data exists is Chinde Wash.

Surface water quality impact assessment is also conducted via comparison to applicable water quality standards as outlined in Table 3, as well as the SMCRA dissolved iron standard of 10mg/L. The NNEPA water quality program is an integral component in the protection of the hydrologic balance and surface water quality. NNEPA developed and implemented water quality based effluent limitations and provide comment on technology-based effluent limitations for inclusion in any permit issued to the discharger. Discharges are reported to USEPA under point source permit No. NN0028193. If the appropriate CWA authority determines a water quality violation exists, OSMRE will use the appropriate permitting and enforcement procedures to ensure compliance with discharge permit NN0028193, and the protection of the hydrologic balance.

5.3.6.2.1 Chinde Wash

Surface water quality data is available on the Chinde Wash at monitoring stations which bracket the lease area; CD-2 and CD-2A downstream of the mine and CD-1 and CD-1A upstream of the mine (Figure 17). Water quality data was collected at CD-1 and CD-2 from 1986 to 1997 and at CD-1A and CD-2A from 1996 to present. There is no pre-mining data on Chinde Wash, however, CD-1 and CD-1A were considered as baseline as they are upstream of the mine. It is important to note that while upstream of mining, CD-1 and CD-1A are both downstream of NAPI activities, and there is no pre-NAPI data on Chinde Wash, which is subject to both direct and indirect NAPI influences. Direct discharge events for the streams are highly variable, occur quickly, and can last up to 12 hours causing significant erosion and sediment transport in the channel. The indirect NAPI related discharges are a result of return flows to the wash caused by the infiltrating irrigation water, and most likely result in the continuous baseflow within Chinde Wash (NTEC 2013, Part 6 Sect. 41). Data from CD-2 and CD-2A will be used for the downstream analysis on Chinde Wash.

Downstream data was found to have slightly higher variability relative to baseline data where the median percent relative standard deviation for all constituents was 100 percent as compared to 85 percent. The NNEPA fish consumption criterion was not exceeded for any samples. NNEPA acute aquatic and wildlife habitat criteria were exceeded for cadmium, chromium, selenium, silver and zinc for 4, 100, 1, 2 and 60 percent of all samples respectively. NNEPA chronic aquatic and wildlife habitat criteria were exceeded for aluminum, cadmium, chromium, lead, selenium, and zinc for 46, 100, 3, 57, 70, and 60 percent of all samples respectively. Lead exceeded the NNEPA secondary human contact standard for 4 percent of all samples. Livestock criteria for boron, chloride, selenium, sulfate and TDS were exceeded for 0.5, 5, 23, 0.5 and 6 percent of all samples. The median cadmium, lead, selenium and zinc concentrations were 6, 2, 1.25 and 1.3 times greater than NNEPA chronic aquatic and wildlife habitat standards. The median chromium and zinc concentrations were 16 and 1.3 times greater than NNEPA acute aquatic and wildlife habitat standards. All other median values are below all criteria indicating that the criteria exceedances are generally more characteristic of the high variability in the data set as compared to the general water quality. Surface water quality within the Chinde Wash as compared to NNEPA and other relevant criteria is appropriate for the designated post-mining land use of livestock grazing. However, elevated levels of selenium were found relative to chronic aquatic and wildlife habitat NNEPA criteria. One sample or approximately 6 percent of all samples exceeded the SMCRA dissolved iron standard; however, the median dissolved iron concentration of 0.1 mg/L is 100 times lower than the criterion.

The comparison to baseline median plus 2 MAD from the upstream stations CD-1 and CD-1A showed the following; minor impacts for boron, selenium, sulfate, TDS, conductivity, and manganese where 15, 24, 21, 22, 22, and 10 percent of all samples exceeded baseline respectively; moderate impacts for aluminum, arsenic, chloride, nitrate, TSS, and total iron where 50, 50, 39, 35, 32, and 32 percent of all samples exceeded baseline respectively. Of these the median concentrations of aluminum and arsenic exceeded the baseline median plus 2 MAD. The median concentrations for all of these criteria except selenium, however, were below the relevant use criteria. Impacts for all other constituents were determined to be negligible. No major impacts have occurred within Chinde Wash and water quality is generally appropriate for the designated post-mining land use of livestock grazing. Selenium concentrations relative to aquatic and wildlife habitat use are not being met at upstream and downstream locations.

5.3.6.2.2 Cottonwood Wash

Cottonwood Wash flows from east to west, and joins Chaco Wash approximately three miles west of the Navajo Tribal Coal Lease. Surface water monitoring location CNS-1 is located near mine access bridge crossing Cottonwood Wash (Figure 17). Location CNS-1 is used to assess downstream water quantity and quality conditions of Cottonwood Wash, and passing flow for approximately 90 percent of the Cottonwood Wash watershed. Cottonwood Wash branches into several tributaries on the east side of the lease area. Surface water monitoring locations CN-2, CM-2, CS-2A, and CS-2B (Figure 17) were installed during 2012-13 during the Burnham Road realignment. The four locations are upstream of current and future mining activities, and used to assess water quality and quantity. The five Cottonwood Wash surface water monitoring locations (one downstream, and four upstream) have flow meters to record flow quantity and quarterly water quality monitoring is ongoing.

5.3.7 Groundwater

OSMRE will evaluate groundwater quantity and quality related to the overall hydrologic balance and potential impact of mining operations on groundwater uses, specifically livestock watering as this is the primary use of groundwater within the CIA, and considering livestock water quality criteria. OSMRE must also evaluate that the operation has been appropriately designed to provide the groundwater quantity and quality information necessary to assess potential impacts per 30 CFR 780.21(g). Minimization of impacts to the hydrologic balance relative to groundwater is focused on reducing the disturbance footprint to the extent practical via contemporaneous reclamation. Additionally, local areas of acid forming material are managed through proper blending and mixing of overburden materials. NTEC also minimizes potential effects to the alluvial groundwater quantity by instituting stream buffer zones to limit disturbances in channel reaches unaffected by mining.

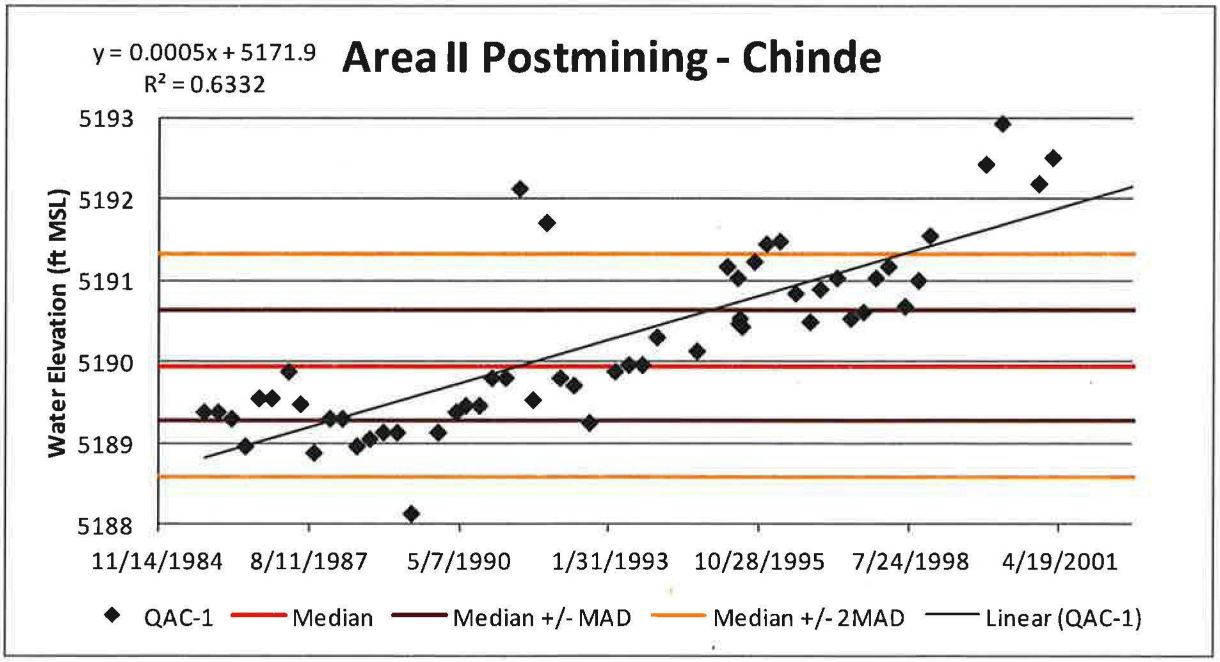
5.3.7.1 Alluvium

OSMRE will evaluate the potential impact of NTEC operations to the existing and foreseeable uses outside the permit area related to alluvial water quantity and quality. Non-baseline downstream or postmining, alluvial wells exist within Areas I and II Alluvial data was collected from 1979 to 1980 at GM-9 on Chinde Wash within the Navajo Tribal Coal Lease, from 1985 to present at QAC-1 at the western mine lease boundary, and from 1975 to 1982 at GM-10 downstream of QAC-1. Additionally, four alluvial wells were installed on Chinde Wash during 2012-13: CA-2, CA-3, CA-4, and CA-5. CA-2 is located upgradient of the Navajo Tribal Coal Lease and in an artificially created wetland developed to manage discharge from NAPI. CA-3, CA-4, and CA-5 are within the lease area on Chinde Wash, and within a second wetland developed through the accumulation of sediment during flow events and also helps in the management of NAPI discharge events. Two alluvial wells on Chinde Wash are proposed: CA-1 (upgradient) and CA-6 (downgradient). Implementations of these two locations is in process, but since both locations are outside the Navajo Tribal Coal Lease, additional regulatory approvals were required. OSMRE anticipates implementation of these two additional monitoring locations on Chinde Wash by 2016. One alluvial well, Bighan-1, exists along drainages that are tributary to Morgan Lake within the permit area; data was collected from 1995 to 2001 at this location along the eastern lease boundary just south of the permit boundary. The location of Bighan-1 along the eastern mine permit boundary suggests that the well would be representative of baseline; however, it was installed after mining impact in the area and is therefore discussed below and not in baseline assessment. Monitoring well locations are illustrated on Figure 19.

5.3.7.1.1 Alluvial Quantity

Currently, there are no uses of the alluvium as a developed water supply resource in Area I or II of the Navajo Tribal Coal Lease, however, there have been historic uses of the alluvium for livestock watering (NTEC 2013, Part 6 Sect. 41). The wells along Chinde Wash and Morgan Lake tributaries were not monitored prior to mining impacts in the area, and can therefore not be used for baseline characterization. Therefore, the alluvial quantity assessment at these locations does not rely on a comparison of pre mining alluvial groundwater quantity to post mining conditions. The potential for impacts to alluvial groundwater quantity was assessed using two metrics: the percent of all sampling events which were dry and the water elevation in feet above Mean Sea Level (MSL). Water elevation was not collected for all samples; however, inference of water presence was based on the presence of water quality data. The total number of samples used to calculate the percent of dry sampling events is often higher than the number of samples used for the water elevation comparisons.

Alluvial groundwater monitoring locations GM-9 and GM-10 are no longer utilized in the hydrologic monitoring program, but the data is considered for hydrologic assessment. Locations CA-1, CA-2, CA-3, CA-4, CA-5, and CA-6 are being implemented with quarterly monitoring data collections requirements. Results will be presented in the next CHIA update, and documented during OSMRE technical review of the annual reclamation status monitoring reports. Alluvial data reviewed indicates the Chinde Wash alluvium is mostly saturated across the length of the lease area, based on water present for all sampling events at GM-9, GM-10 and QAC-1. Alluvium at Custer-1 and Custer-4 was dry for 75 percent of all sampling events, whereas Bighan-1 had water for all sampling events. Water elevation data was, available at QAC-1 along Chinde Wash, and at Custer-1, Custer-4 and Bighan-1. Variability as characterized by the percent relative standard deviation (%RSD) for water elevation data indicated the Custer wells had the highest variability, where the median %RSD was 14 times greater than that of Bighan-1; and 11 times greater than that QAC-1 on Chinde Wash. The lower variability of water elevation levels in Chinde Wash may be due to perennial conditions of the drainage as a result of NAPI agricultural irrigation discharges. Water levels at QAC-1 and Bighan-1 have been increasing over time (Figure 30), likely a result of infiltration of NAPI runoff and agricultural irrigation discharges. As water levels are steadily increasing in the alluvium of Area I and II it is reasonable to assume that groundwater levels are not below baseline fluctuations, therefore, potential impact is negligible. More detailed alluvial quantity data can be found in Appendix F.



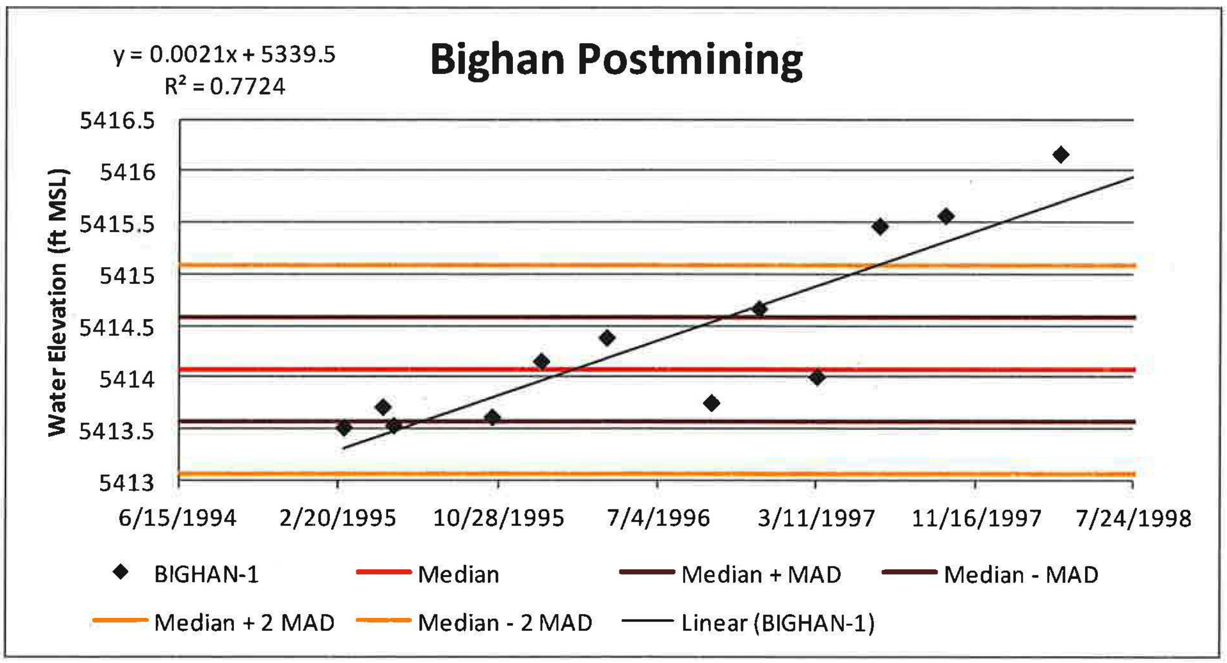


Figure 30: Chinde and Bighan Alluvial Water Elevations

Alluvial groundwater downstream of the Area IV North permit boundary has been monitored at QACW-2 since 2005, after mining began in the North Fork of the Cottonwood Arroyo, and recorded as dry for all monitoring events. Dry periods of this length are not outside of the variability observed in the baseline quantity data at this well, therefore, the dry period can be characterized as a negligible impact. Groundwater modeling of Area IV North conducted as part of the PHC assessment was used to evaluate the approximate magnitude of changes in groundwater flow in the Cottonwood alluvium that might occur as a result of mining in Area IV North. The groundwater model simulated a steady-state post-reclamation alluvial groundwater flow at the mouth of Cottonwood Arroyo of about 4.6 gallons per minute (gpm) compared to the pre-mine alluvial groundwater flow estimate of 4.3 gpm (NTEC 2013, Part 6 Sect. 41). However, baseline groundwater flows in the Cottonwood alluvium are never at steady state and vary considerably seasonally and from year to year and will continue to vary throughout mining and after reclamation. The model-predicted 0.3 gpm increase in groundwater flow in the Cottonwood alluvium is low relative to the baseline variability in the Cottonwood alluvial groundwater. Thus, mining and reclamation within Area IV North is not expected to result in a long-term measurable change to the alluvial groundwater quantities or potential well yield from the alluvium. Groundwater quantities in the Cottonwood alluvium have historically been insufficient to sustain a reliable water supply at two of the three wells that were monitored for baseline conditions. The conditions are not expected to change with a modeled flow increase of 0.3 gpm. Impacts to the Cottonwood alluvial quantity are considered to be negligible because they are consistent with fluctuations caused by natural processes (Ecosphere Associates Inc. 2011).

5.3.7.1.2 Alluvial Quality

Water quality data was evaluated at all three wells (GM-9, GM-10 and QAC-1) along Chinde Wash, and at Bighan-1 along Morgan Lake tributaries. The wells along Chinde Wash and Morgan Lake tributaries were not monitored prior to mining impacts in the area and not used for baseline characterization. Instead, baseline data collected along Cottonwood Arroyo was used as an analog for the area. Cottonwood Arroyo data was selected since data in Area I and II is subject to NAPI influences. However, this is an imperfect representation as Cottonwood Arroyo is only subject to NAPI direct discharges and not NAPI irrigation return flows, which leach water soluble constituents from the unconfined surface formations. This difference in source water type suggests that Cottonwood Arroyo baseline alluvial water quality dissolved concentrations would most likely be lower than the baseline concentrations along Chinde Wash and in Area I. Therefore impacts assessed by this method may be overestimated.

5.3.7.1.2.1 Bighan Alluvium

The location of Bighan-1 along the eastern mine permit boundary suggests that the well would be representative of baseline; however, it was installed after mining impact in the area, therefore, discussed below and not in baseline assessment. It is important to note that there is ambiguity with the representation of baseline conditions.

The variability of Bighan-1 data is relatively low where the median %RSD is 31, significantly lower than that of the Cottonwood baseline which has a median %RSD of 121. At Bighan-1 arsenic, selenium, chloride, sulfate, TDS and fluoride exceeded livestock criteria for 4, 4, 4, 13, 6 and 100 percent of all samples. Of these Median fluoride concentrations exceed livestock criteria where the median fluoride concentration was 5 times larger than criteria.

A comparison to the Cottonwood baseline Median + 2MAD showed the following; moderate impacts for total iron where 50 percent of all samples exceeded baseline; major impacts for arsenic, fluoride, selenium, and nitrate where 95, 100, 100, and 100 percent of all samples exceeded baseline respectively. Impacts for all other constituents were found to be negligible. Of these, the median concentrations of arsenic, boron, selenium, fluoride, and nitrate exceeded the Cottonwood baseline Median + 2MAD where they were 5, 6, 3, 4, and 21 times larger respectively. The median concentrations for all of these criteria except fluoride, however, were below the relevant livestock use criteria. Therefore, while the impact designation can be considerable for certain constituents it does not appear to transfer to a significant impairment of use. Alluvial water quality at Bighan-1 is generally appropriate for the designated post-mining land use of livestock grazing, although there are potential concerns with fluoride concentrations. The fluoride exceedance may indicate impacts to the alluvial system or may also be indicative of general alluvial quality in the area, as Cottonwood is not a perfect analog baseline since it is only impacted by NAPI direct discharges. In contrast, the Bighan area is impacted by indirect NAPI irrigation return flows which leach the unconfined surface formations and may have significant quality impacts. Additionally, based on spoil leachate data and observations in spoil wells located in the historic mining area north of the Navajo tribal Coal Lease, fluoride is lower in spoil water leachate than in the coal water and is attenuated in flow through mine spoil. There are no apparent trends over time in the Bighan-1 fluoride concentrations.

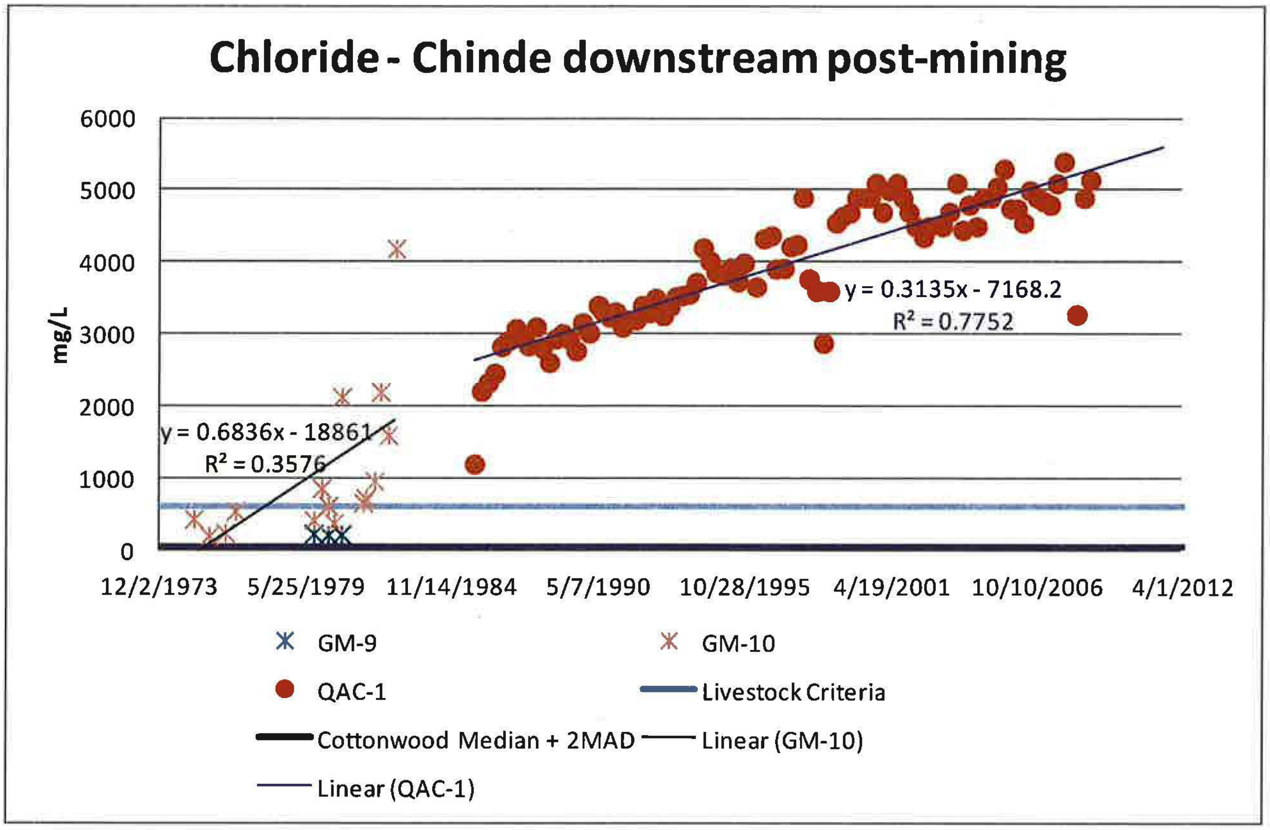
5.3.7.1.2.2 Chinde Wash Alluvium

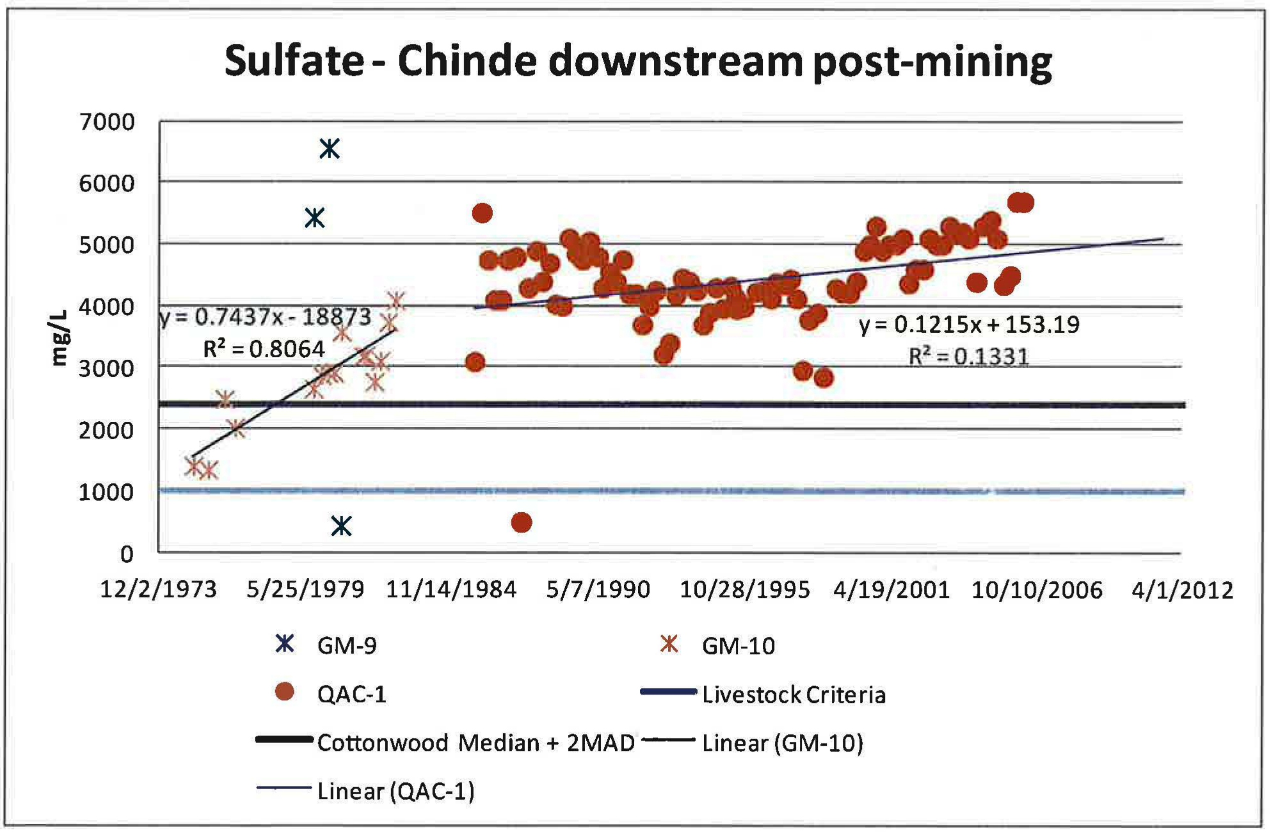
The variability of Chinde Wash alluvium water quality is greater than Bighan-1 where the median %RSDs were 114 and 31 respectively, and both show lower variability than Cottonwood Wash baseline alluvium water quality which had a median %RSD of 121. Additionally, Chinde Wash alluvium water quality is more variable than Chinde surface water quality which had a median %RSD of 100.

Along Chinde Wash the pH was below the NNEPA standard range for one sample where the pH was 6.45. Arsenic, cadmium, lead, selenium, chloride, fluoride, nitrate, sulfate and TDS exceeded livestock criteria for 1, 1, 8, 7, 92, 11, 3, 98 and 98 percent of all samples respectively. The median concentrations for chloride, sulfate, and TDS exceeded livestock criteria and concentrations were 6, 4, and 4 times larger than the applicable criteria respectively.

A comparison to the Cottonwood baseline Median + 2MAD showed the following; moderate impacts for total iron where 50 percent of all samples exceeded baseline respectively; minor impacts for pH, cadmium, copper, selenium, fluoride and nitrate where 24, 16, 19, 25, 11 and 18 percent of all samples exceeded baseline respectively; moderate impacts for arsenic, chromium, lead and radium where 43, 51, 52 and 47 percent of all samples exceeded baseline respectively; major impacts for conductivity, boron, total iron, manganese, chloride, sulfate and TDS where 94, 98, 74, 88, 100, 95 and 97 percent of all samples exceeded baseline respectively. Impacts for all other constituents were found to be negligible. Of these the median concentrations of conductivity, boron, chromium, total iron, lead, manganese, chloride, sulfate, and TDS exceeded the Cottonwood baseline Median + 2MAD where they were 4, 6, 2, 2, 2, 15, 22, 2 and 3 times larger respectively. The median concentrations for all of these criteria except chloride, sulfate, and TDS, however, were below the relevant livestock use criteria. Therefore, while the impact designation can be considerable for certain constituents it does not appear to transfer to a significant impairment of use. Alluvial water quality along Chinde is generally appropriate for the designated post-mining land use of livestock grazing, except for concerns over chloride, sulfate and TDS concentrations.

These exceedances relative to baseline may indicate mining related impacts to the alluvial system or may be indicative of general alluvial quality in the area, as Cottonwood is not a perfect analog for baseline. Cottonwood is only impacted by NAPI direct discharges, whereas, Chinde Wash is impacted by both NAPI direct discharges and indirect NAPI irrigation return flows which leach water soluble constituents from the unconfined surface formations and may have significant water quality impacts. However, elevated sulfate and TDS concentrations at the Navajo Tribal Coal Lease are associated with water quality from backfilled spoil and CCB disposal areas as characterized in section 5.2.2.1 below. Additionally, the concentrations of chloride, sulfate, and TDS have been steadily increasing within the Chinde Wash alluvium over time, as illustrated in Figure 31. More detailed alluvial quality data can be found in Appendix F.


Chloride - Chinde downstream post-mining
mg/L
6000
5000
4000
3000
2000
1000
0
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
y = 0.3135x - 7168.2
R² = 0.7752
y = 0.6836x - 18861
R² = 0.3576
GM-9
GM-10
QAC-1
Livestock Criteria
Cottonwood Median + 2MAD
Linear (GM-10)
Linear (QAC-1)


Sulfate - Chinde downstream post-mining
mg/L
7000
6000
5000
4000
3000
2000
1000
0
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
y = 0.7437x - 18873
R² = 0.8064
y = 0.1215x + 153.19
R² = 0.1331
GM-9
GM-10
QAC-1
Livestock Criteria
Cottonwood Median + 2MAD
Linear (GM-10)
Linear (QAC-1)

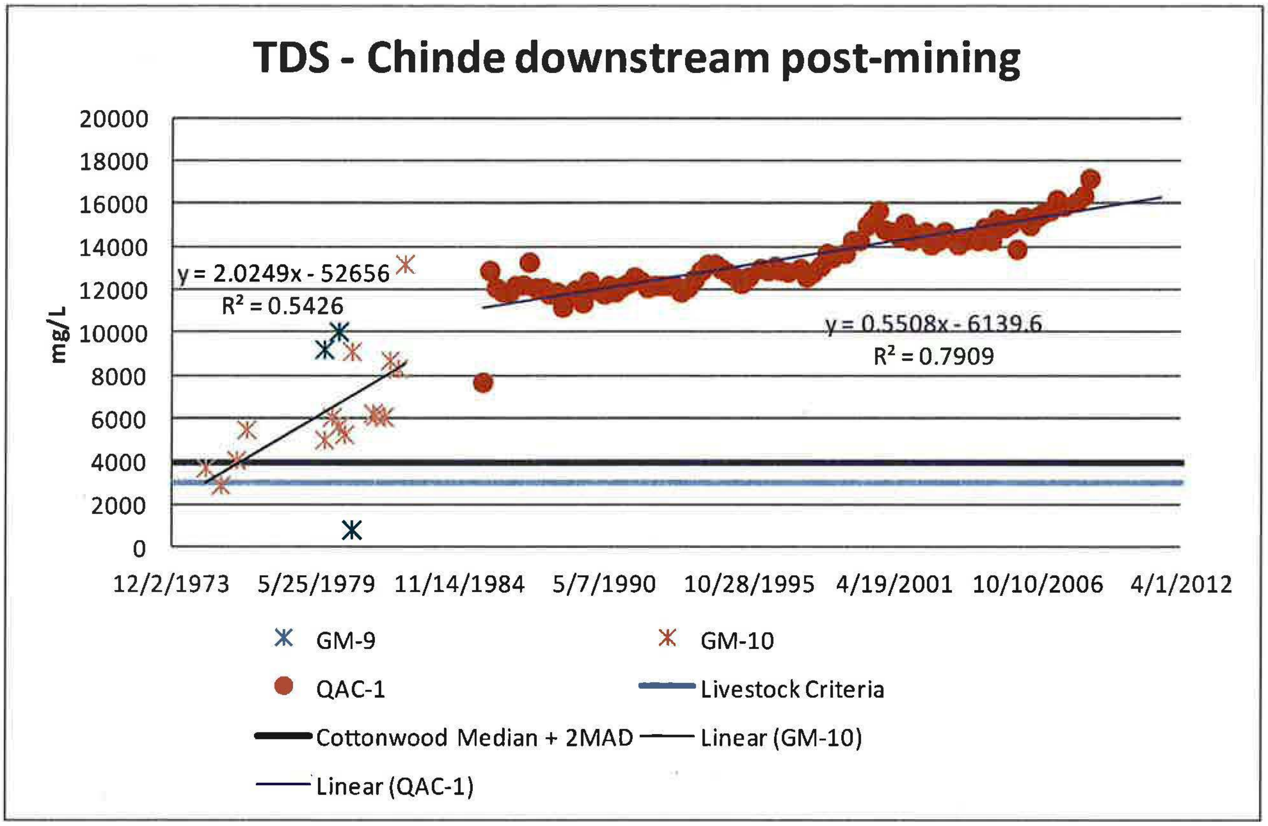


Figure 31: Chinde Alluvium Concentrations over Time

5.3.7.1.2.3 Cottonwood Arroyo Alluvium

Although QACW-2 has been monitored since 2005 after mining began in the North Fork of the Cottonwood Arroyo, it has been dry for all monitoring events; therefore no water quality data has been collected for comparison to baseline. Impacts to alluvium in Area IV North are not expected to be significant as there is a stream buffer zone around the main stem of the Cottonwood Arroyo including the alluvial deposit.

Long-term (500 years) TDS transport modeling simulations within Area IV North were performed using a lower bound source TDS concentration of 3,550 mg/l and an upper bound TDS concentration of 11,850 mg/l (NTEC 2013, Part 6 Sect. 41). Based on these results, the long-term post-reclamation TDS concentrations in the groundwater in the Cottonwood alluvium will likely increase down gradient of the Area IV North mine area. The results indicate a delayed long-term increase in the TDS concentrations in the Cottonwood alluvium between 0 to 22 percent near the mouth of Cottonwood after more than 500 years. A 22 percent increase would result in a predicted TDS concentration of 3687 mg/L. TDS concentrations between 3000 and 5000 mg/L may not cause adverse effects to adult livestock, however, growing/young livestock could be affected by looseness or poor feed conversion (Lardy, Stoltenow and Johnson 2008).

The natural variability in the baseline TDS concentrations in the Cottonwood alluvium is comparable to or greater than the magnitude of the model-predicted changes in TDS concentrations. For example, the median plus one median absolute deviation of the TDS concentrations measured in baseline samples at Cottonwood alluvial wells QACW-2 and QACW-2B are 22 percent and 10 percent higher than the median respectively, indicating large natural variation in TDS concentrations in the alluvium water quality. Cottonwood Arroyo alluvial monitoring at QACW-1 had insufficient water for sampling so it is not possible to assess the variability in TDS concentrations at this location. The median plus one median absolute deviation of the TDS concentrations measured in baseline samples at alluvial well GM-17 on the North Fork of Cottonwood was 3 percent higher than the median. However, the median TDS concentration in baseline samples from this well was 15,210 mg/l, making the alluvial groundwater at this location on the North Fork of Cottonwood unsuitable for use. In summary, the baseline median plus one median absolute deviation ranges from 3 to 22 percent higher relative to the medians (Ecosphere Associates Inc. 2011).

Although predicted TDS change of 0 to 22 percent could result in TDS concentrations above livestock criteria, the predicted change is within the variability of 3 to 22 percent observed in baseline fluctuations. Therefore, the impact of the model predicted changes in TDS concentrations in the Cottonwood alluvium are considered to be negligible as the predicted long-term changes in water quality are within the variability observed in the baseline fluctuations. Additionally, changes unrelated to mining could result in a greater magnitude of change in TDS concentrations in the Cottonwood Arroyo alluvium, within the 500 year modeled timeframe. Any changes in alluvial groundwater quality are not expected to affect surface water quality or potential ecological receptors, as alluvial groundwater is not a source of base flow and generally does not discharge to the surface (Ecosphere Associates Inc. 2011).

5.3.7.2 Fruitland Formation Quantity

Based on mining experience at the Navajo Tribal Coal Lease, the coals, the overburden, and the interburden in the Fruitland Formation are not expected to yield appreciable water during mining in Area IV North or the Pinabete Permit Area. The mine pits have remained dry throughout the lease area except on rare occasions when surface flows are captured. Groundwater seeps are rarely observed along the highwall as any groundwater in the Fruitland overburden and coal is consumed by evaporation along the highwall (NTEC 2013). The few seeps that have been observed during mining were at locations within Area I where the highwall was near NAPI irrigation plots. Groundwater flow rates through the Fruitland coals within Area III are low based on the low hydraulic conductivities of the coal and the relatively flat hydraulic gradients. Area III gradients will be toward the mine backfill for an extended period following mining. As the mine spoils begin to saturate over the long-term, the buildup of hydraulic head in the mine spoil will increase, reversing the gradients with respect to the mine spoils. Based on model estimates of Area IV North it could take as long as 80 years for gradient reversal to occur (NTEC 2013). Transport directions for mine spoil water at that time would be laterally down dip in the Fruitland Formation, toward the outcrop areas to the south and west of Area III, and vertically into the PCS. Lateral flow from the mine spoils through the Fruitland Formation and vertically into the PCS will be very low due to the low hydraulic conductivity of these units and due to the relatively flat gradients that can be expected based on pre-mine conditions. Most discharge to the PCS and Fruitland Formation outcrops to the south and west of Area III is expected to be removed by evapotranspiration, although a portion of this groundwater discharge could reach the Cottonwood Arroyo alluvium.

Potentiometric gradients in the other coal seams within Areas III, IV, and V of the Navajo Tribal Coal Lease are anticipated to be generally toward the northeast, similar to the gradients for No. 3 coal seam. However, the upper coal seams (No. 6, No. 7, and No. 8) outcrop to a greater extent within the valleys of Pinabete Arroyo, No Name Wash, and Cottonwood Arroyo within the coal lease. The groundwater gradients within these upper coal seams are influenced by outcrop discharge along the arroyos. The baseline hydrogeologic model generated to support the PHC assessment simulated local potentiometric gradients toward the Pinabete Arroyo, No Name Wash, and Cottonwood Arroyo in all of the Fruitland coal units. The local influence of topography on potentiometric gradients was greatest for the shallowest coal, the No. 8 seam (Norwest Corporation 2011). Field observations of salt deposits and enhanced vegetation production also indicate that local discharge may occur from the No. 8 coal at the coal outcrop along Pinabete Arroyo. Baseline groundwater model simulations and potentiometric elevations at wells KF-2007- 01, KF84-22A, and KF83-10A were used to prepare the potentiometric surface of the No. 8 coal seam provided in Figure 21.

The open mine pit acts as a drain for drawdown of any groundwater in the overburden/interburden, in the coal seams as the backfill spoil material resaturates. Model simulations of the advance of open pit mining in Area IV North have been performed to provide estimates of drawdown and recovery in the Fruitland coals during mining and reclamation. It is estimated that mining in Area IV North will cause around 5 feet of drawdown by the time of completion of mining in both the No.3 and the No. 8 coal seams (NTEC 2013). The groundwater model developed for the PHC was also applied to simulate the rate of recovery of water levels in mine backfill and in the Fruitland coals adjacent to the mining block. Maximum drawdown is less than 17 feet, occurring approximately 30 years following the start of mining (NTEC 2013). Upward gradients of groundwater movement from the PCS to the mine backfill do not occur until about 85 years after the start of mining. After that time, the recovery of the potentiometric surface in the backfill is complete and gradients are vertically downward from the backfill to the PCS.

These results together with the estimated 5-foot drawdown contour maps at the end of mining show that the hydrogeologic effects of proposed mining within Area IV North are localized and occur over a long time period. The long-term change resulting from the removal of the interbedded coal, shales, mudstones, and sandstone strata and replacement with a relatively homogeneous and isotropic mine backfill will be an increase in the rate of vertical flow into the PCS from the mine backfill compared with the vertical flow into the PCS from the Fruitland formation prior to mining.

Cumulative effects of drawdown are determined to be negligible because there are no wells completed in the Fruitland Formation or the PCS that could be impacted and these units are not capable of providing a sustainable water supply (NTEC 2013).

The projected and observed impacts to the water quantity within the Fruitland Formation resulting from coal mining at the Navajo Mine have been minimal to date. Since there are no current uses for the Fruitland formation in or adjacent to the Navajo Mine and no foreseeable uses other than oil and gas extraction, impacts to the Fruitland formation are not expected to preclude current or foreseeable uses. Additionally, the predicted and observed impacts to the Fruitland Formation do not extend outside of the immediate areas surrounding the mine pits and reclaimed areas; and the Fruitland Formation is generally not capable of providing a sustainable water supply (NTEC 2013, Part 6 Sect. 41). Therefore for the purpose of this assessment, the impacts to the groundwater quantity of the Fruitland Formation are considered to be negligible.

5.3.7.3 **Fruitland Formation Quality**

Spoil leaching tests were performed in support of the PHC assessment for the Navajo Mine and Pinabete Permit Areas. The spoil leaching test results show a considerable range in the concentrations of TDS and sulfate, which are the primary constituents of concern with respect to spoil leachate. Spoil leaching test results indicate an increase in TDS concentrations in spoil water leachate ranging from 400 to 2,700 mg/l and an increase in sulfate concentrations in spoil water leachate ranging from 630 to 2,580 mg/l (NTEC 2013, Appendix 41.B). The leaching test results are fairly consistent with the results for the Bitsui #5 spoil well completed in the mine spoils in the Bitsui Pit, located at the north end of the Navajo Tribal Coal Lease. The Bitsui Pit was backfilled in the 1980s and is the only pit at Navajo Mine where saturation of mine spoils has been observed. Arsenic and selenium were below detection in most of the leaching test results and in the Bitsui 5 spoil well. Fluoride is also lower in the spoil water leachate than in the coal water and is attenuated in flow through mine spoil. Boron and manganese concentrations are also elevated in mine spoil water (NTEC 2013, Part 6 Sect. 41).

During active mining, hydraulic gradients and groundwater flow directions in the Fruitland Formation are towards the mine pits and backfill areas. Therefore, it is anticipated that there would be little change in the quality of groundwater beyond the limits of the mine pit and mine backfill during mining and reclamation operations. These results indicate that in addition to increases in concentrations of TDS and sulfate, concentrations of boron and manganese may also increase relative to the baseline coal water (NTEC 2013, Part 6 Sect. 41).

A comparison of baseline water quality to livestock criteria found that water in the Fruitland Formation is a very poor source of supply for livestock watering use, specifically because of elevated chloride and TDS concentrations, which are above livestock criteria. There are no livestock watering wells completed in the Fruitland Formation that would be impacted and the aquifer is generally not capable of providing a sustainable water supply for this use. The only documented current and historic use of the Fruitland Formation in the area is for oil and gas extraction, which does not have protective use criteria designations since water quality is not particularly significant for this use. Therefore, analysis of post mining groundwater quality in the Fruitland Formation including adjacent Fruitland Formation coal aquifers, CCB disposal areas and the backfilled spoil will be evaluated against baseline Fruitland Formation groundwater quality as well as livestock use criteria. A complete comparison to livestock use criteria is provided in Appendix F. An analysis of constituents generally associated with backfill spoil and CCB leachate including pH, conductivity, boron, total iron, manganese, selenium, chloride, fluoride, sulfate and TDS is presented below.

The variability of groundwater quality data from backfill spoil, and non-baseline Fruitland Formation coal aquifers is similar to that of the corresponding baseline groundwater quality data within the coal lease where the median %RSDs are 68 and 67 respectively. A comparison of spoil wells to the Median + 2MAD for baseline Fruitland coals within the NTEC lease area showed the following; negligible impacts for conductivity, chloride, and fluoride; minor impact for total iron where 27 percent of all samples exceeded baseline; moderate impact for selenium where 33 percent of all samples exceeded baseline; major impacts for pH, boron, manganese, sulfate and TDS where 64, 98, 64, 100 and 93 percent of all samples exceeded baseline respectively. Of these the median concentrations for boron, manganese, sulfate, and TDS exceeded the baseline Median + 2MAD where they were 2, 10, 187 and 1.3 times larger respectively. No pH values were outside of the livestock criteria range. There is no livestock criterion for manganese, and median boron concentrations were below the livestock criterion; however, median concentrations for sulfate and TDS exceeded livestock criteria where they were 8 and 5 times larger respectively. Therefore, within spoil wells sulfate and TDS are all considered to be of concern relative to baseline and livestock criteria. It is important to note that impact to boron and fluoride concentrations is lower in spoil wells relative to CCB wells.

A comparison of non-baseline Fruitland Formation coal aquifer wells to the Median + 2MAD for baseline Fruitland Formation coal aquifer wells within the NTEC lease showed the following; negligible impacts for pH, conductivity, total iron, manganese, chloride, and TDS; minor impacts for selenium and fluoride where 20 and 13 percent of all samples exceeded baseline respectively; major impacts for boron and sulfate where 92 and 64 percent of all samples exceeded baseline respectively. The median concentrations for boron and sulfate exceeded the baseline Median + 2MAD and concentrations were 1.3 and 6 times larger respectively. When compared against livestock water quality criteria, median boron and sulfate concentrations were below the livestock criteria. Therefore, within non-baseline Fruitland coal wells no constituents are considered to be of concern relative to baseline and livestock criteria, although boron and sulfate have major impacts relative to baseline. It is important to note that impact to non-baseline Fruitland coal wells within the NTEC lease is significantly reduced relative to impacts in CCB and spoil wells.

Since there are no current uses for the Fruitland formation in or adjacent to the Navajo Tribal Coal Lease and no foreseeable uses other than oil and gas extraction, impacts to the Fruitland formation are not expected to preclude water uses. Additionally, the predicted and observed impacts to the Fruitland Formation do not extend outside of the immediate areas surrounding the mine pits and reclaimed areas and the aquifer is generally not capable of providing a sustainable water supply (NTEC 2013, Part 6 Sect. 41). Therefore for the purpose of this assessment, the impacts to the Fruitland Formation groundwater quantity are considered to be negligible.

5.3.7.4 Pictured Cliffs Sandstone Quantity

The PCS is a marginal water resource due to low permeability, poor water quality, gas production, and low yields. The PCS is also a natural gas reservoir in the San Juan Watershed. Stone et al. (1983) state that the PCS cannot be considered a major aquifer and it is important only because it is the water-bearing horizon immediately underlying the coals in the Fruitland Formation.

Lateral flow through the PCS within Area II is expected to be generally toward the northeast as indicated by the potentiometric surface provided in Figure 15. There could also be a component of flow west toward the PCS outcrop located east of the Chaco River. Groundwater flow rates through the PCS will be very low due to the very low hydraulic conductivity of the PCS. Any discharge along the PCS outcrop to the west of Area II will likely be removed by evapotranspiration. Based on pre-mine observations along the PCS outcrop adjacent to Areas III and IV North, flow rates in the PCS are expected to be insufficient to sustain flow at seeps and into the alluvial aquifer.

It is estimated that a 5 foot drawdown will be present in the PCS at the completion of proposed mining in Area IV North. The layer of shale separating the bottom of the lowest coal seam and the PCS serves to restrict groundwater inflow from the PCS during mining. The thickness of shale layer between the No. 2 coal and the PCS averages about 8.7 feet over the Area IV North mine block but is absent in some places. This variation in the shale thickness has been accounted for in the estimates of drawdown within the PCS. Artesian pressures in the PCS occur in the eastern portion of the Area IV North mine block where the shale thickness separating the coal from the PCS is greater. Accordingly, any drawdown in the PCS is dampened, particularly in these locations where the shale thickness is greater.

The model simulated steady-state post mining potentiometric surface in the PCS is provided in Figure 32. This surface is similar to the pre-mining PCS potentiometric surface in Figure 15, except for the localized increase in the heads in the PCS below the mine backfill within Area IV North. The higher head in the PCS below the mine backfill is due to the higher heads at the base of the mine backfill. Very little change in heads is predicted at locations away from mine backfill, including at the former PCS wells GM-19 and GM-28, located within the lease area at distances of about 3,500 and 3,000 feet from the Area IV North mine pit. This localized increase in heads in the PCS results in an increase in gradients toward the northwest and toward the northeast.

There is one identified livestock watering well completed in the PCS located along the western side of the Chaco River west of Area V which may be influenced by alluvial waters of the Chaco River and it is not known if the well is actively being used. The unit is known to have very low yields in the vicinity of the Navajo Tribal Coal Lease and is generally not capable of providing a sustainable water supply for this use. The primary documented current and historic use of the PCS in the area is for oil and gas extraction, which is not particularly sensitive to water quantity loses within the extraction zones. Therefore impacts to the PCS are not expected to disturb water users. Additionally, the predicted and observed impacts to the PCS do not extend outside of the immediate areas surrounding the mine pits and subsequent reclaimed areas. Therefore for the purpose of this assessment, the impacts to the PCS groundwater quantity are considered to be negligible.

5.3.7.5 **Pictured Cliffs Sandstone Quality**

Comparison of baseline water quality to livestock criteria found that water in the PCS is a very poor source of supply for livestock watering use, specifically because of elevated chloride, sulfate, and TDS concentrations, which are above livestock criteria. However, there is one identified livestock watering well completed in the PCS located along the western side of the Chaco River west of Area V which may be influenced by alluvial waters of the Chaco River. It is uncertain if the well is actively being used. The unit is known to have low yields in the vicinity of the Navajo Tribal Coal Lease and is generally not capable of providing a sustainable water supply for this use. The primary documented current and historic use of the PCS in the area is for oil and gas extraction, which does not have protective use criteria designations, as water quality is not particularly significant for this use. Therefore, impacts to the PCS are not expected to disturb water users. The only non-baseline PCS monitoring well KP-84 did not have sufficient water for sampling during the historic monitoring period from 1990 to 1998. Therefore there will be no comparison of non-baseline PCS quality to baseline conditions.

Direct intermediate-term impacts to the groundwater quality beyond the active mine area are not anticipated to occur during mining and reclamation operations. During active mining, hydraulic gradients and groundwater flow directions in the PCS would be toward the mine pits and backfill areas. Thus, it is expected that there would be little change in the quality of groundwater beyond the limits of the mine pit and mine backfill during mining and reclamation operations. However, over the long term as these gradients reverse post-reclamation increase in TDS and sulfate concentrations in mine spoil backfill may result in increased TDS and sulfate concentrations in the PCS adjacent to mining (Ecosphere Associates Inc. 2011). Additionally, the predicted and observed impacts to the PCS do not extend outside of the immediate areas surrounding the mine pits and subsequent reclaimed areas and are not expected to disturb water users. Therefore for the purpose of this assessment, the impacts to the PCS groundwater quantity are considered to be negligible.

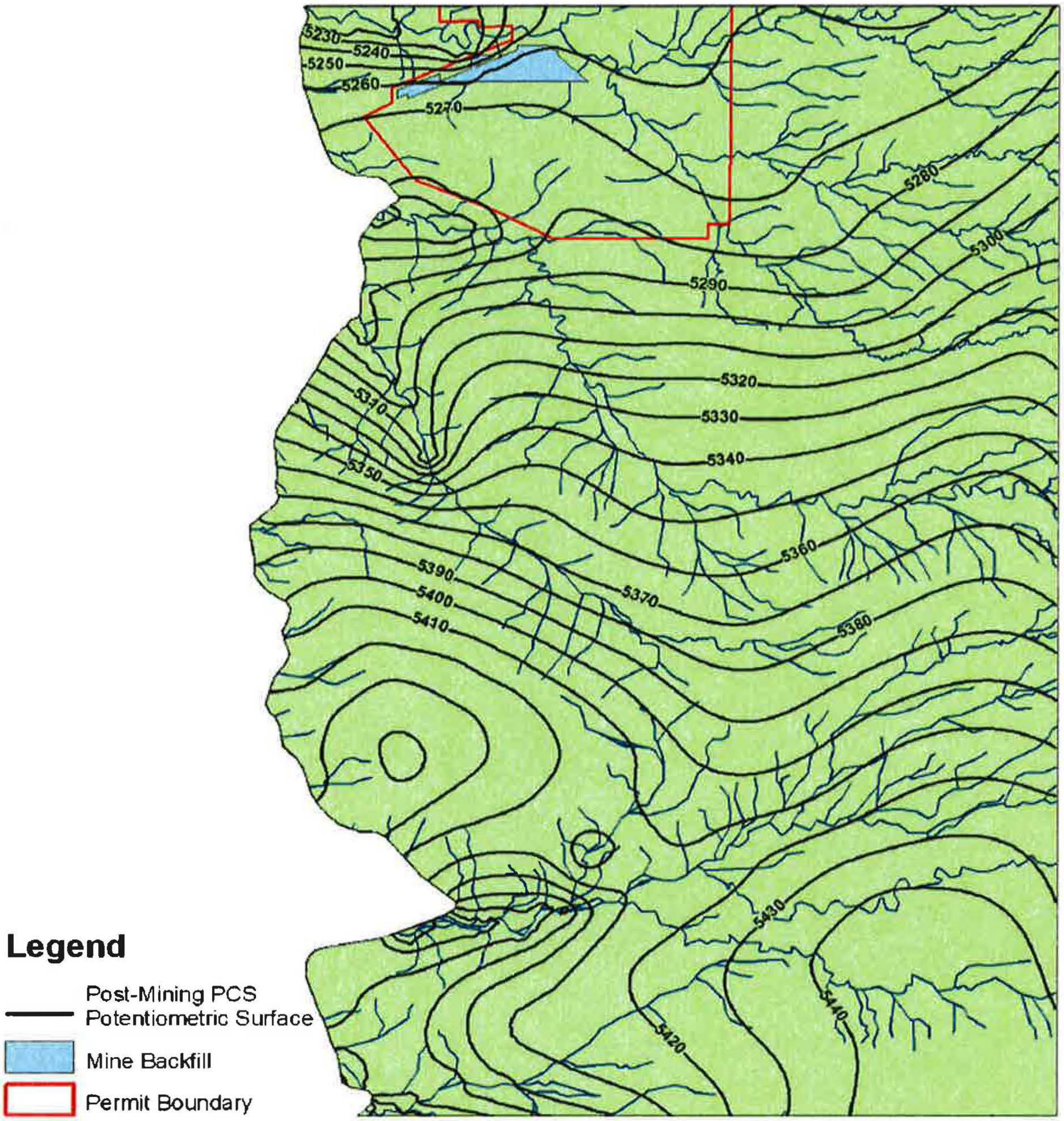


Figure 32: Post-Mining Potentiometric Surface in the PCS Aquifer (NTEC 2013)

6 MATERIAL DAMAGE

Sections 507(b) (11) and 510(b) (3) of SMCRA, and 30 CFR § 780.21 (g) require OSMRE to determine that a mining and reclamation operation has been designed to prevent material damage to the hydrologic balance outside the permit area. "Hydrologic balance" is defined at 30 CFR § 701.5 as, "the relationship between the quality and quantity of water inflow to, water outflow from, and water storage in a hydrologic unit such as a drainage basin, aquifer, soil zone, lake or reservoir. It encompasses the dynamic relationships among precipitation, runoff, evaporation, and changes in ground and surface water storage."

"Material damage to the hydrologic balance" is not defined in SMCRA or at 30 CFR § 701.5. The intent of not developing a programmatic definition for "material damage to the hydrologic balance" was to provide the Regulatory Authority the ability to develop a definition based on regional environmental and regulatory conditions. Therefore, for the purpose of this CHIA;

> Material damage to the hydrologic balance outside the permit area means any quantifiable permanent adverse impact from surface coal mining and reclamation operations on the quality or quantity of surface water or groundwater that exceeds the identified material damage **limits** and that would preclude any existing or reasonably foreseeable use of surface water or groundwater outside the permit area.

The hydrologic impact assessment presented in Chapter 5 of this document considers available quantity and quality information related to surface water and groundwater resources potentially affected by the Navajo Mine and Pinabete Permit Areas. Chapter 5 contains definitions for impact designation of negligible, minor, moderate, and major (Table 7). Detailed discussion of the monitoring program, impact minimization, and impact designation determinations can be found in Chapter 5. The material damage assessment determines if material damage to the hydrologic balance has occurred, or the has the potential to occur, due to the mining operation.

6.1 Cumulative Impact of NTEC Operations and El Segundo Mine

OSMRE has concluded that surface water quantity and quality cumulative impacts relative to the Chaco River from the El Segundo are negligible. Additionally, the State of New Mexico Mining and Minerals Division has determined that all anticipated mining within the El Segundo Mine has been designed to prevent material damage to the hydrologic regime outside the permit area (NMEMNRD 2008).

6.2 NTEC Operations Impact on NAPI

OSMRE has determined that NTEC operations have negligible impacts on NAPI operations.

6.3 NTEC Operations Impact to Morgan Lake and APS

OSMRE has determined that flow contribution to Morgan Lake from tributaries which traverse the NTEC Navajo Mine and Pinabete Permit area is negligible, and quality impacts associated with these tributaries are also negligible.

NTEC operations are not anticipated to adversely impact the water quantity or quality necessary for power plant operations, and OSMRE has determined that NTEC operations will have a negligible impact on power plant operations.

6.4 Chaco River

OSMRE has determined that impacts of the NTEC mining operation on Chaco River surface water quantity is considered to be negligible. Relative to the Chaco River surface water quality, although the impact designation may be considerable for certain constituents, it does not appear to translate to a significant impairment of use. OSMRE finds that surface water quality within the Chaco River is generally appropriate for the designated post-mining land use of livestock grazing.

6.5 Historic Mining North of the Navajo Mine Permit

OSMRE finds that changes in alluvial groundwater quantity will not preclude use; therefore, the impact is designated to be negligible. Relative to Fruitland formation and PCS quantity and quality, impact designation is *negligible,* since observed impacts do not extend outside of the immediate areas surrounding the reclaimed areas and the hydrologic units are generally not capable of providing sustainable water supply. OSMRE's assessment has concluded that potential impacts to use from historic CCB disposal are *negligible.*

6.6 Navajo Mine and Pinabete Permit Area

OSMRE has identified both **hydrologic balance thresholds** and **material damage limits** for the Navajo Mine (Table 2).

- A **material damage limit** is a long-term coal mining effect on the hydrologic balance by the mining operation that permanently precludes an existing or reasonably foreseeable designated use outside of the permit boundary, and specifically pertains to the designated post-mining land use within the permit area. Such an effect cannot be effectively mitigated or replaced by the coal operator.
- A **hydrologic balance threshold** constitutes changes to the hydrologic balance caused by the mining operation that are short-term and can be effectively mitigated by reclamation or by water supply replacement, or changes to the hydrologic balance that do NOT preclude existing or reasonably foreseeable uses.

For the purpose of this material damage assessment, short-term impacts are defined as impacts that occur to the hydrologic balance during mining, but are not projected to persist after the reclamation liability period. Long-term impacts are defined as impacts that are projected to persist after the reclamation liability period. The reclamation liability period ends after the permittee has met all of the requirements at 30 CFR 750, including those at 30 CFR 800.13. At a minimum an application for final (Phase III) reclamation liability release would not be considered by the regulatory authority until the reclaimed (back filled, re-graded and top soiled) lands have been revegetated for ten years.

The intent of determining a hydrologic balance **threshold** is to alert NTEC and OSMRE of potential water resource impacts of concern, such that NTEC may take appropriate actions to prevent material damage. The exceedance of a material damage **limit** would result in a finding that material damage to the hydrologic balance outside the permit area had occurred. At the time of final bond release OSMRE must make a determination that material damage to the hydrologic balance outside of the permit area has been prevented. Final bond release shall not be granted until such a determination is made.

The distinction between long-term and short-term impacts is supported in research. Various studies have determined that a number of requirements that must be met by a coal operator in order to achieve final bond release can restore water quality and quantity. Appropriate reclamation has been found to restore the seasonal variation rainfall-runoff watershed processes (Bonta, et al. 1997). Reclaiming diversions and re-vegetation have been shown to considerably improve water quality (Bonta and Dick 2003). Additionally, drastic decreases in suspended sediment concentrations, load rates, and yields have been documented to occur at surface coal mines subsequent to reclamation (J. V. Bonta 2000).

Table 12: Material Damage Limits and Hydrologic Balance Thresholds

Category			Definition
General	Quantity	Limit	irretrievable loss of the water resource to support existing or reasonably foreseeable uses outside of the lease area that cannot be provided by alternate water supplies
		Threshold	long term loss of the water resource that does not preclude the current or potential future use potential of the resource or short term loss of the water resource to support existing uses that can be mitigated by reclamation or by provision of alternate water supplies
	Quality	Limit	long-term changes in water quality outside the lease area that preclude existing or reasonably foreseeable uses that cannot be provided by alternate water supplies
		Threshold	long term changes in water quality that occasionally exceed the water quality observed in the baseline fluctuations but that do not preclude the current or potential future use potential of the resource or short term changes in water quality that consistently exceed the water quality observed in the baseline fluctuations but that do not preclude the current use or can be mitigated by reclamation or by provision of alternate water supplies
Criteria Applied to the Navajo Mine		Limit	**Long-term** (impact remains after final reclamation and bond-release) Impact Designation of **Major** as defined in Table 7, and which **Preclude** Existing or Reasonably Foreseeable **Uses Outside** of the Lease area that **Cannot be Mitigated** by Reclamation or Provision of Alternate Water Supplies
		Threshold	**Long-term** (impact remains after final reclamation and bond-release) Impact Designation of **Moderate or Major** as defined in Table 7 **Outside of the Lease area** that **Does NOT Preclude** Existing or Reasonably Foreseeable **Uses** **OR** **Short-term** (impact occurs only during active mining and reclamation prior to final bond release) Impact Designation of **Major** as defined in Table 7, which **may Preclude** Existing or Reasonably Foreseeable **Uses Outside of the Lease area** that **Can be Mitigated** by Reclamation or Provision of Alternate Water Supplies

A summary of OSMRE's material damage assessment and findings is presented in Table 13 and further discussed below. For clarity in the discussion hydrologic balance **threshold** and material damage **limit** will be bolded, and the impact designations of *negligible, minor, moderate*, and *major* will be italicized.

Table 13: Assessment of Material Damage for the Waters of the Navajo Mine and Pinabete Permit Areas

Water Resource	Assessment Approach	Hydrologic Balance Threshold Reached	Material Damage Limit Reached	Impact Mitigation	Adequate Monitoring Program
Fruitland & PCS Quantity	Evaluation of potentiometric surface contour maps	No	No	Contemporaneous Reclamation	Yes
Alluvial Quantity	Comparison of water levels at individual wells over-time	No	No	Contemporaneous Reclamation; mining limited to ephemeral channels; stream buffer zones	Yes
Surface Water Quantity	SEDCAD modeling- assessment of pre- and post-mining impacts; Percent of HUC12 Watersheds controlled with impoundments	Yes	No		Yes
Fruitland & PCS Quality	Comparison of baseline water quality to potentially impacted or non-baseline wells, including spoil and CCB wells	No	No	Contemporaneous Reclamation; mixing of overburden/ backfill materials	Yes
Alluvial Quality	Comparison baseline (upstream/pre-mining) water quality to non-baseline (post-mining/downstream) water quality	Yes	No	Contemporaneous Reclamation; mining limited to ephemeral channels; stream buffer zones	Yes
Surface Water Quality		No	No	Contemporaneous Reclamation; mining limited to ephemeral channels; stream buffer zones; Sedimentation Ponds	Yes

6.6.1 Material Damage Assessment

6.6.1.1 Surface Water

Surface water quantity impacts are assessed as a relative percentage of the watershed controlled through the use of sediment impoundments compared to the corresponding Hydrologic Unit Code (HUC) 12 watershed delineation. Hydrologic balance **thresholds** and material damage **limits** have not been reached for any of the assessed HUC 12 watersheds, since all impact designations are *negligible* or *minor.*

When modeled pre-mining peak flows are compared to-post-mining peak flows, the comparison indicates that hydrologic balance **thresholds** and material damage **limits** have not been reached for the Chinde Wash Watershed, Coal Creek-Chaco River Watershed, or Cottonwood Arroyo Watershed.

In the Chinde-Chaco River Watershed a long-term impact designation of *moderate* has been determined for the area outside of the permit boundary. This *moderate* impact designation is due to a reduction in post-mining peak flow. Therefore, the hydrologic balance **threshold** has been reached for this watershed. The material damage **limit** has not been reached since the impact designation has not been determined to be *major* current designated water uses are not expected to be precluded. NTEC and OSMRE are currently discussing modifications to the reclamation plan that may be needed for this area to ensure material damage to the hydrologic balance is prevented outside of the permit area over the long-term.

Relative to Chinde Wash surface water quality, the hydrologic balance **threshold** and material damage **limit** have not been reached, since impacts are not long-term, not determined to be *major*, and will not preclude designated water uses.

6.6.1.2 Alluvium

The material damage assessment for alluvial water quantity confirms that hydrologic balance **thresholds** and material damage **limits** have not been reached, since all impact designations are *negligible*.

It has also been determined that the alluvial water quality hydrologic balance **threshold** has been reached in the Chinde Wash alluvium, since a short-term *major* impact designation has been assigned, which may preclude designated water use. The material damage **limit** has not been reached since impacts are not considered long-term. The alluvial monitoring plan in this area was augmented in 2012-13 to further assess and verify the duration of coal mining impacts in the Chinde Wash alluvium outside the permit area.

Relative to Cottonwood alluvial water quality, the hydrologic balance **thresholds** and material damage **limits** have not been reached since all impact designations are *negligible*.

6.6.1.3 Fruitland Formation and PCS

Relative to Fruitland formation and PCS quantity and quality, hydrologic balance **thresholds** and material damage **limits** have not been reached since impact designation is *negligible* and designated water use is not expected to be precluded. See Section 6.2 Historic Mining North of NTEC Operations for CCB disposal determination.

6.6.2 Conclusion

OSMRE finds that NTEC's Navajo Mine and Pinabete Permit monitoring programs have supplied sufficient information in the approved PAPs for this CHIA and finding. OSMRE finds that the operations of Navajo Mine and proposed Pinabete Permit Area have been designed to minimize impacts within the permit area and to prevent material damage to the hydrologic balance outside of the permit area.

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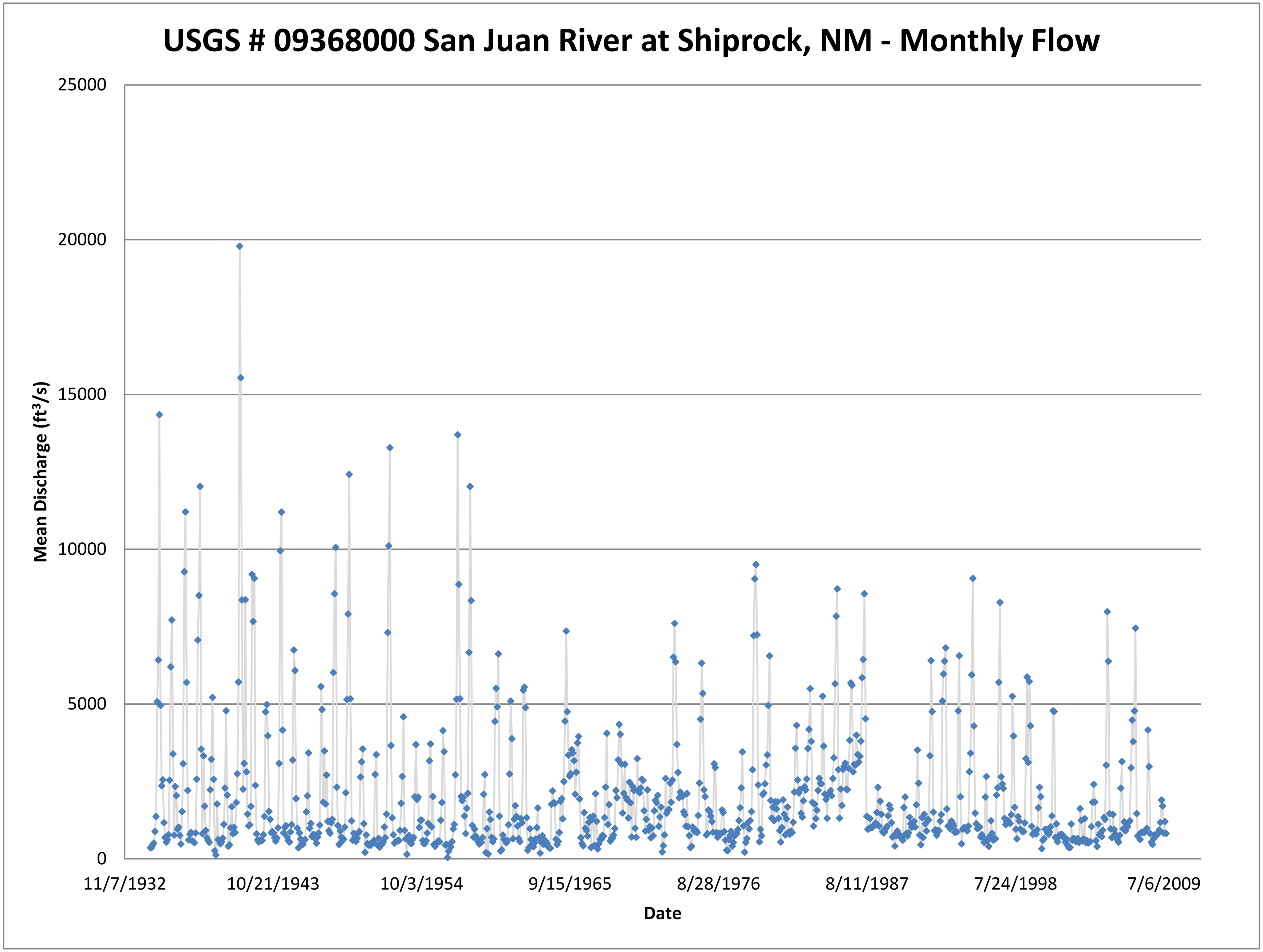
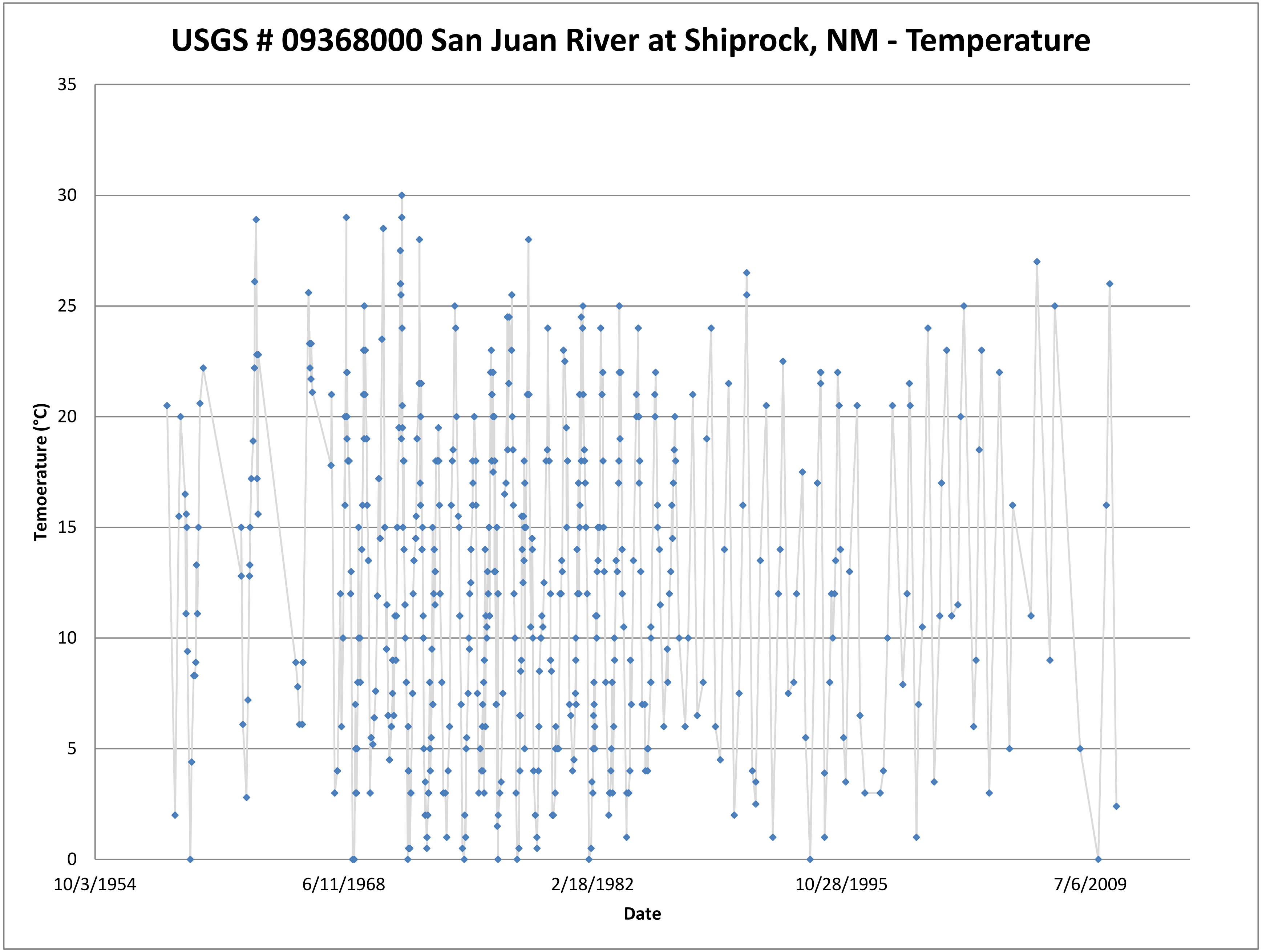
Appendix A - USGS Stations
USGS # 09368000



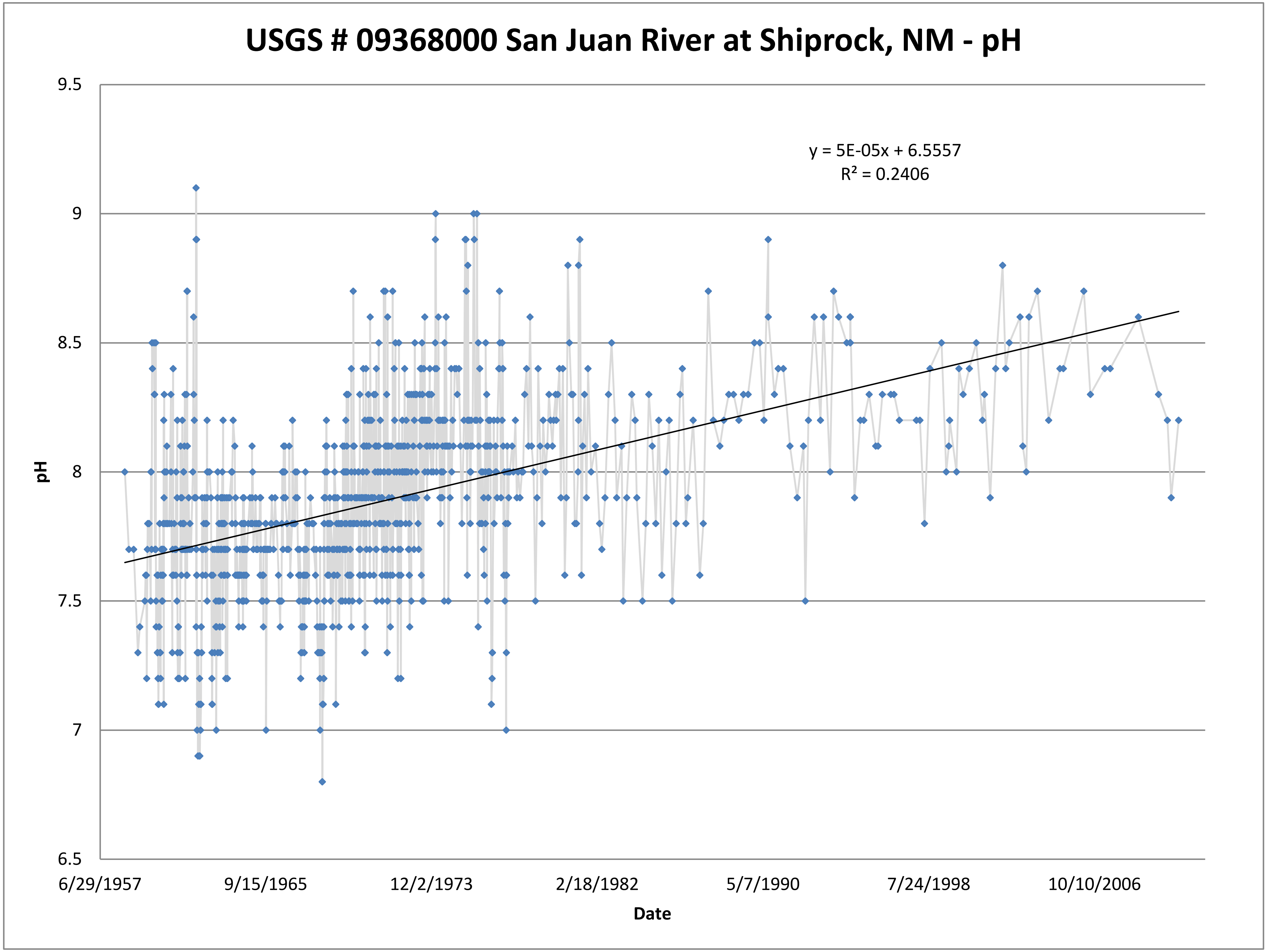
Appendix A - USGS Stations

USGS # 09368000

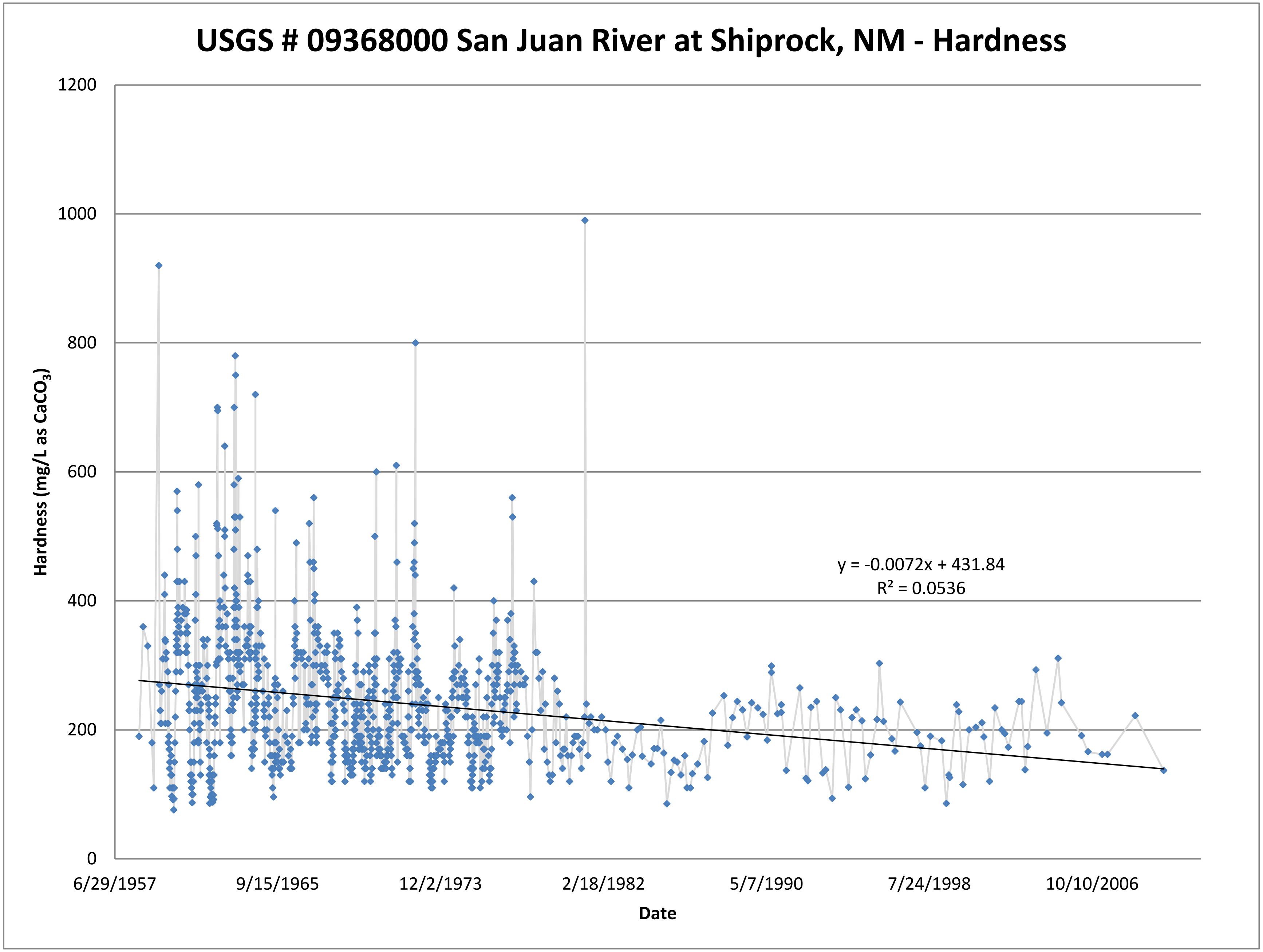


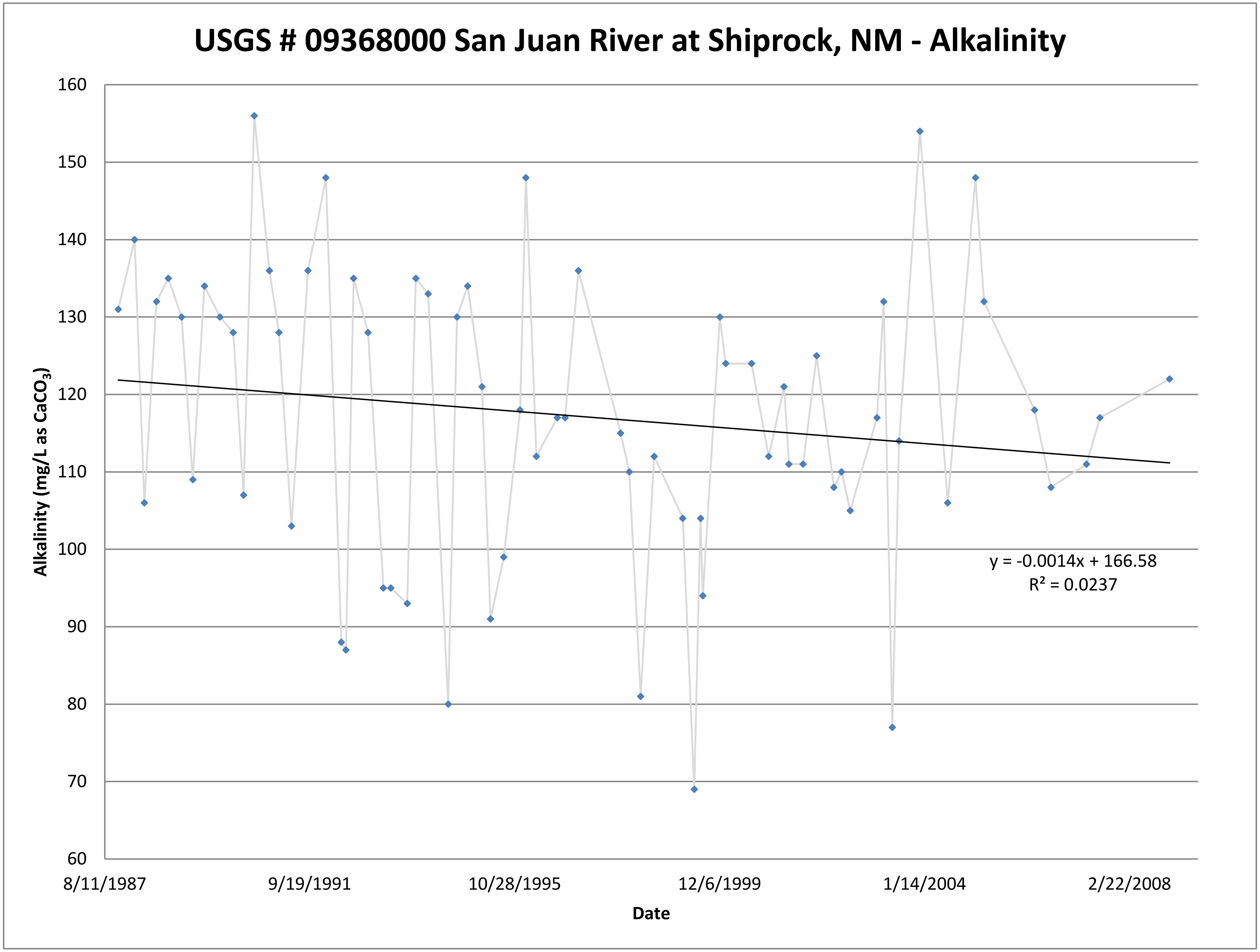
Appendix A - USGS Stations

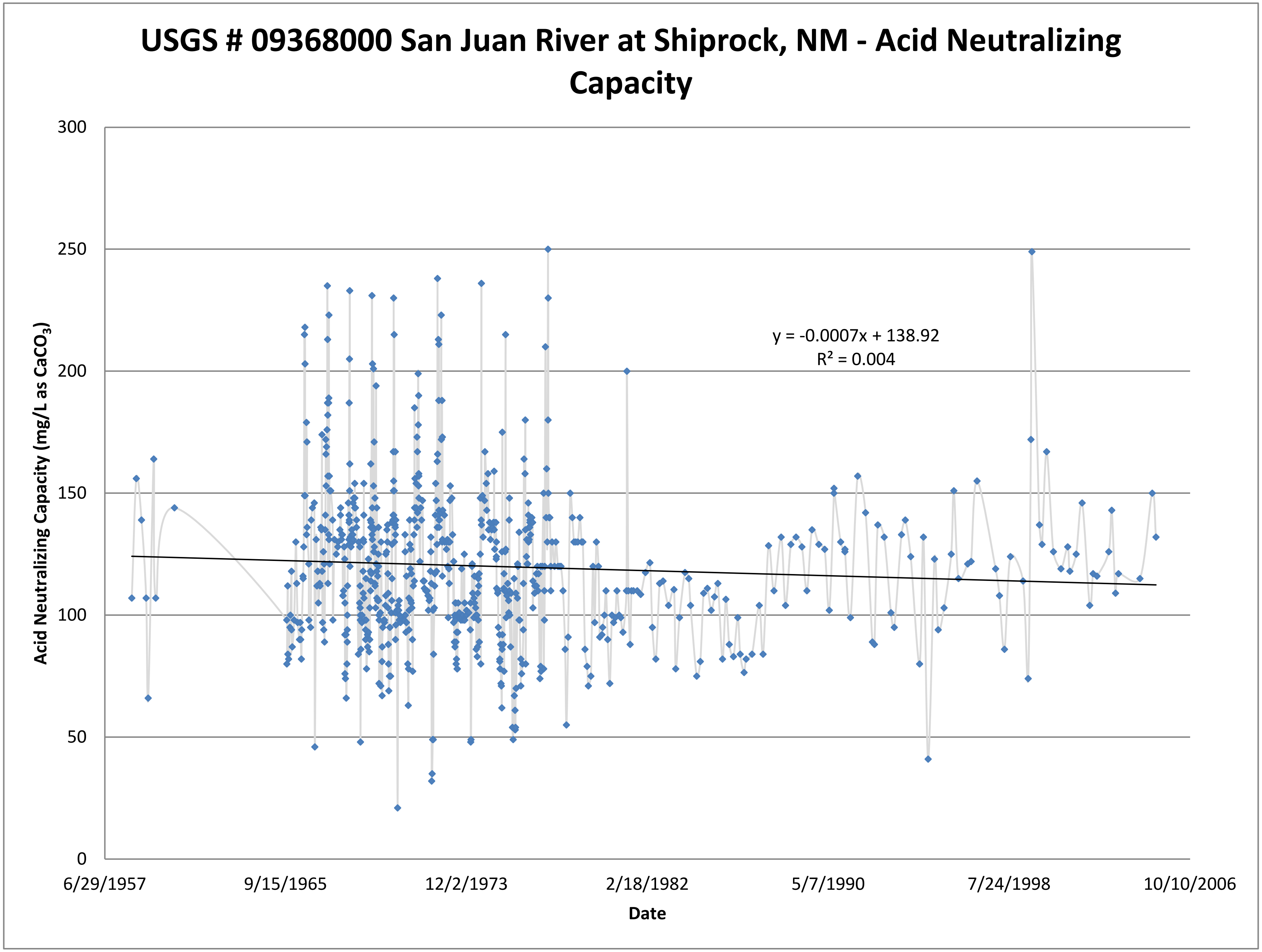
USGS # 09368000

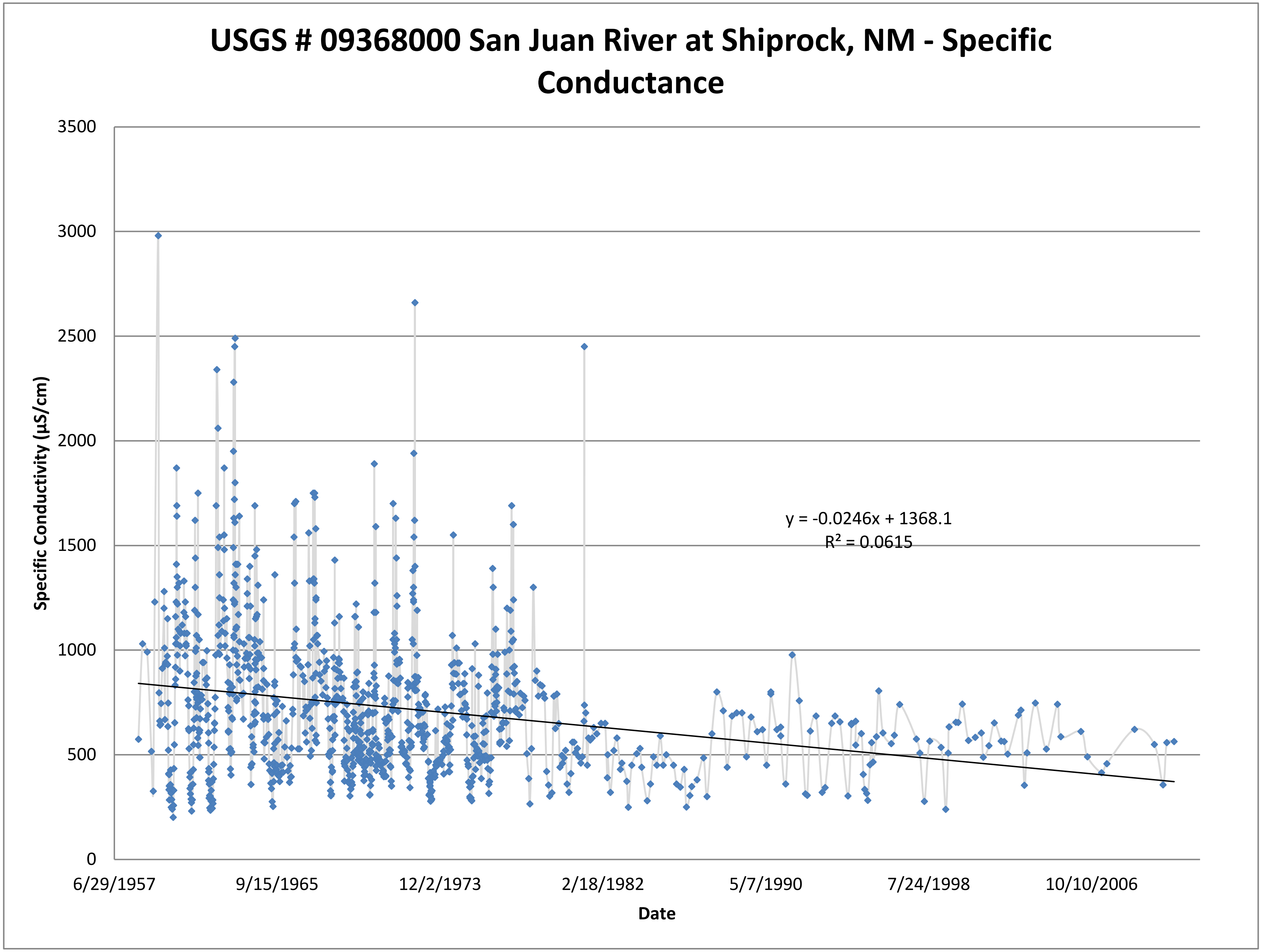


Appendix A - USGS Stations
USGS # 09368000

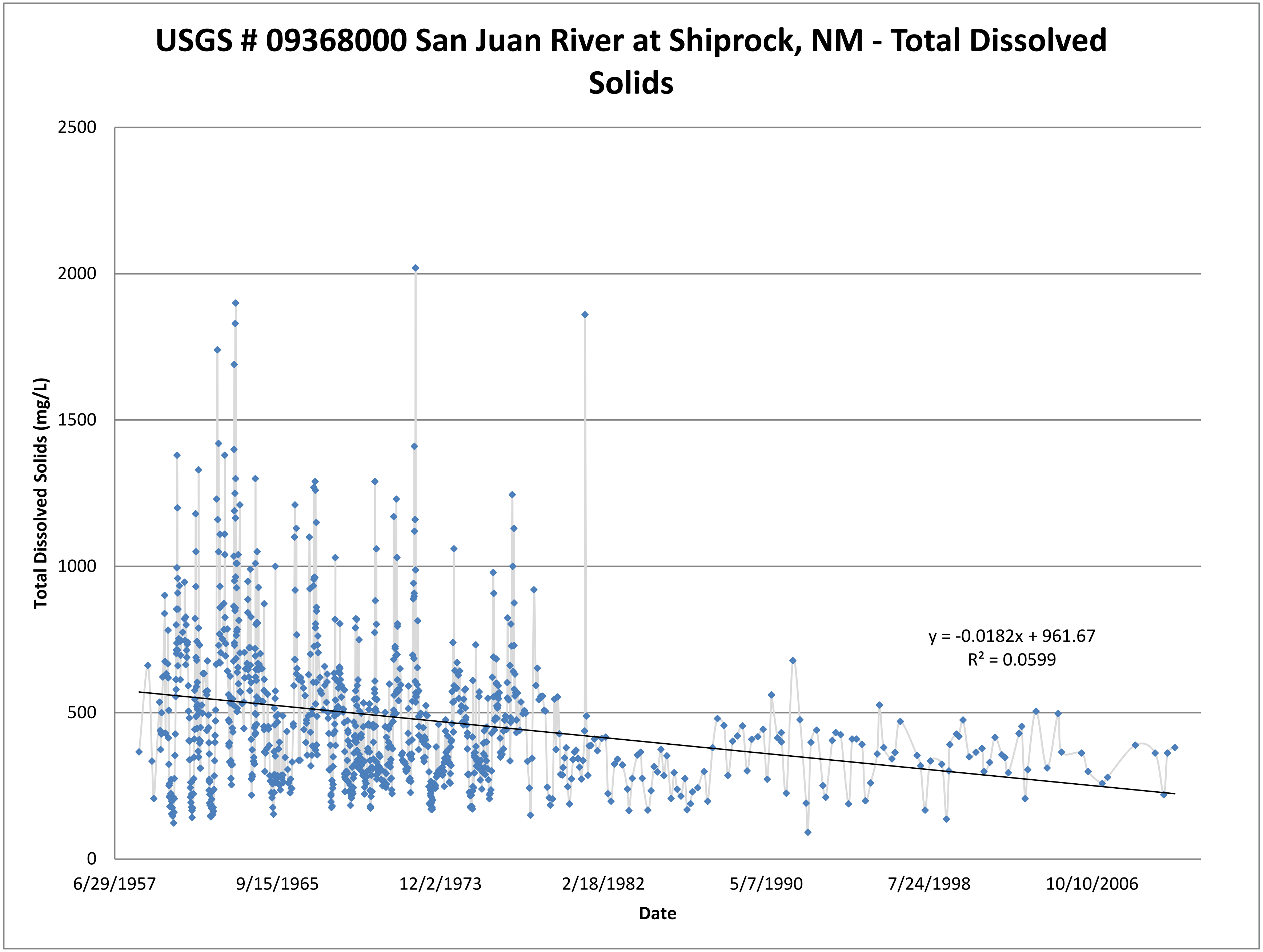



USGS # 09368000 San Juan River at Shiprock, NM - Alkalinity
160
150
140
130
120
110
100
90
80
70
60
Alkalinity (mg/L as CaCO3)
y = -0.0014x + 166.58
R² = 0.0237
8/11/1987
9/19/1991
10/28/1995
12/6/1999
1/14/2004
2/22/2008
Date

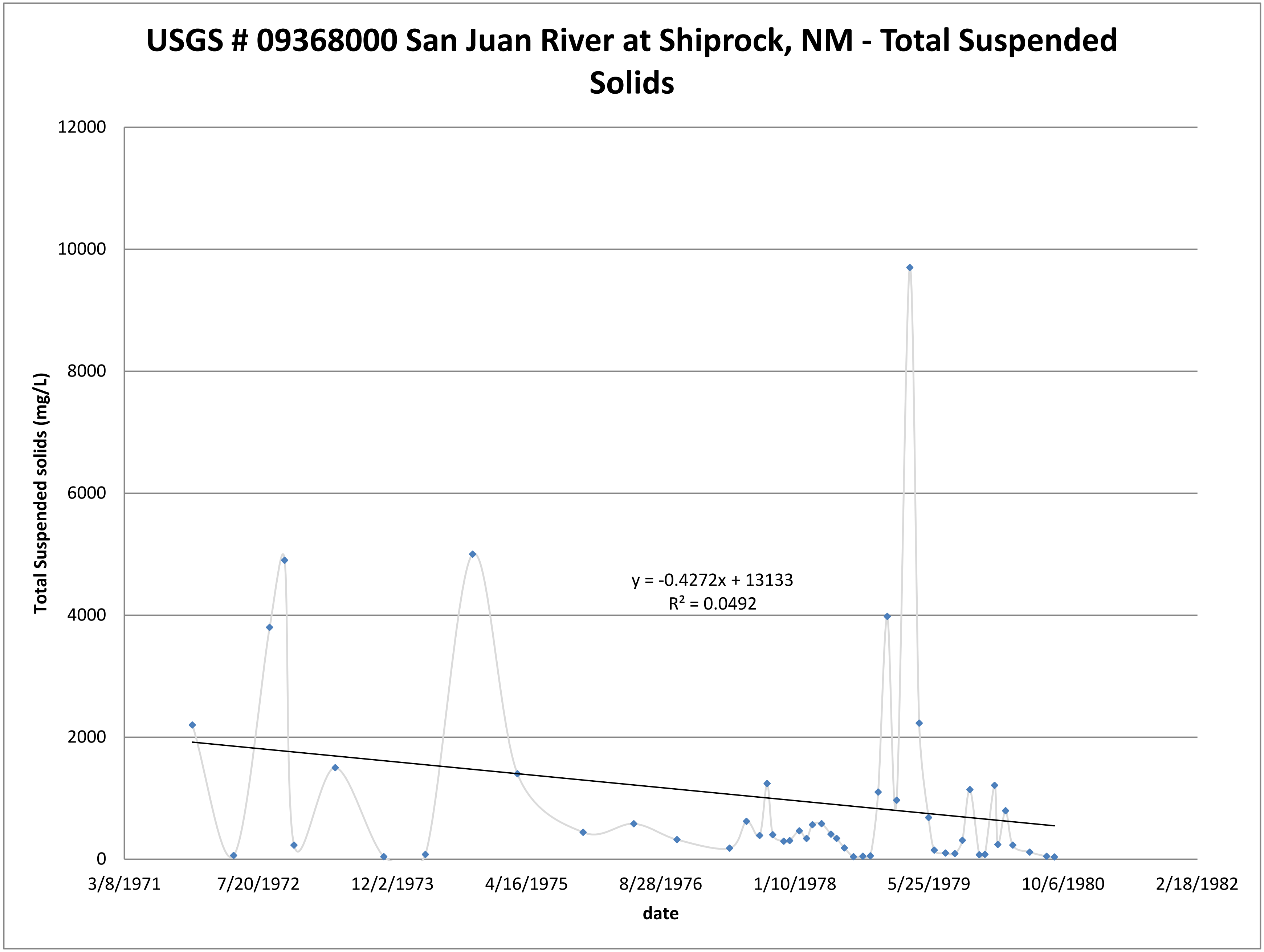

USGS # 09368000 San Juan River at Shiprock, NM - Acid Neutralizing Capacity
Acid Neutralizing Capacity (mg/L as CaCO3)
300
250
200
150
100
50
0
y = -0.0007x + 138.92
R² = 0.004
6/29/1957
9/15/1965
12/2/1973
2/18/1982
5/7/1990
7/24/1998
10/10/2006
Date

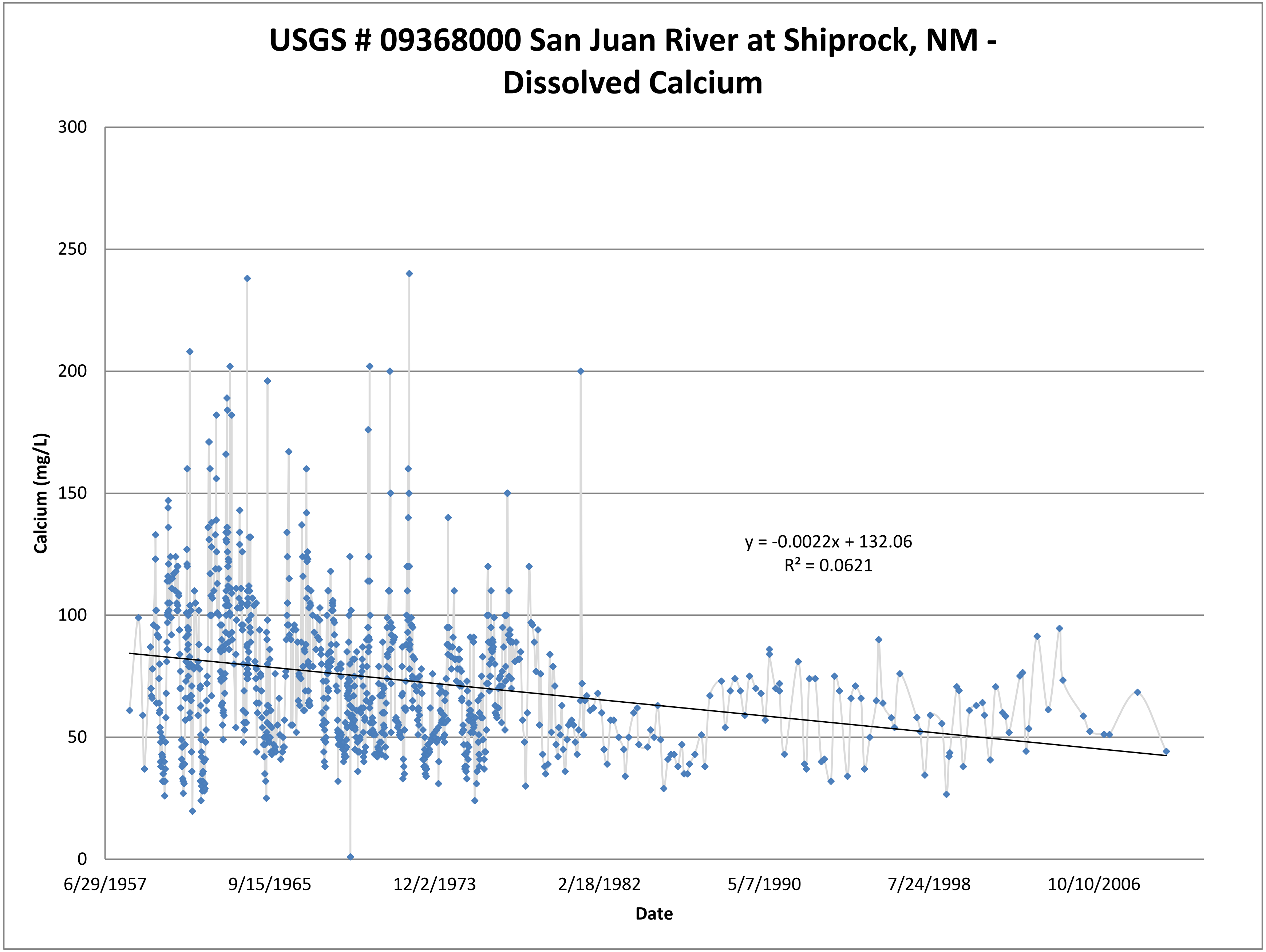

USGS # 09368000 San Juan River at Shiprock, NM - Specific Conductance
Specific Conductivity (µS/cm)
3500
3000
2500
2000
1500
1000
500
0
6/29/1957
9/15/1965
12/2/1973
2/18/1982
5/7/1990
7/24/1998
10/10/2006
Date
y = -0.0246x + 1368.1
R² = 0.0615

Appendix A - USGS Stations
USGS # 09368000

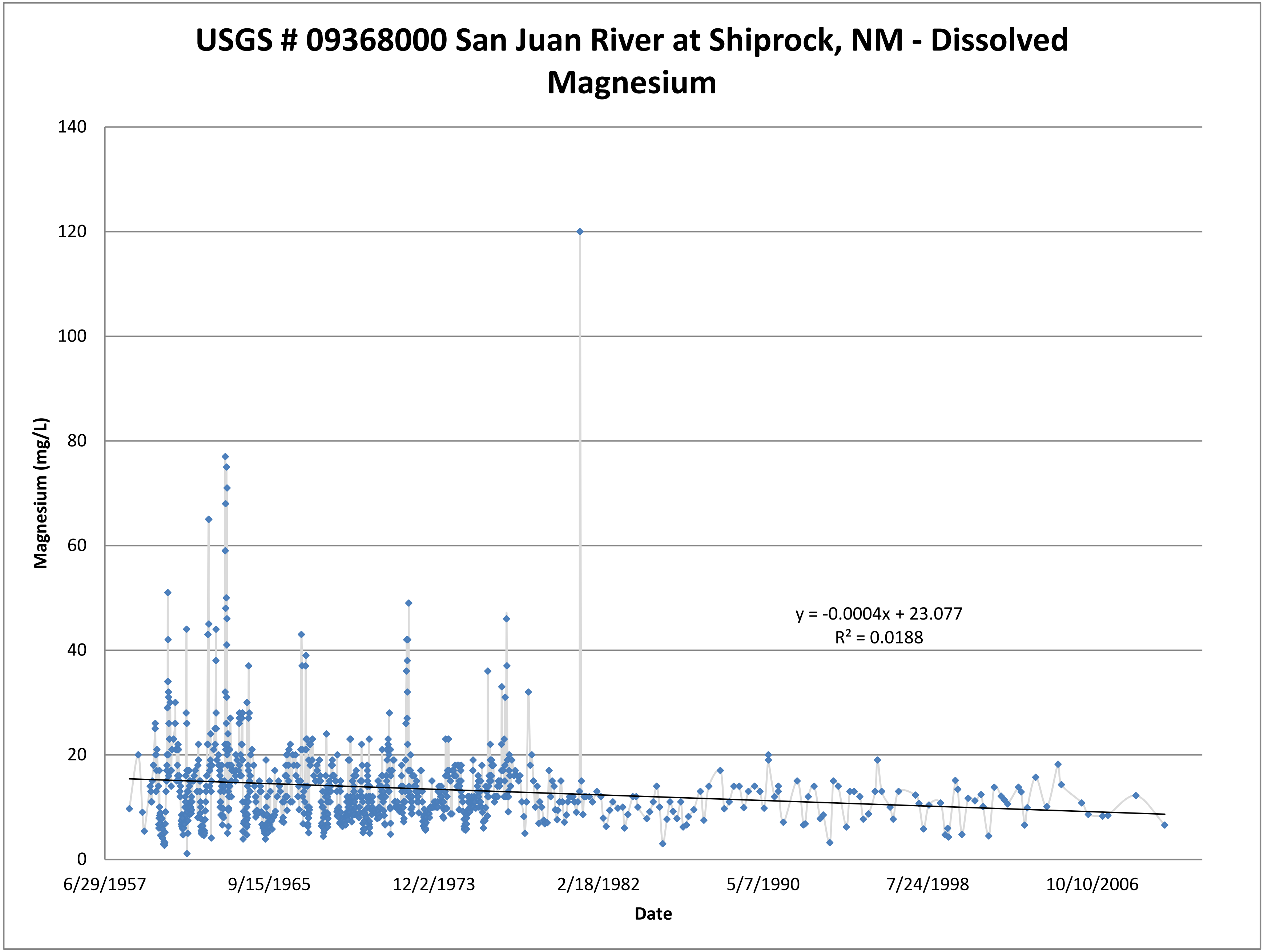


Appendix A - USGS Stations
USGS # 09368000

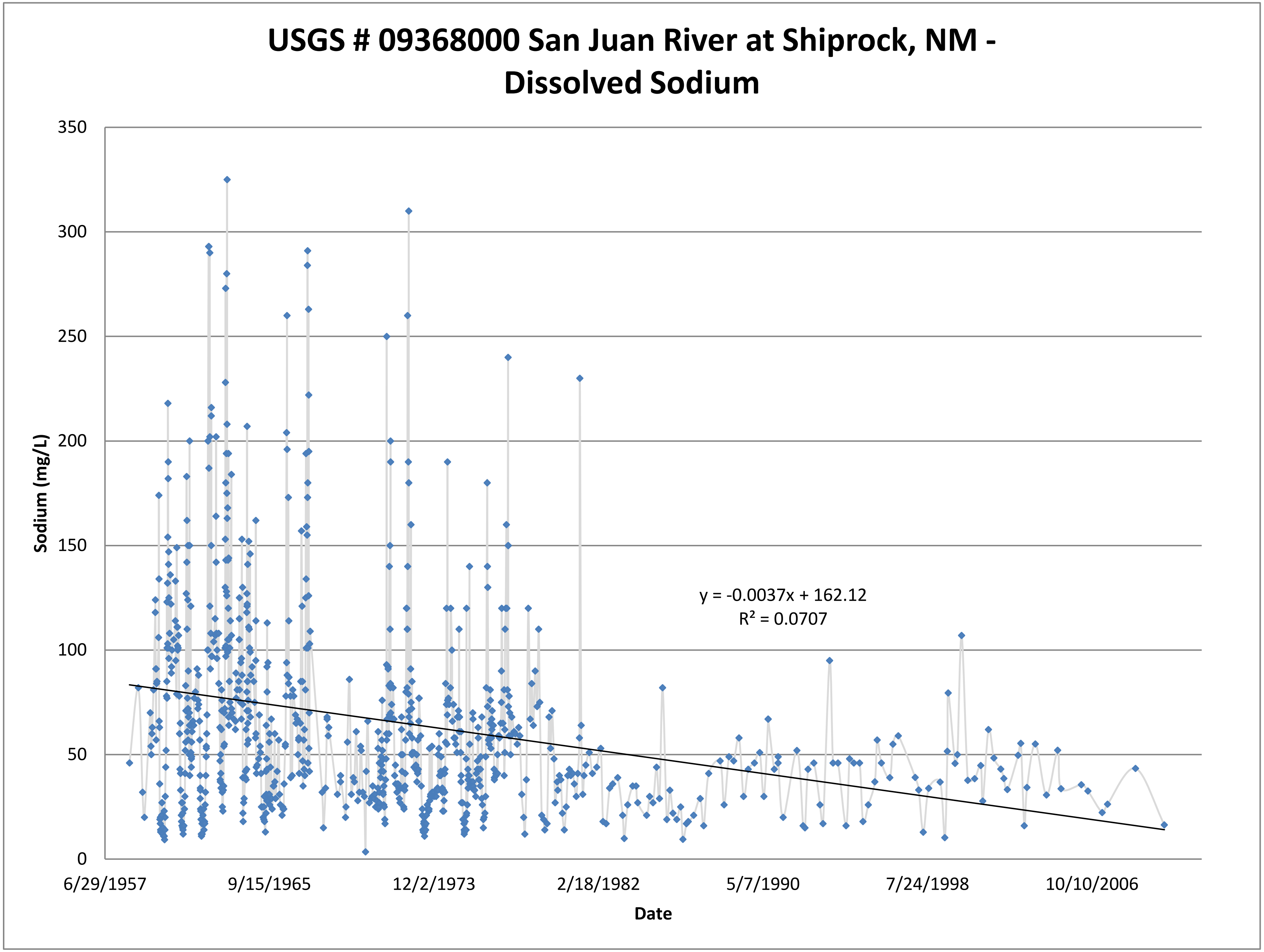


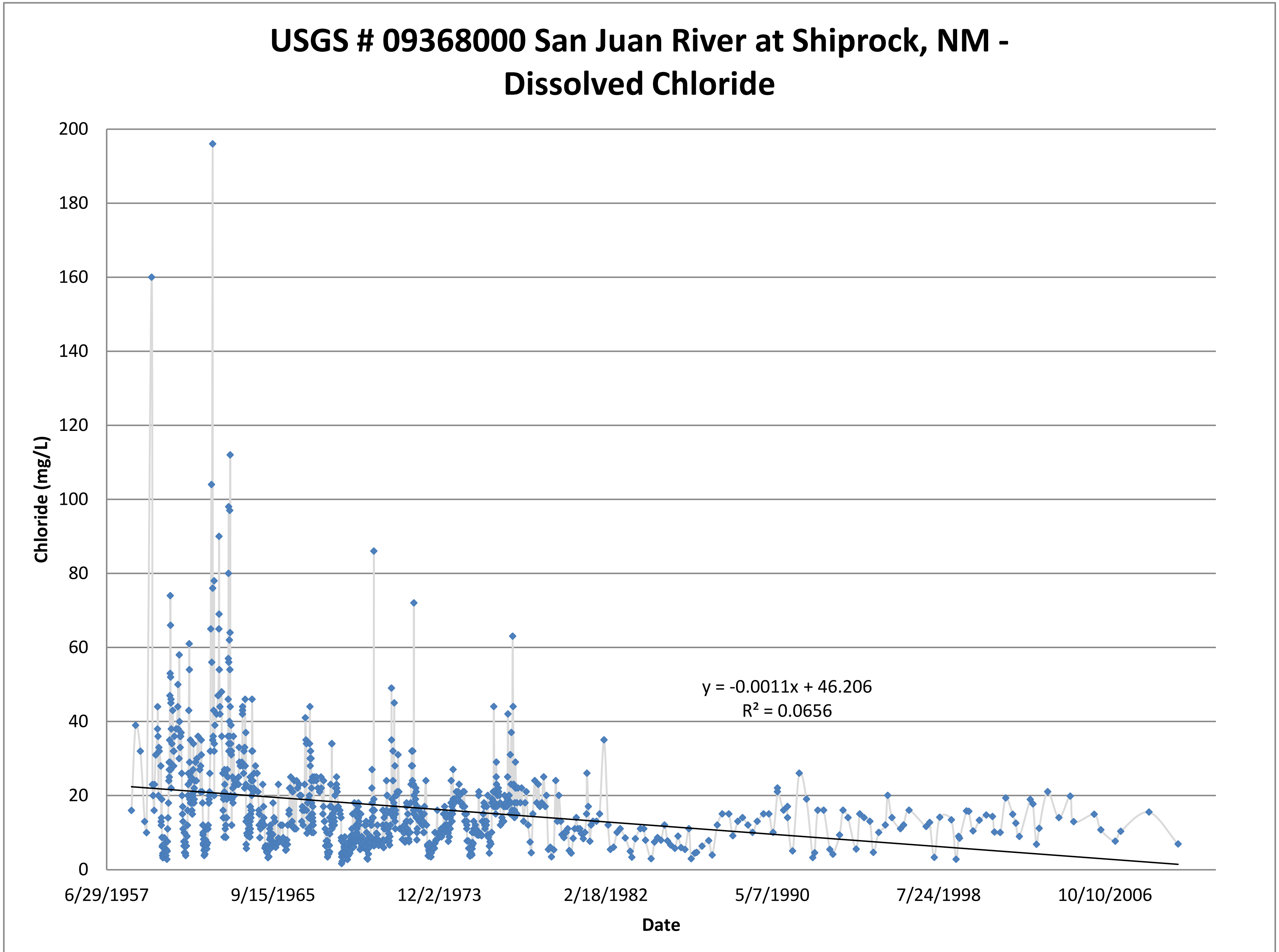

USGS # 09368000 San Juan River at Shiprock, NM - Dissolved Calcium
300
250
200
150
100
50
0
Calcium (mg/L)
y = -0.0022x + 132.06
R² = 0.0621
6/29/1957
9/15/1965
12/2/1973
2/18/1982
5/7/1990
7/24/1998
10/10/2006
Date

Appendix A - USGS Stations
USGS # 09368000

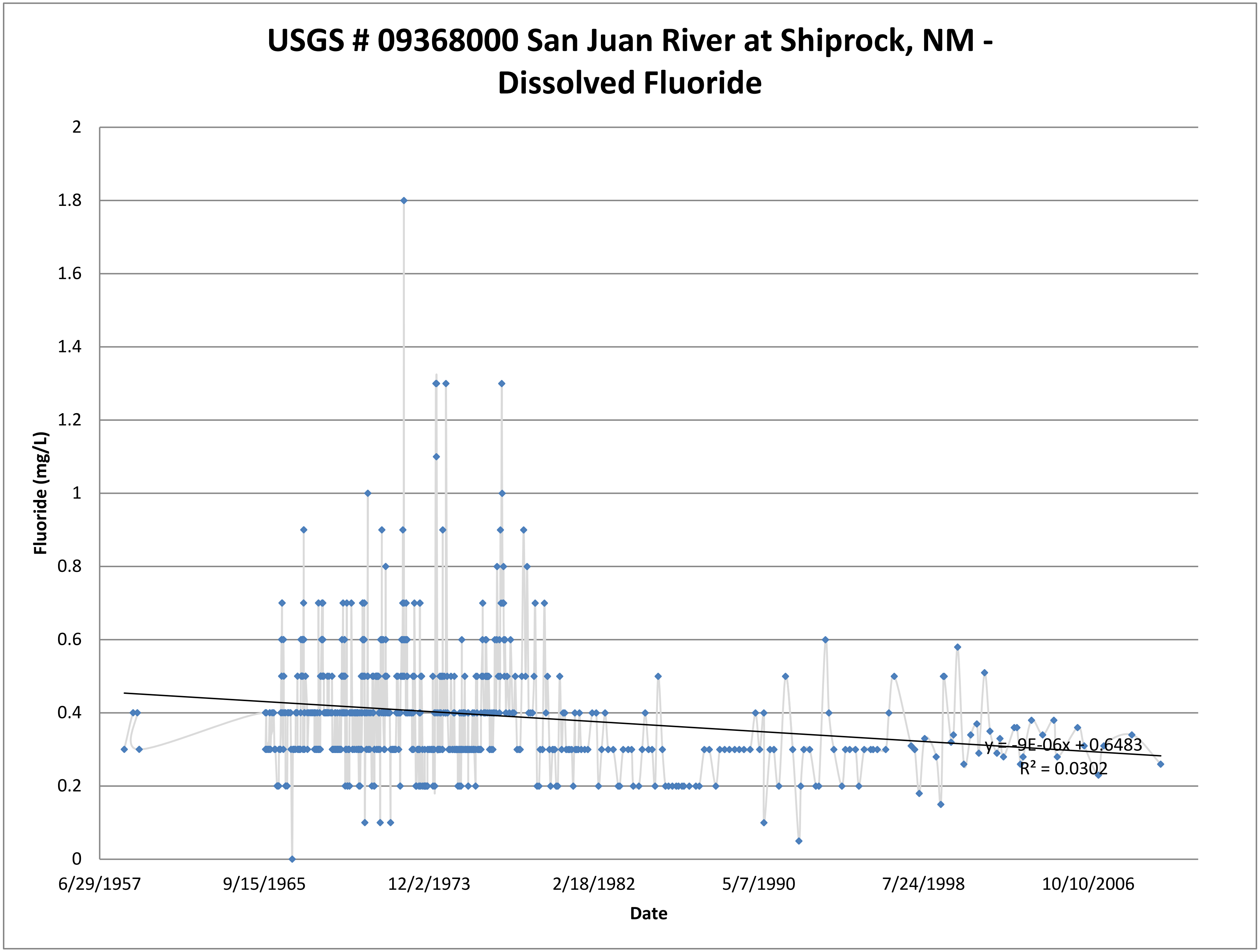


Appendix A - USGS Stations
USGS # 09368000

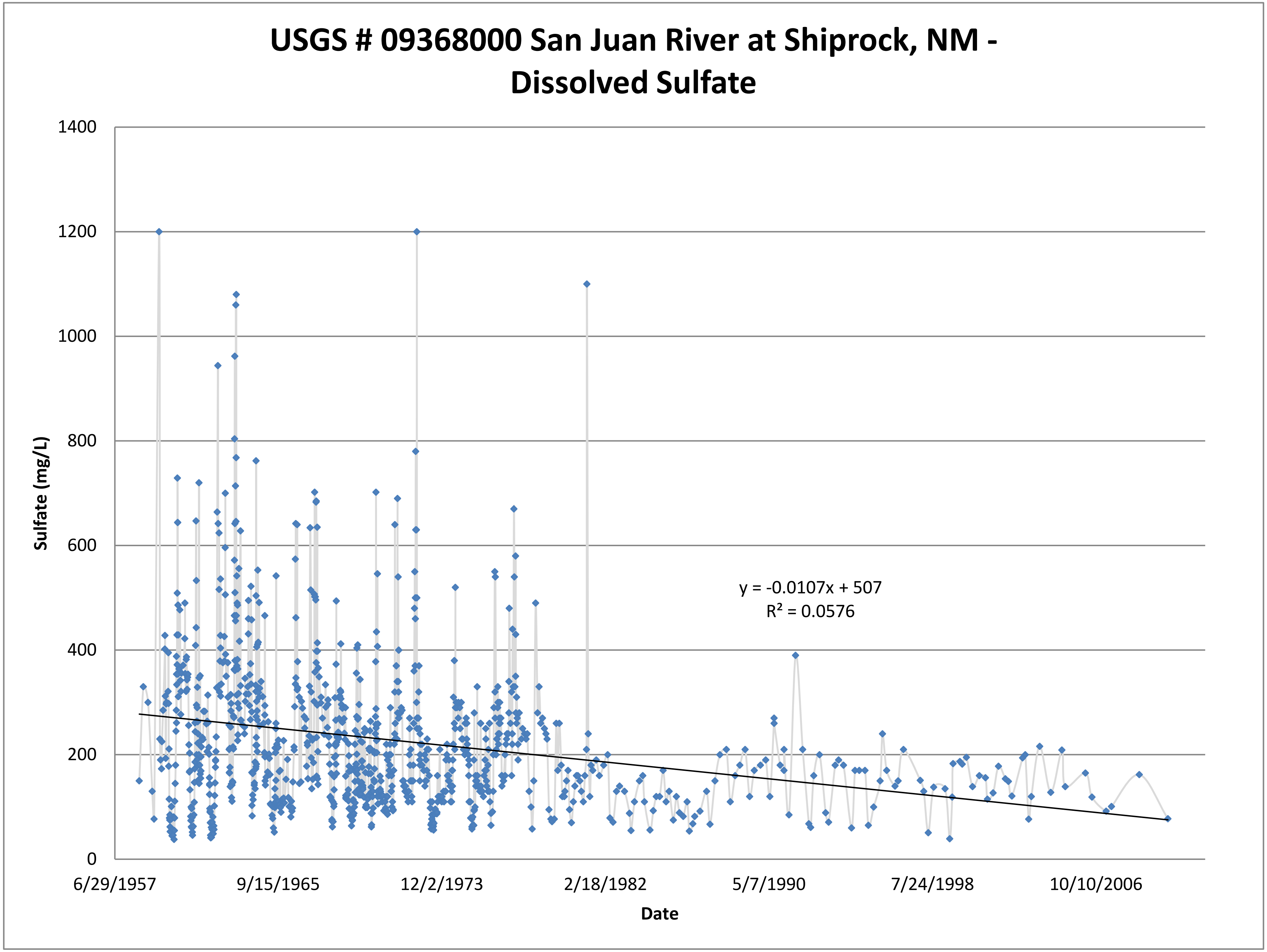


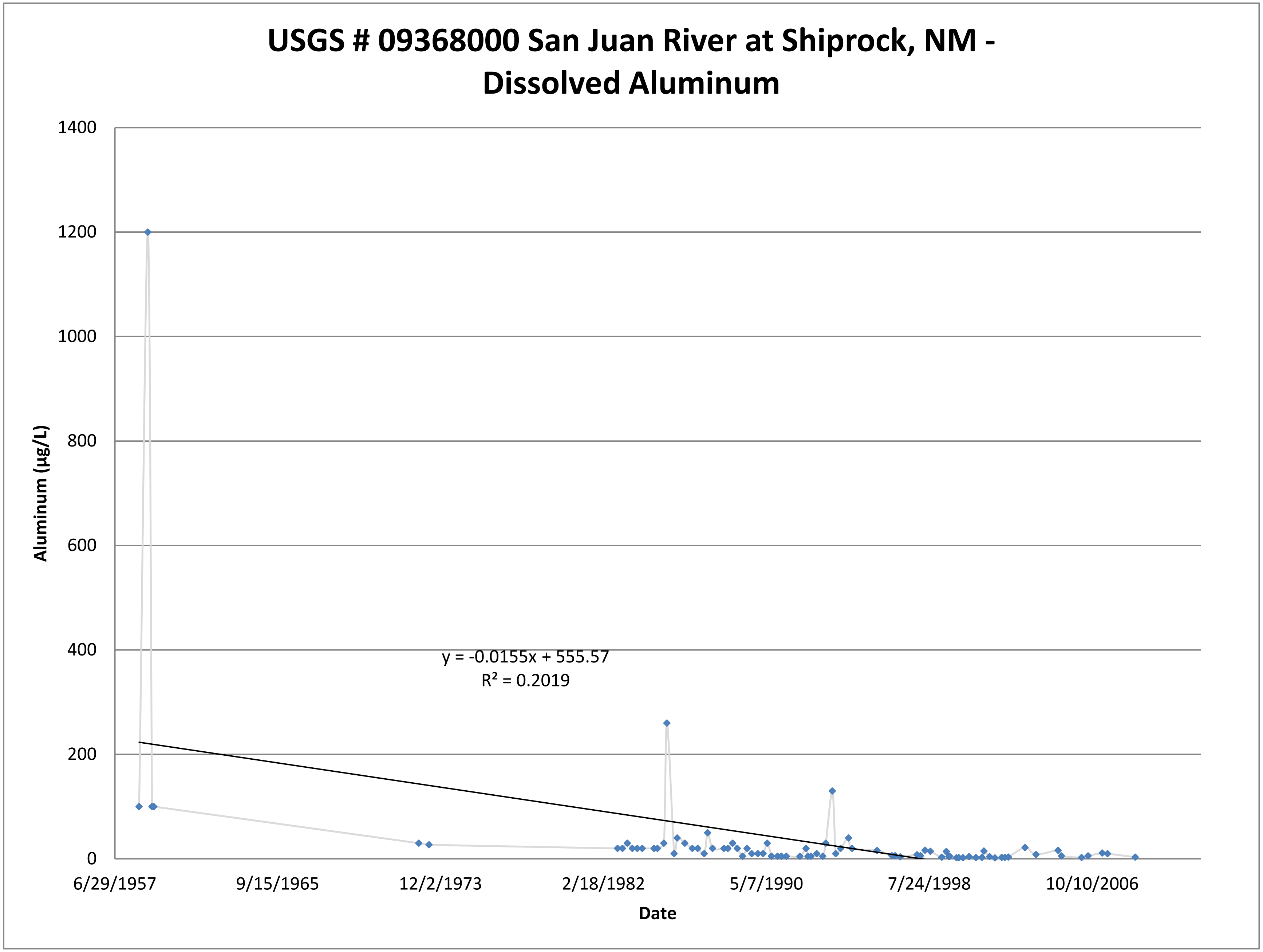

USGS # 09368000 San Juan River at Shiprock, NM - Dissolved Chloride
Chloride (mg/L)
200
180
160
140
120
100
80
60
40
20
0
y = -0.0011x + 46.206
R² = 0.0656
6/29/1957
9/15/1965
12/2/1973
2/18/1982
5/7/1990
7/24/1998
10/10/2006
Date

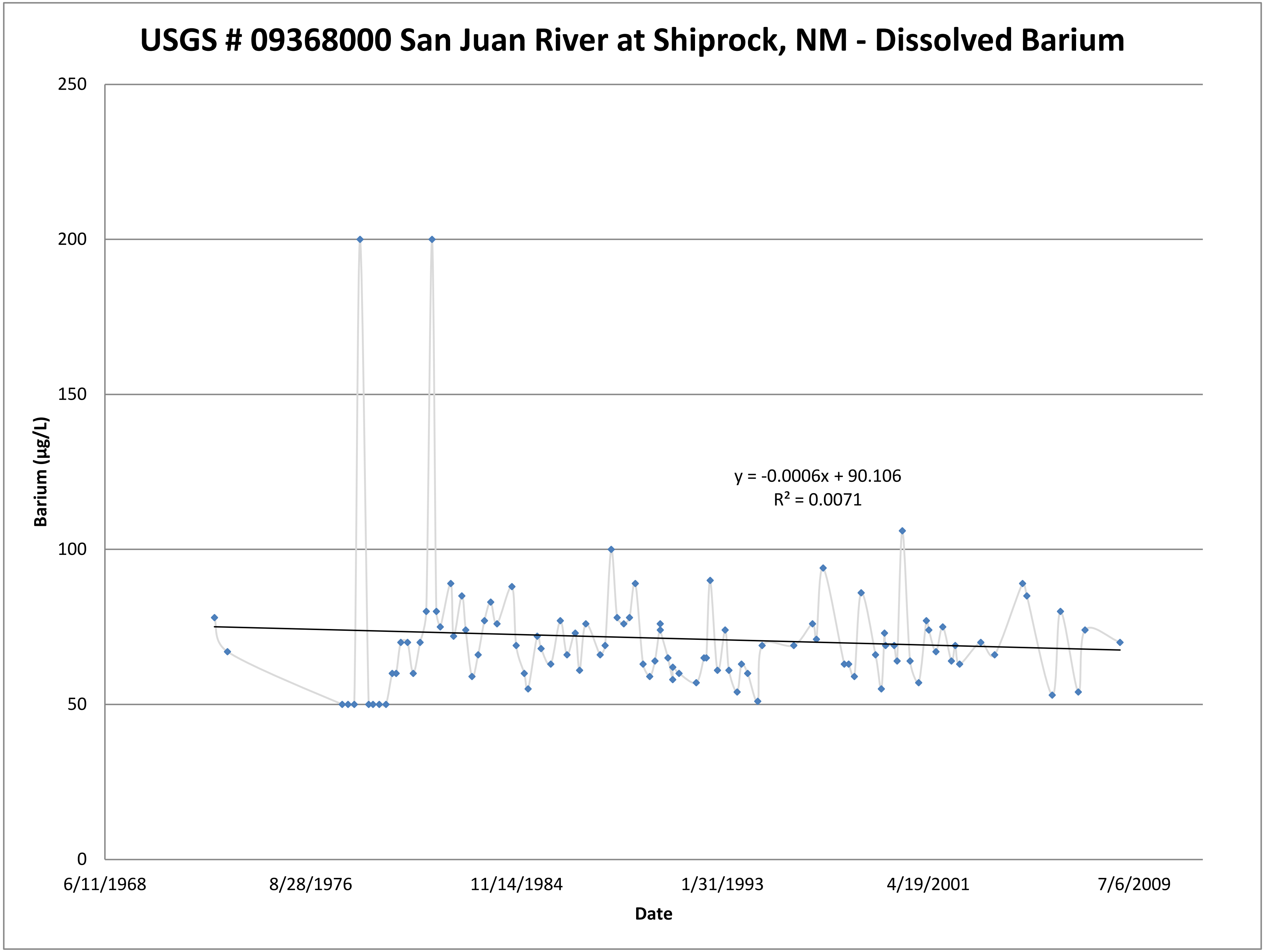
Appendix A - USGS Stations
USGS # 09368000

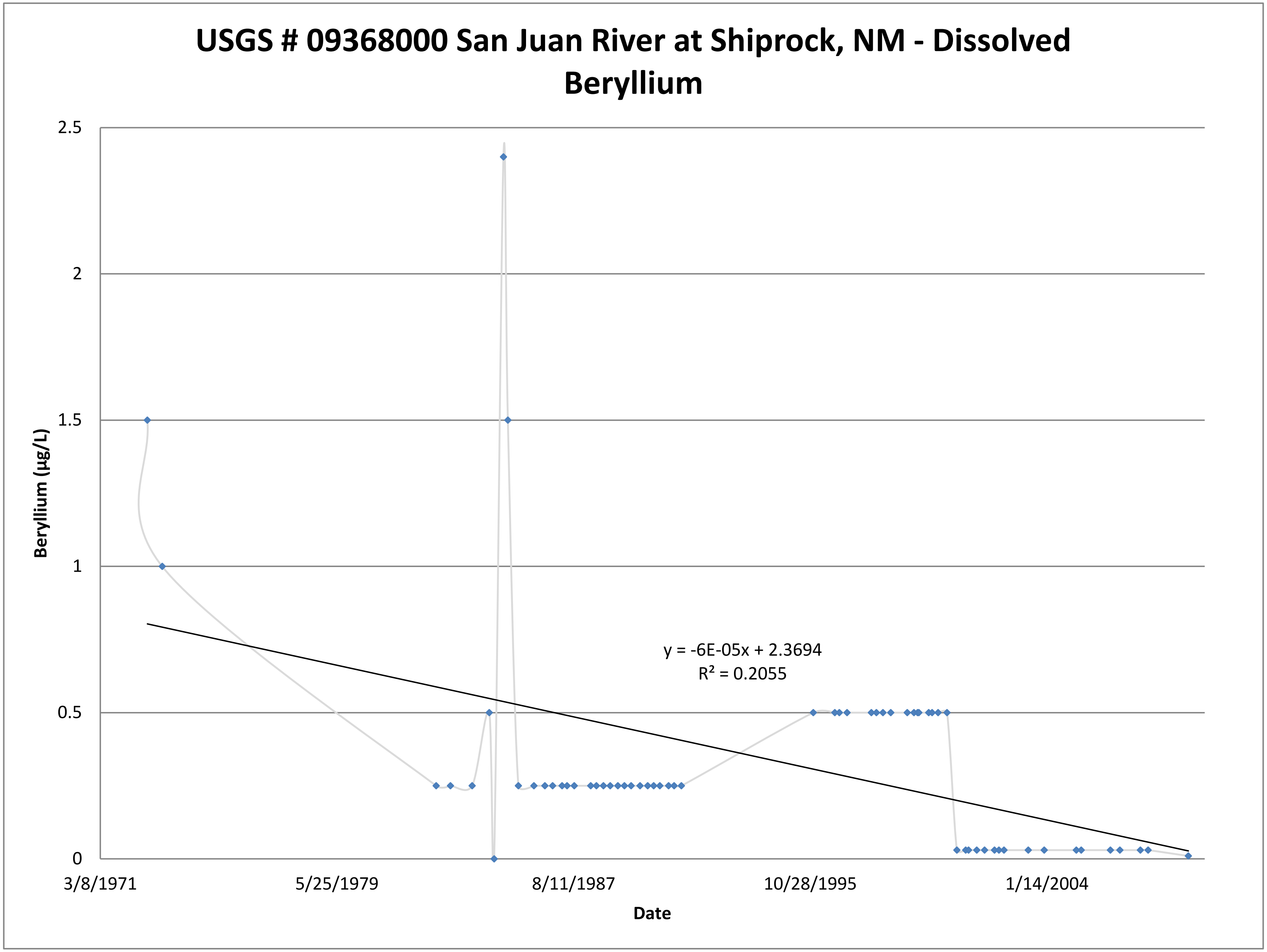


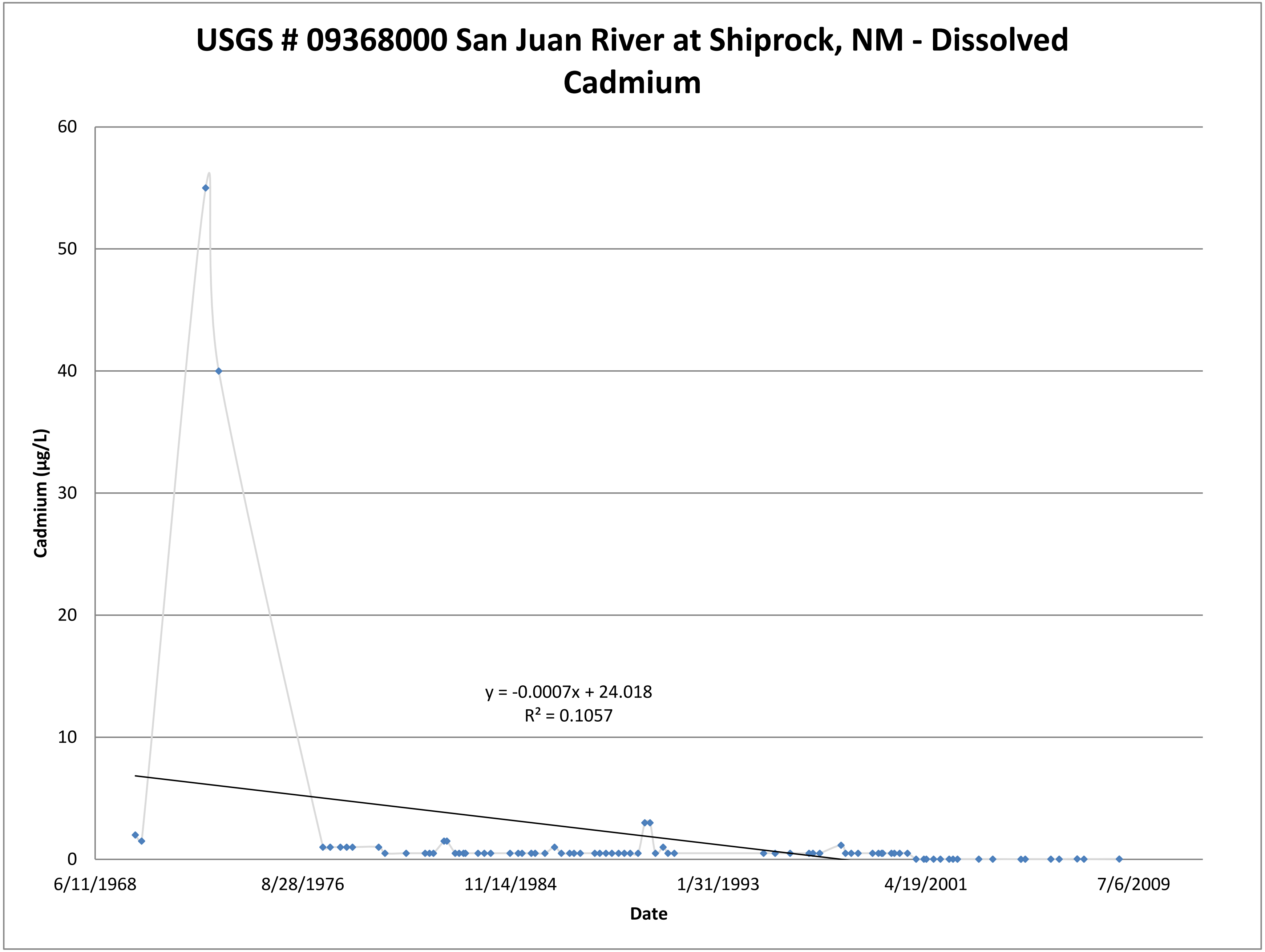
Appendix A - USGS Stations
USGS # 09368000



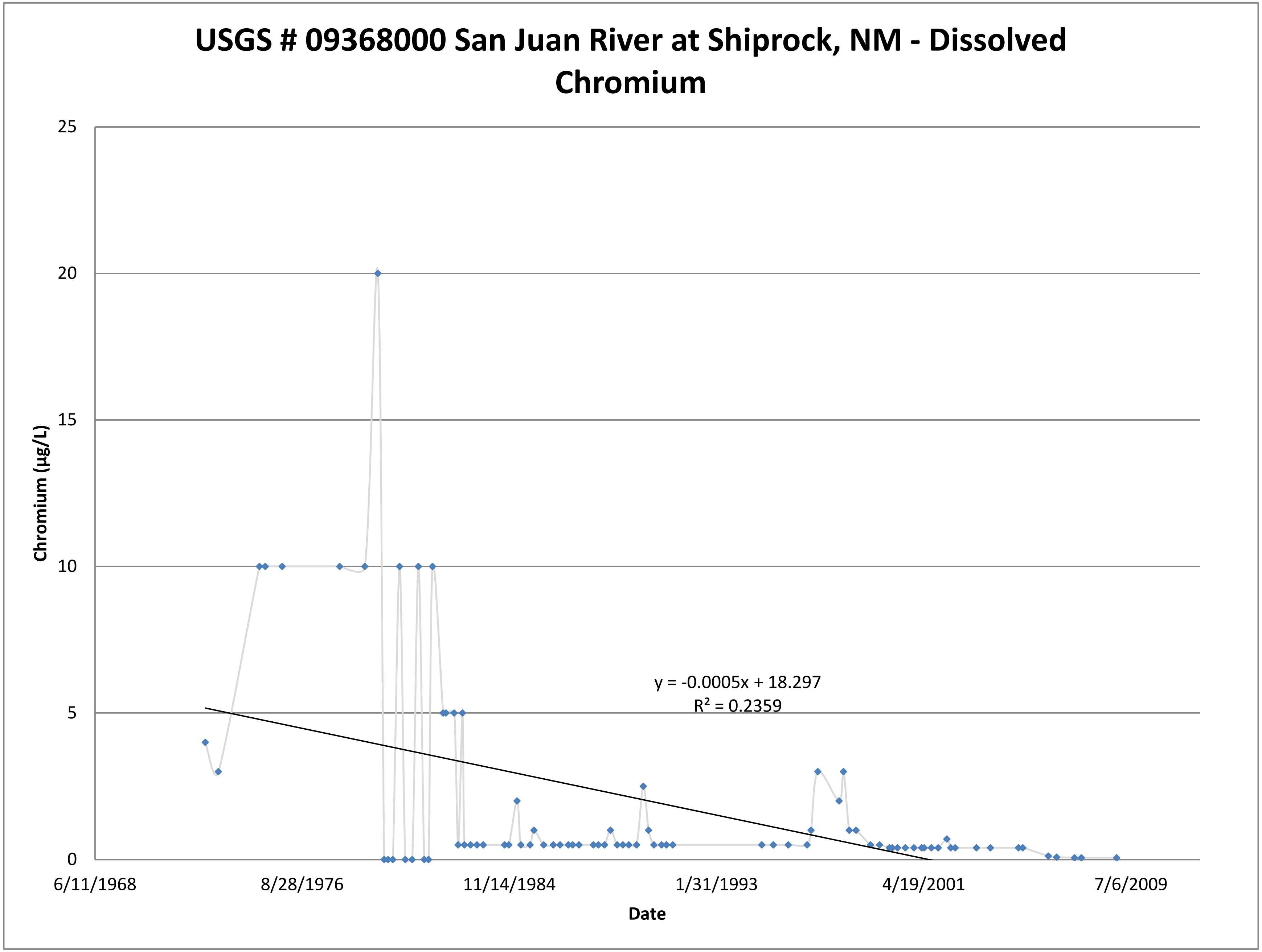

USGS # 09368000 San Juan River at Shiprock, NM - Dissolved Aluminum
1400
1200
1000
800
600
400
200
0
Aluminum (µg/L)
y = -0.0155x + 555.57
R² = 0.2019
6/29/1957
9/15/1965
12/2/1973
2/18/1982
5/7/1990
7/24/1998
10/10/2006
Date


USGS # 09368000 San Juan River at Shiprock, NM - Dissolved Barium
Barium (µg/L)
250
200
150
100
50
0
y = -0.0006x + 90.106
R² = 0.0071
6/11/1968
8/28/1976
11/14/1984
1/31/1993
4/19/2001
7/6/2009
Date

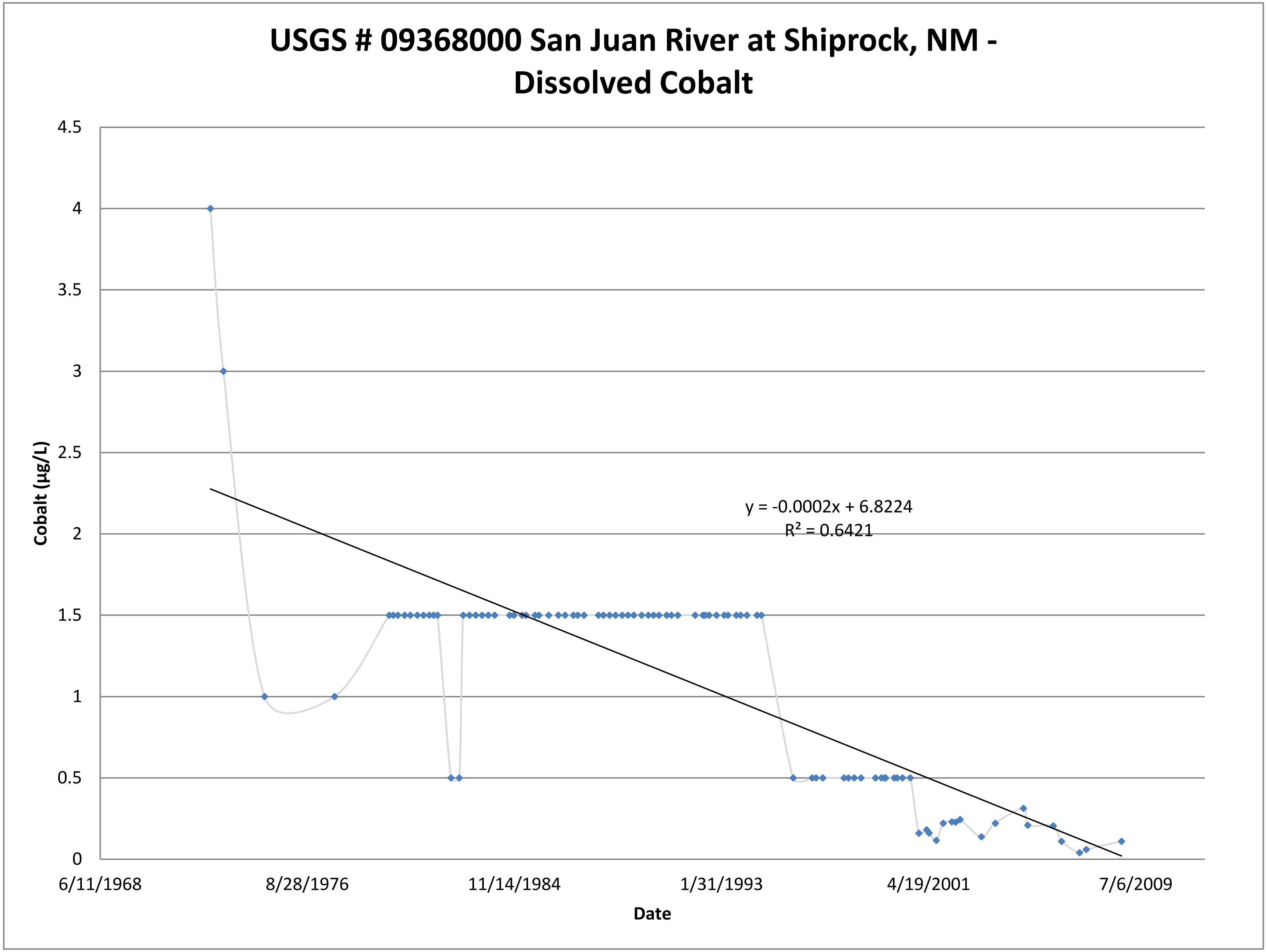

USGS # 09368000 San Juan River at Shiprock, NM - Dissolved Beryllium
2.5
2
1.5
1
0.5
0
Beryllium (µg/L)
y = -6E-05x + 2.3694
R² = 0.2055
3/8/1971
5/25/1979
8/11/1987
10/28/1995
1/14/2004
Date

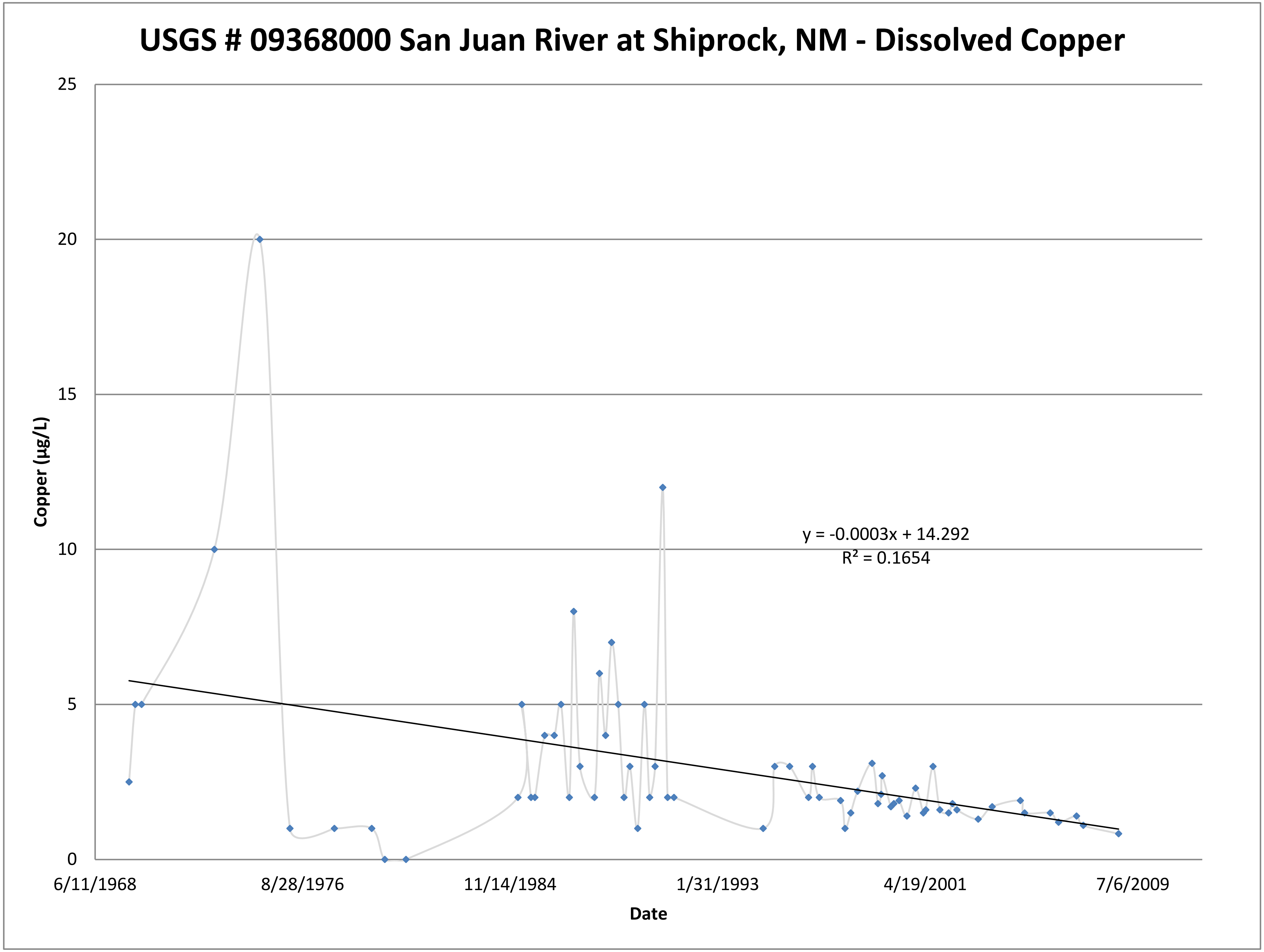

USGS # 09368000 San Juan River at Shiprock, NM - Dissolved Cadmium
Cadmium (µg/L)
60
50
40
30
20
10
0
y = -0.0007x + 24.018
R² = 0.1057
6/11/1968
8/28/1976
11/14/1984
1/31/1993
4/19/2001
7/6/2009
Date

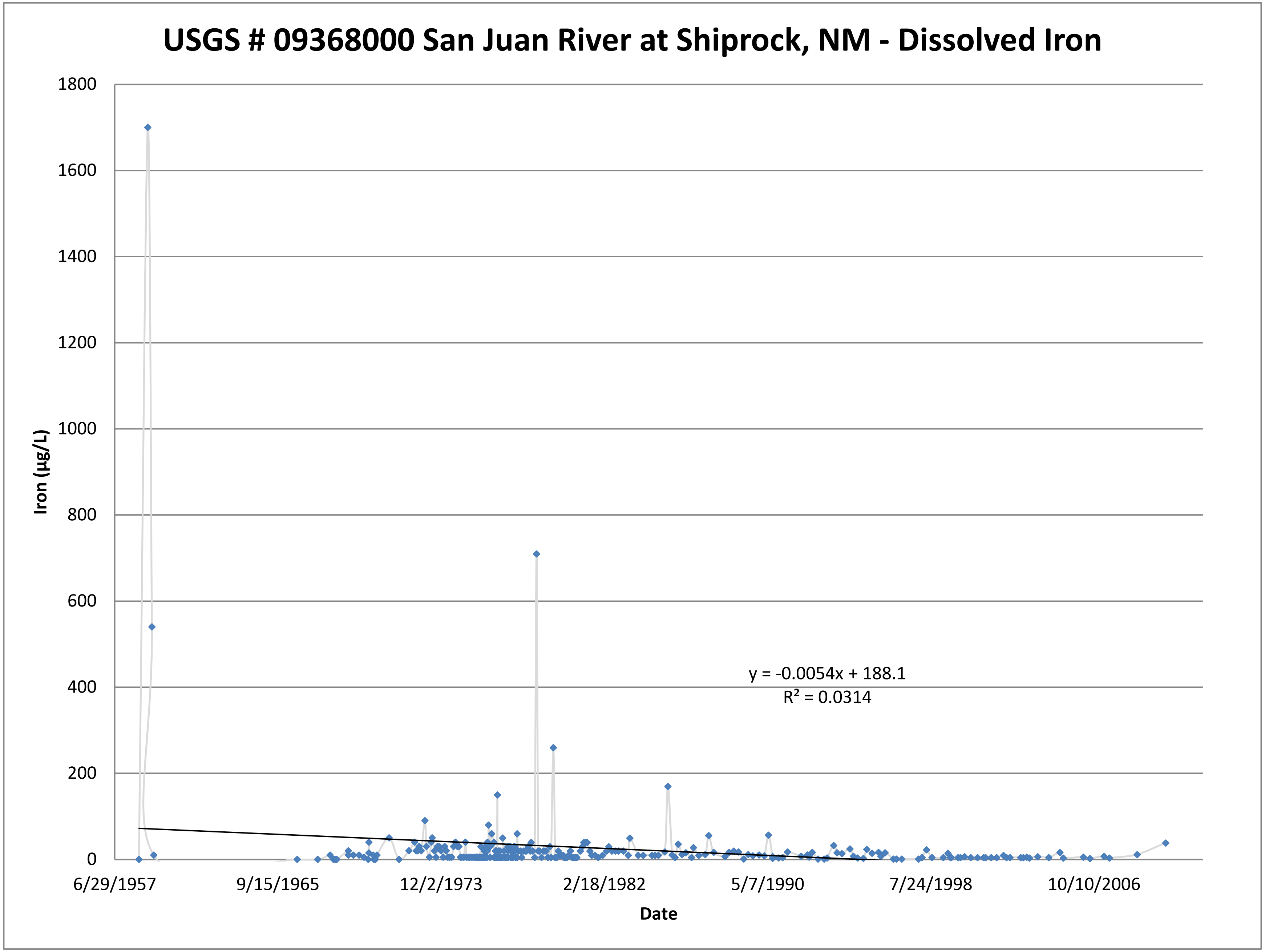
Appendix A - USGS Stations
USGS # 09368000

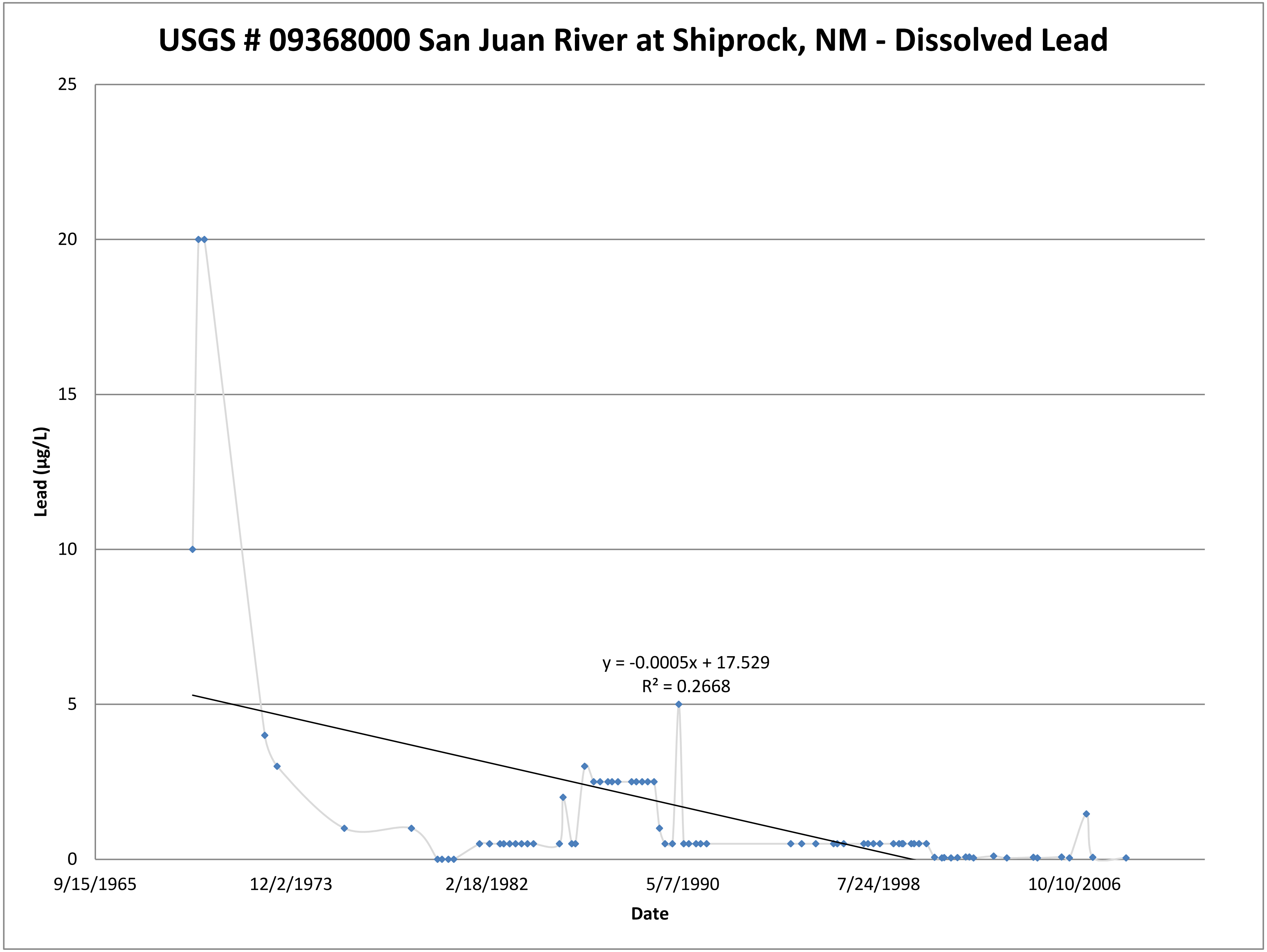


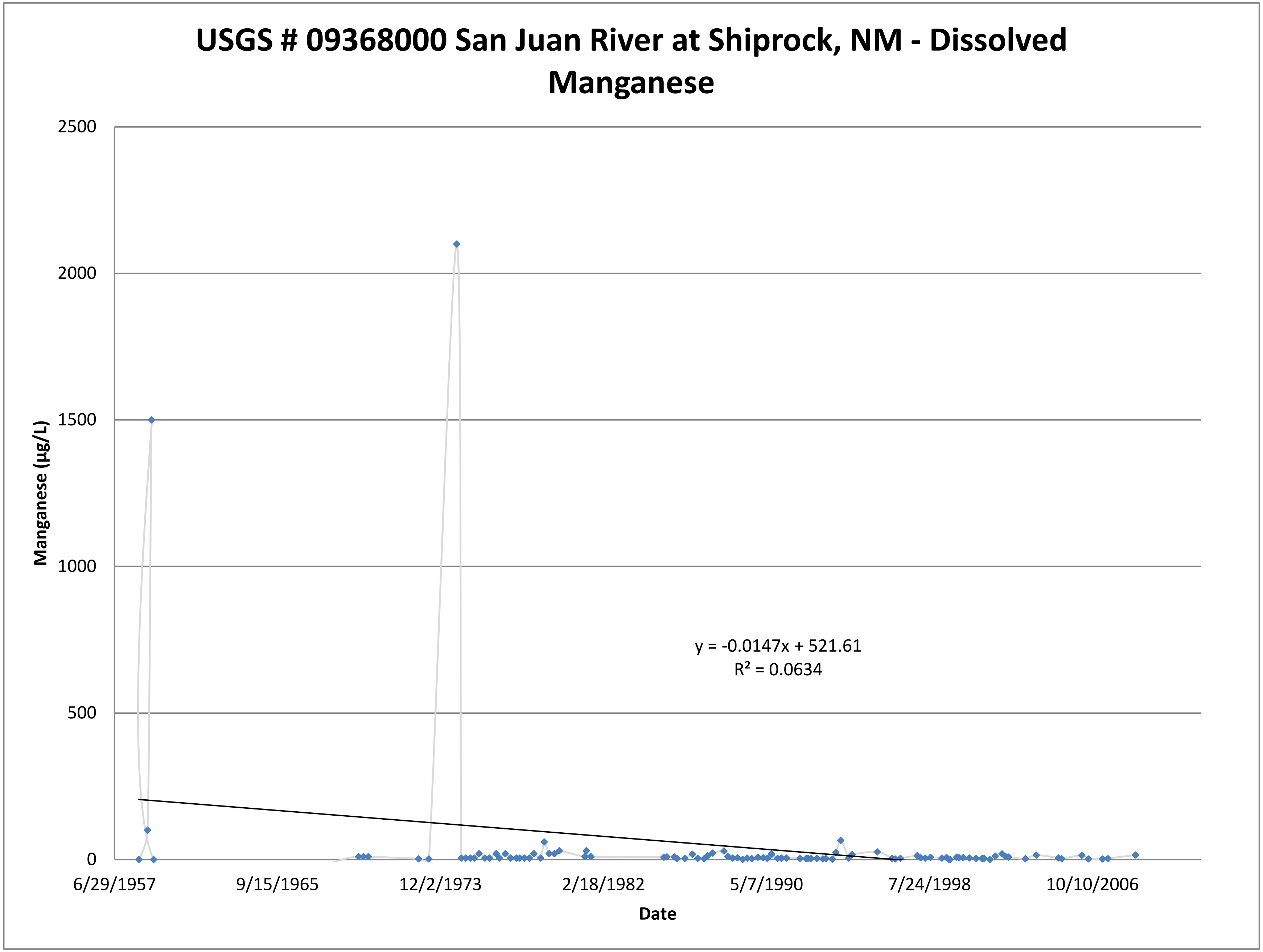
Appendix A - USGS Stations
USGS # 09368000

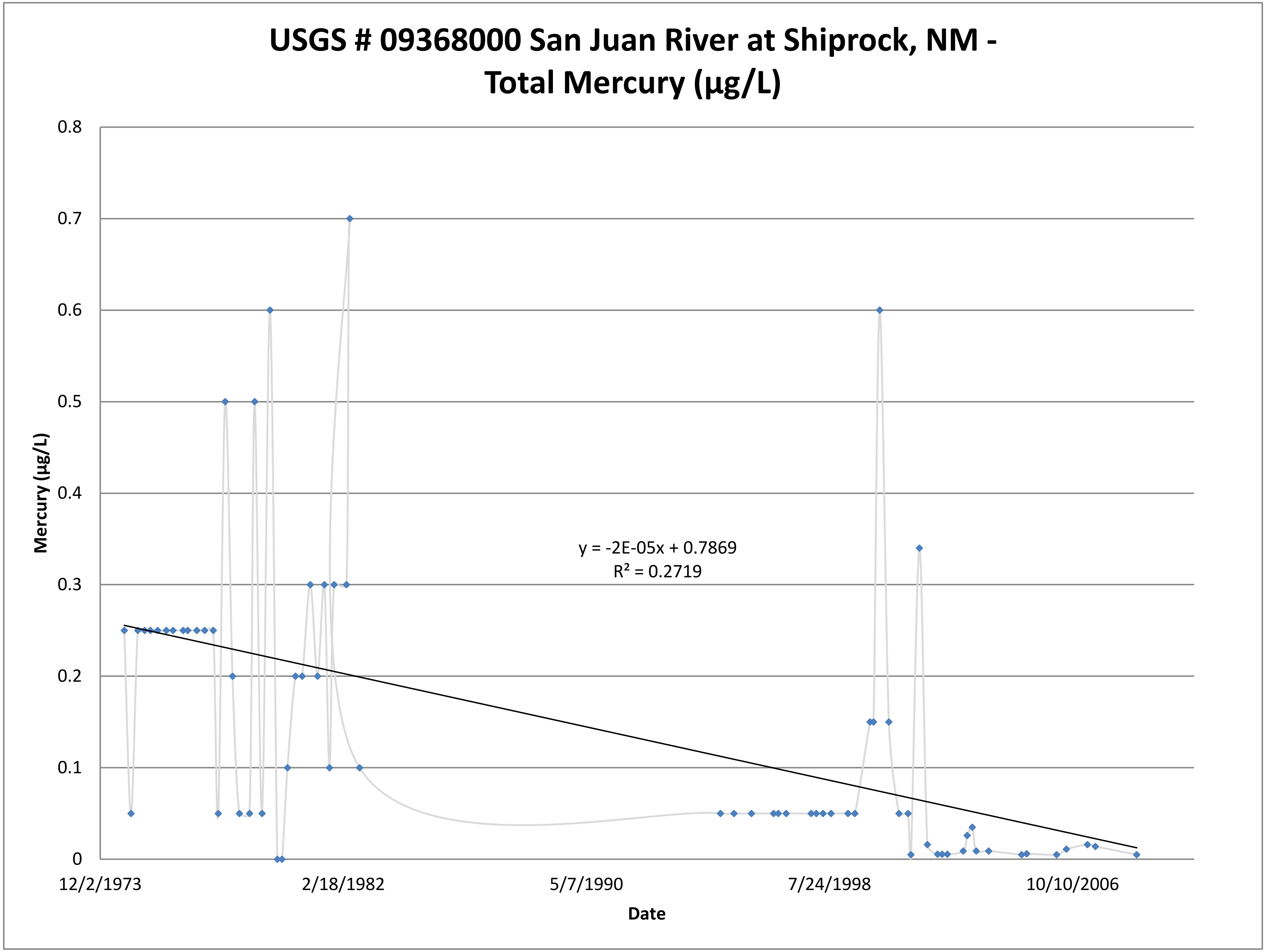



USGS # 09368000 San Juan River at Shiprock, NM - Dissolved Copper
Copper (µg/L)
25
20
15
10
5
0
y = -0.0003x + 14.292
R² = 0.1654
6/11/1968
8/28/1976
11/14/1984
1/31/1993
4/19/2001
7/6/2009
Date

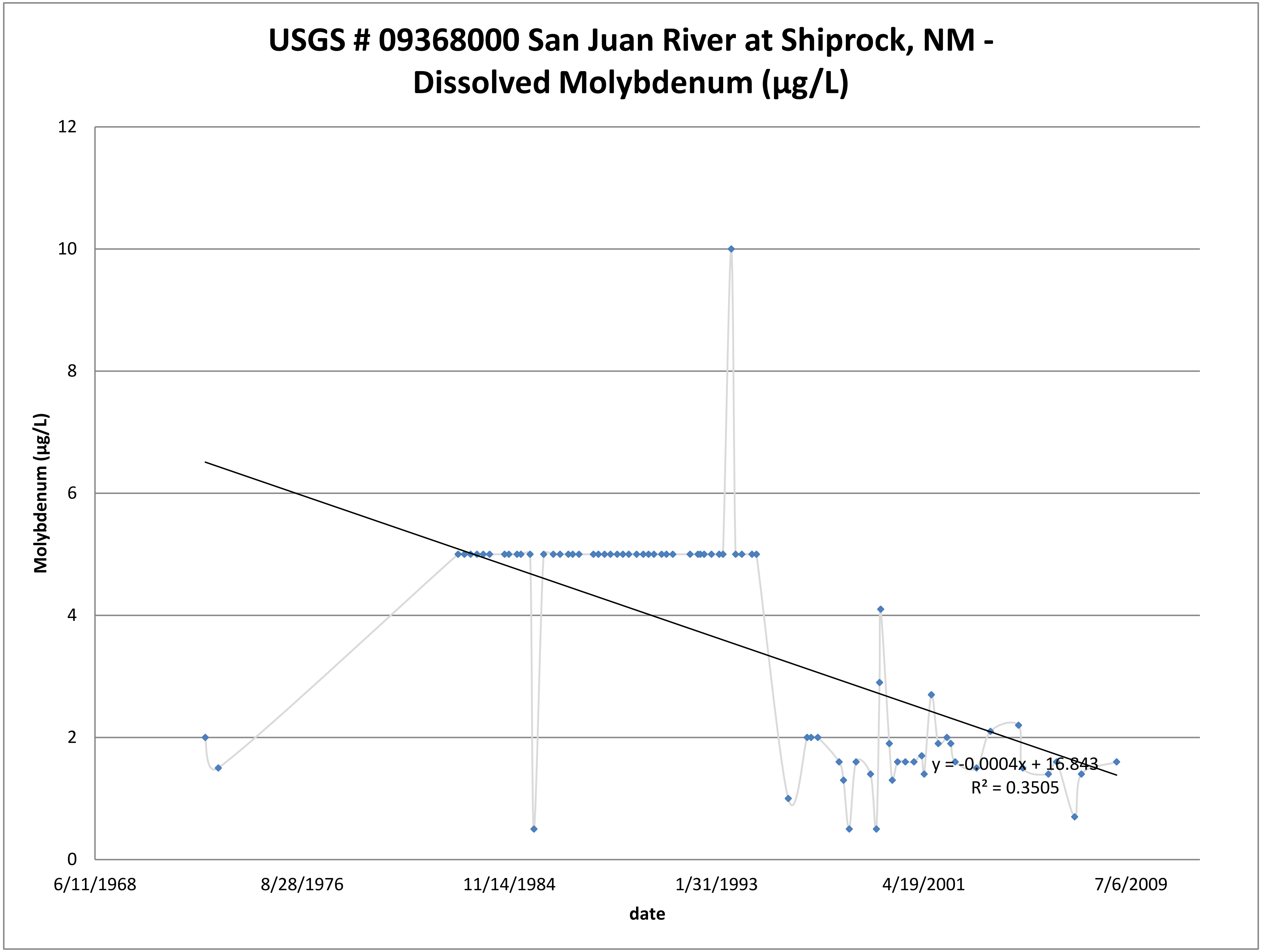

USGS # 09368000 San Juan River at Shiprock, NM - Dissolved Iron
Iron (µg/L)
1800
1600
1400
1200
1000
800
600
400
200
0
y = -0.0054x + 188.1
R² = 0.0314
6/29/1957
9/15/1965
12/2/1973
2/18/1982
5/7/1990
7/24/1998
10/10/2006
Date

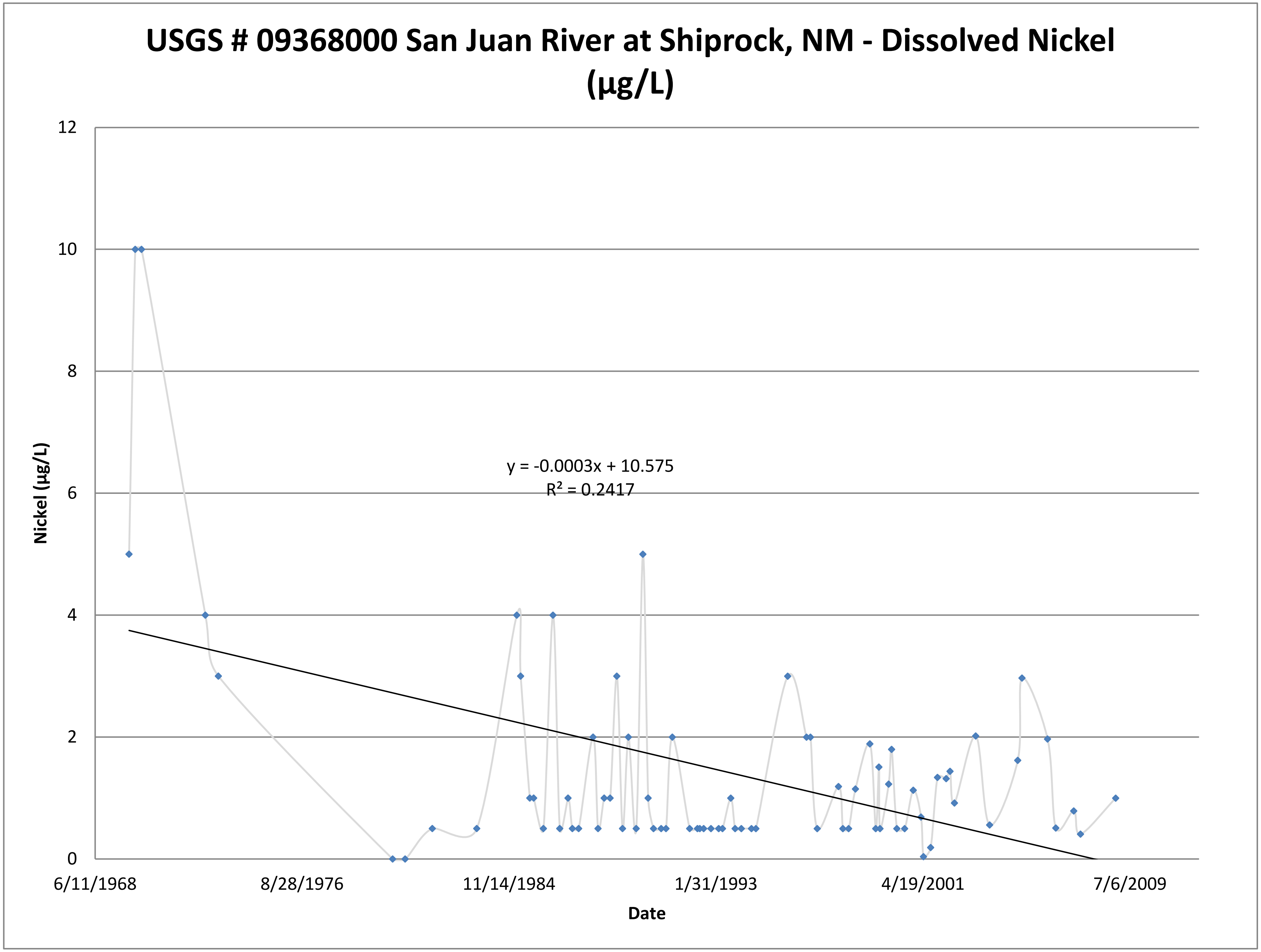

USGS # 09368000 San Juan River at Shiprock, NM - Dissolved Lead
Lead (µg/L)
25
20
15
10
5
0
9/15/1965
12/2/1973
2/18/1982
5/7/1990
7/24/1998
10/10/2006
Date
y = -0.0005x + 17.529
R² = 0.2668

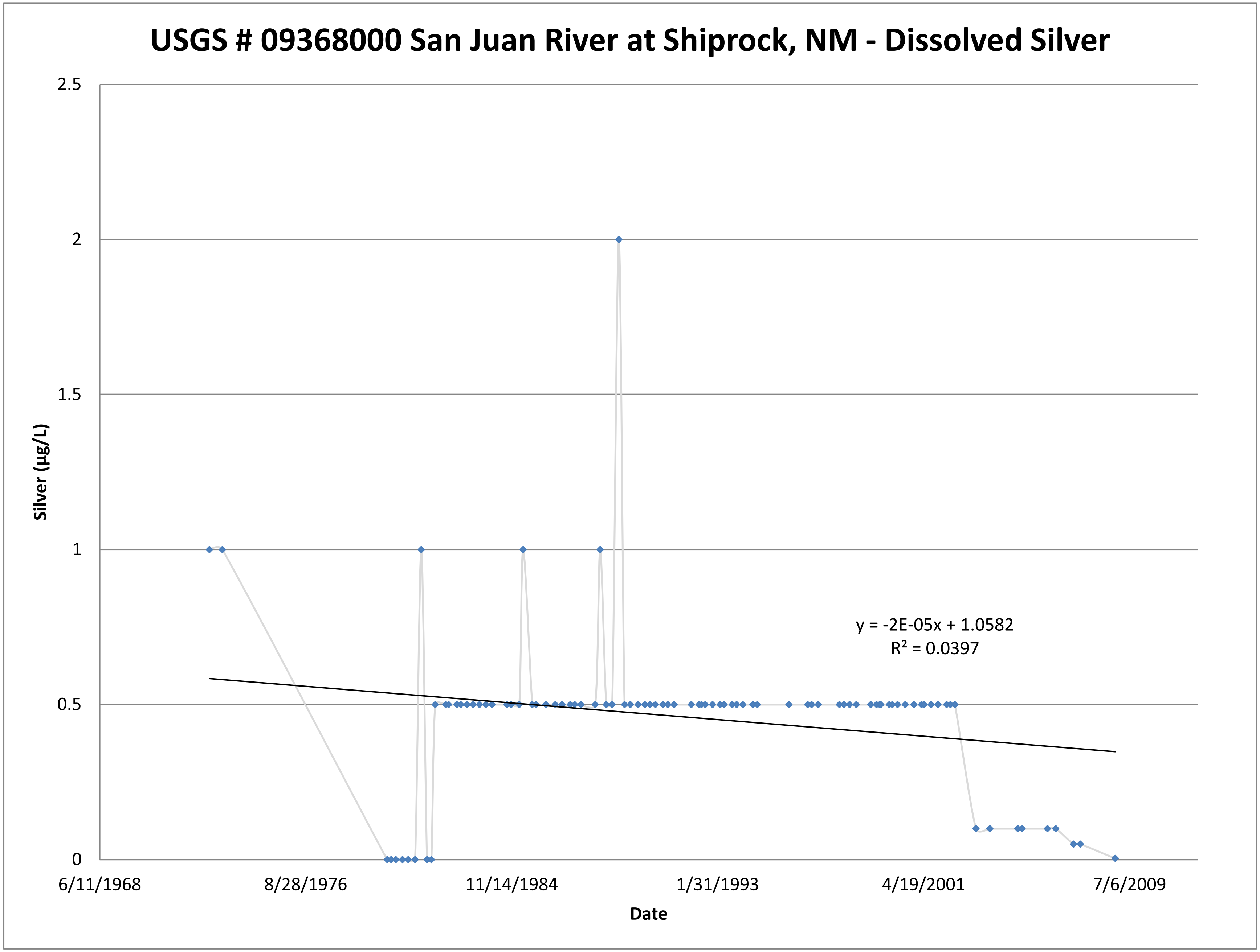

USGS # 09368000 San Juan River at Shiprock, NM - Dissolved Manganese
2500
2000
1500
1000
500
0
Manganese (µg/L)
6/29/1957
9/15/1965
12/2/1973
2/18/1982
5/7/1990
7/24/1998
10/10/2006
Date
y = -0.0147x + 521.61
R² = 0.0634

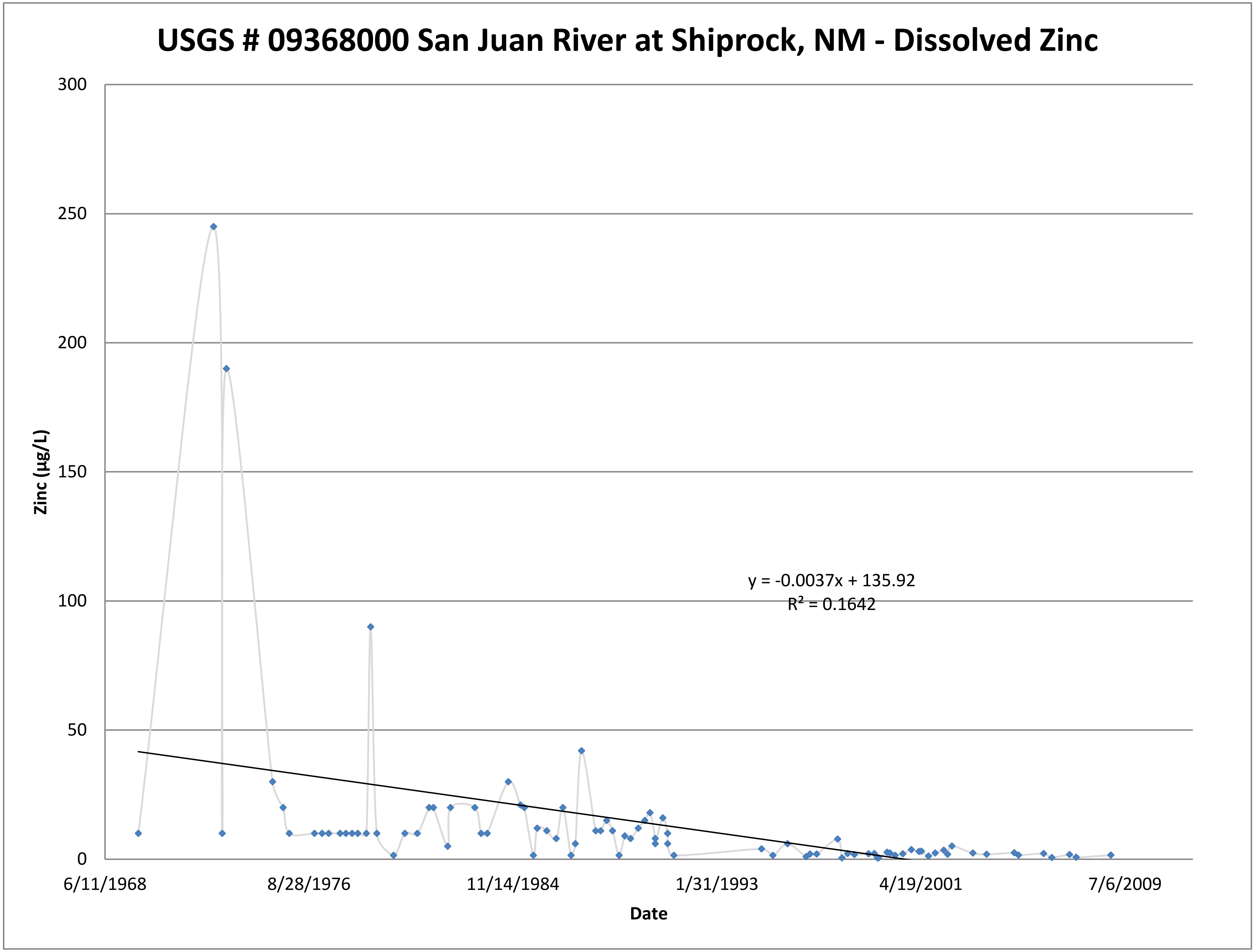

USGS # 09368000 San Juan River at Shiprock, NM - Total Mercury (µg/L)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Mercury (µg/L)
y = -2E-05x + 0.7869
R² = 0.2719
12/2/1973
2/18/1982
5/7/1990
7/24/1998
10/10/2006
Date

Appendix A - USGS Stations
USGS # 09368000



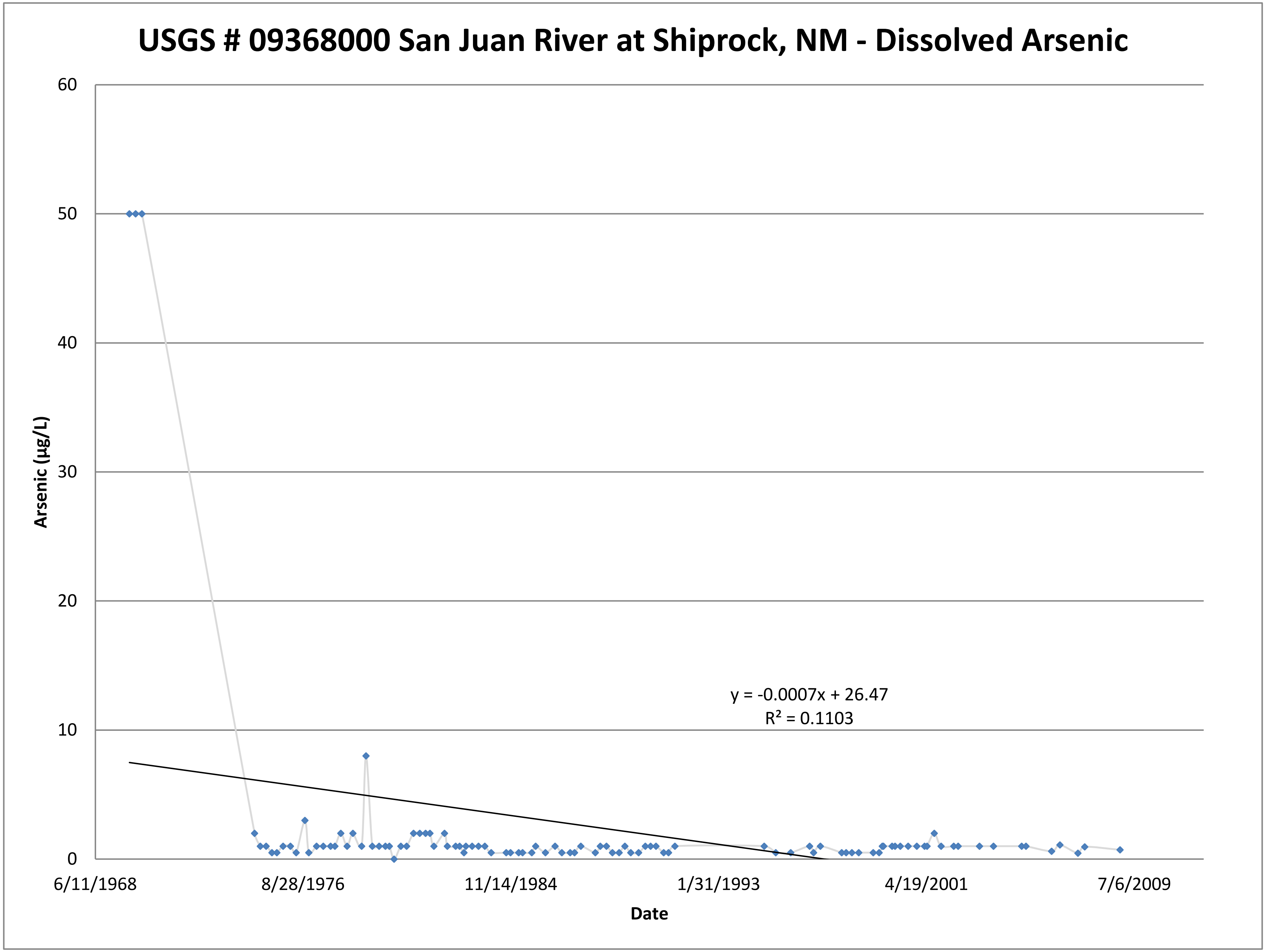

USGS # 09368000 San Juan River at Shiprock, NM - Dissolved Nickel (µg/L)
Nickel (µg/L)
0
2
4
6
8
10
12
y = -0.0003x + 10.575
R² = 0.2417
6/11/1968
8/28/1976
11/14/1984
1/31/1993
4/19/2001
7/6/2009
Date


USGS # 09368000 San Juan River at Shiprock, NM - Dissolved Silver
2.5
2
1.5
1
0.5
0
Silver (µg/L)
y = -2E-05x + 1.0582
R² = 0.0397
6/11/1968
8/28/1976
11/14/1984
1/31/1993
4/19/2001
7/6/2009
Date

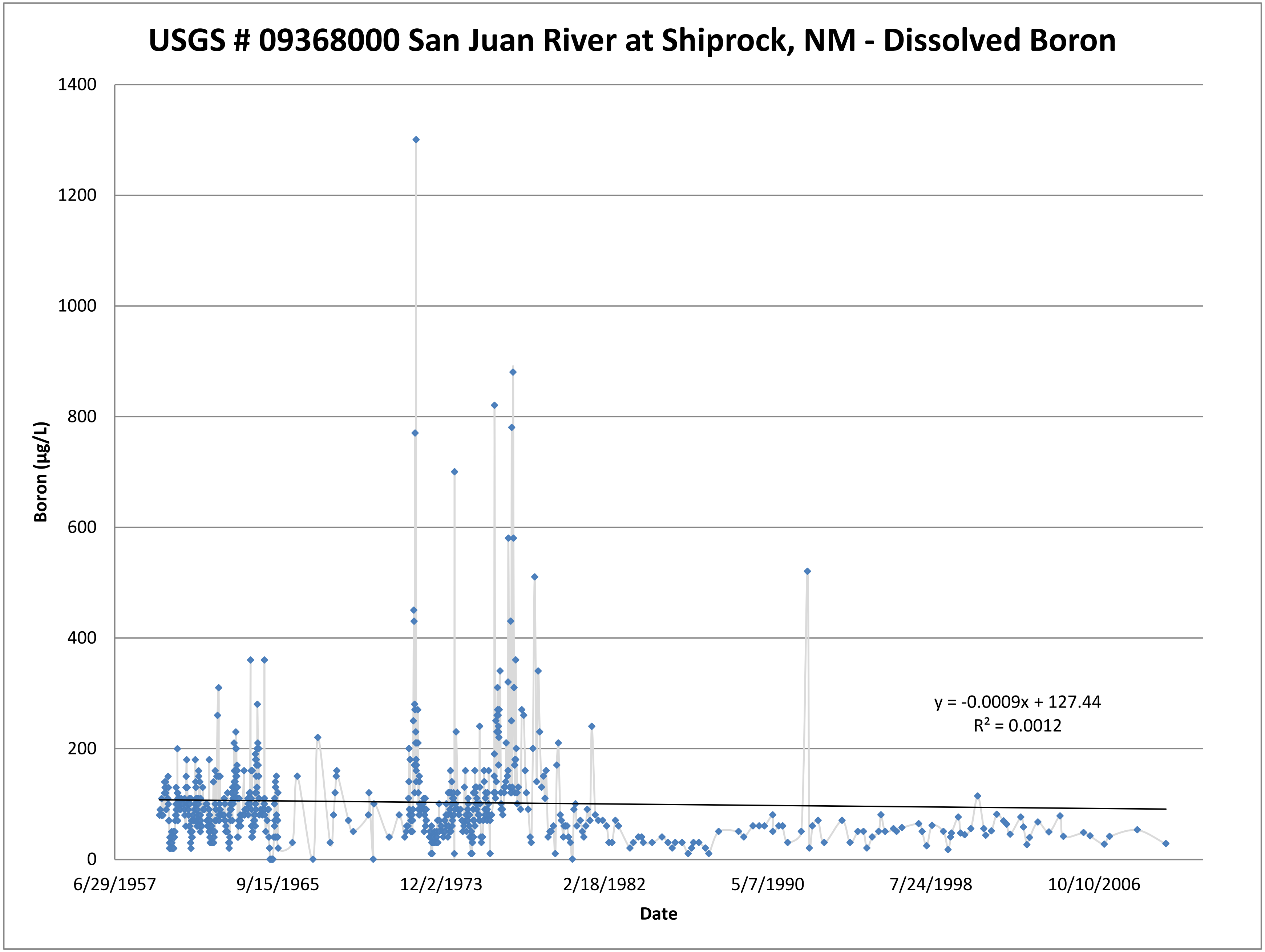

USGS # 09368000 San Juan River at Shiprock, NM - Dissolved Zinc
300
250
200
150
100
50
0
Zinc (µg/L)
y = -0.0037x + 135.92
R² = 0.1642
6/11/1968
8/28/1976
11/14/1984
1/31/1993
4/19/2001
7/6/2009
Date

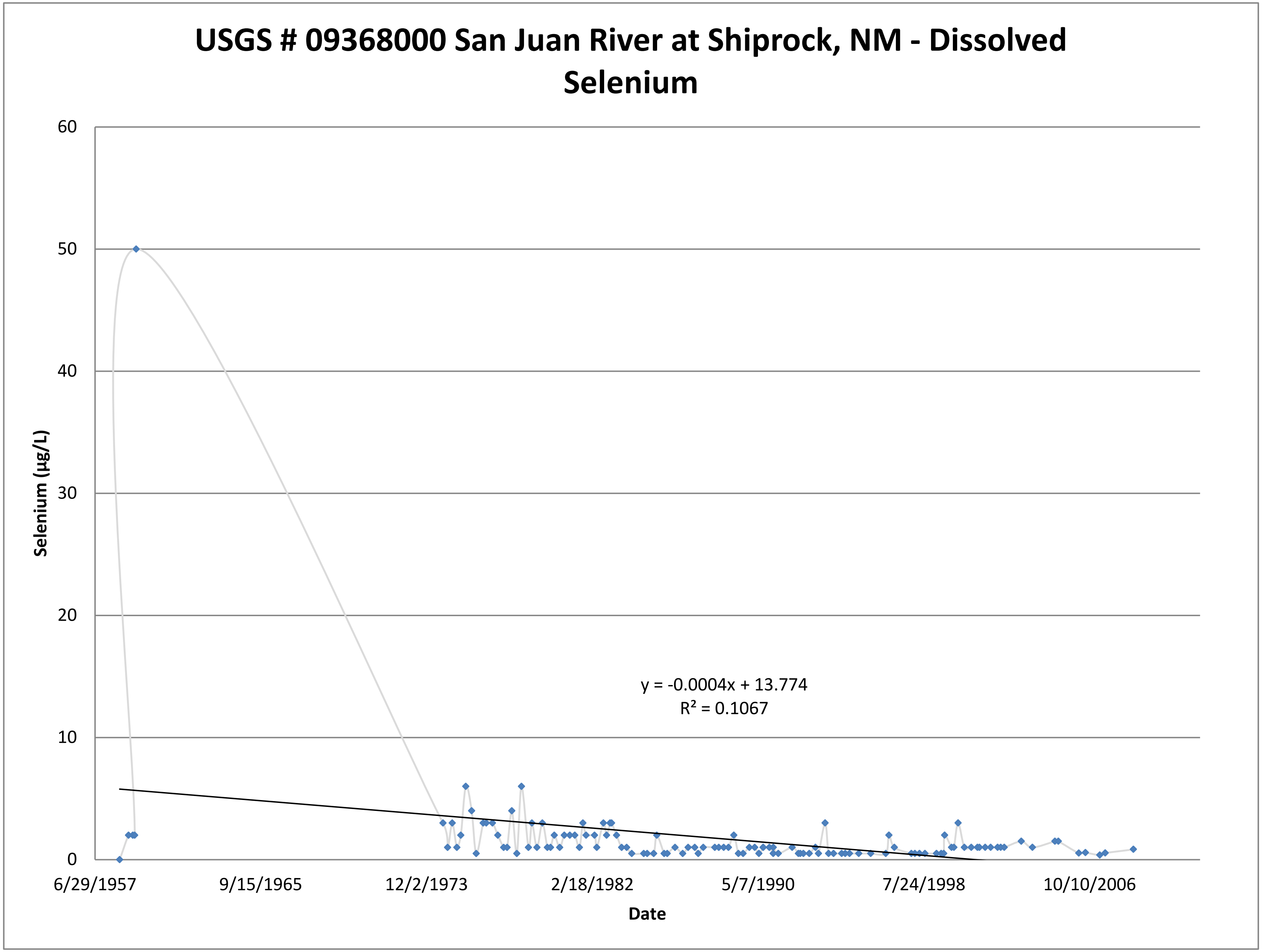
Appendix A - USGS Stations

USGS # 09368000

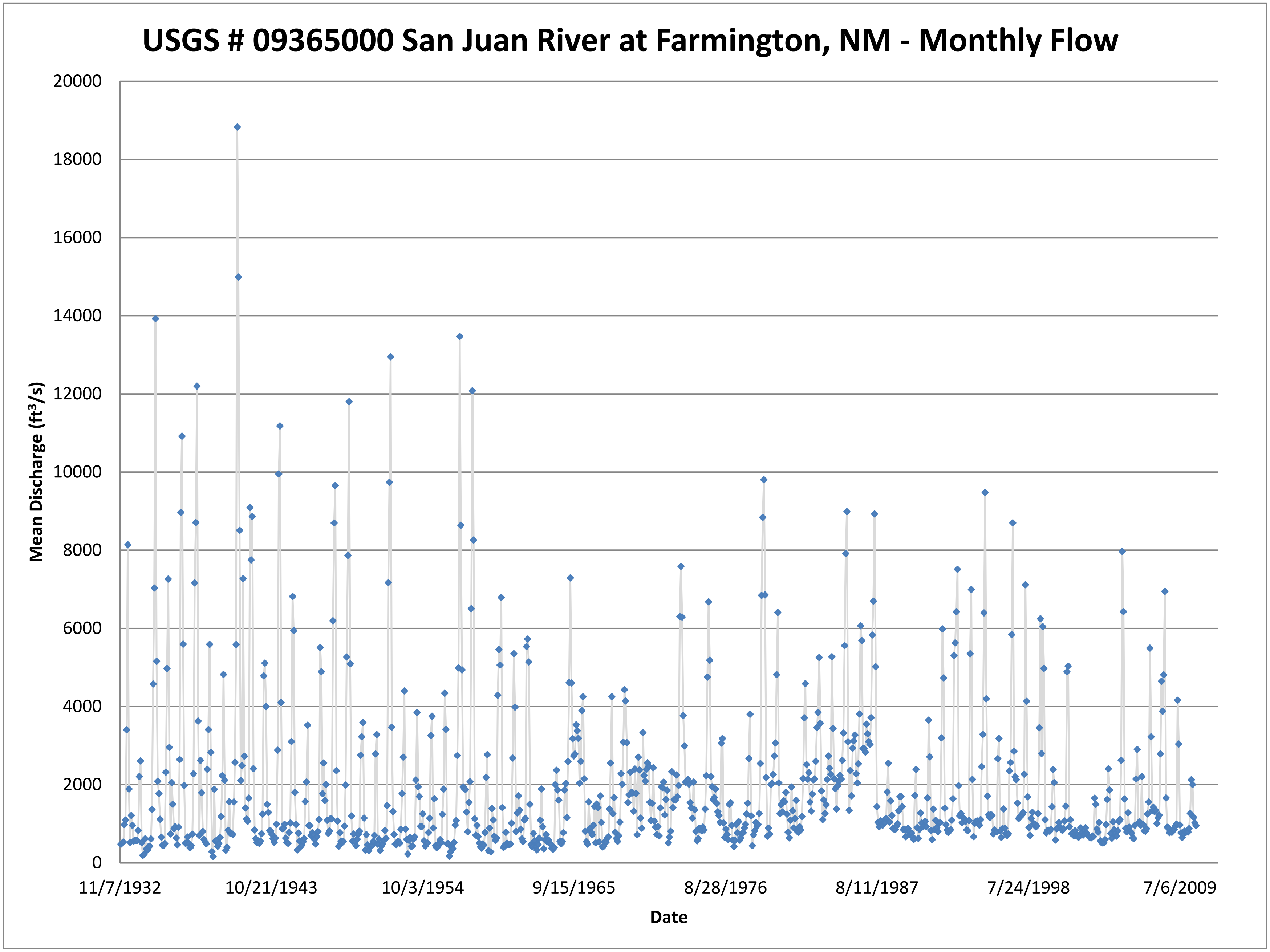


Appendix A - USGS Stations
USGS # 09368000

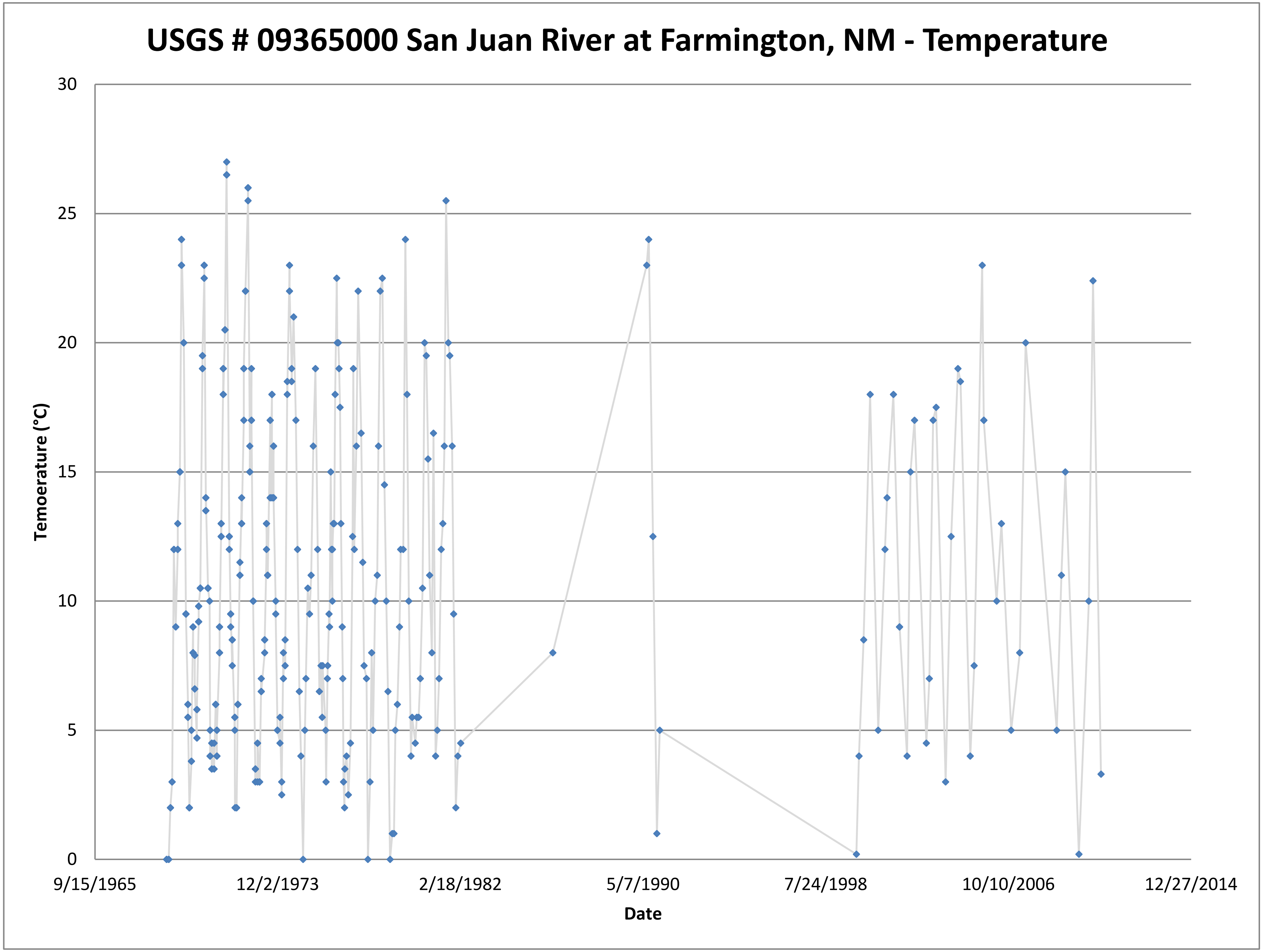


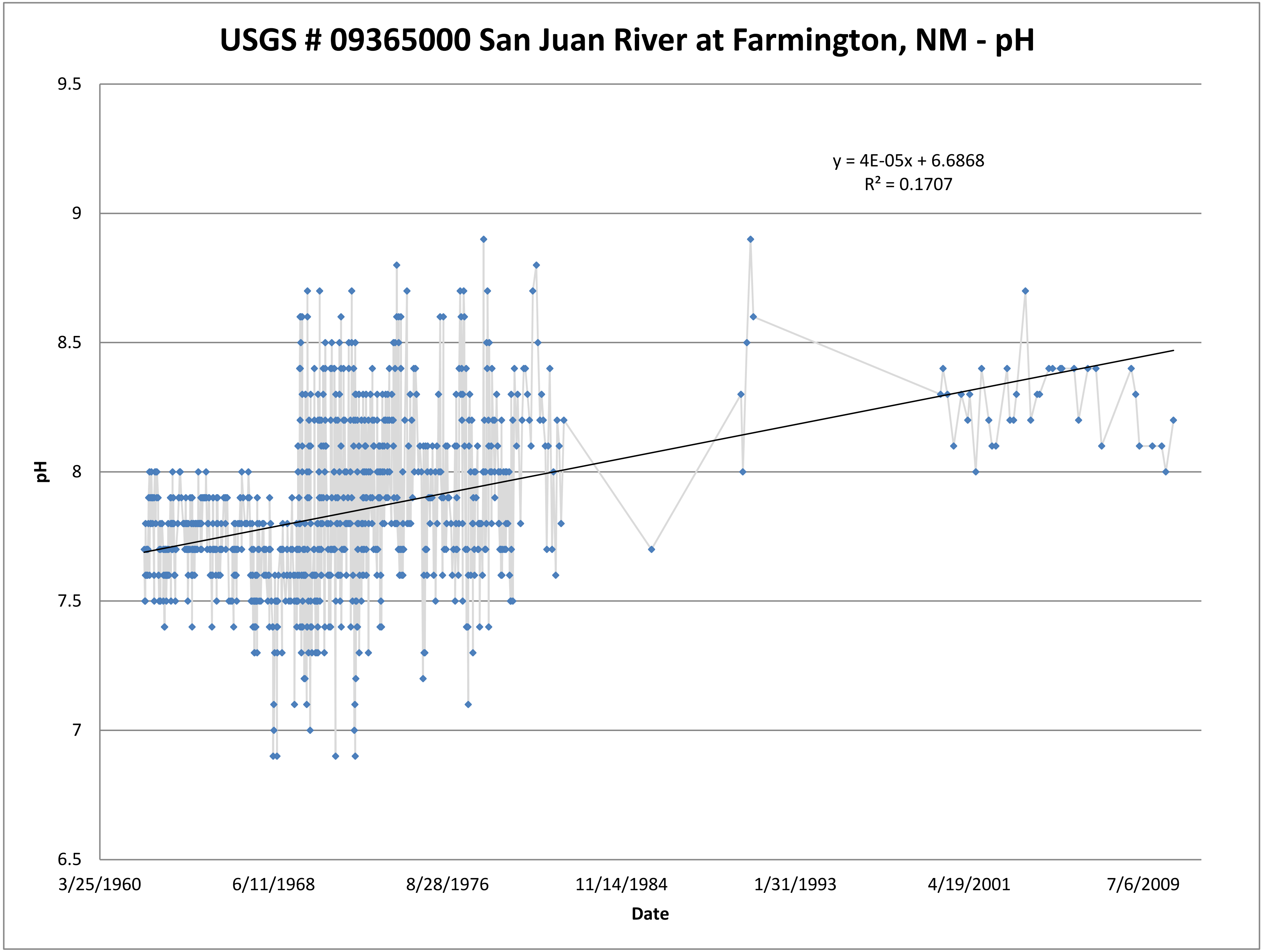

USGS # 09368000 San Juan River at Shiprock, NM - Dissolved Selenium
60
50
40
30
20
10
0
Selenium (µg/L)
y = -0.0004x + 13.774
R² = 0.1067
6/29/1957
9/15/1965
12/2/1973
2/18/1982
5/7/1990
7/24/1998
10/10/2006
Date

Appendix A - USGS Stations
USGS # 09365000

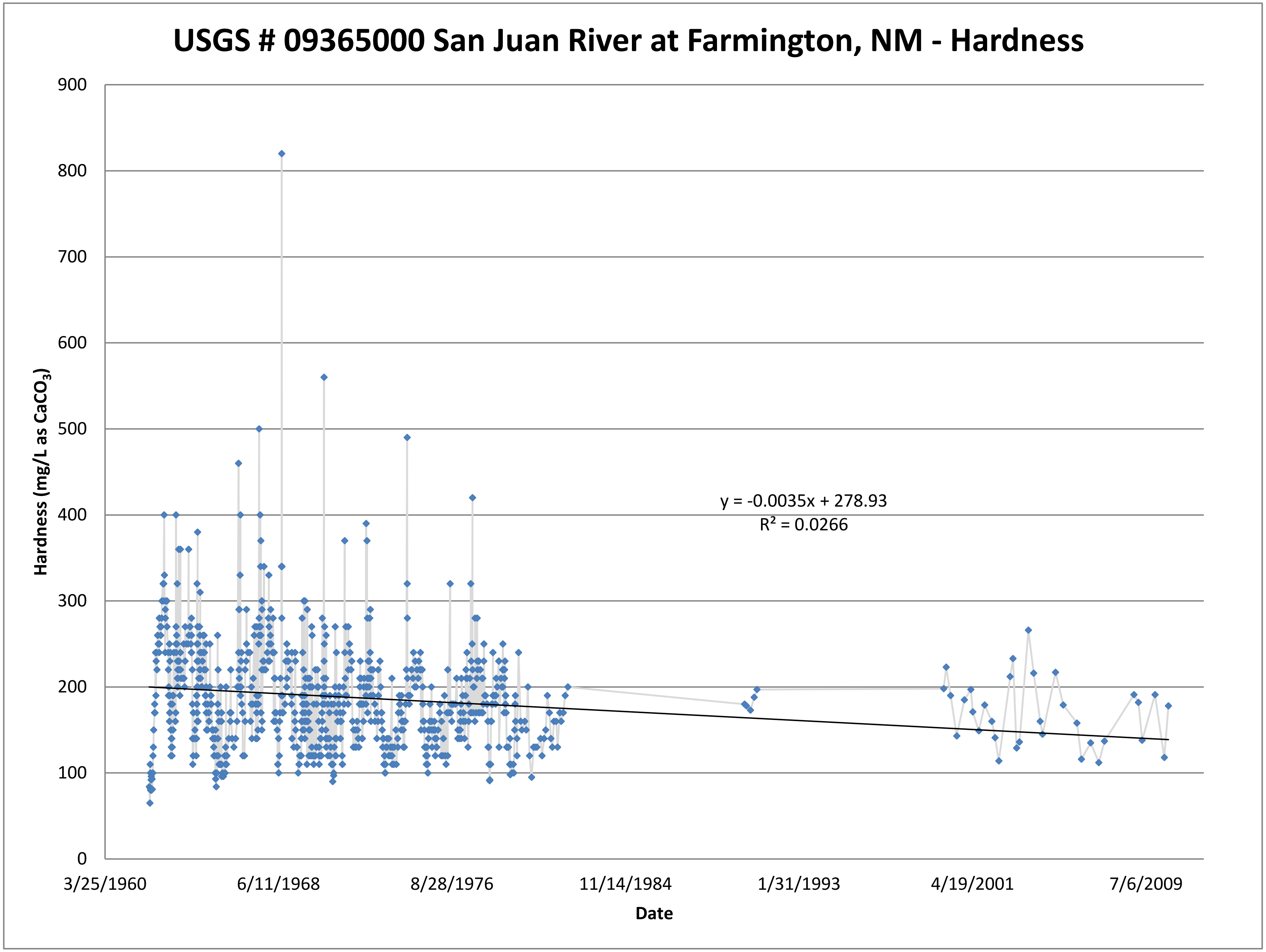


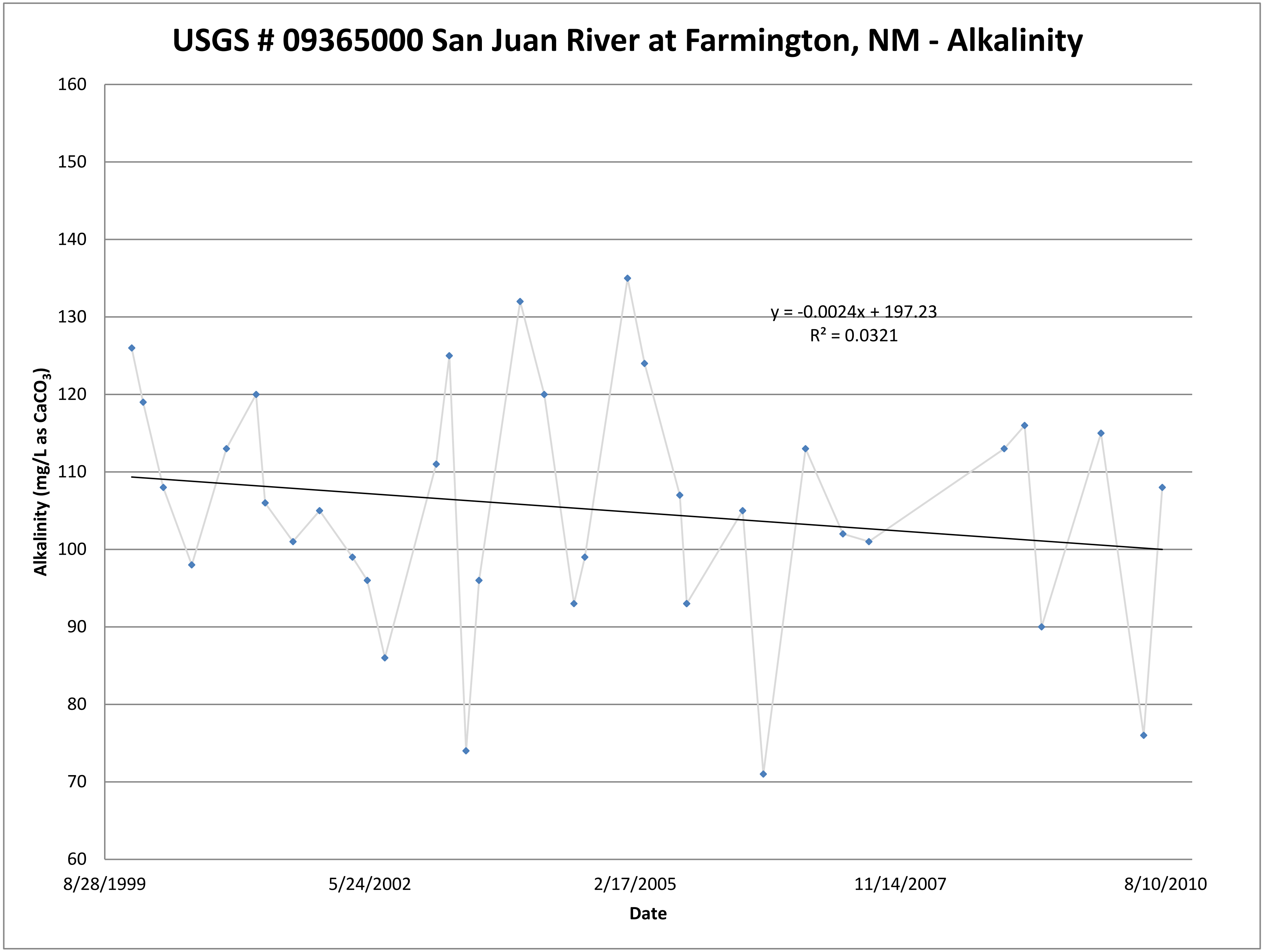
Appendix A - USGS Stations
USGS # 09365000



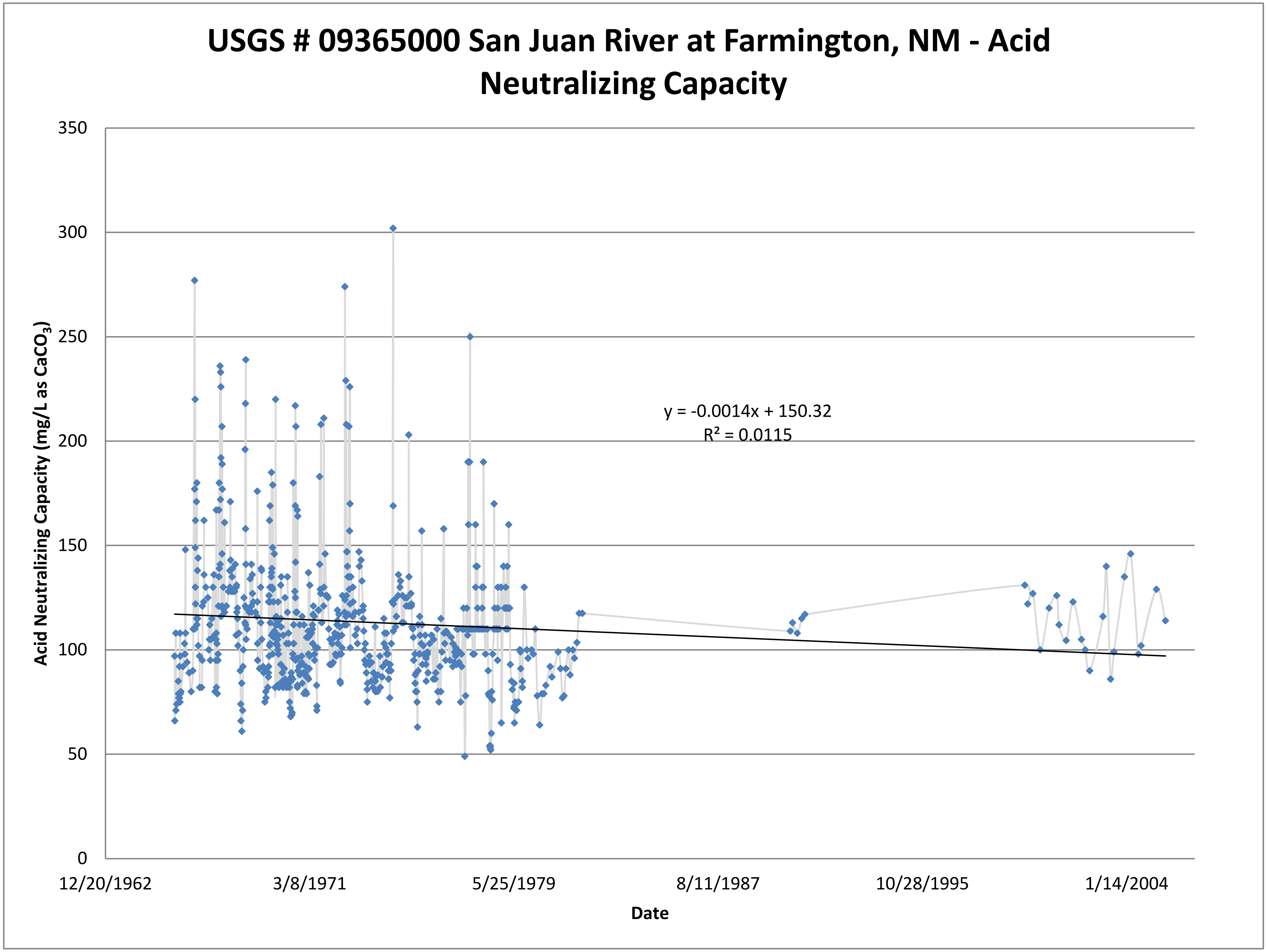

USGS # 09365000 San Juan River at Farmington, NM - pH
y = 4E-05x + 6.6868
R² = 0.1707
pH
9.5
9
8.5
8
7.5
7
6.5
3/25/1960
6/11/1968
8/28/1976
11/14/1984
1/31/1993
4/19/2001
7/6/2009
Date

Appendix A - USGS Stations
USGS # 09365000

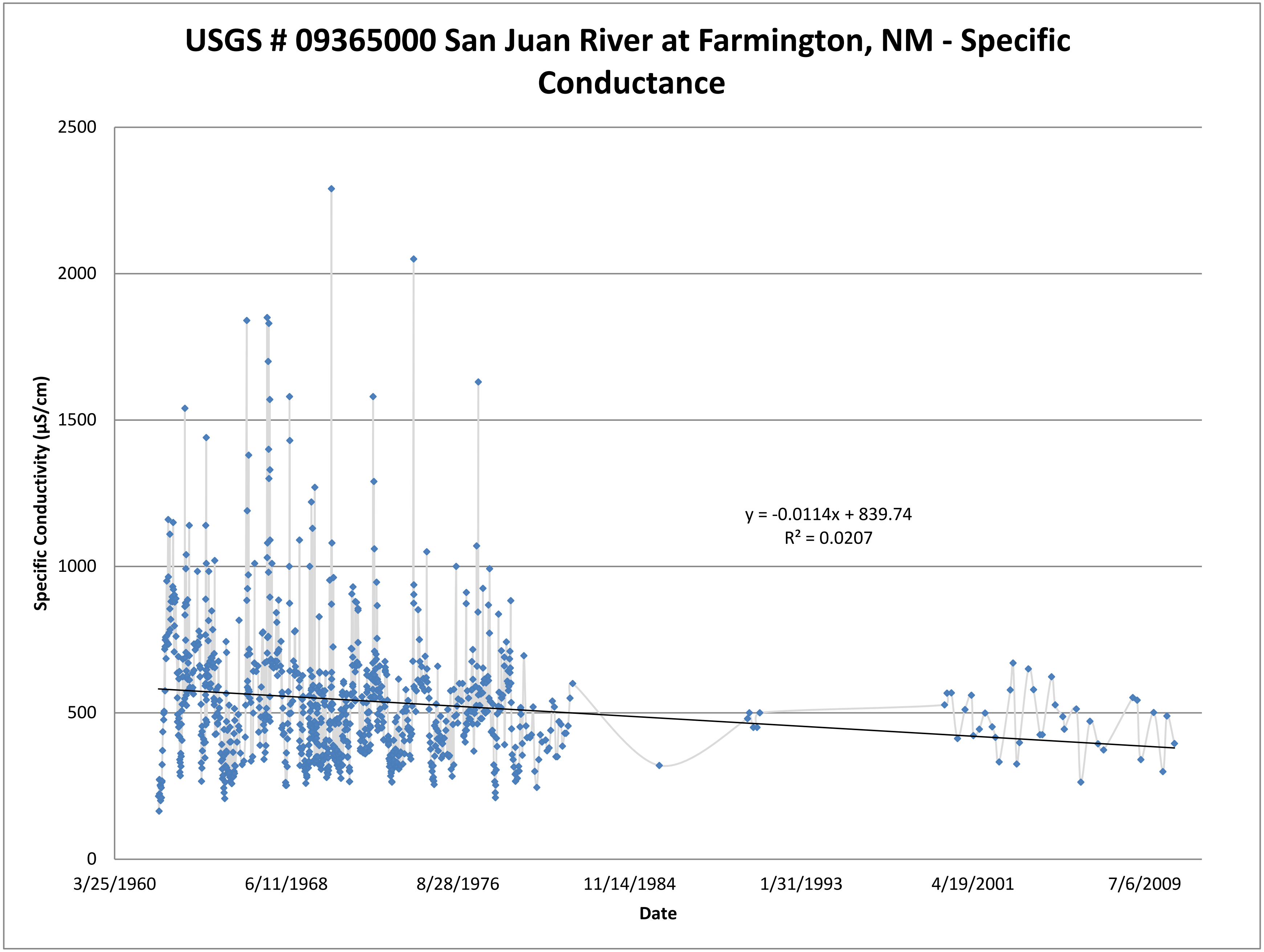



USGS # 09365000 San Juan River at Farmington, NM - Alkalinity
160
150
140
130
120
110
100
90
80
70
60
Alkalinity (mg/L as CaCO3)
y = -0.0024x + 197.23
R² = 0.0321
8/28/1999
5/24/2002
2/17/2005
11/14/2007
8/10/2010
Date

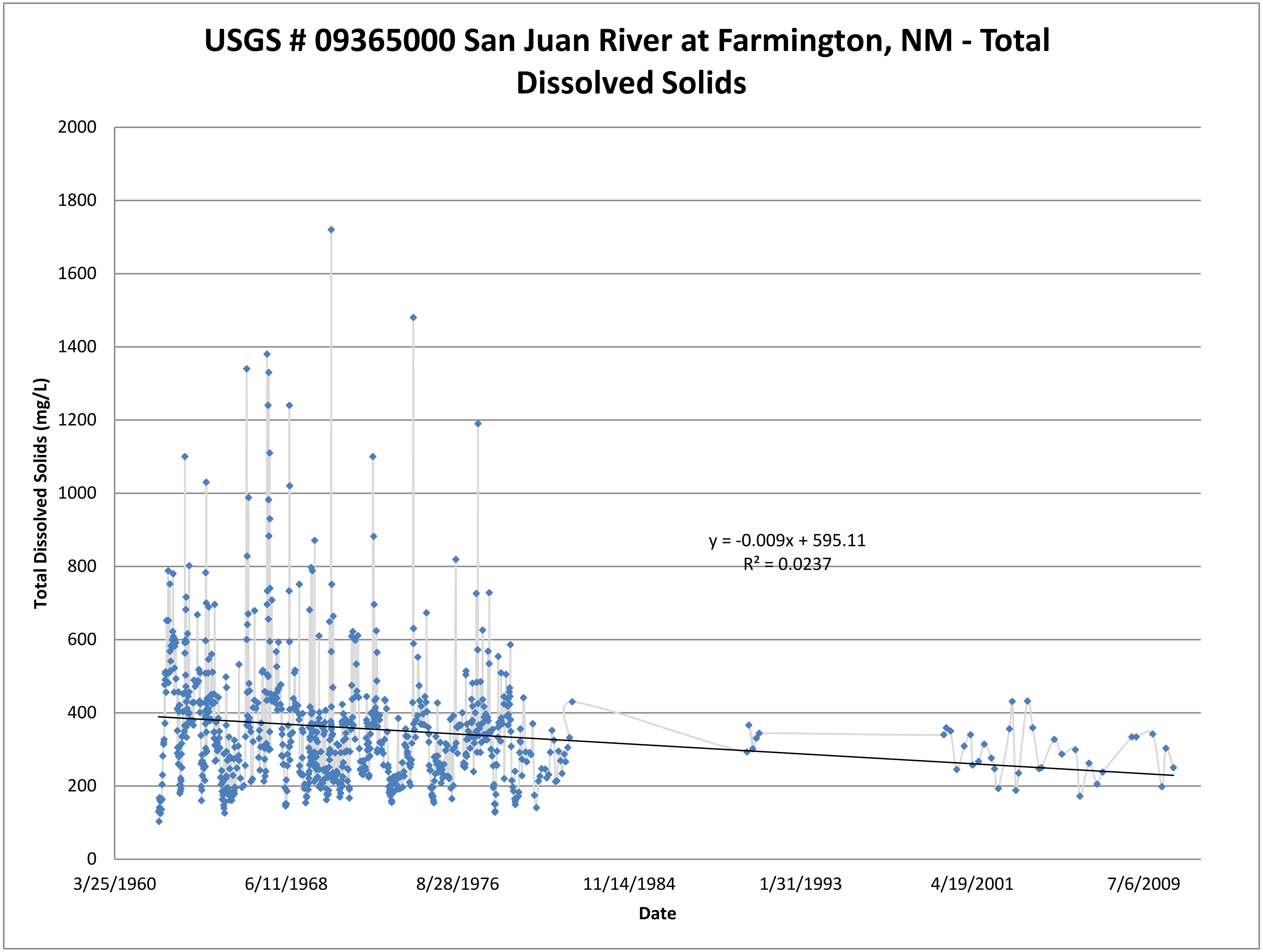
Appendix A - USGS Stations
USGS # 09365000

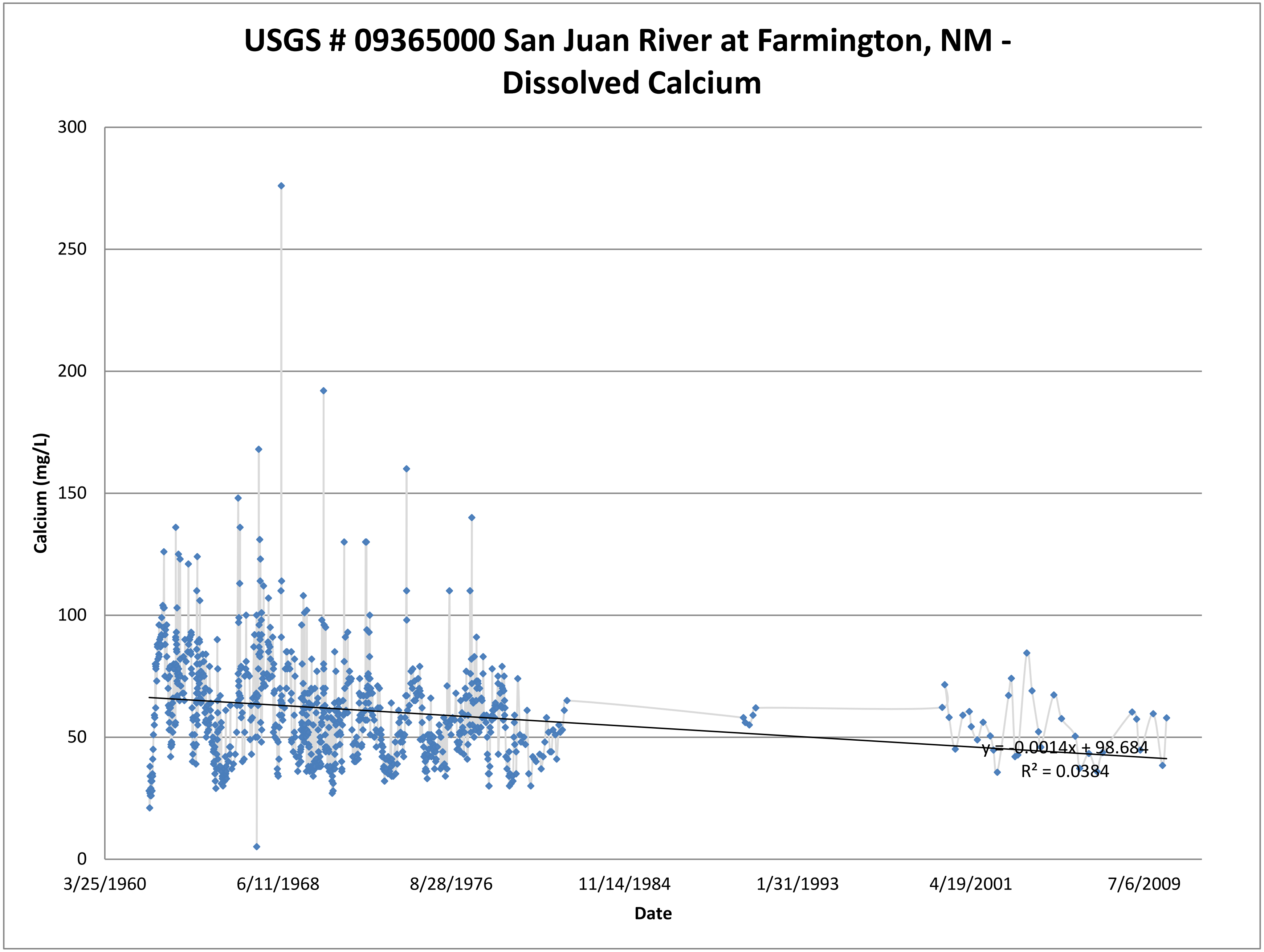


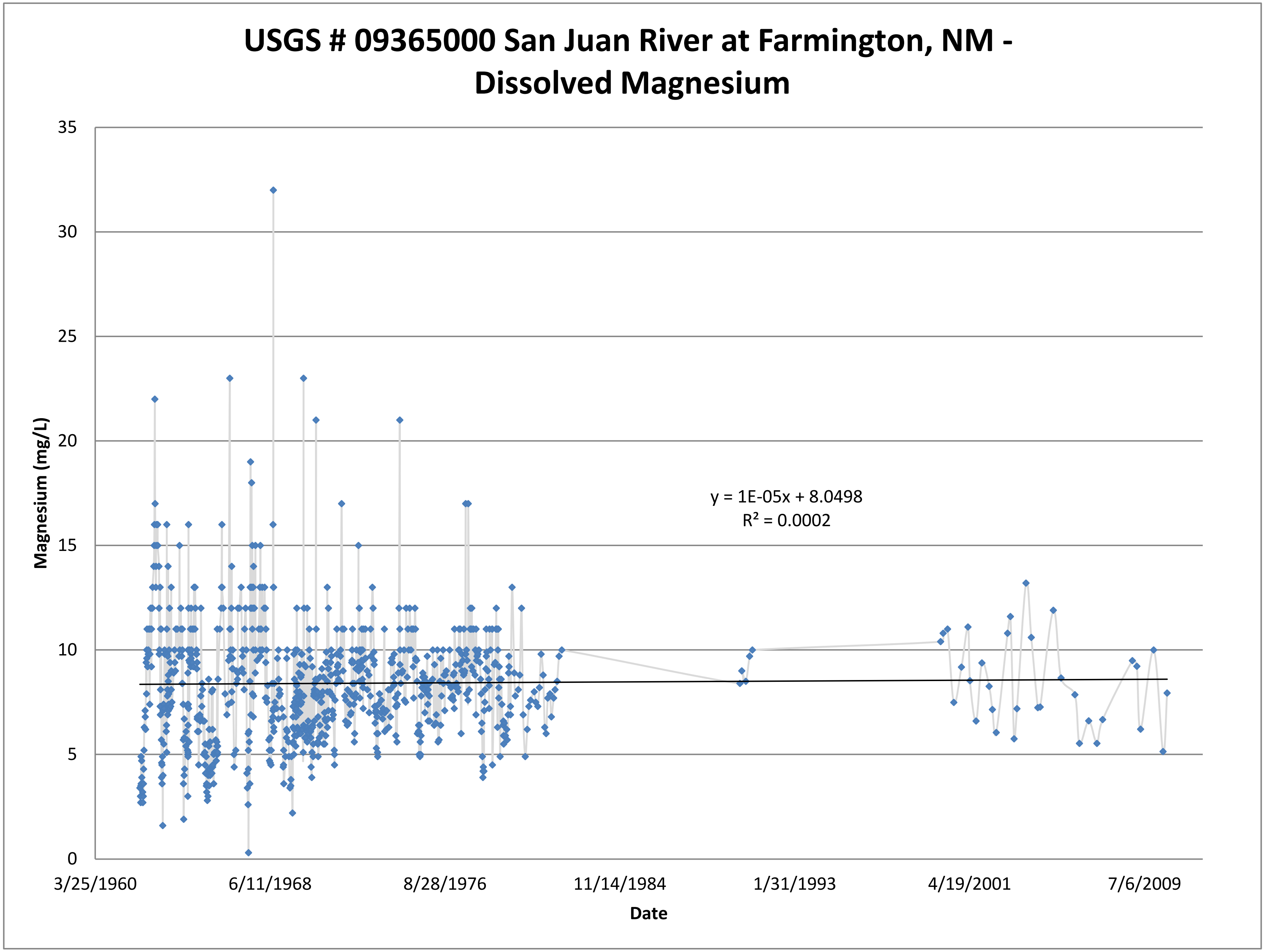
Appendix A - USGS Stations
USGS # 09365000



Appendix A - USGS Stations
USGS # 09365000

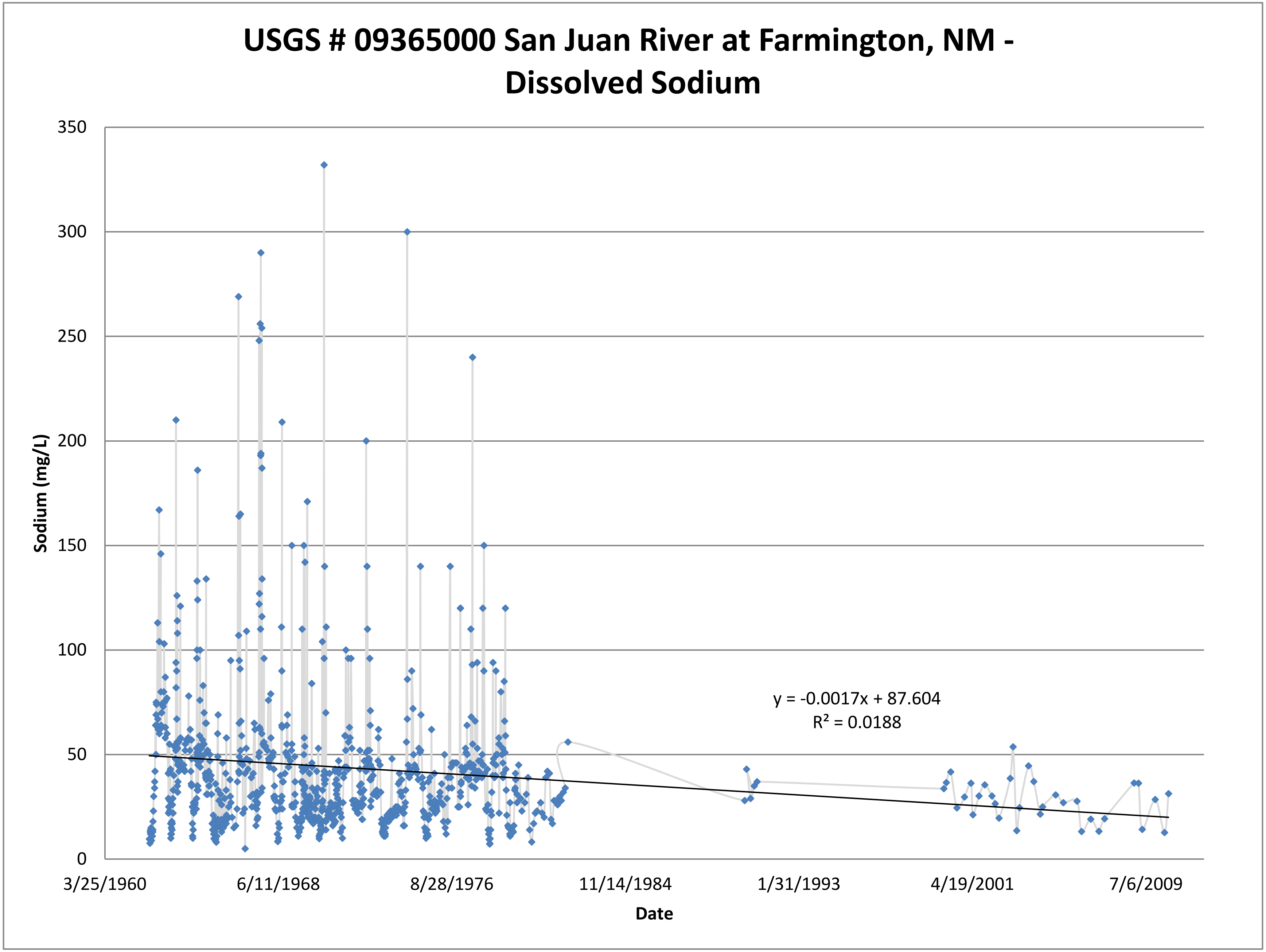



USGS # 09365000 San Juan River at Farmington, NM - Dissolved Calcium
Calcium (mg/L)
300
250
200
150
100
50
0
3/25/1960
6/11/1968
8/28/1976
11/14/1984
1/31/1993
4/19/2001
7/6/2009
Date
y = -0.0014x + 98.684
R² = 0.0384

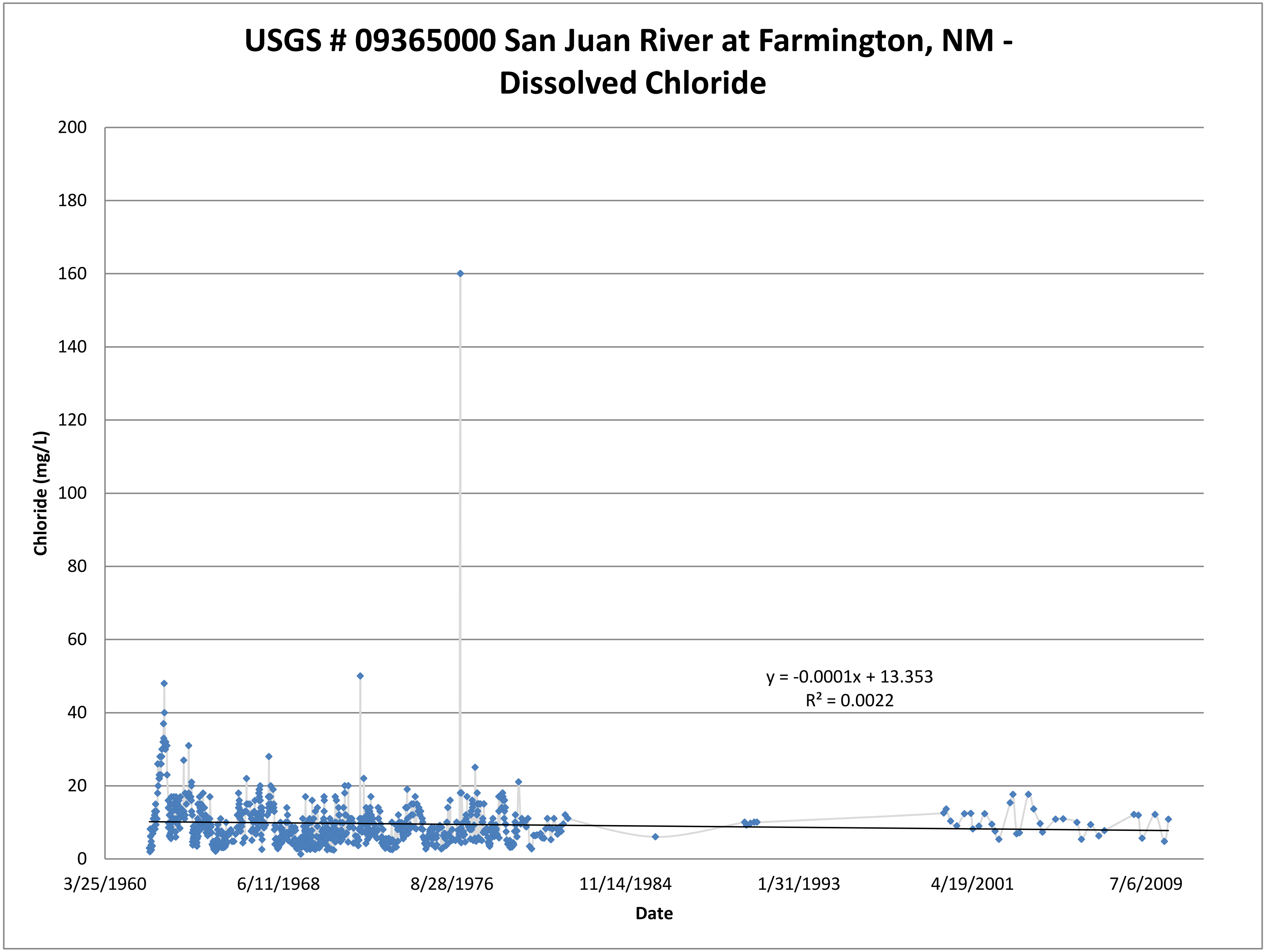

USGS # 09365000 San Juan River at Farmington, NM - Dissolved Magnesium
Magnesium (mg/L)
35
30
25
20
15
10
5
0
y = 1E-05x + 8.0498
R² = 0.0002
3/25/1960
6/11/1968
8/28/1976
11/14/1984
1/31/1993
4/19/2001
7/6/2009
Date

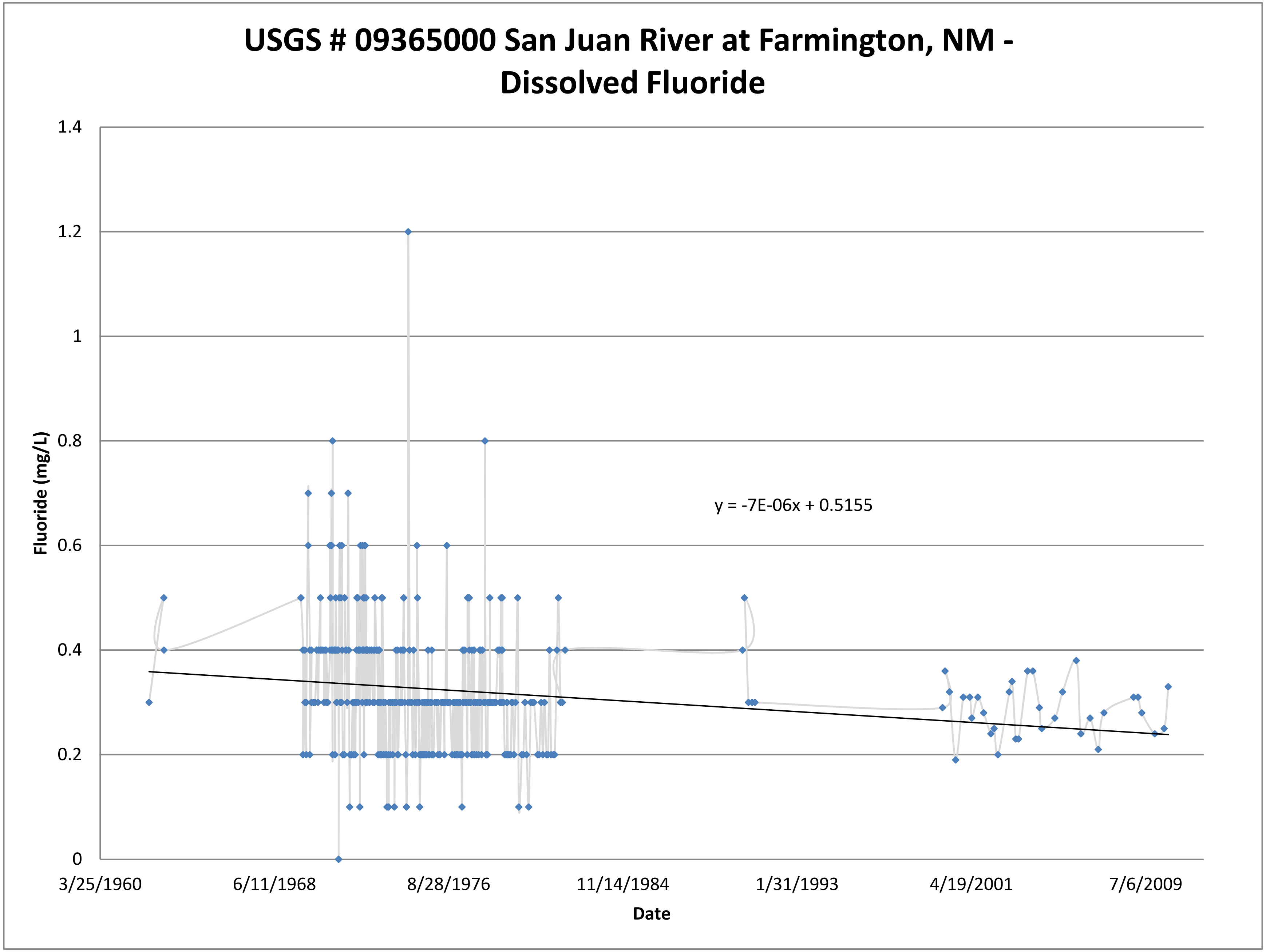
Appendix A - USGS Stations

USGS # 09365000

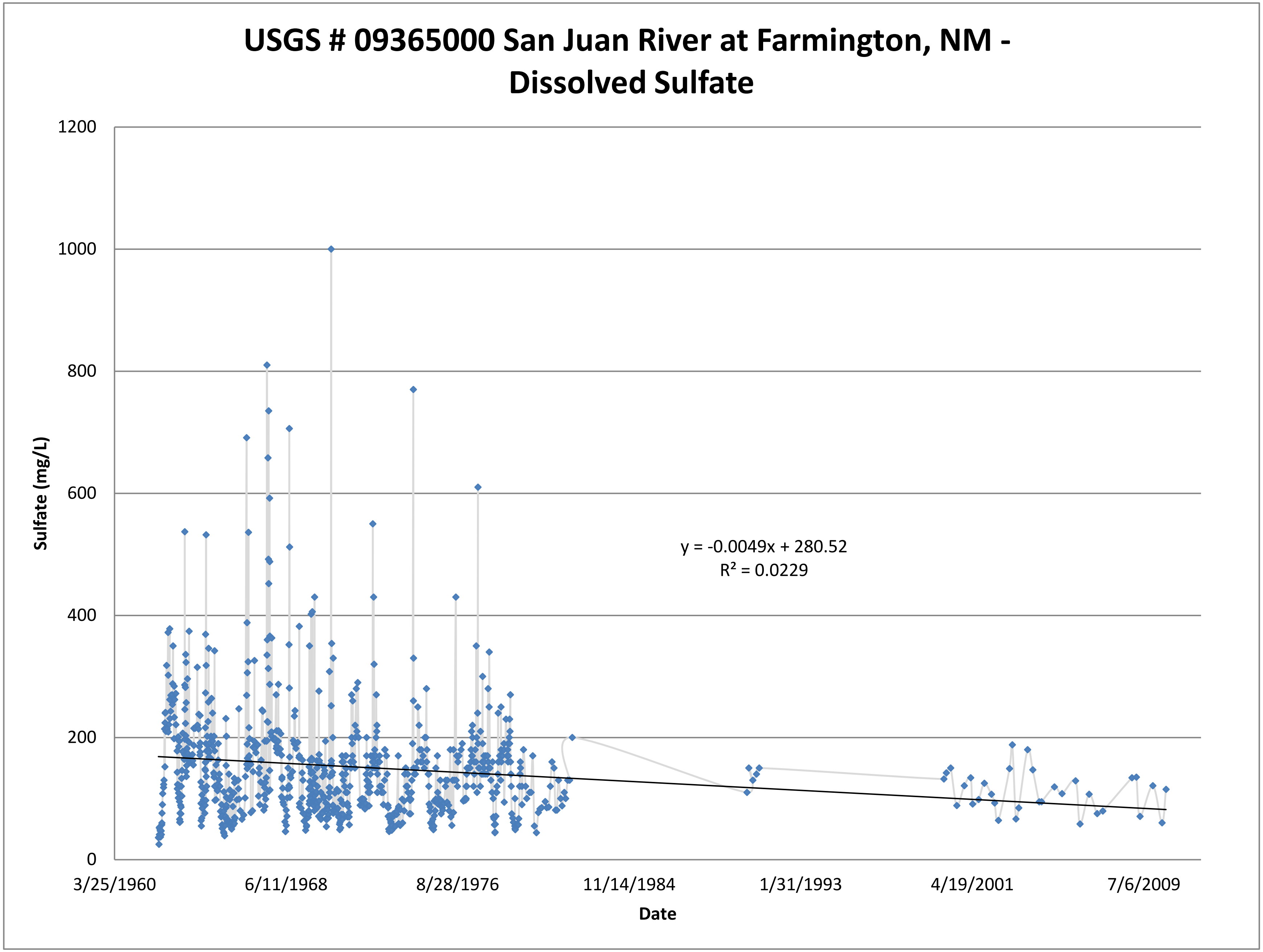


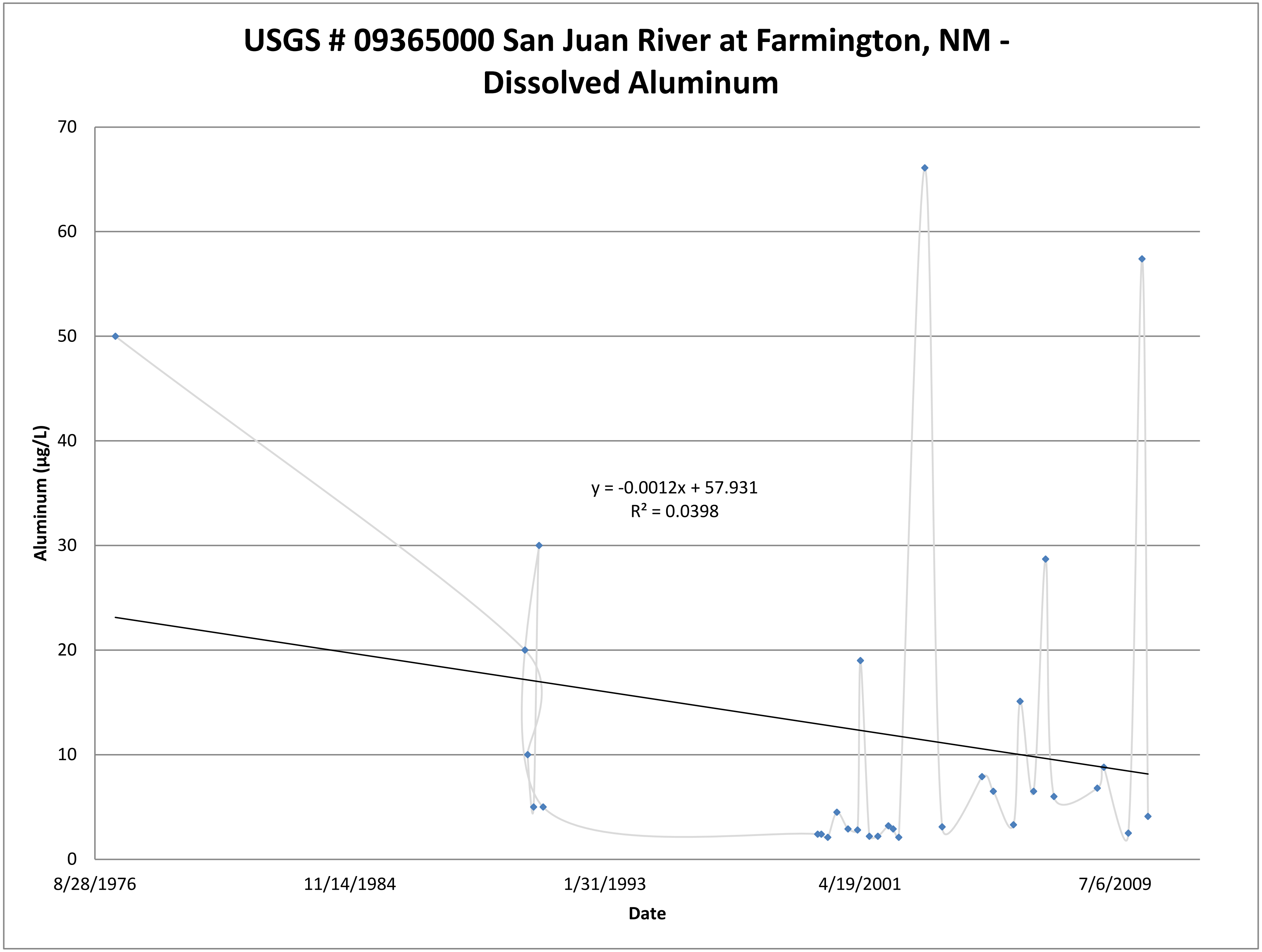
Appendix A - USGS Stations
USGS # 09365000

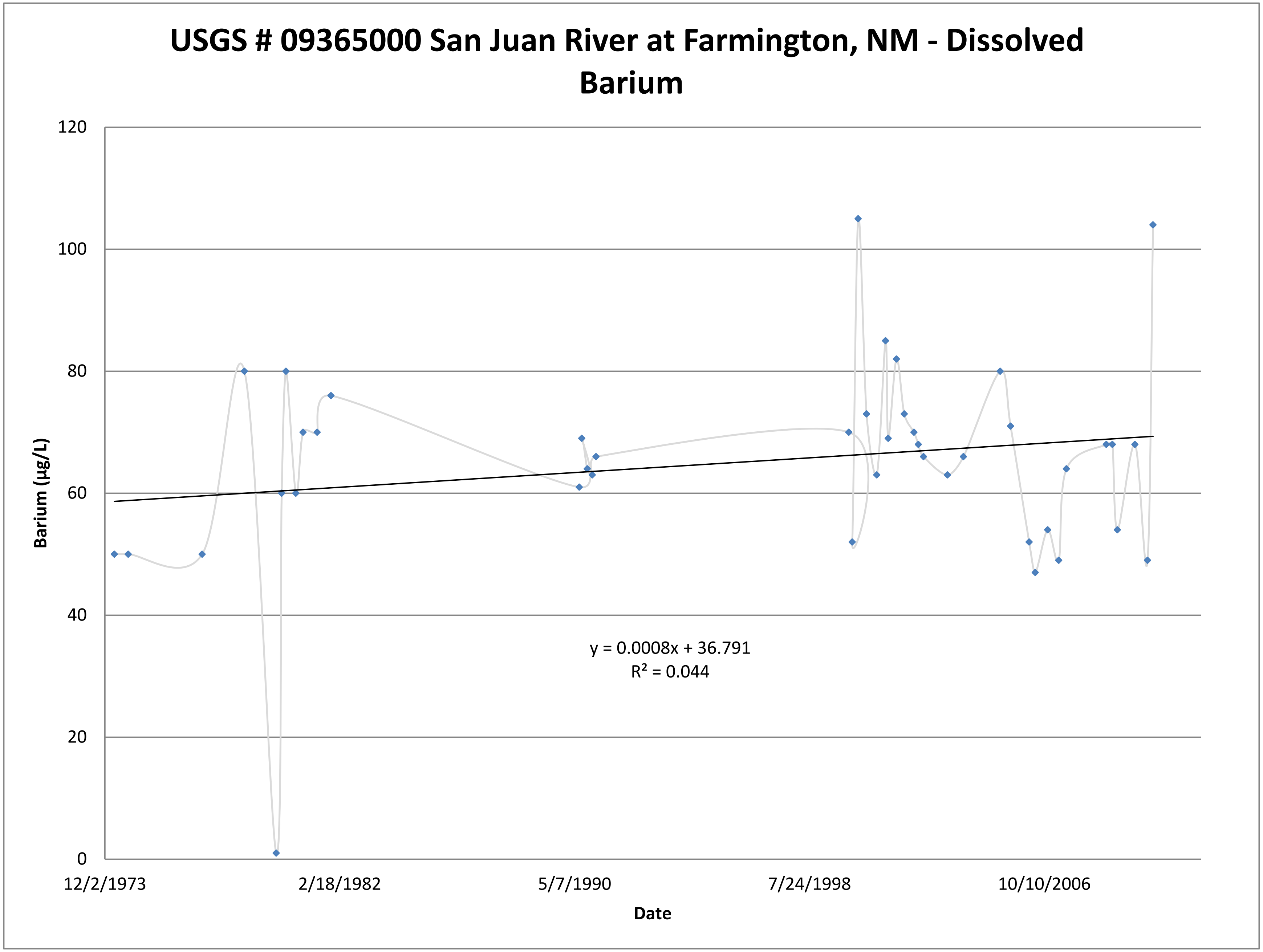


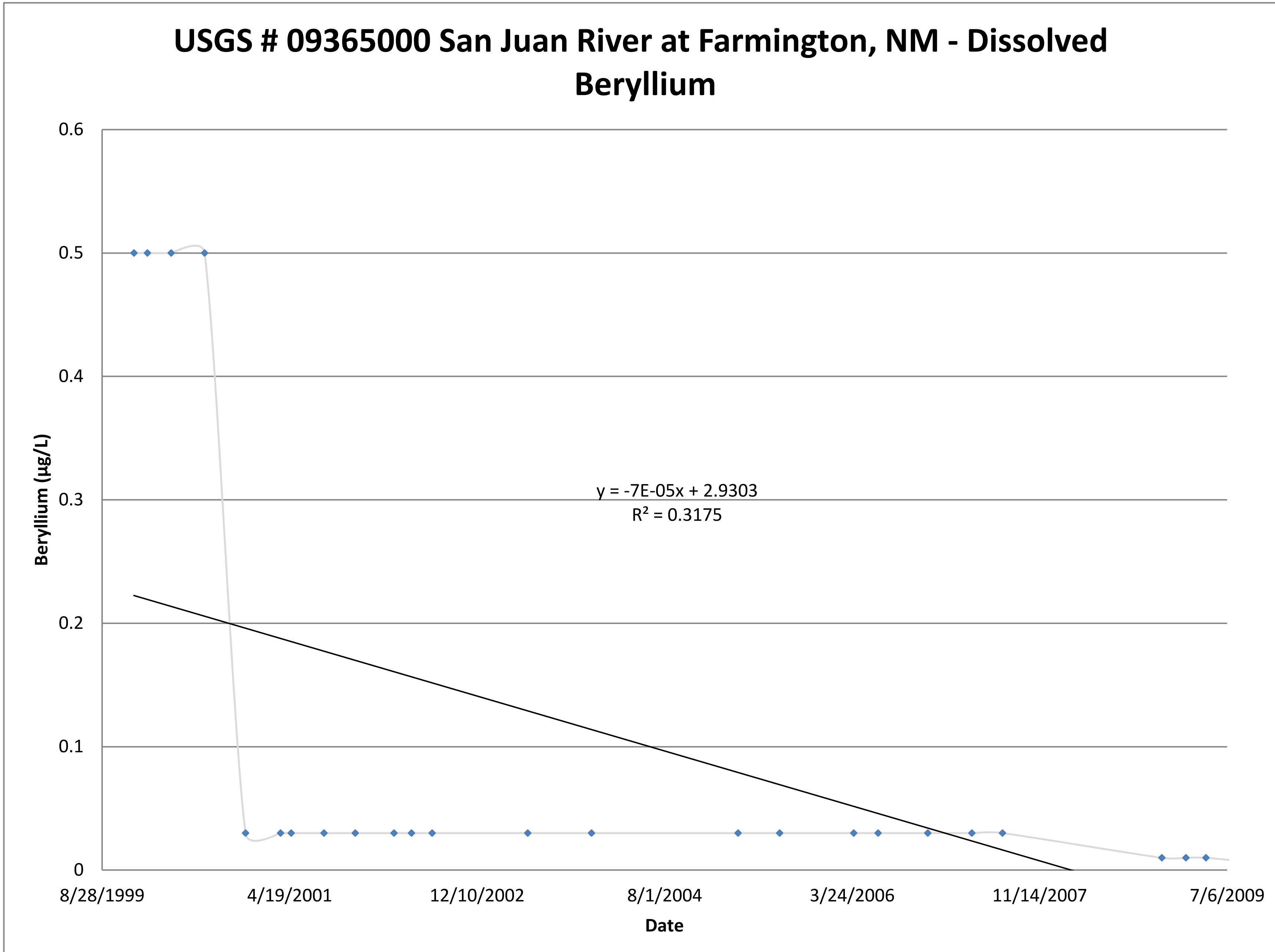

USGS # 09365000 San Juan River at Farmington, NM - Dissolved Fluoride
Fluoride (mg/L)
1.4
1.2
1
0.8
0.6
0.4
0.2
0
y = -7E-06x + 0.5155
3/25/1960
6/11/1968
8/28/1976
11/14/1984
1/31/1993
4/19/2001
7/6/2009
Date

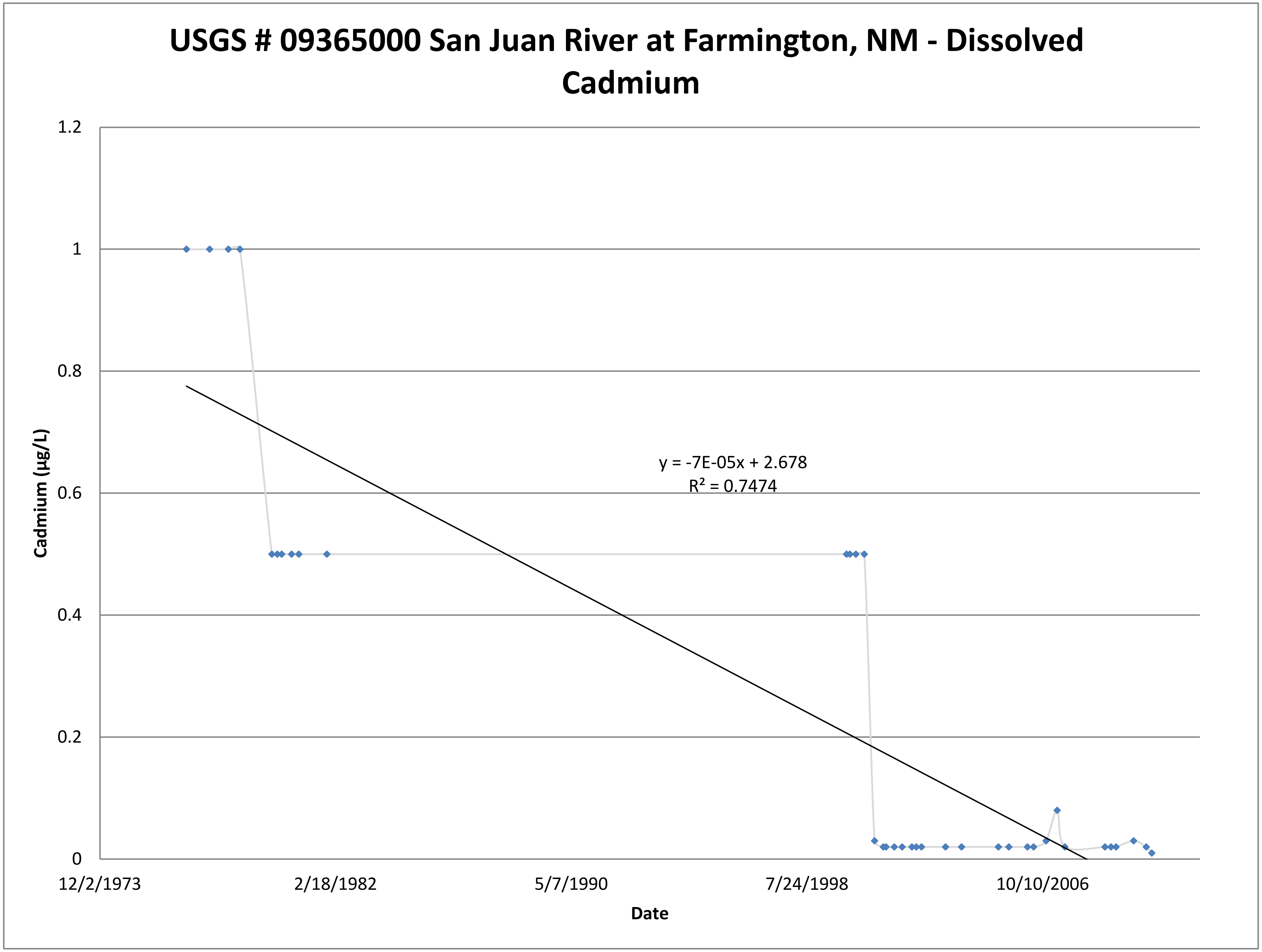
Appendix A - USGS Stations
USGS # 09365000



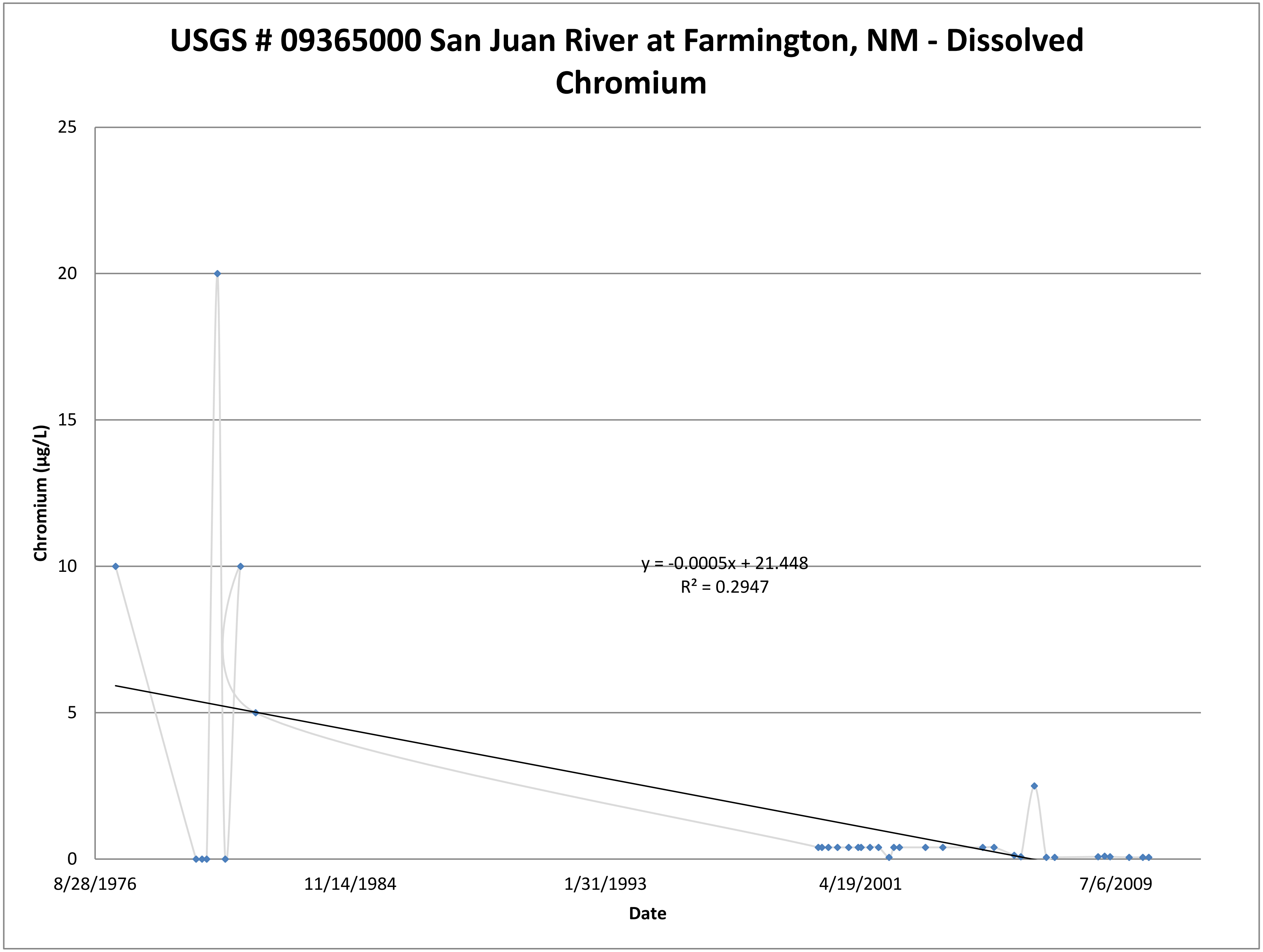

USGS # 09365000 San Juan River at Farmington, NM - Dissolved Aluminum
70
60
50
40
30
20
10
0
Aluminum (µg/L)
y = -0.0012x + 57.931
R² = 0.0398
8/28/1976
11/14/1984
1/31/1993
4/19/2001
7/6/2009
Date

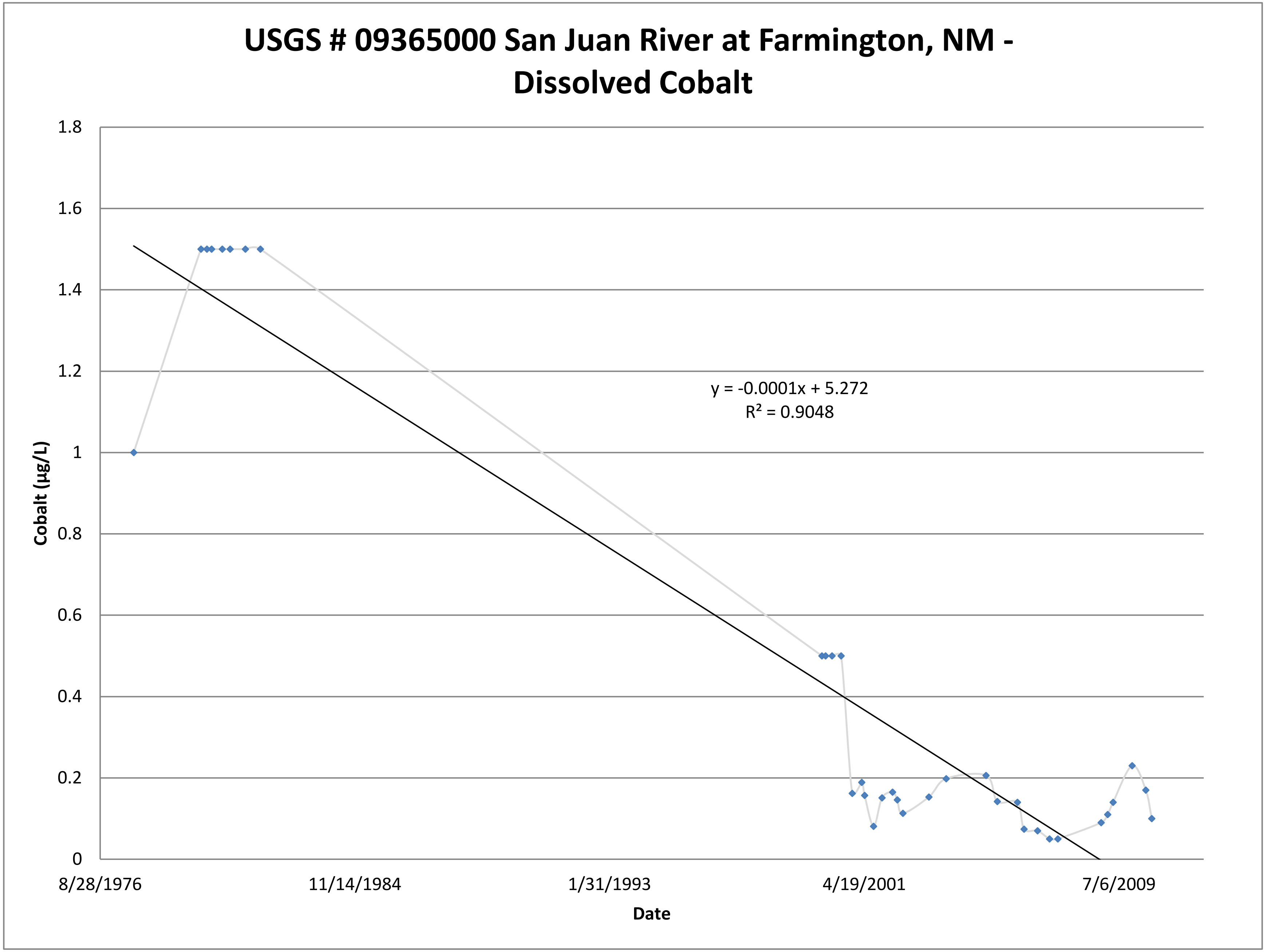

USGS # 09365000 San Juan River at Farmington, NM - Dissolved Barium
120
100
80
60
40
20
0
Barium (µg/L)
y = 0.0008x + 36.791
R² = 0.044
12/2/1973
2/18/1982
5/7/1990
7/24/1998
10/10/2006
Date


USGS # 09365000 San Juan River at Farmington, NM - Dissolved Beryllium
0.6
0.5
0.4
0.3
0.2
0.1
0
Beryllium (µg/L)
y = -7E-05x + 2.9303
R² = 0.3175
8/28/1999
4/19/2001
12/10/2002
8/1/2004
3/24/2006
11/14/2007
7/6/2009
Date

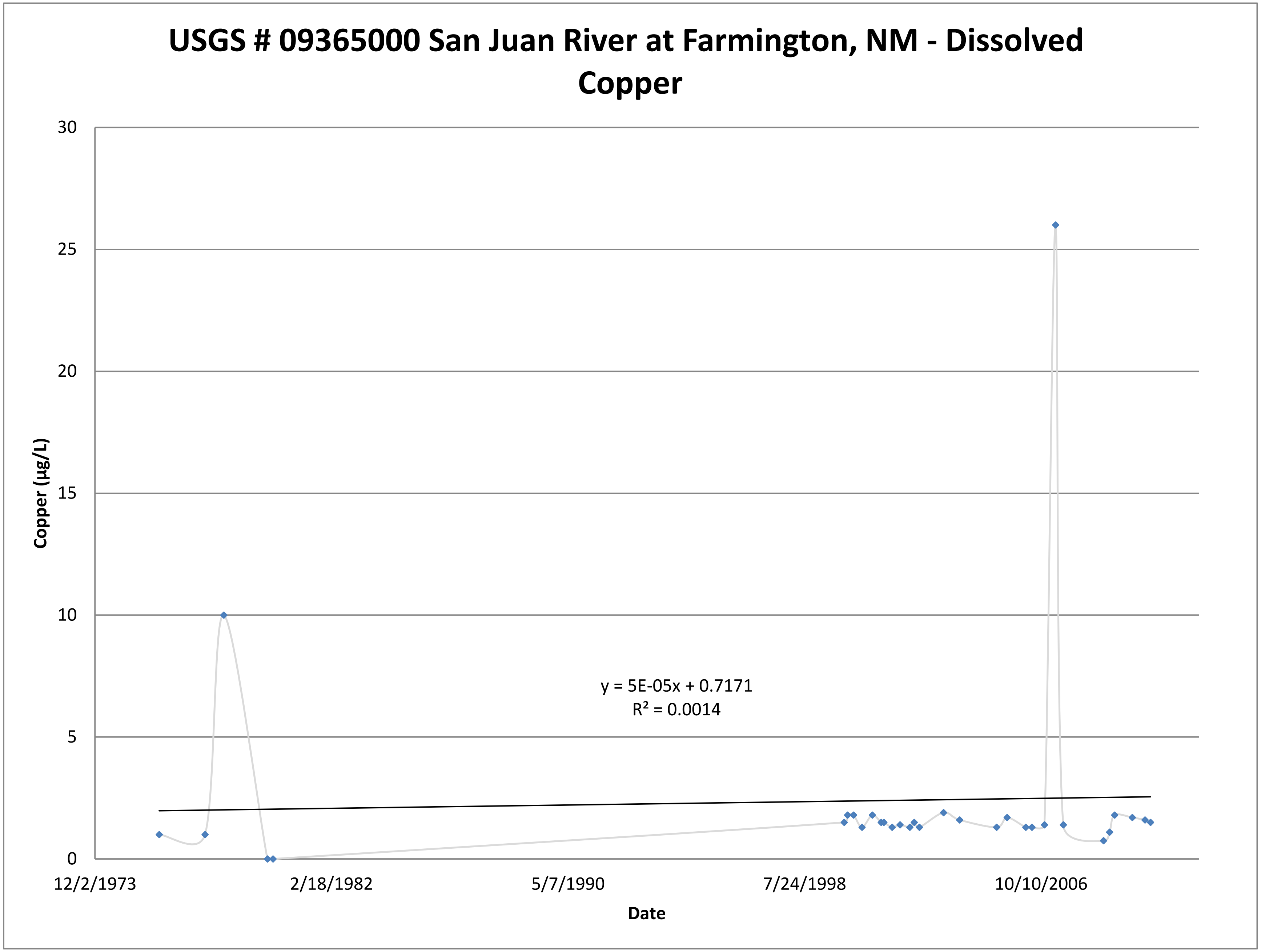

USGS # 09365000 San Juan River at Farmington, NM - Dissolved Cadmium
1.2
1
0.8
0.6
0.4
0.2
0
Cadmium (µg/L)
y = -7E-05x + 2.678
R² = 0.7474
12/2/1973
2/18/1982
5/7/1990
7/24/1998
10/10/2006
Date

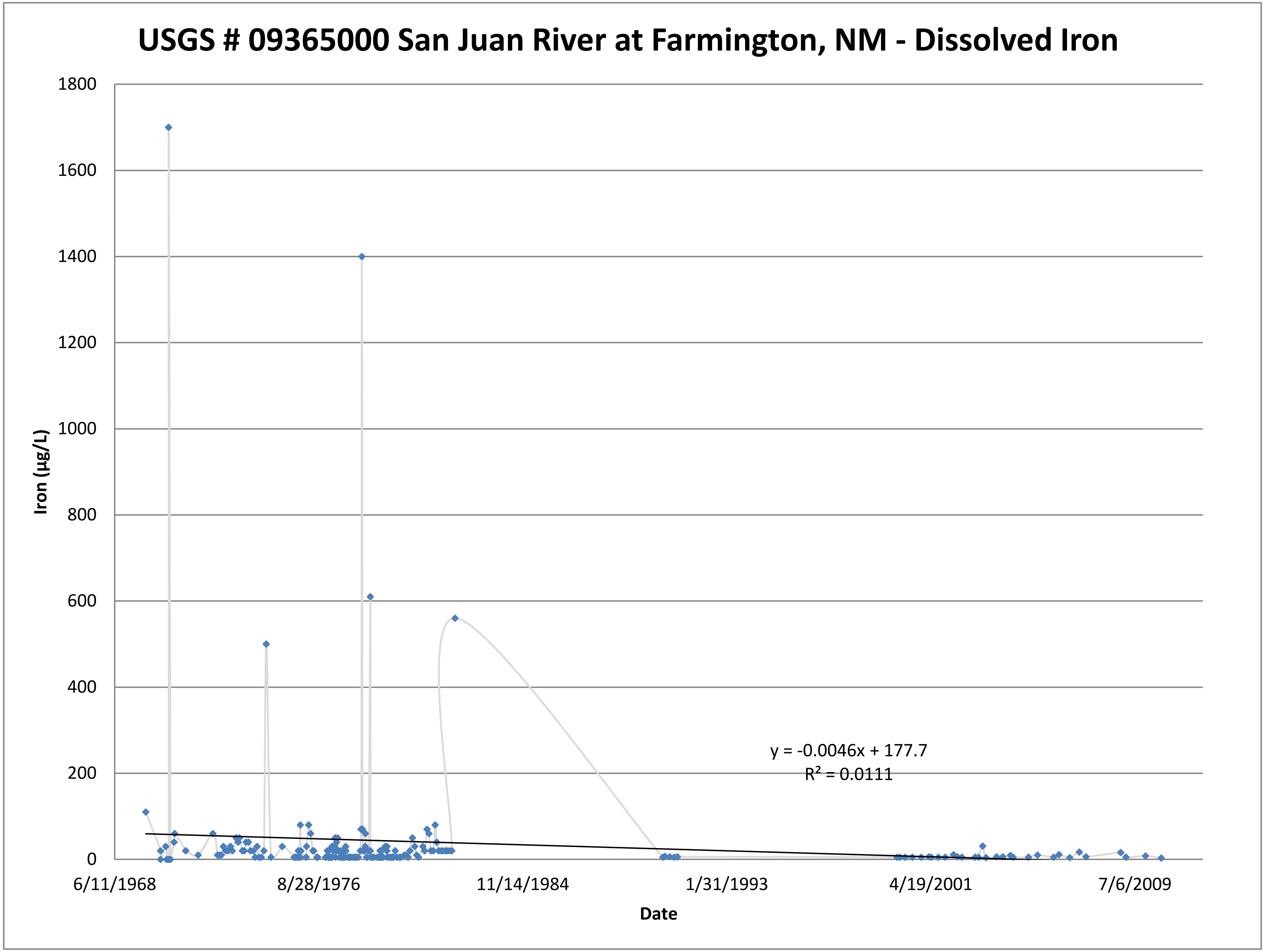
Appendix A - USGS Stations
USGS # 09365000



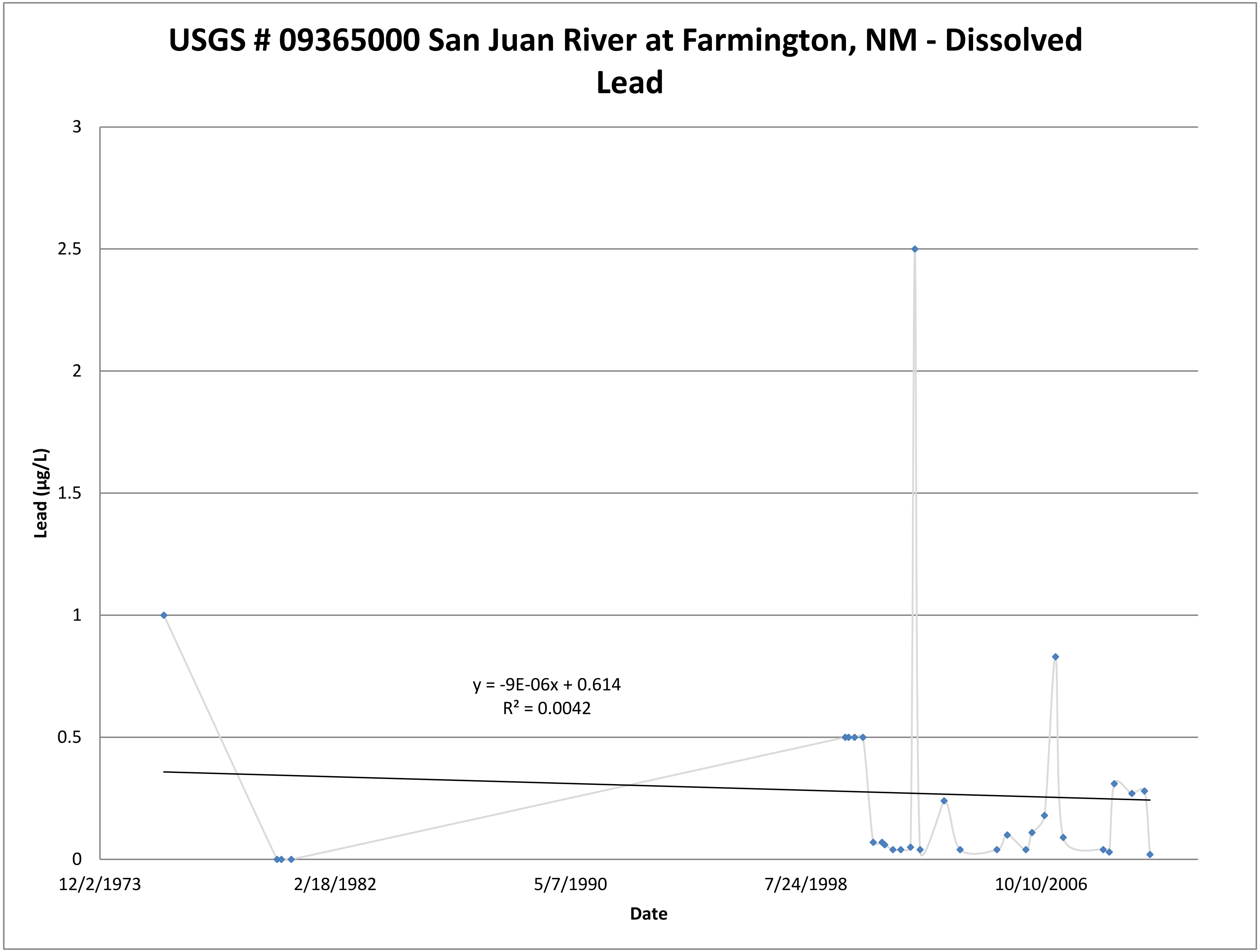

USGS # 09365000 San Juan River at Farmington, NM - Dissolved Cobalt
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Cobalt (µg/L)
y = -0.0001x + 5.272
R² = 0.9048
8/28/1976
11/14/1984
1/31/1993
4/19/2001
7/6/2009
Date

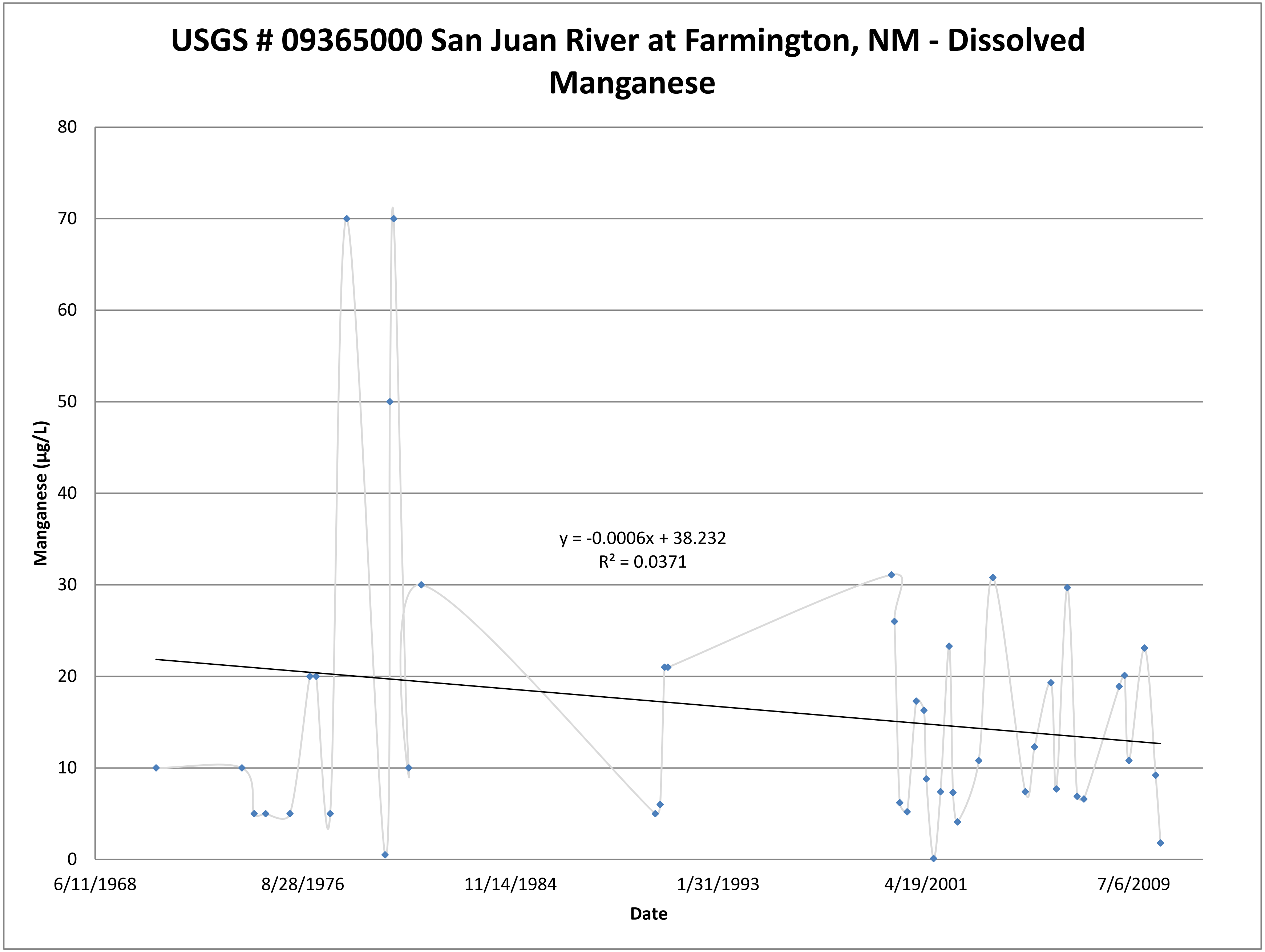
Appendix A - USGS Stations
USGS # 09365000

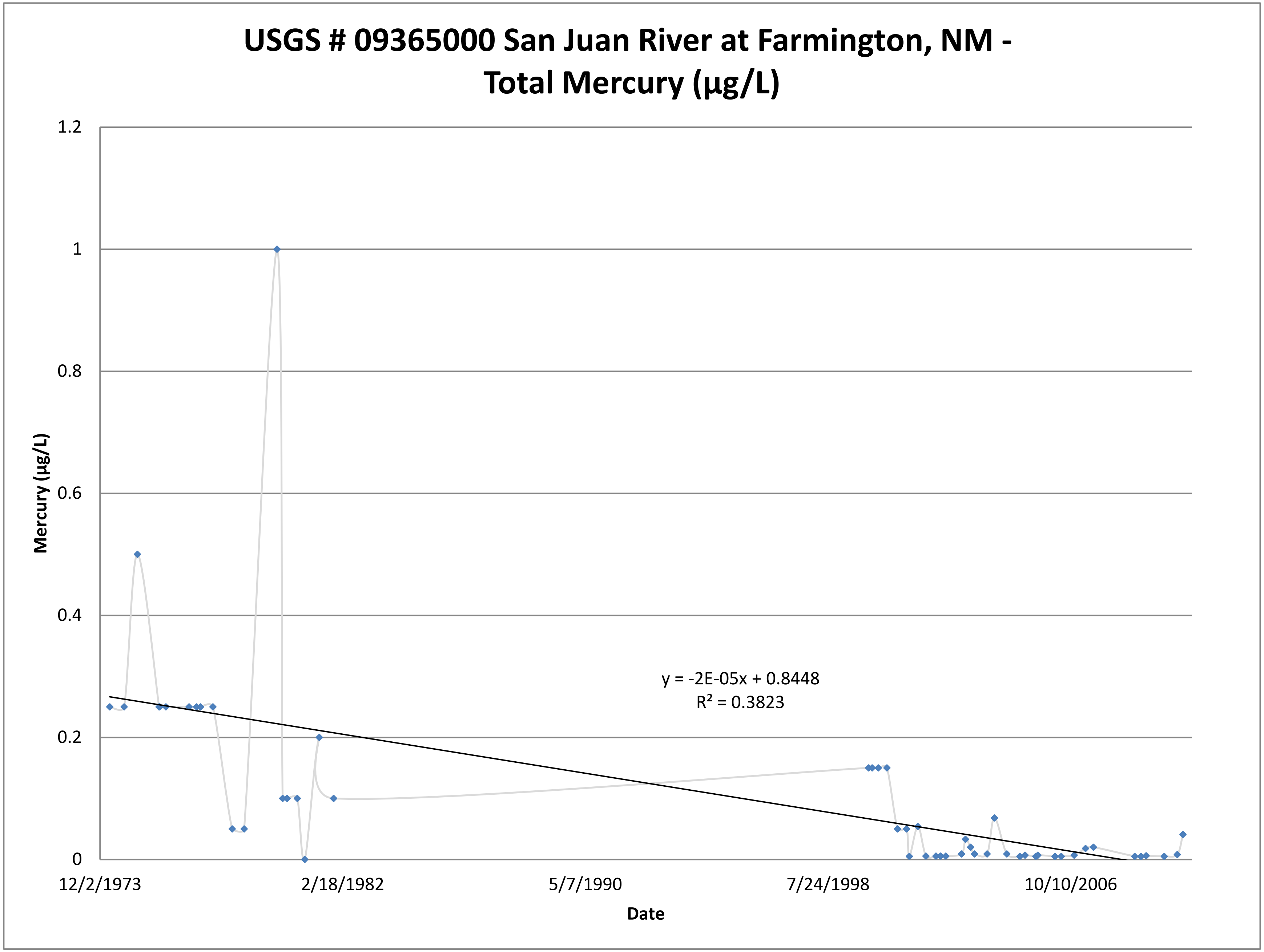


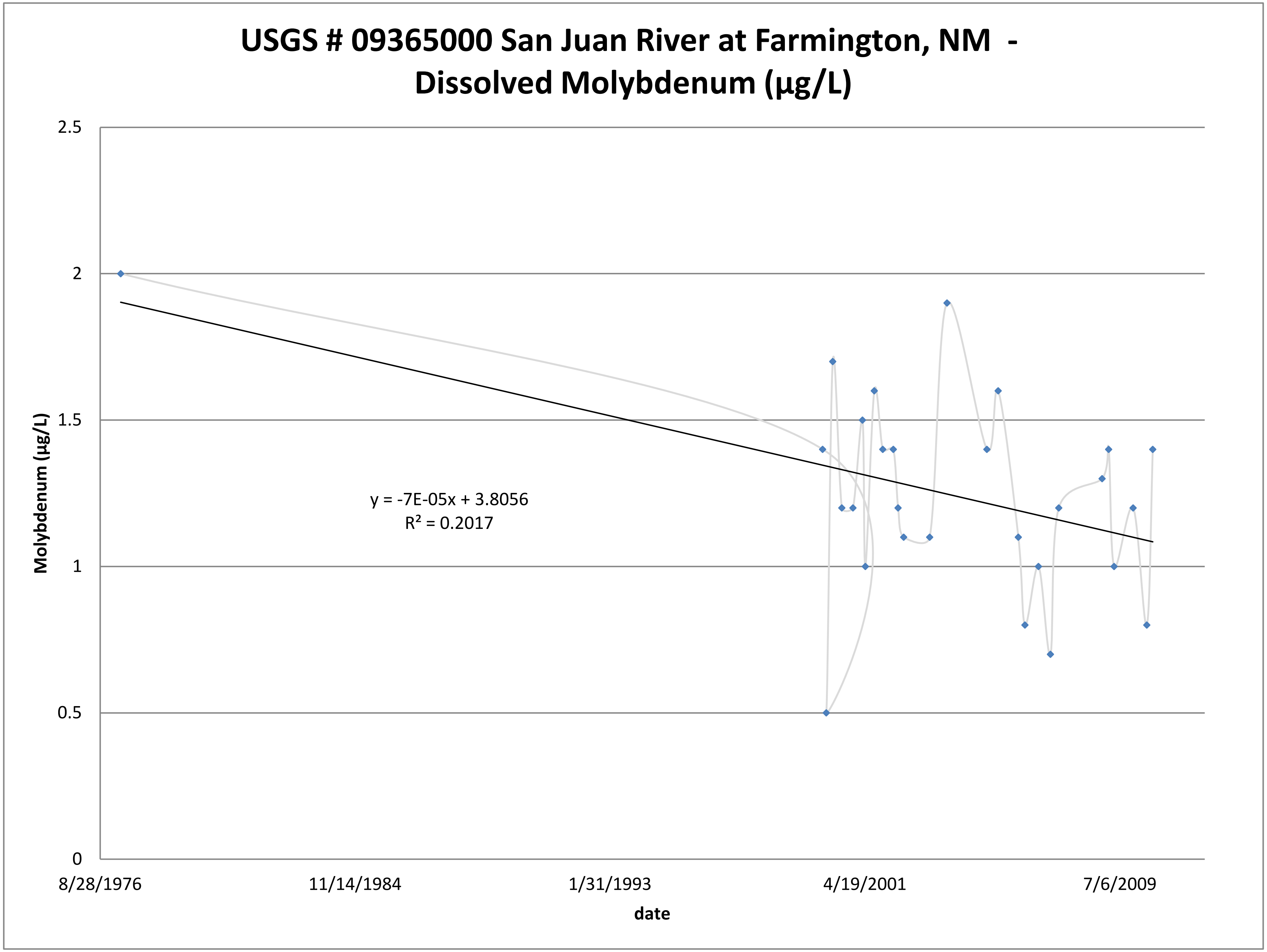

USGS # 09365000 San Juan River at Farmington, NM - Dissolved Iron
Iron (µg/L)
1800
1600
1400
1200
1000
800
600
400
200
0
6/11/1968
8/28/1976
11/14/1984
1/31/1993
4/19/2001
7/6/2009
Date
y = -0.0046x + 177.7
R² = 0.0111

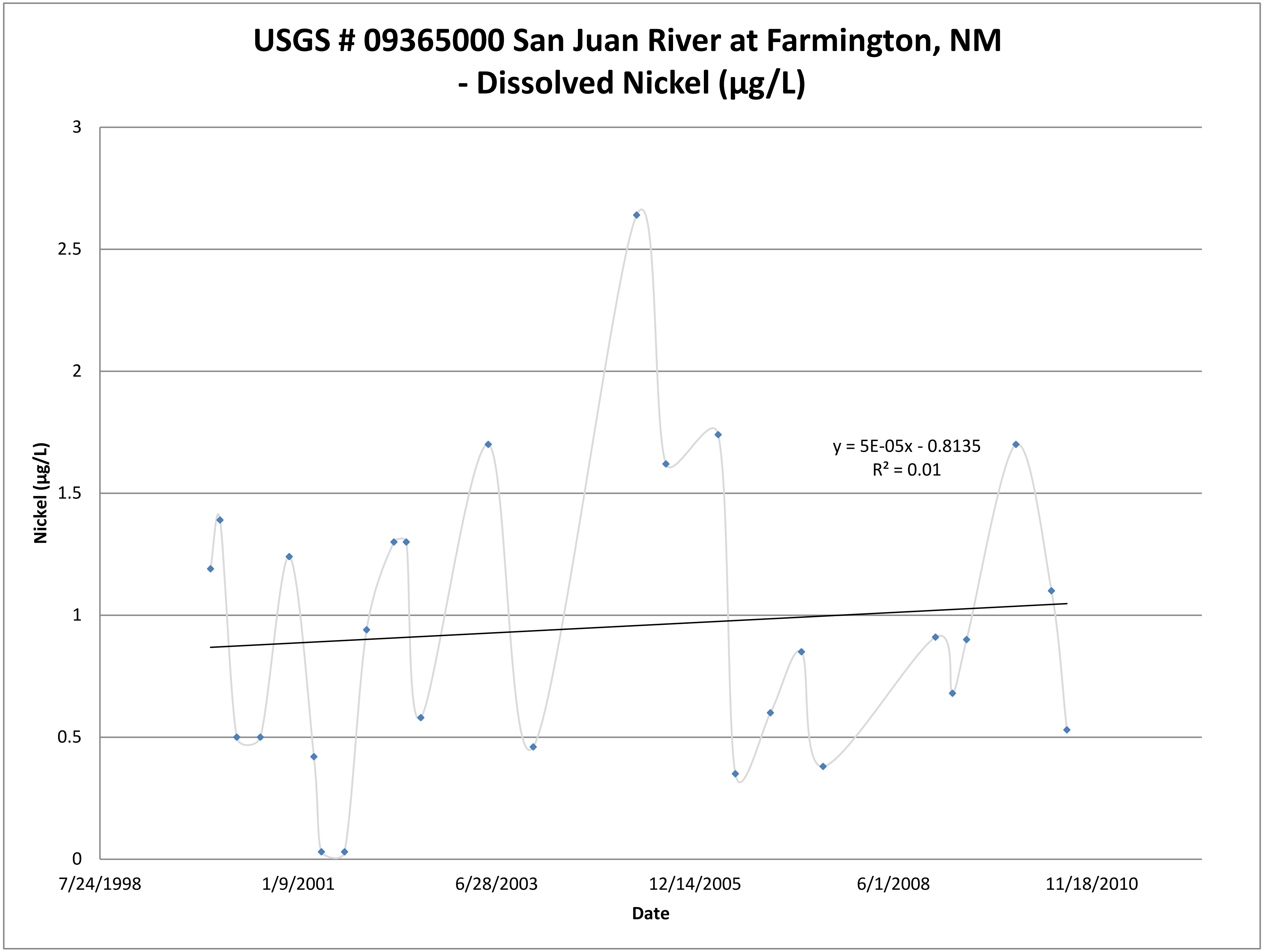
Appendix A - USGS Stations
USGS # 09365000

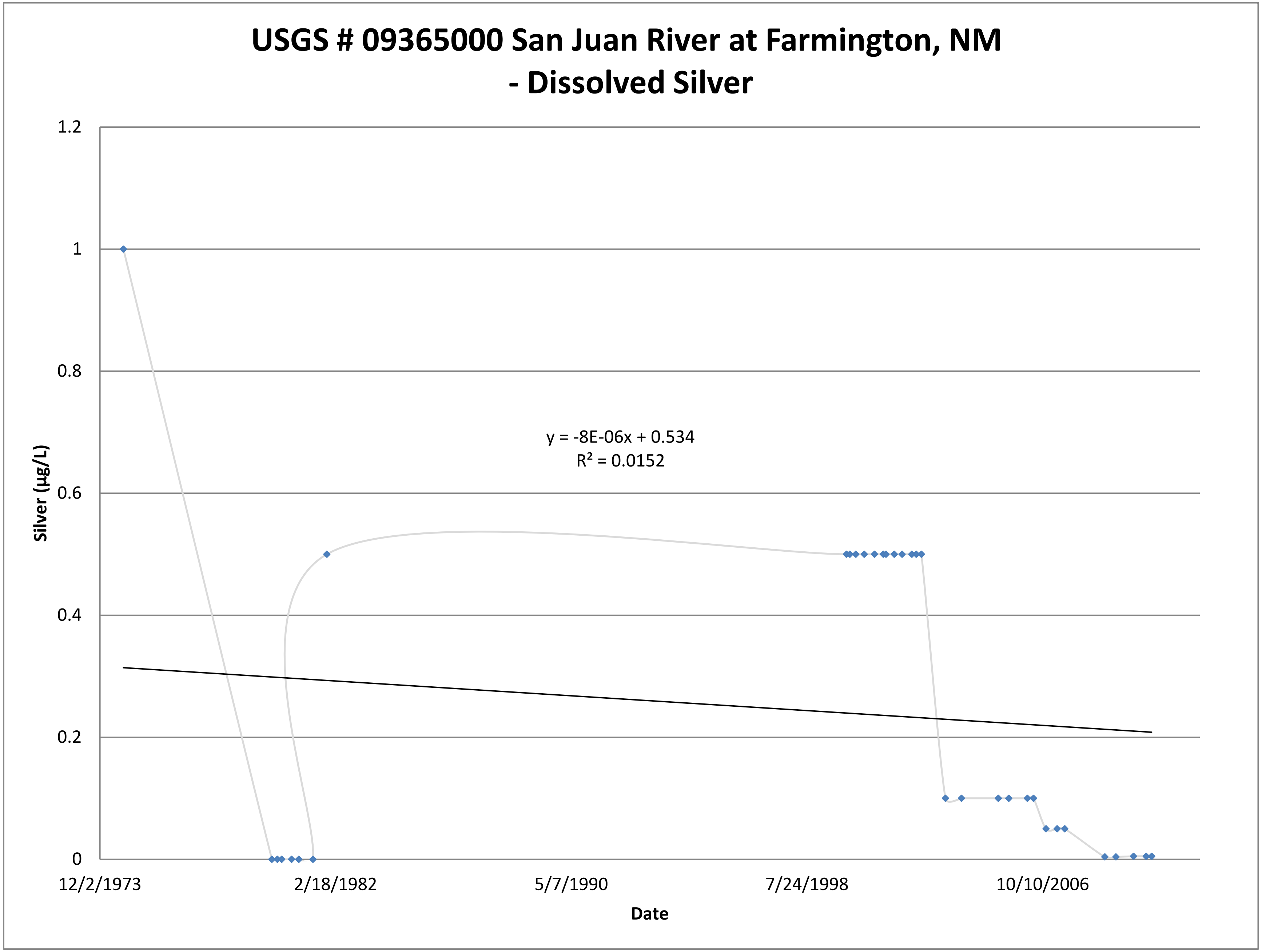


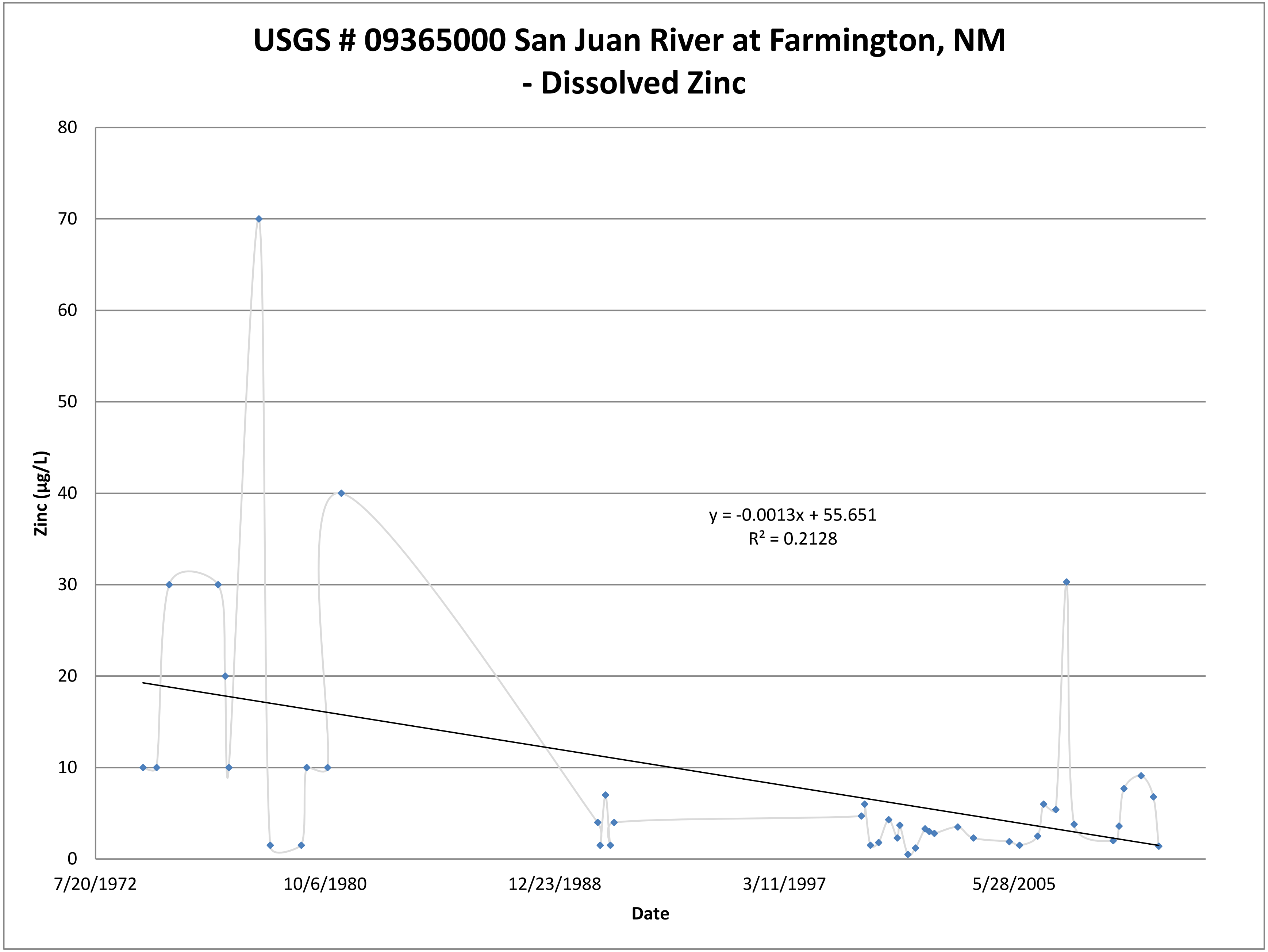

USGS # 09365000 San Juan River at Farmington, NM - Dissolved Manganese
80
70
60
50
40
30
20
10
0
Manganese (µg/L)
y = -0.0006x + 38.232
R² = 0.0371
6/11/1968
8/28/1976
11/14/1984
1/31/1993
4/19/2001
7/6/2009
Date

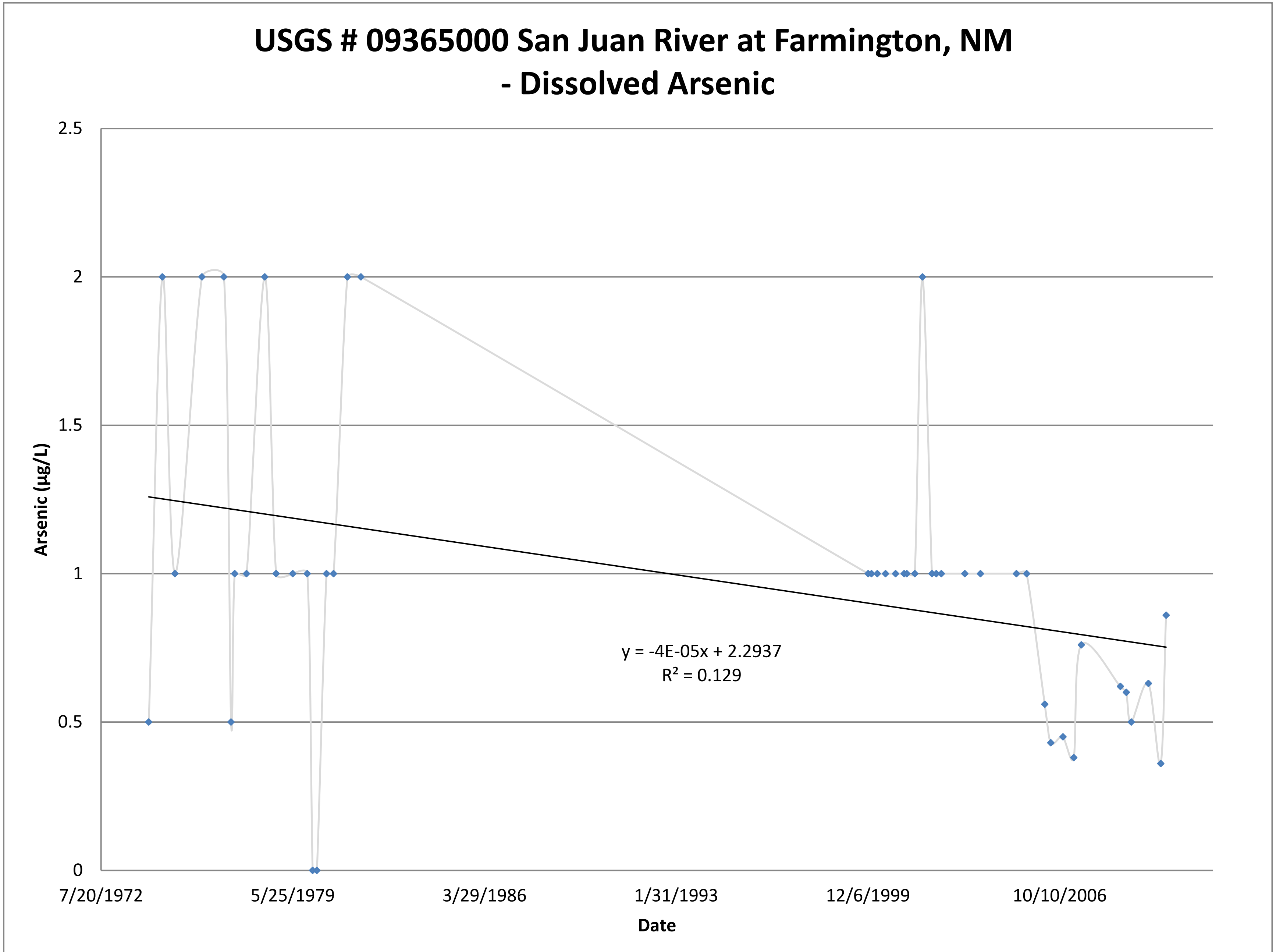

USGS # 09365000 San Juan River at Farmington, NM - Total Mercury (µg/L)
1.2
1
0.8
0.6
0.4
0.2
0
Mercury (µg/L)
y = -2E-05x + 0.8448
R² = 0.3823
12/2/1973
2/18/1982
5/7/1990
7/24/1998
10/10/2006
Date


USGS # 09365000 San Juan River at Farmington, NM -
Dissolved Molybdenum (µg/L)
Molybdenum (µg/L)
2.5
2
1.5
1
0.5
0
y = -7E-05x + 3.8056
R² = 0.2017
8/28/1976
11/14/1984
1/31/1993
4/19/2001
7/6/2009
date

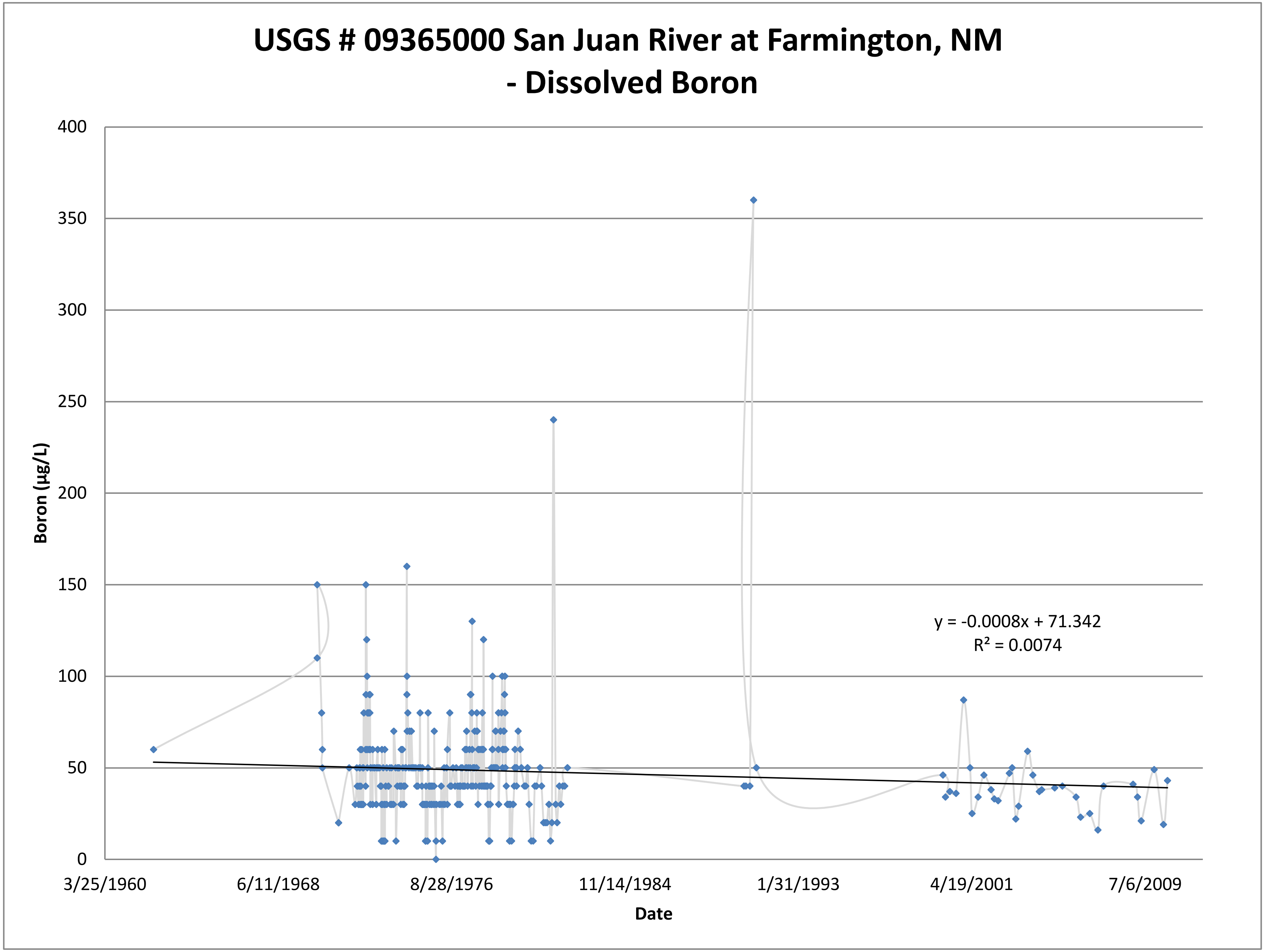

USGS # 09365000 San Juan River at Farmington, NM
- Dissolved Nickel (µg/L)
Nickel (µg/L)
0
0.5
1
1.5
2
2.5
3
7/24/1998
1/9/2001
6/28/2003
12/14/2005
6/1/2008
11/18/2010
Date
y = 5E-05x - 0.8135
R² = 0.01

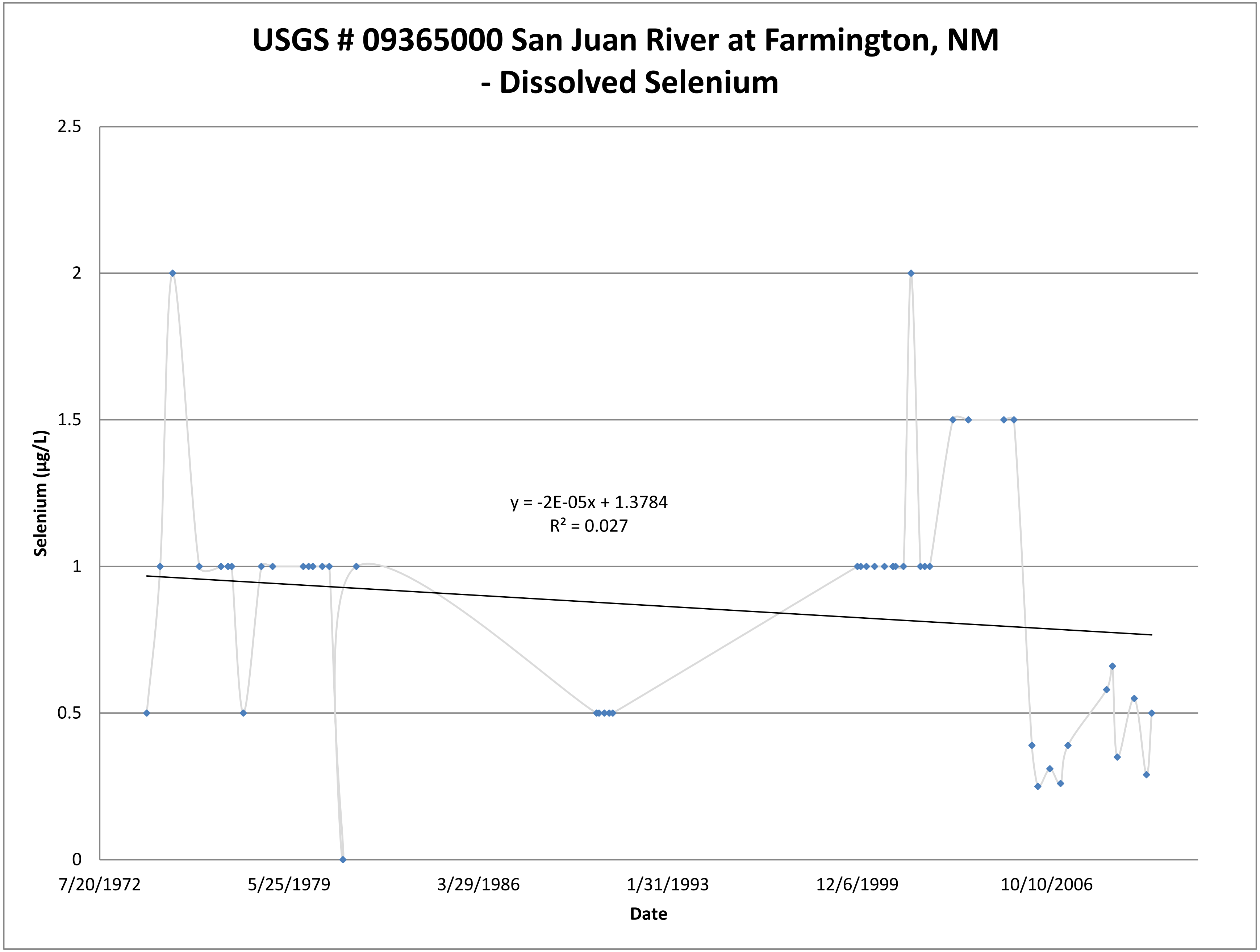

USGS # 09365000 San Juan River at Farmington, NM - Dissolved Silver
1.2
1
0.8
0.6
0.4
0.2
0
Silver (µg/L)
y = -8E-06x + 0.534
R² = 0.0152
12/2/1973
2/18/1982
5/7/1990
7/24/1998
10/10/2006
Date

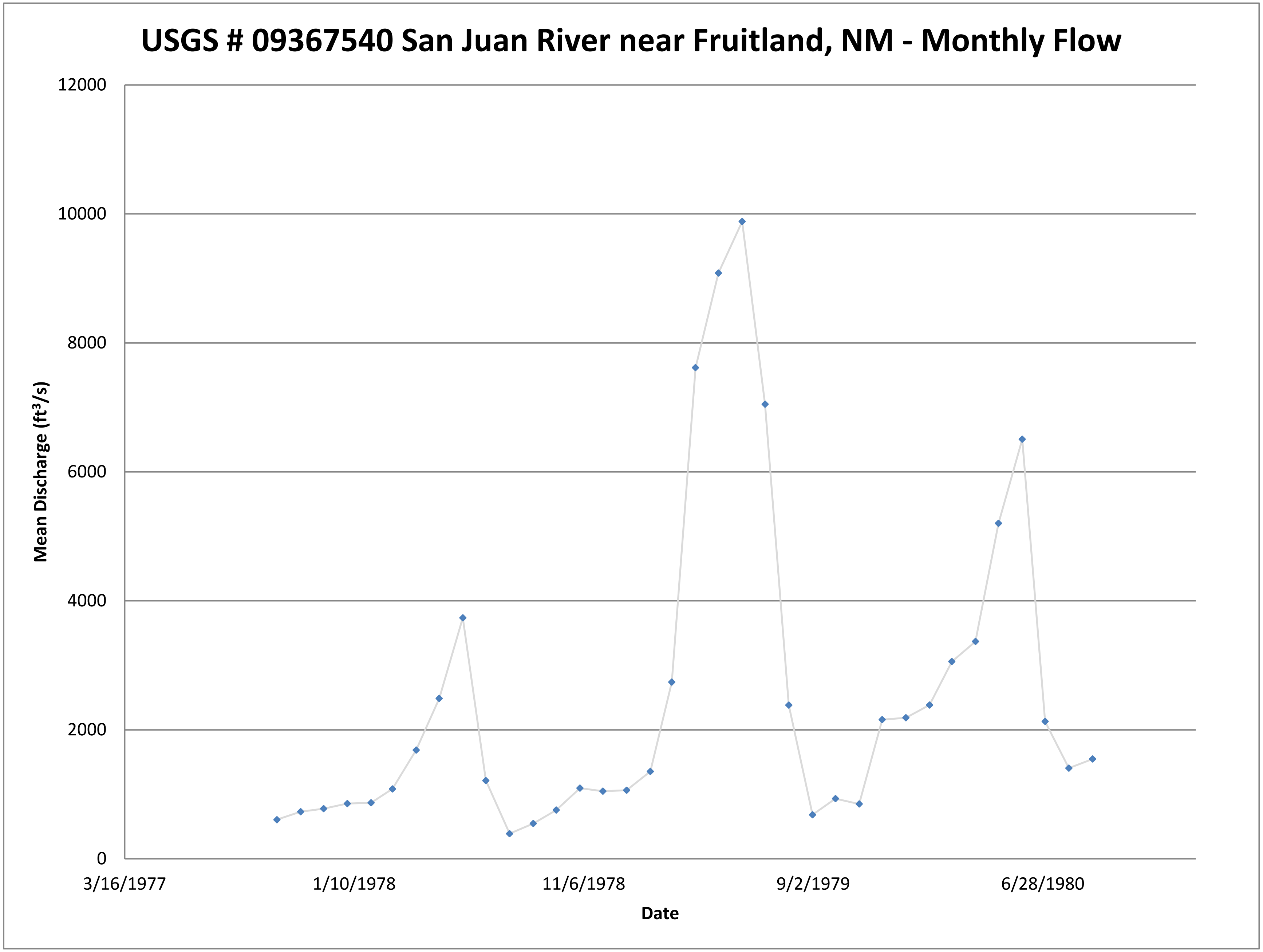

USGS # 09365000 San Juan River at Farmington, NM - Dissolved Zinc
Zinc (µg/L)
0
10
20
30
40
50
60
70
80
y = -0.0013x + 55.651
R² = 0.2128
7/20/1972
10/6/1980
12/23/1988
3/11/1997
5/28/2005
Date

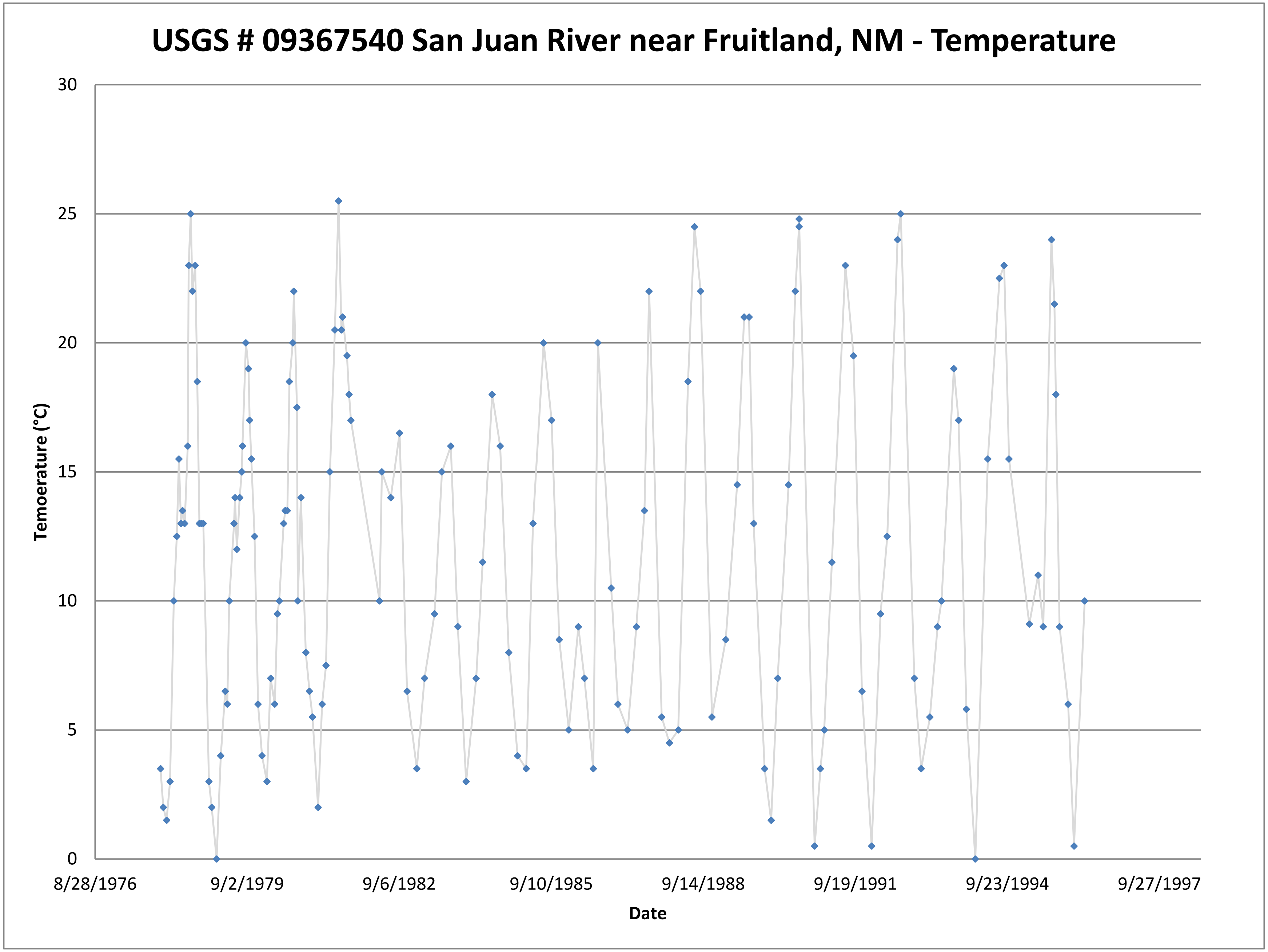

USGS # 09365000 San Juan River at Farmington, NM - Dissolved Arsenic
2.5
2
1.5
1
0.5
0
Arsenic (µg/L)
y = -4E-05x + 2.2937
R² = 0.129
7/20/1972
5/25/1979
3/29/1986
1/31/1993
12/6/1999
10/10/2006
Date

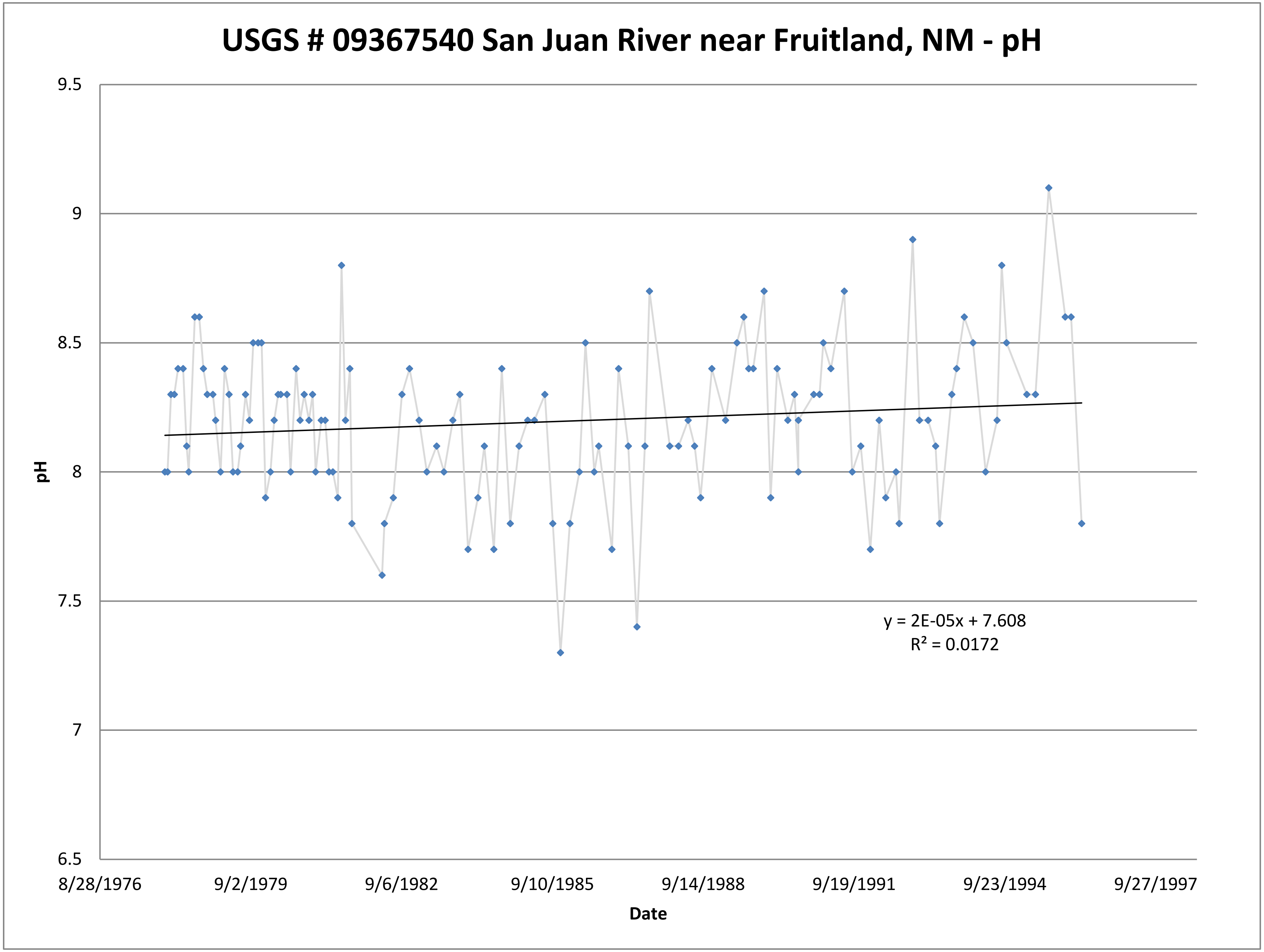
Appendix A - USGS Stations
USGS # 09365000



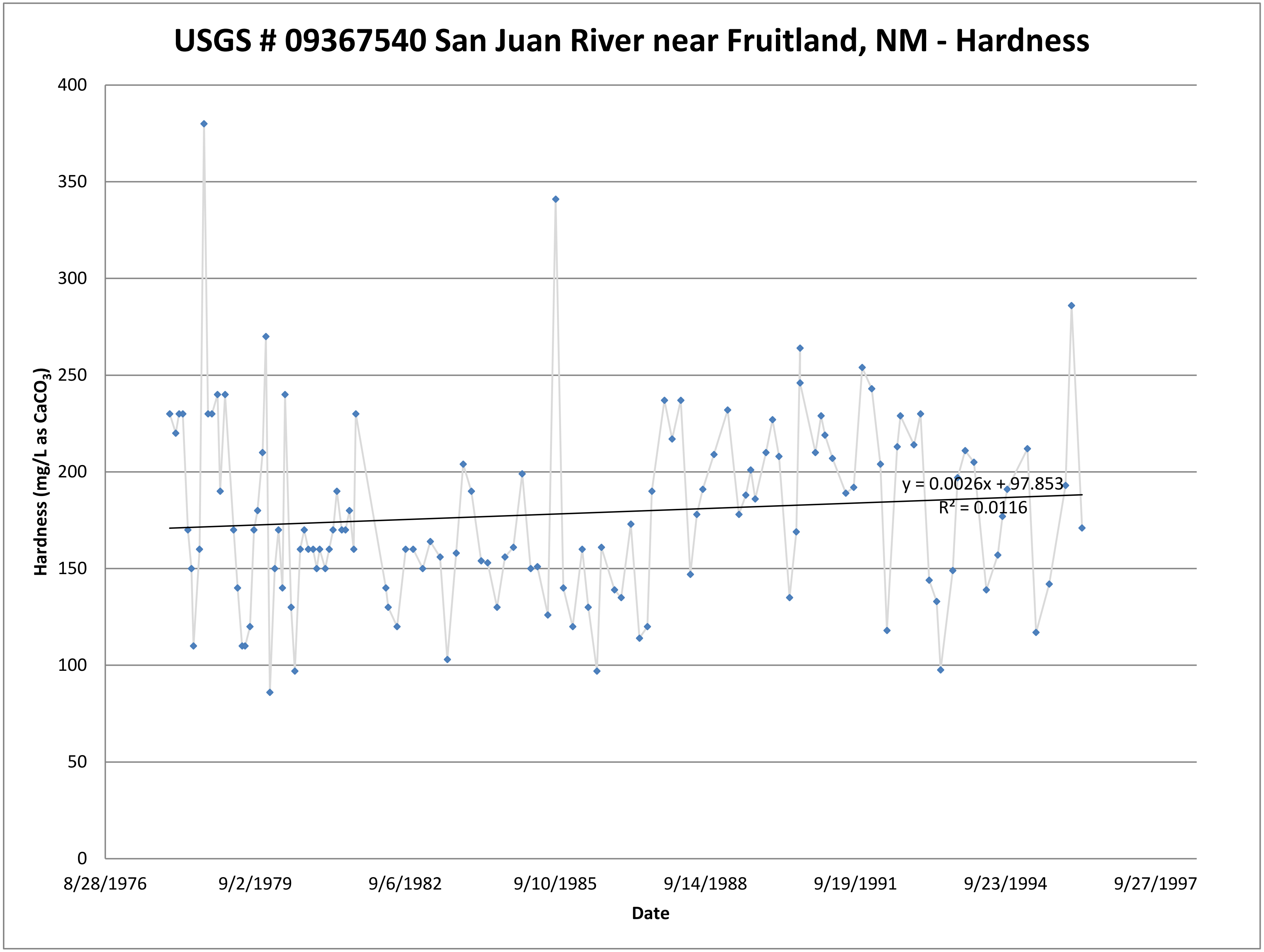

USGS # 09365000 San Juan River at Farmington, NM - Dissolved Selenium
2.5
2
1.5
1
0.5
0
Selenium (µg/L)
y = -2E-05x + 1.3784
R² = 0.027
7/20/1972
5/25/1979
3/29/1986
1/31/1993
12/6/1999
10/10/2006
Date


USGS # 09367540 San Juan River near Fruitland, NM - Monthly Flow
Mean Discharge (ft³/s)
12000
10000
8000
6000
4000
2000
0
3/16/1977
1/10/1978
11/6/1978
9/2/1979
6/28/1980
Date

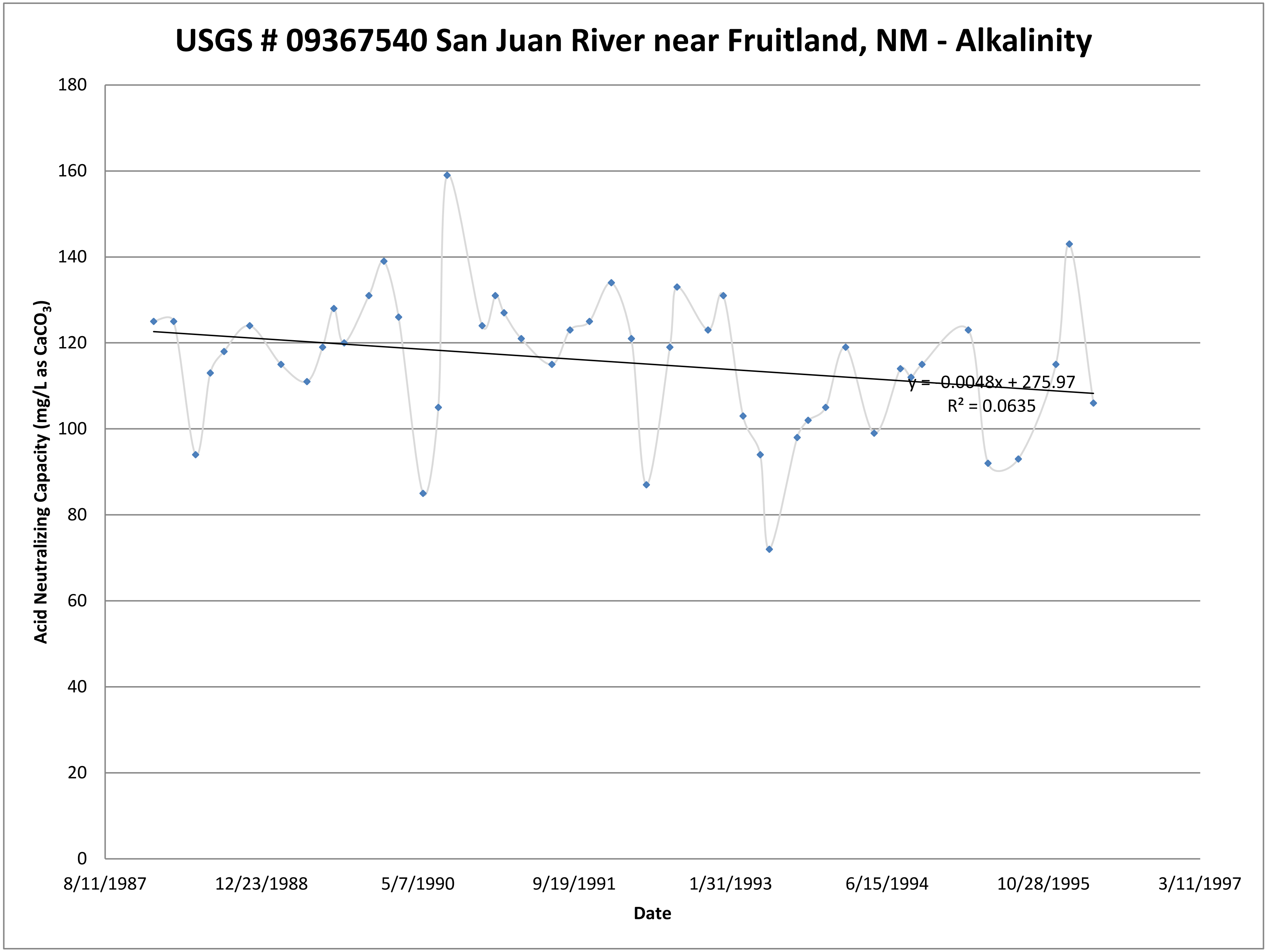

USGS # 09367540 San Juan River near Fruitland, NM - Temperature
30
25
20
15
10
5
0
Temoerature (°C)
8/28/1976
9/2/1979
9/6/1982
9/10/1985
9/14/1988
9/19/1991
9/23/1994
9/27/1997
Date

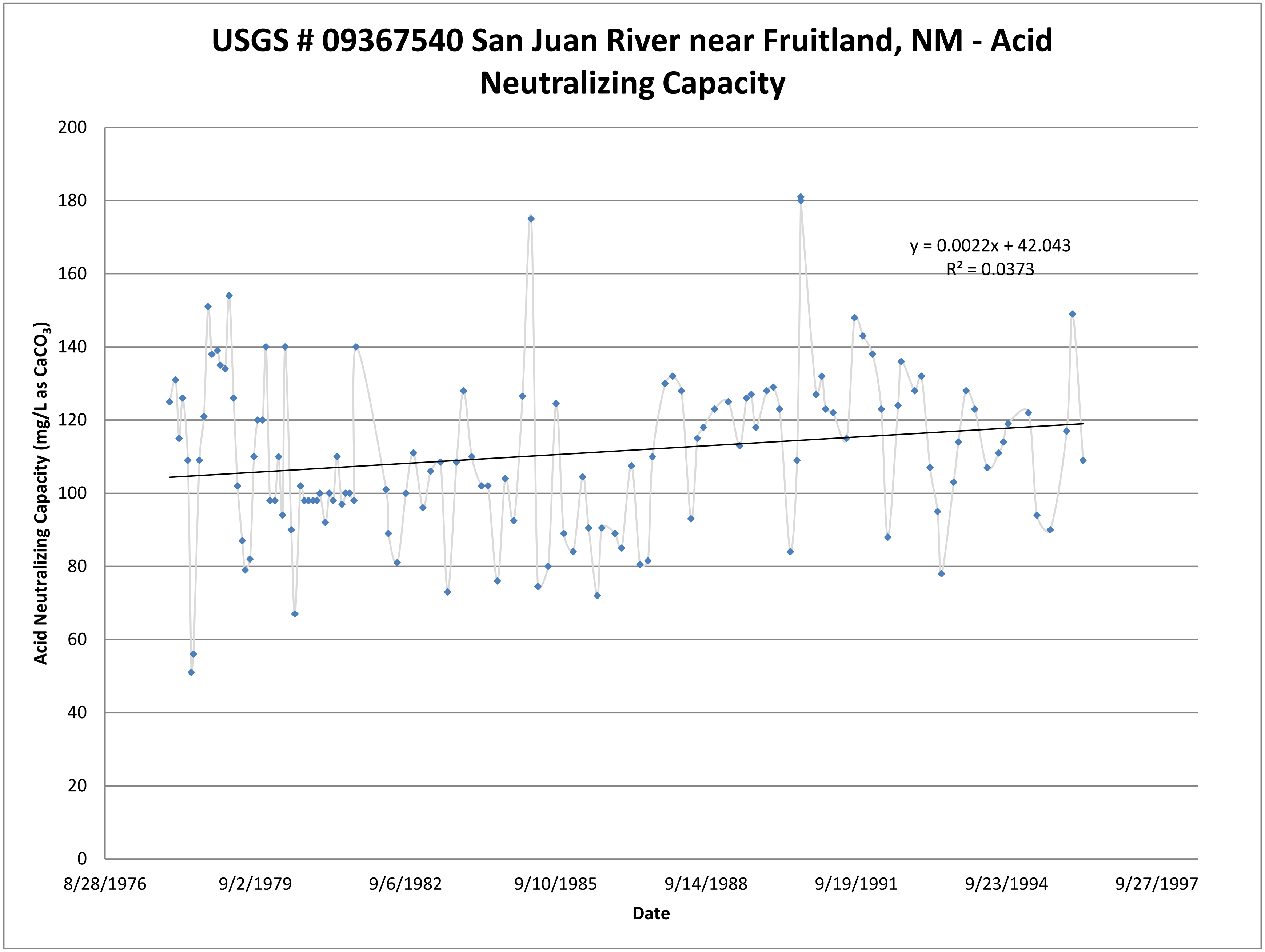

USGS # 09367540 San Juan River near Fruitland, NM - pH
9.5
9
8.5
8
7.5
7
6.5
pH
y = 2E-05x + 7.608
R² = 0.0172
8/28/1976
9/2/1979
9/6/1982
9/10/1985
9/14/1988
9/19/1991
9/23/1994
9/27/1997
Date

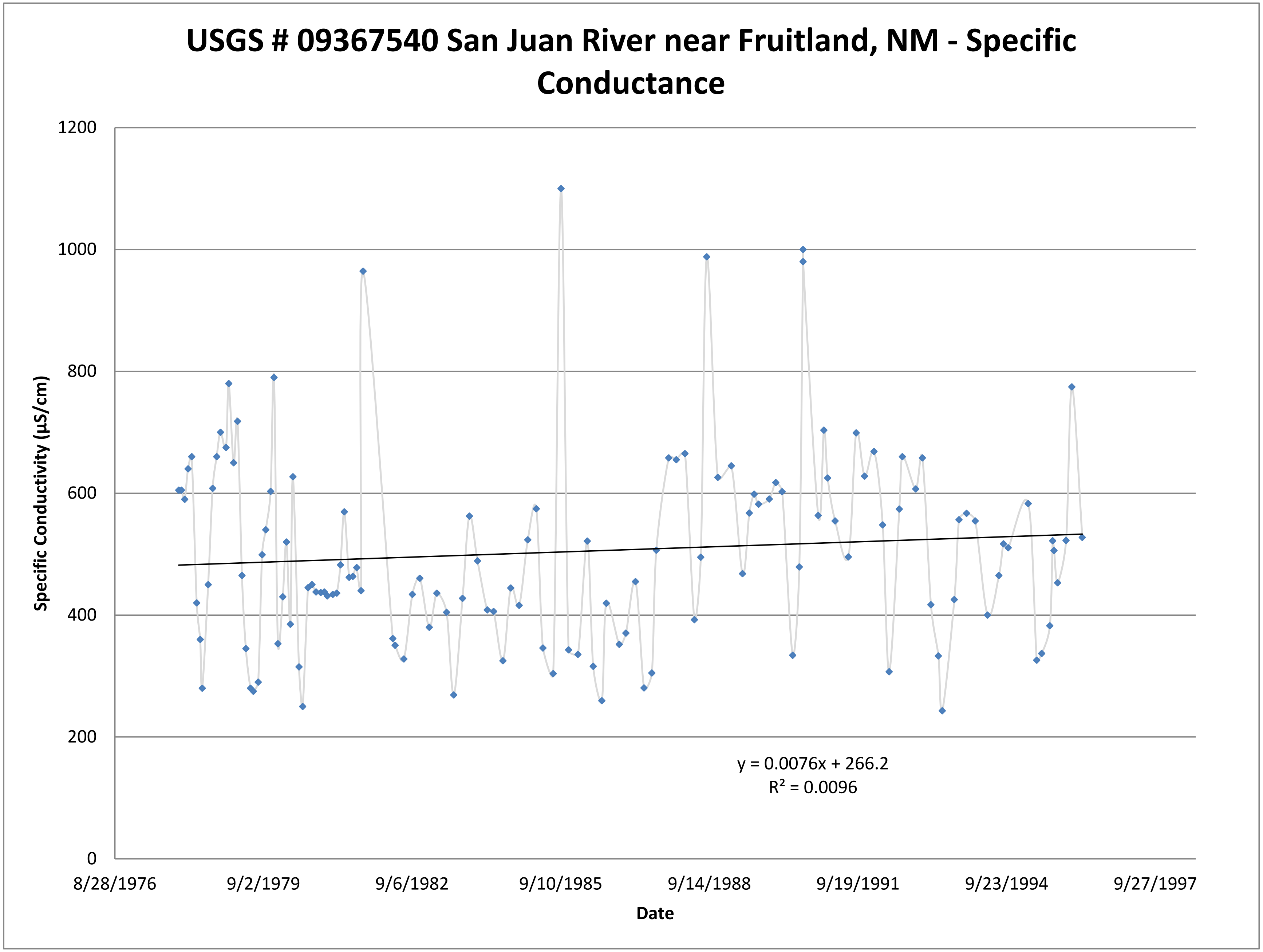
Appendix A - USGS Stations
USGS # 09367540



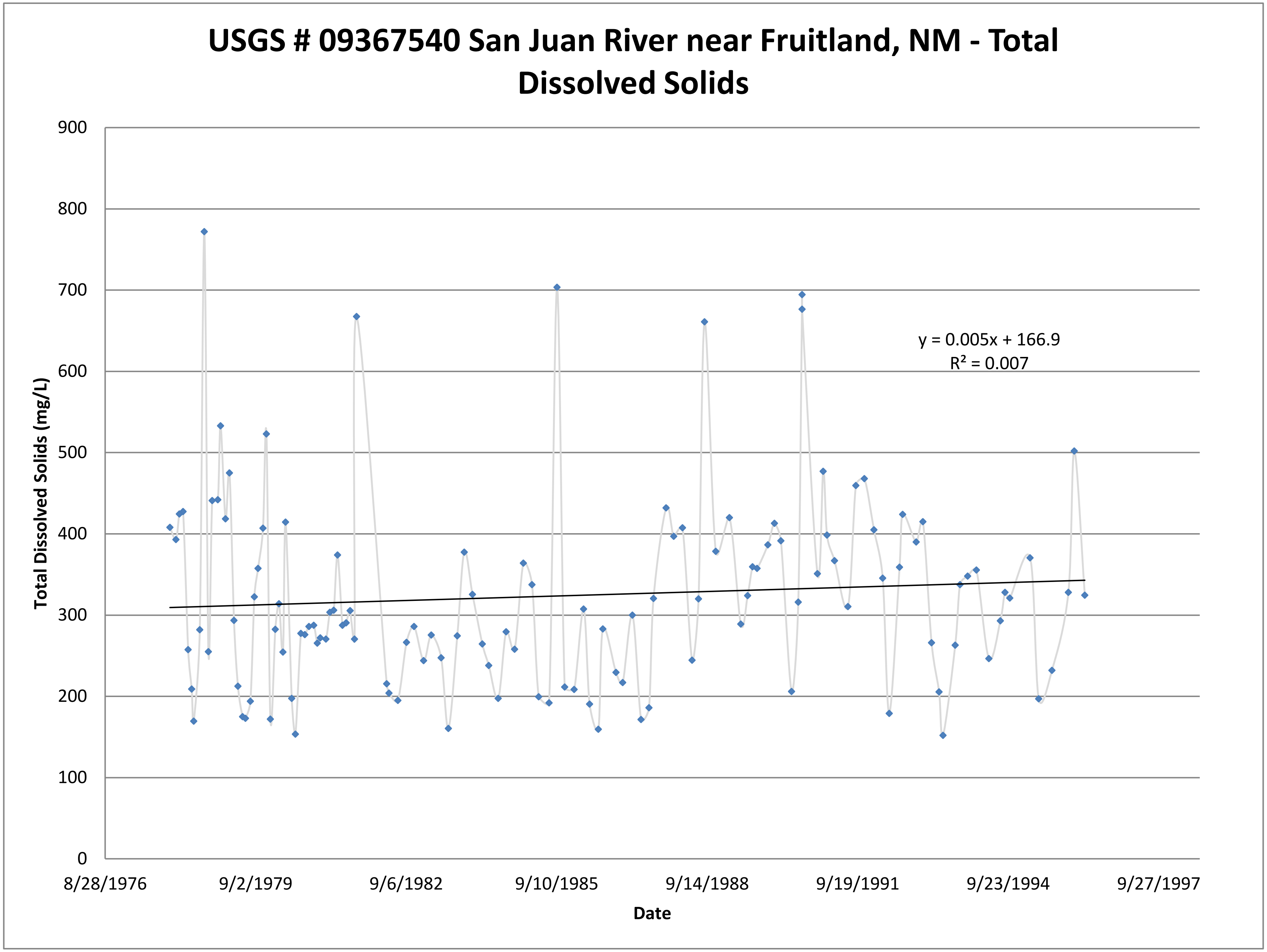
Appendix A - USGS Stations
USGS # 09367540

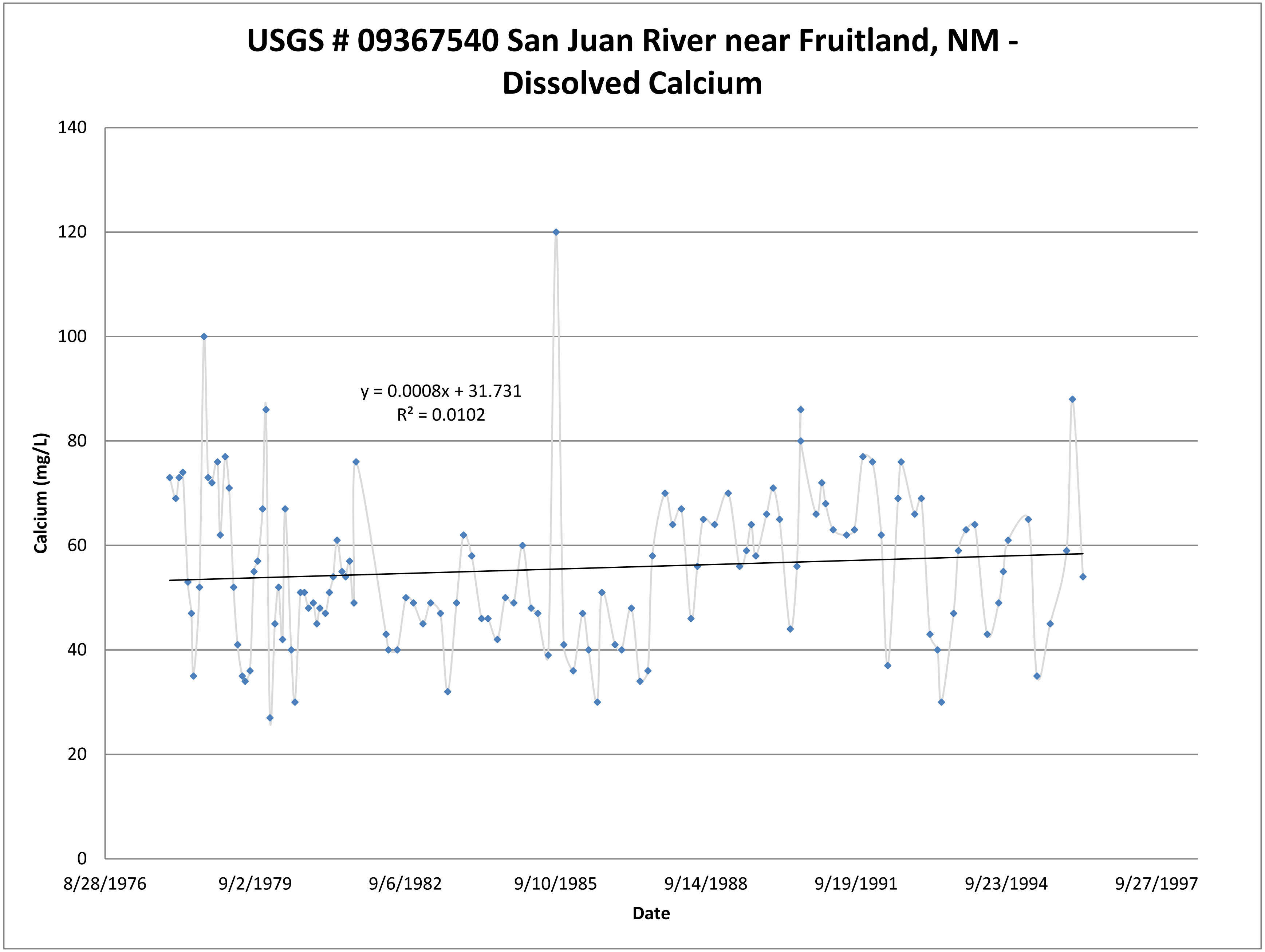


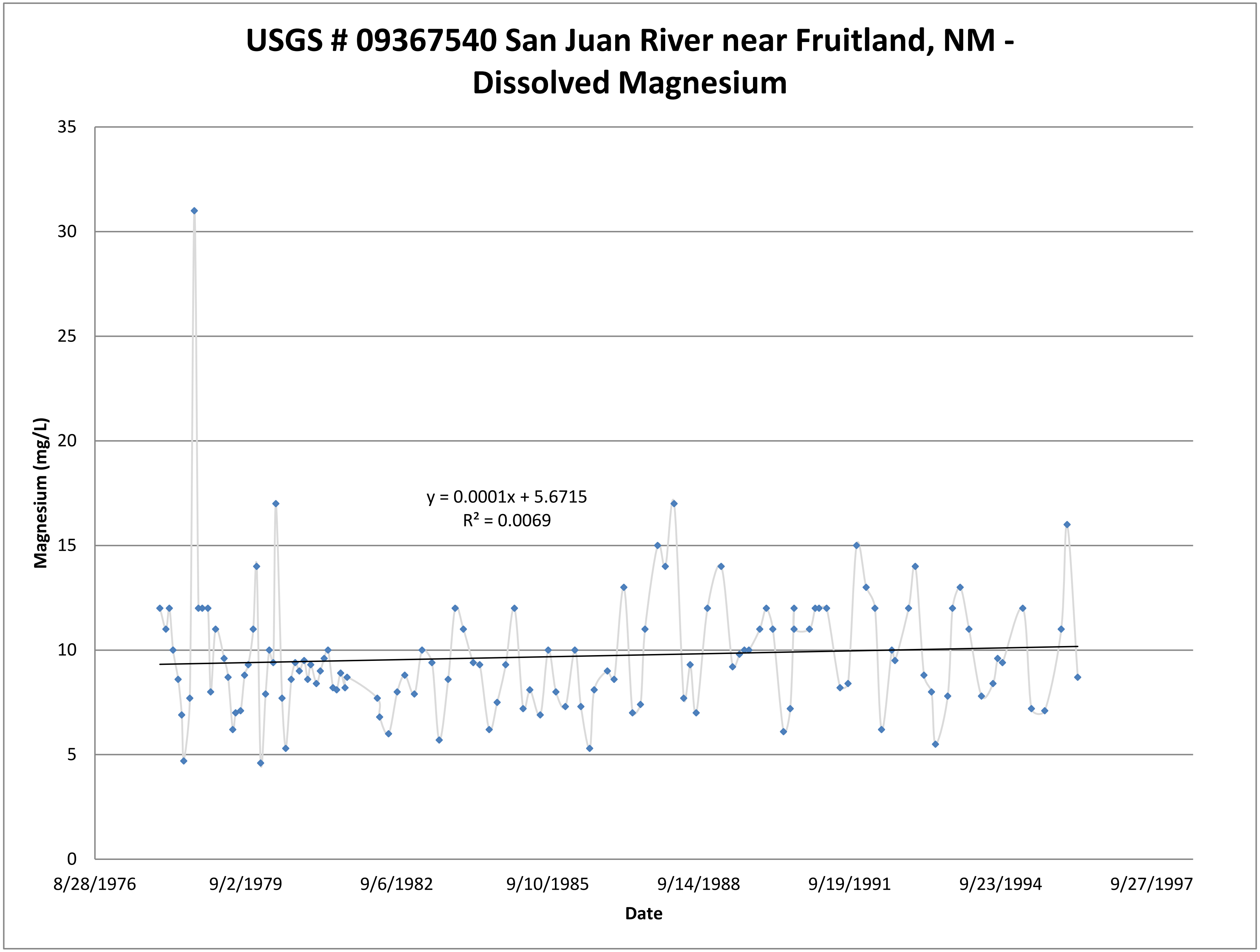

USGS # 09367540 San Juan River near Fruitland, NM - Acid Neutralizing Capacity
Acid Neutralizing Capacity (mg/L as $CaCO_3$)
200
180
160
140
120
100
80
60
40
20
0
8/28/1976
9/2/1979
9/6/1982
9/10/1985
9/14/1988
9/19/1991
9/23/1994
9/27/1997
Date
y = 0.0022x + 42.043
R^2 = 0.0373

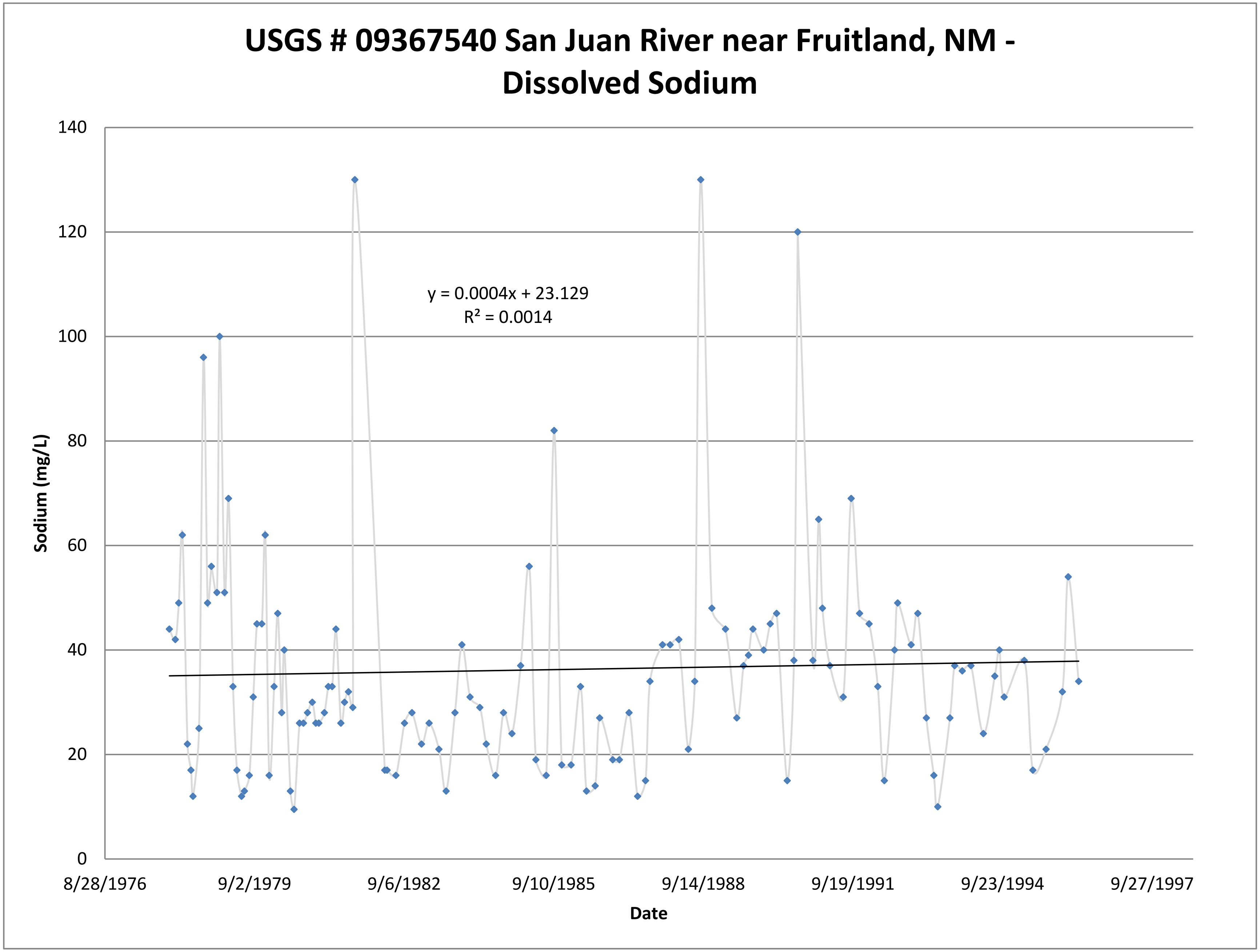

USGS # 09367540 San Juan River near Fruitland, NM - Specific Conductance
1200
1000
800
600
400
200
0
Specific Conductivity (µS/cm)
y = 0.0076x + 266.2
R² = 0.0096
8/28/1976
9/2/1979
9/6/1982
9/10/1985
9/14/1988
9/19/1991
9/23/1994
9/27/1997
Date

Appendix A - USGS Stations
USGS # 09367540

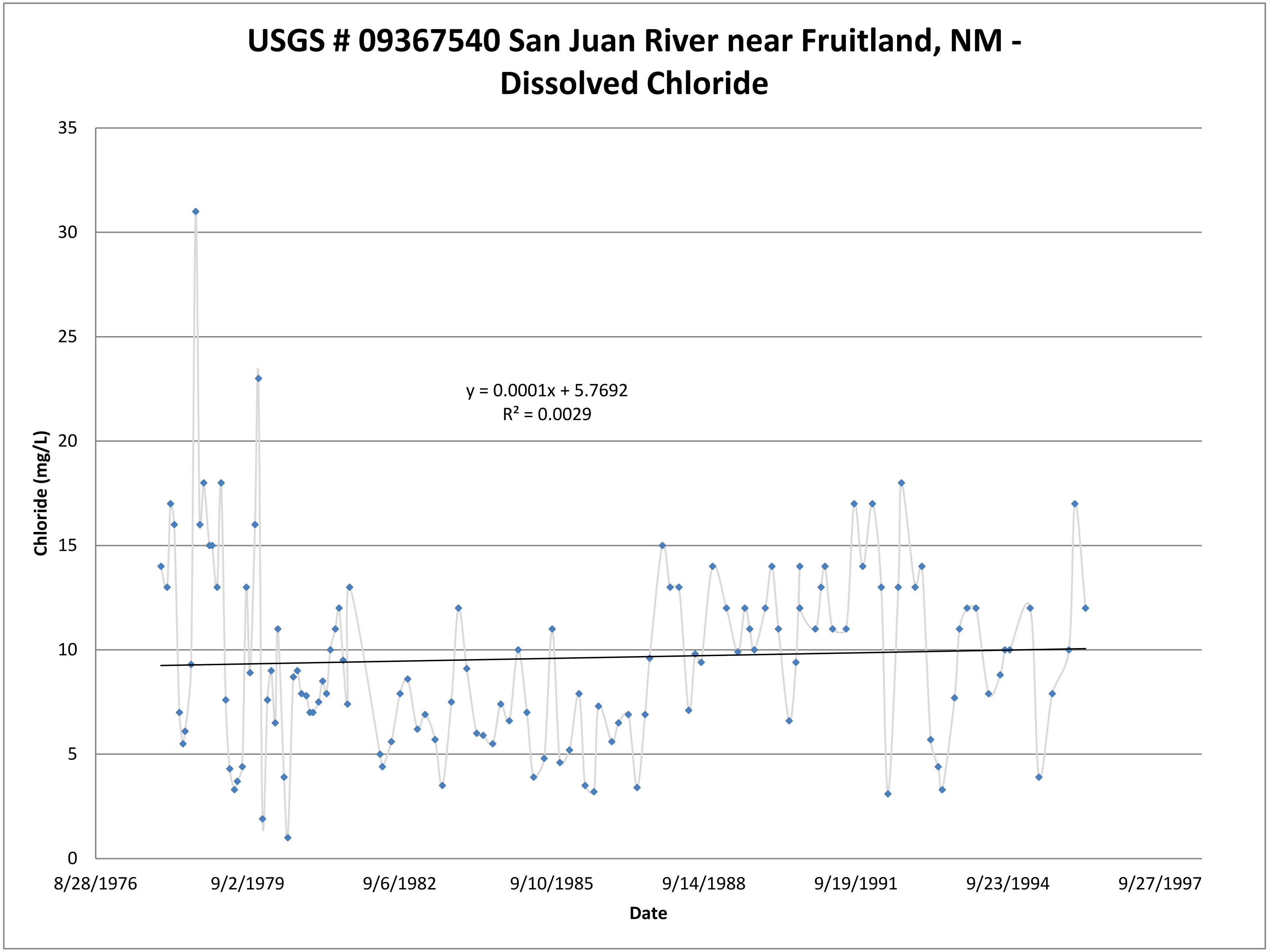


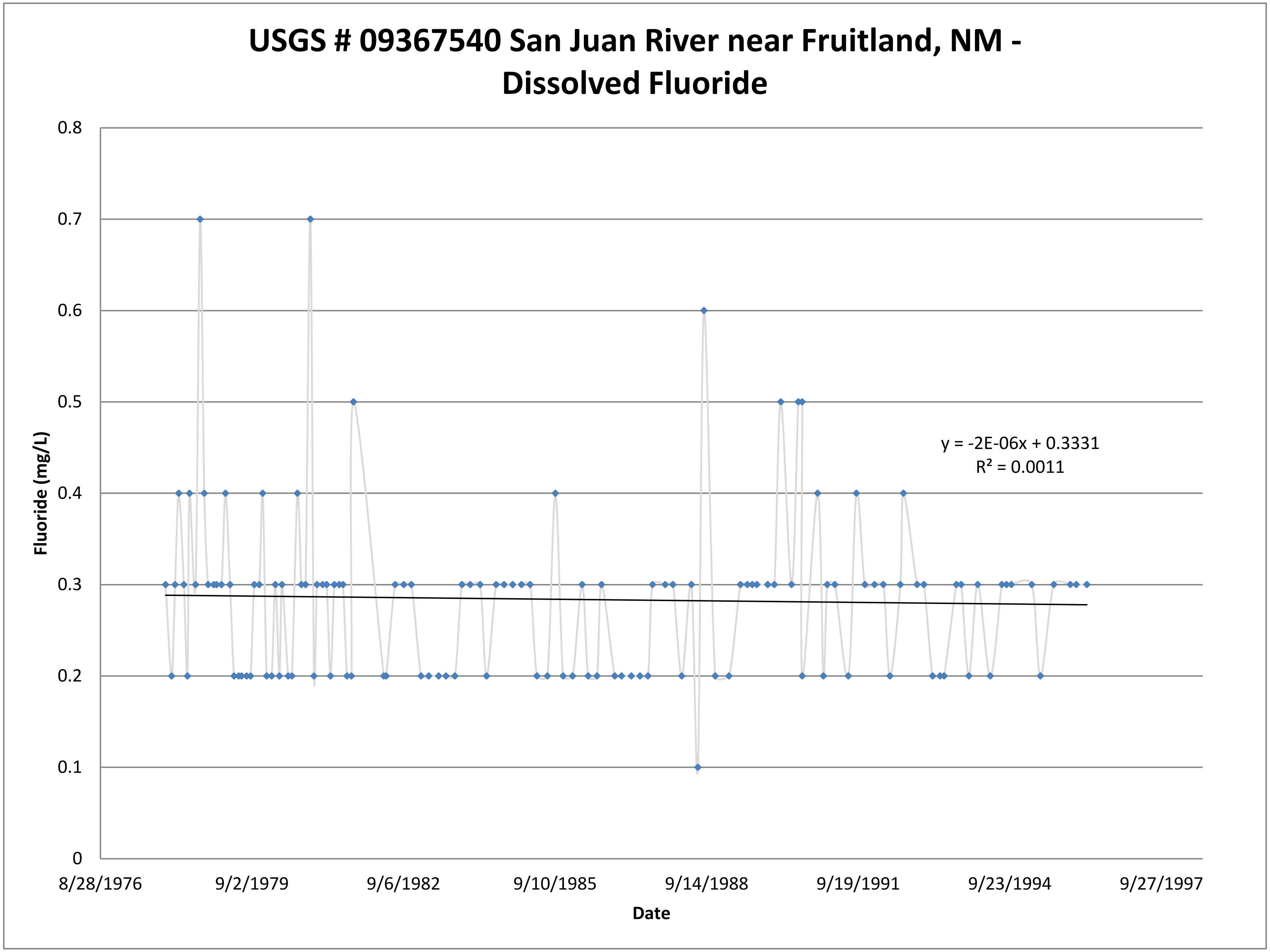

USGS # 09367540 San Juan River near Fruitland, NM -
Dissolved Calcium
y = 0.0008x + 31.731
R² = 0.0102
Calcium (mg/L)
140
120
100
80
60
40
20
0
8/28/1976
9/2/1979
9/6/1982
9/10/1985
9/14/1988
9/19/1991
9/23/1994
9/27/1997
Date

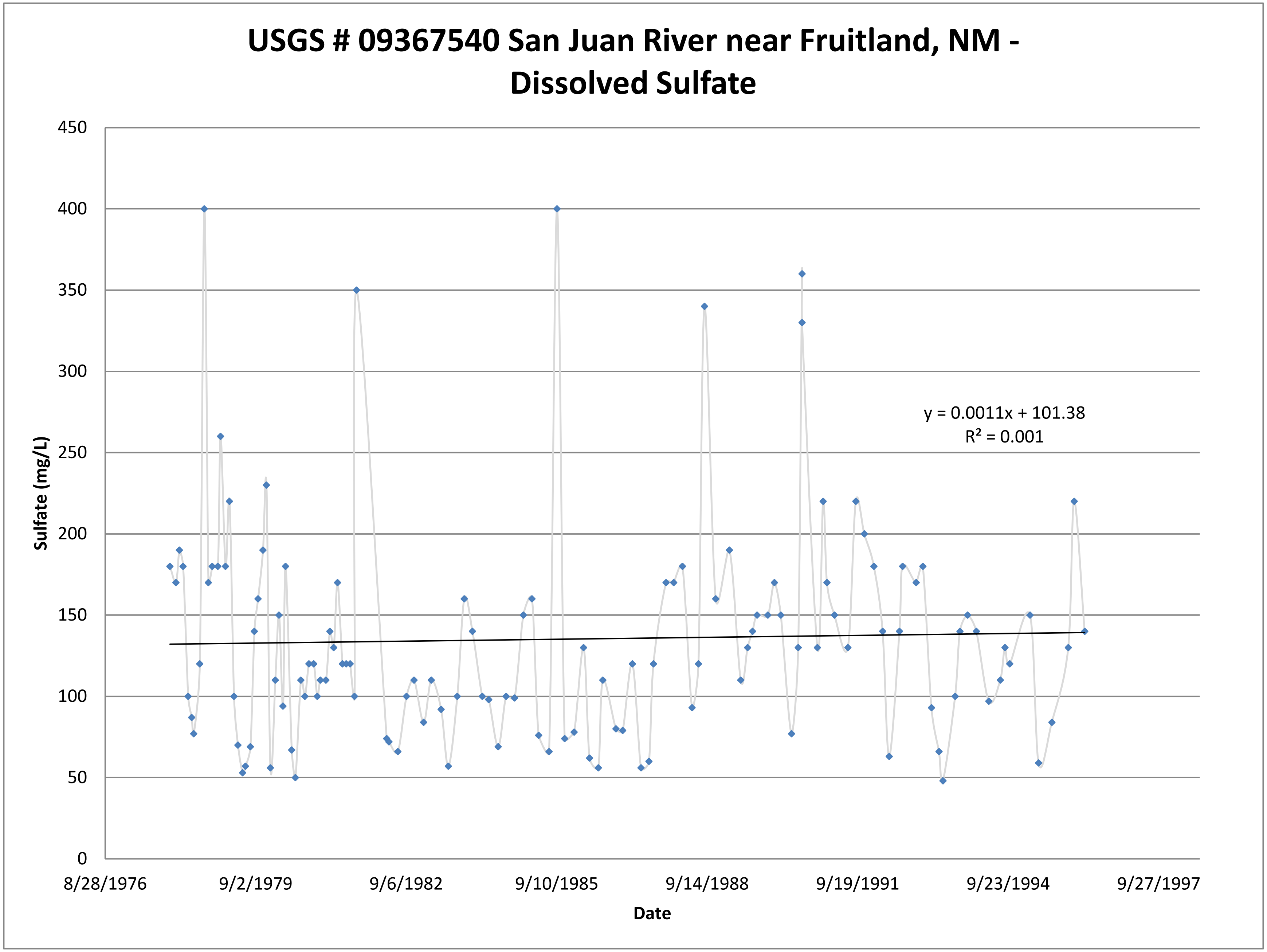

USGS # 09367540 San Juan River near Fruitland, NM - Dissolved Magnesium
Magnesium (mg/L)
35
30
25
20
15
10
5
0
y = 0.0001x + 5.6715
R² = 0.0069
8/28/1976
9/2/1979
9/6/1982
9/10/1985
9/14/1988
9/19/1991
9/23/1994
9/27/1997
Date


USGS # 09367540 San Juan River near Fruitland, NM - Dissolved Sodium
y = 0.0004x + 23.129
R² = 0.0014
Sodium (mg/L)
140
120
100
80
60
40
20
0
8/28/1976
9/2/1979
9/6/1982
9/10/1985
9/14/1988
9/19/1991
9/23/1994
9/27/1997
Date

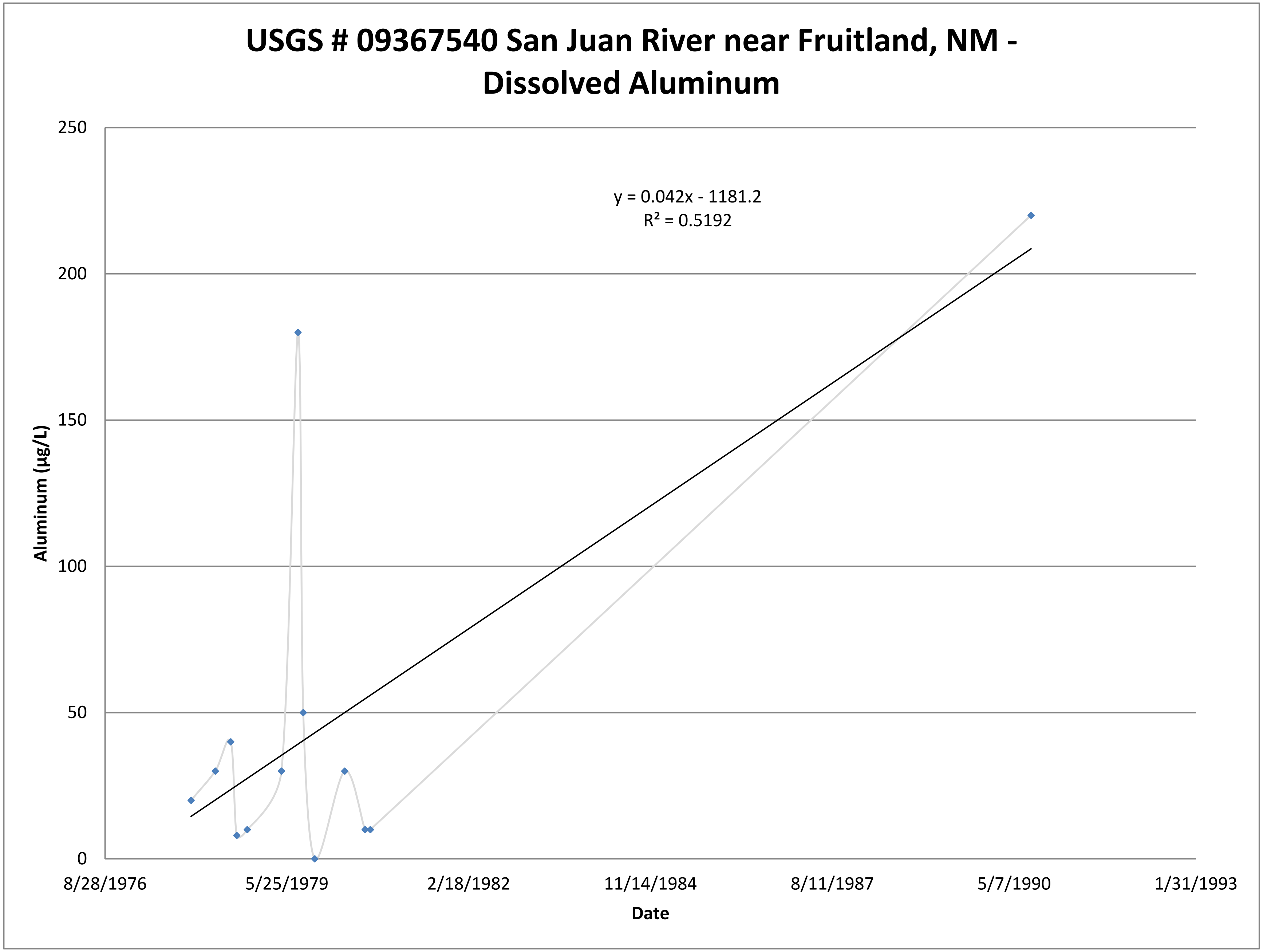
Appendix A - USGS Stations
USGS # 09367540

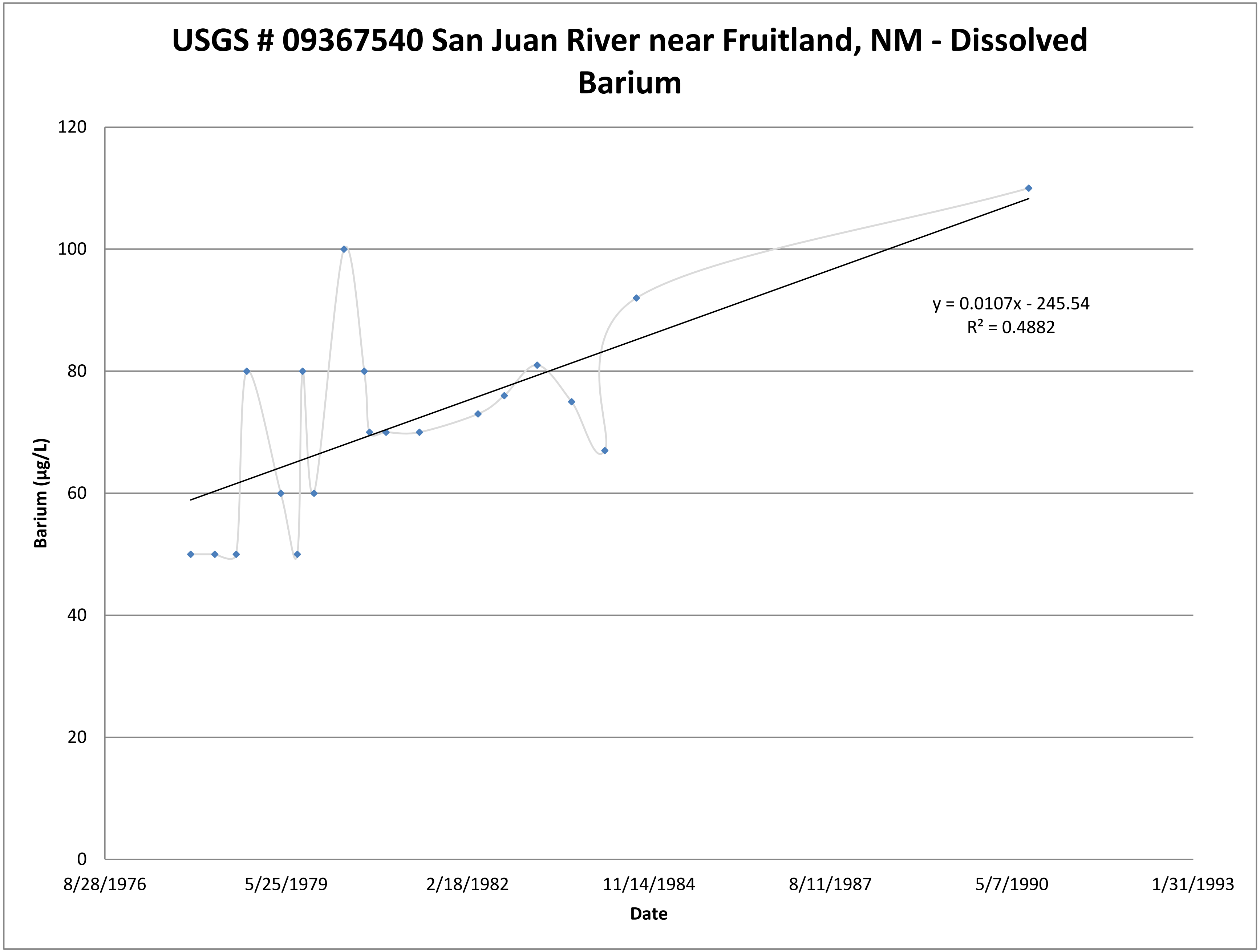


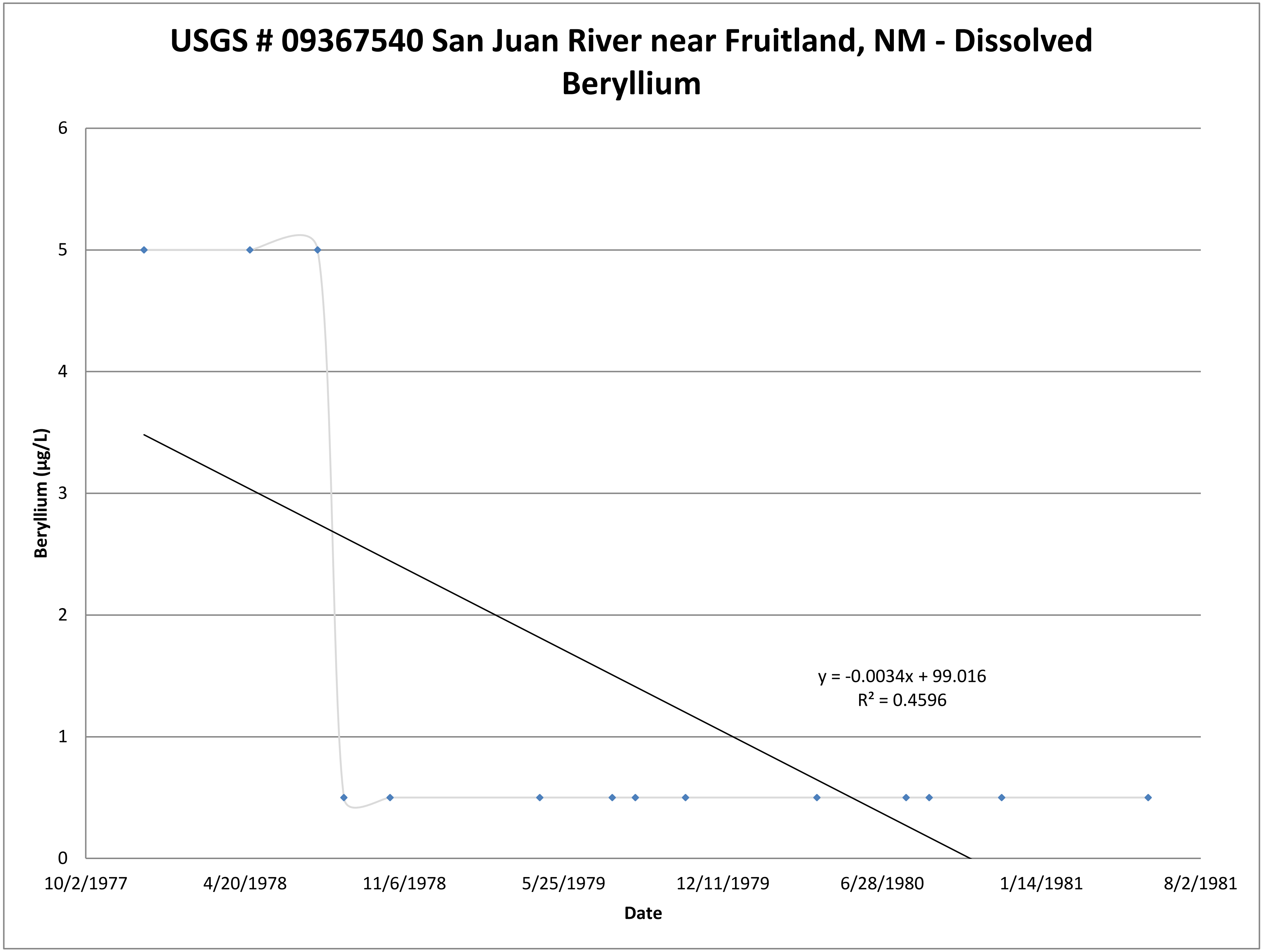

USGS # 09367540 San Juan River near Fruitland, NM - Dissolved Fluoride
Fluoride (mg/L)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
y = -2E-06x + 0.3331
R^2 = 0.0011
8/28/1976
9/2/1979
9/6/1982
9/10/1985
9/14/1988
9/19/1991
9/23/1994
9/27/1997
Date

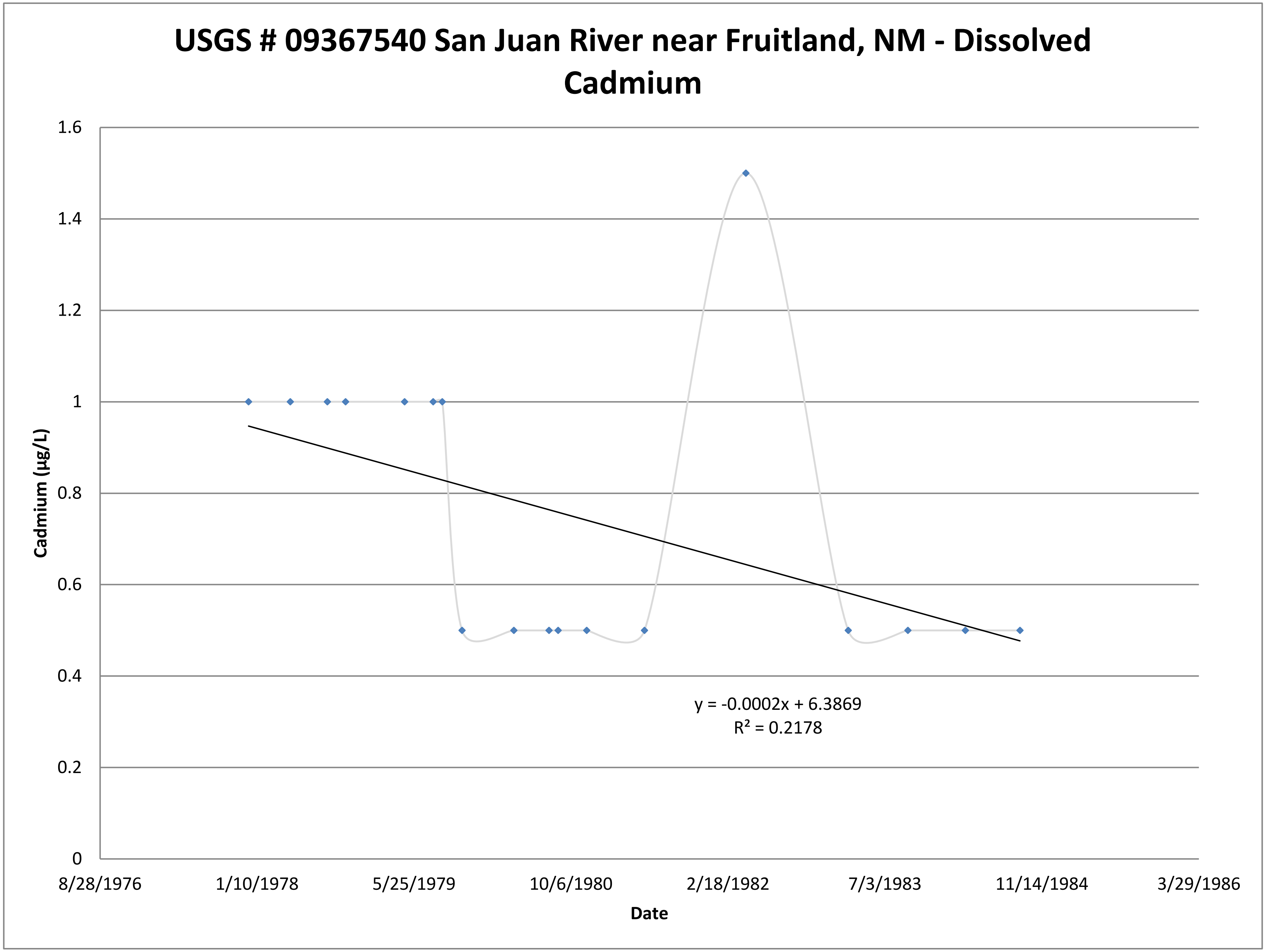

USGS # 09367540 San Juan River near Fruitland, NM - Dissolved Sulfate
450
400
350
300
250
200
150
100
50
0
Sulfate (mg/L)
y = 0.0011x + 101.38
R² = 0.001
8/28/1976
9/2/1979
9/6/1982
9/10/1985
9/14/1988
9/19/1991
9/23/1994
9/27/1997
Date

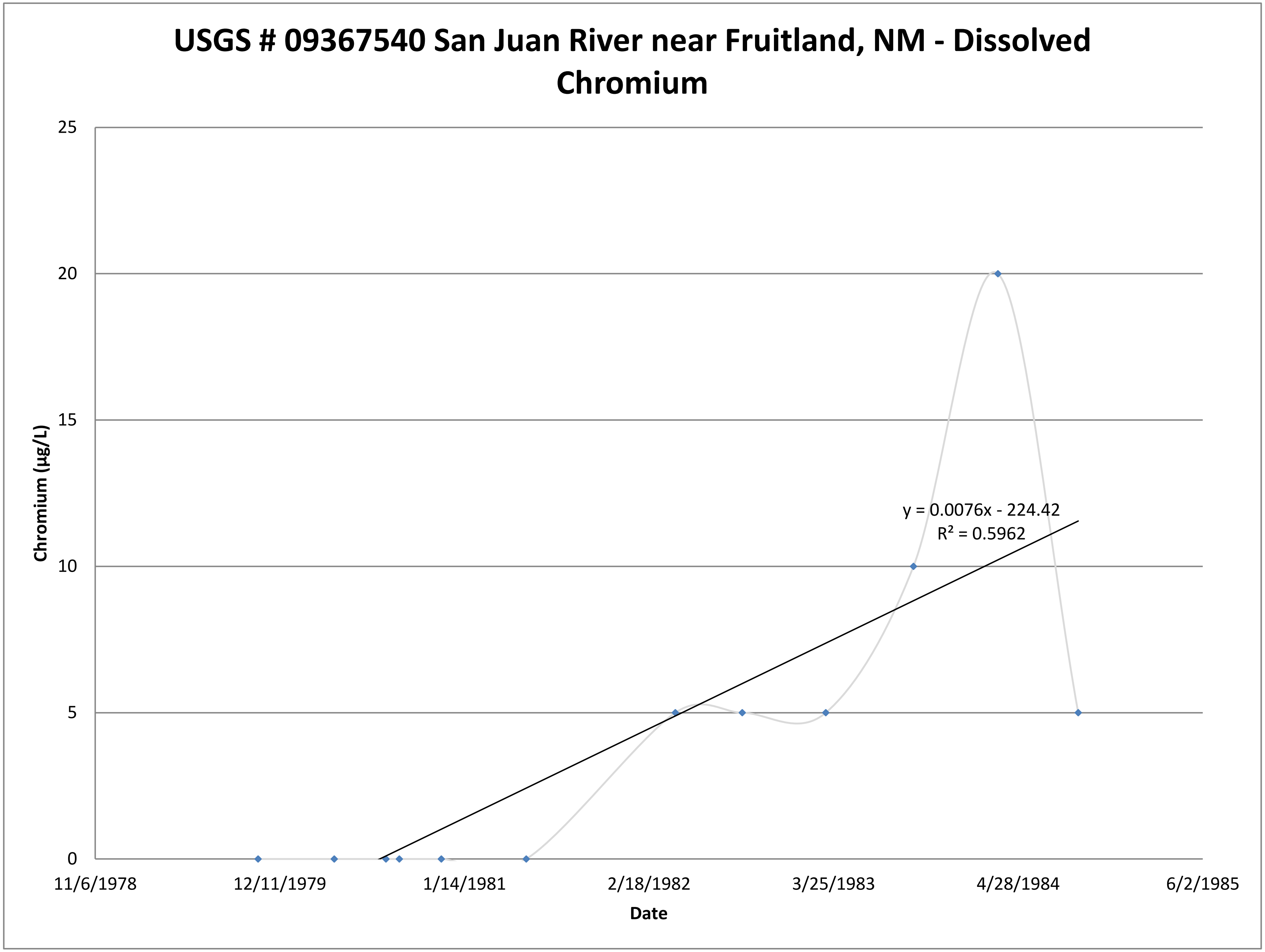
Appendix A - USGS Stations
USGS # 09367540

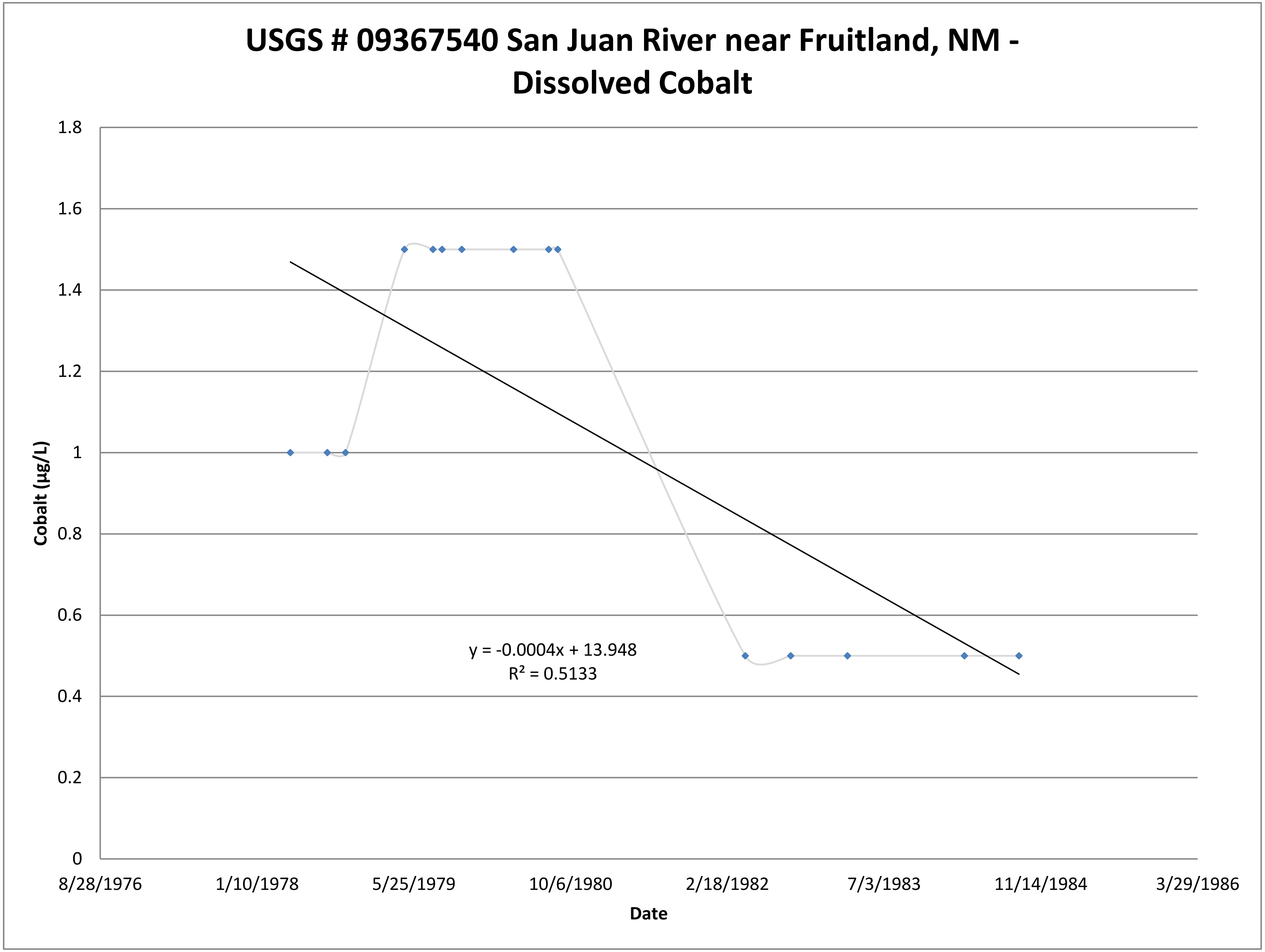


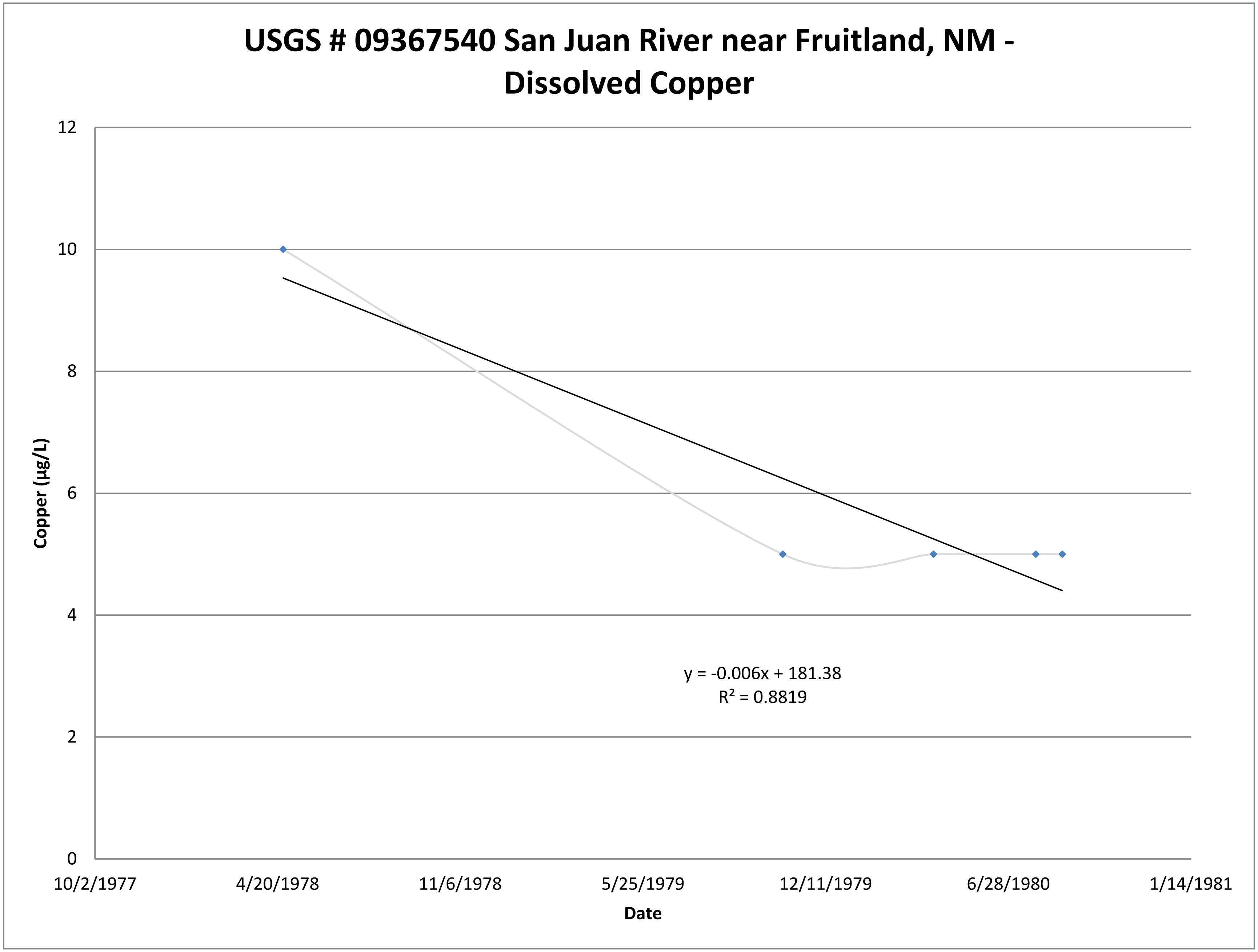

USGS # 09367540 San Juan River near Fruitland, NM - Dissolved Barium
120
100
80
60
40
20
0
Barium (µg/L)
y = 0.0107x - 245.54
R² = 0.4882
8/28/1976
5/25/1979
2/18/1982
11/14/1984
8/11/1987
5/7/1990
1/31/1993
Date

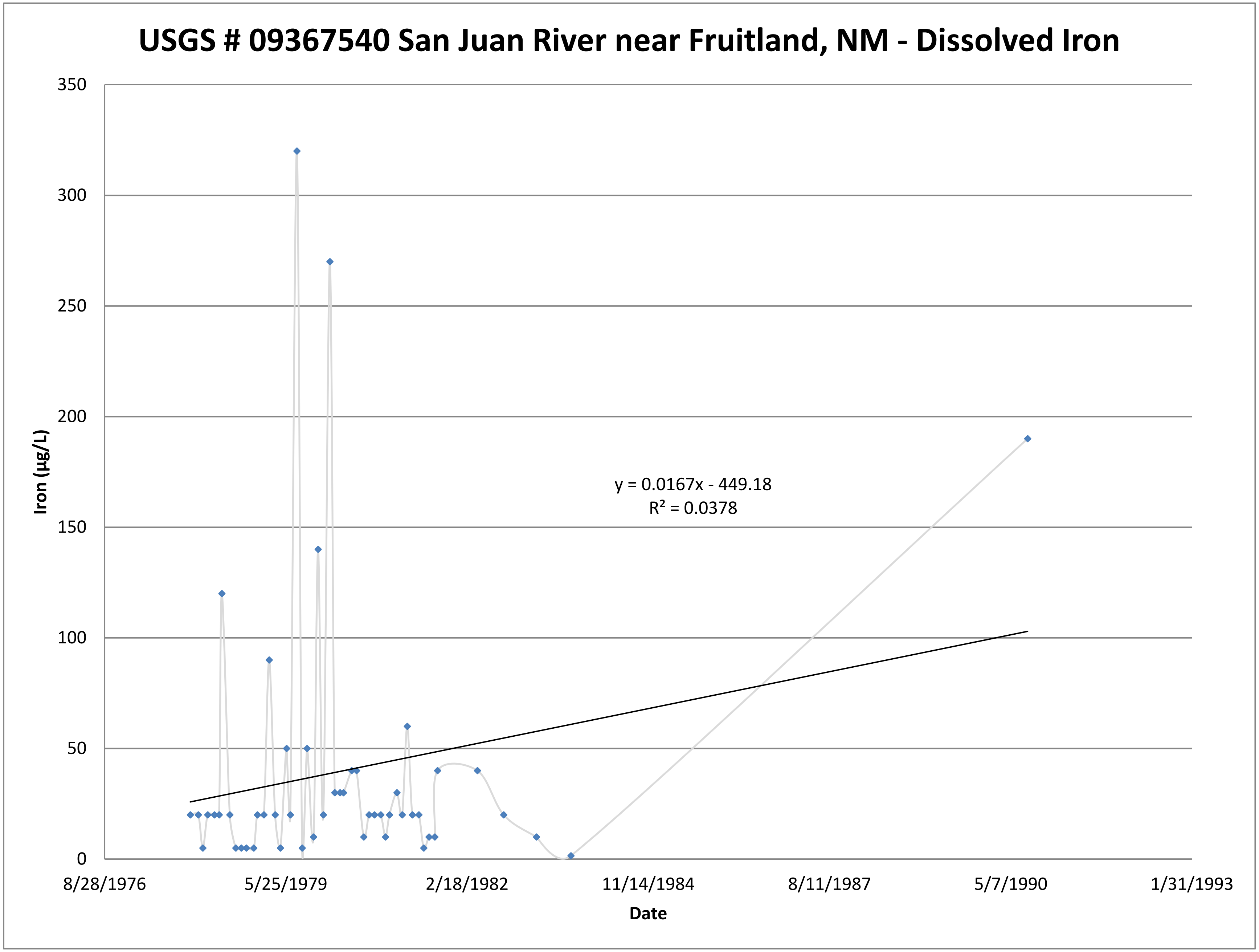

USGS # 09367540 San Juan River near Fruitland, NM - Dissolved Beryllium
Beryllium (µg/L)
0
1
2
3
4
5
6
y = -0.0034x + 99.016
R² = 0.4596
10/2/1977
4/20/1978
11/6/1978
5/25/1979
12/11/1979
6/28/1980
1/14/1981
8/2/1981
Date

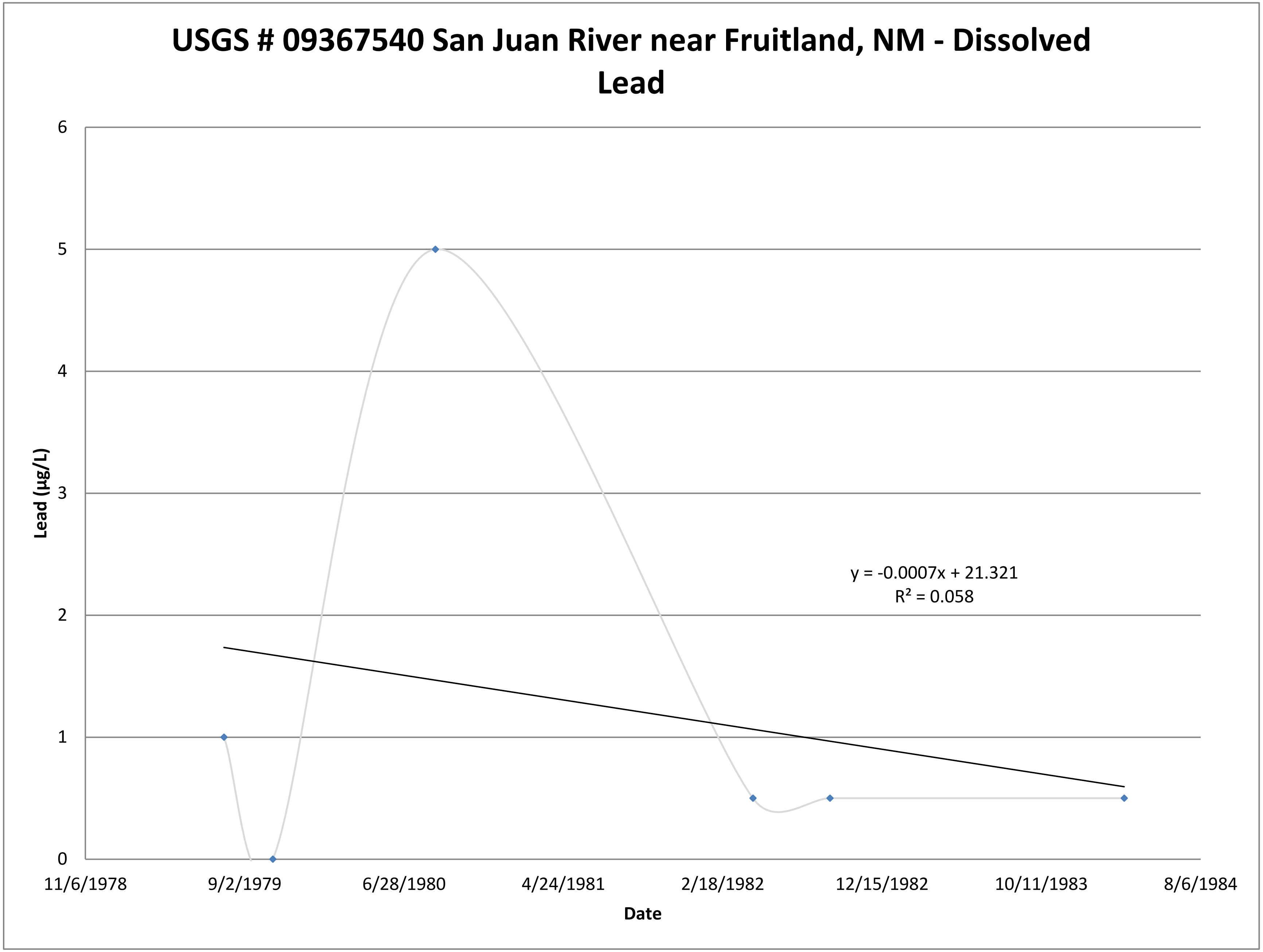

USGS # 09367540 San Juan River near Fruitland, NM - Dissolved Cadmium
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Cadmium (µg/L)
y = -0.0002x + 6.3869
R² = 0.2178
8/28/1976
1/10/1978
5/25/1979
10/6/1980
2/18/1982
7/3/1983
11/14/1984
3/29/1986
Date

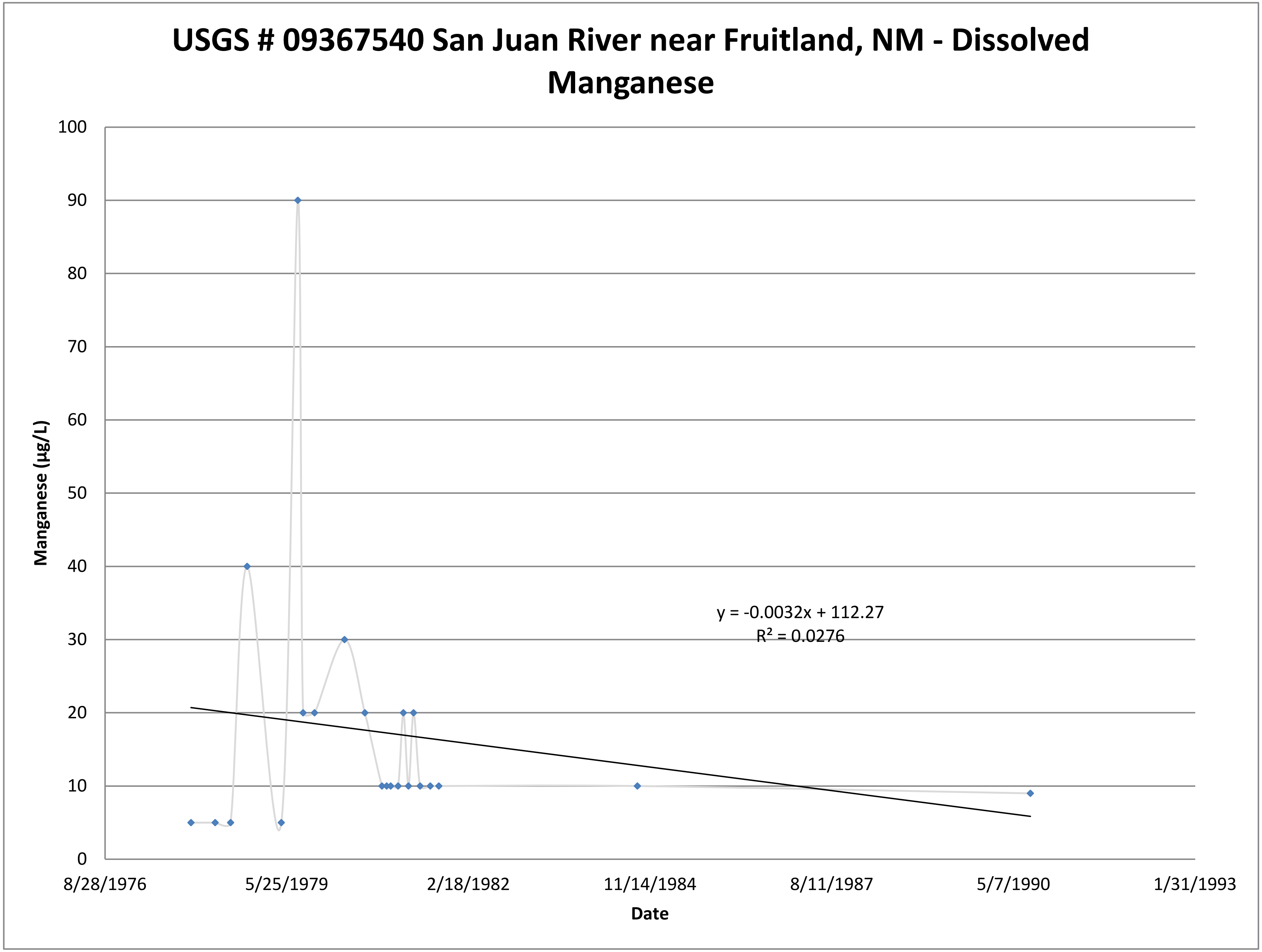

USGS # 09367540 San Juan River near Fruitland, NM - Dissolved Chromium
25
20
15
10
5
0
Chromium (µg/L)
y = 0.0076x - 224.42
R² = 0.5962
11/6/1978
12/11/1979
1/14/1981
2/18/1982
3/25/1983
4/28/1984
6/2/1985
Date

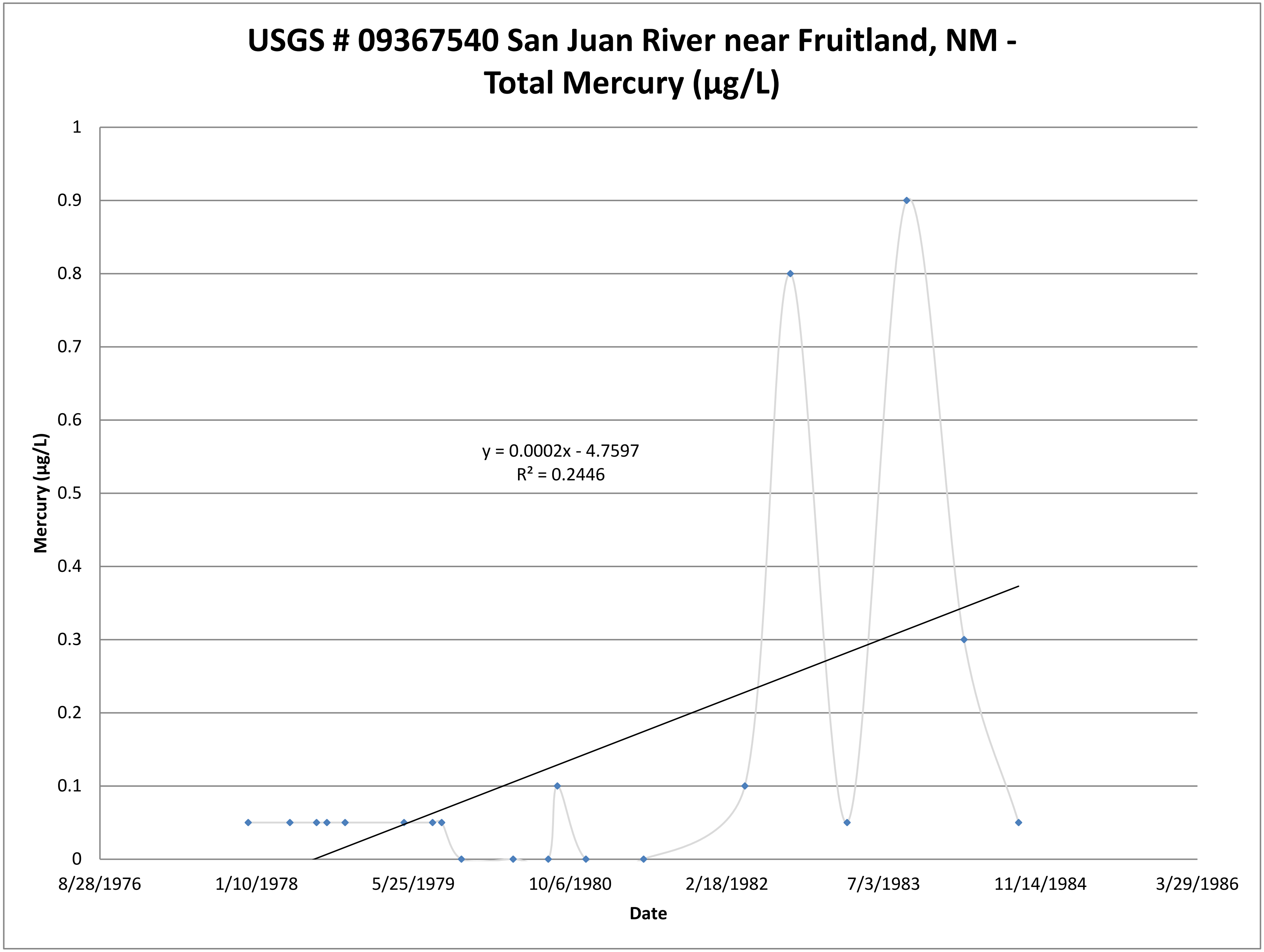

USGS # 09367540 San Juan River near Fruitland, NM - Dissolved Cobalt
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Cobalt (µg/L)
y = -0.0004x + 13.948
R² = 0.5133
8/28/1976
1/10/1978
5/25/1979
10/6/1980
2/18/1982
7/3/1983
11/14/1984
3/29/1986
Date

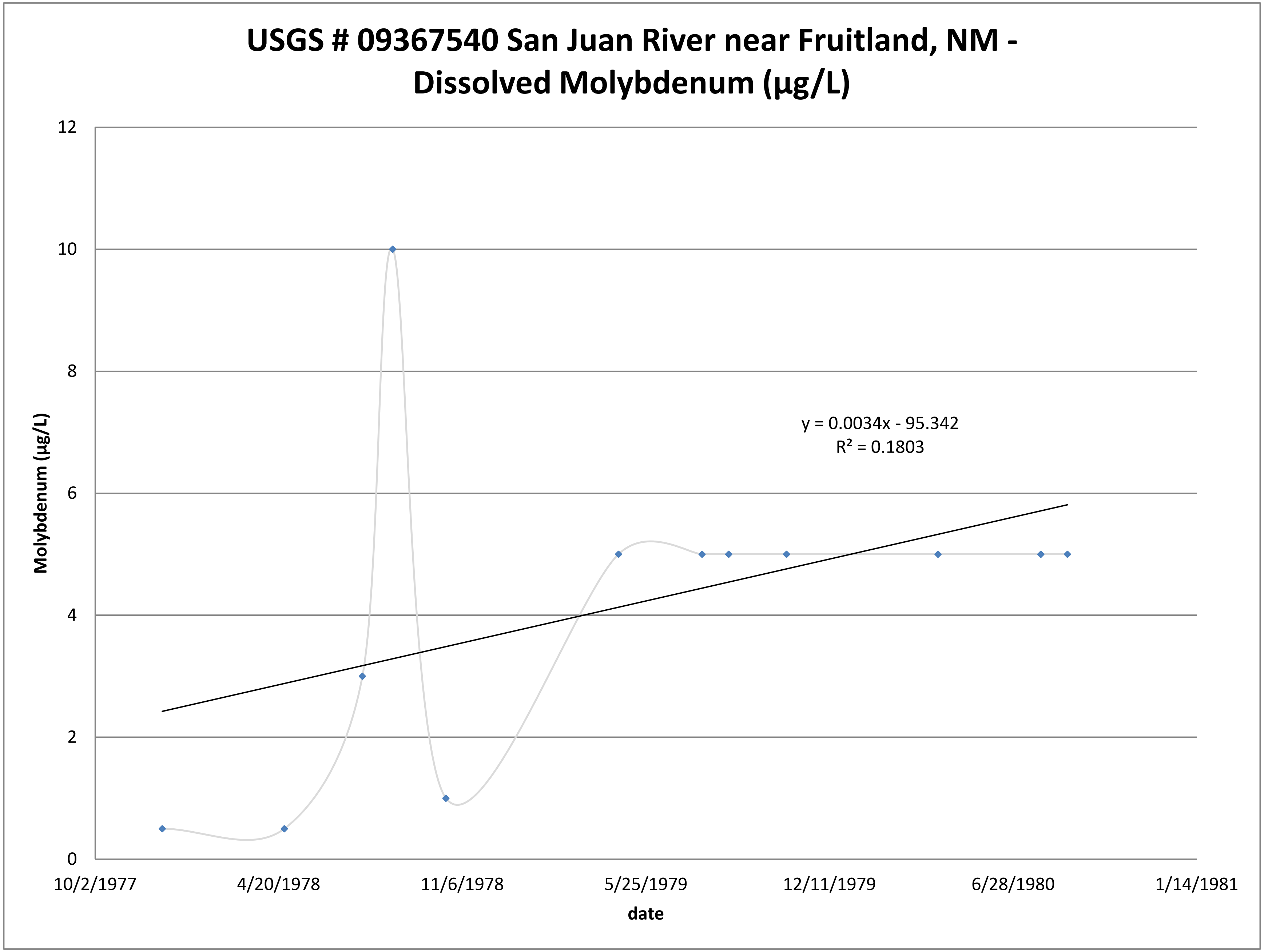

USGS # 09367540 San Juan River near Fruitland, NM - Dissolved Copper
Copper (µg/L)
12
10
8
6
4
2
0
10/2/1977
4/20/1978
11/6/1978
5/25/1979
12/11/1979
6/28/1980
1/14/1981
Date
y = -0.006x + 181.38
R² = 0.8819


USGS # 09367540 San Juan River near Fruitland, NM - Dissolved Iron
Iron (µg/L)
350
300
250
200
150
100
50
0
y = 0.0167x - 449.18
R² = 0.0378
8/28/1976
5/25/1979
2/18/1982
11/14/1984
8/11/1987
5/7/1990
1/31/1993
Date

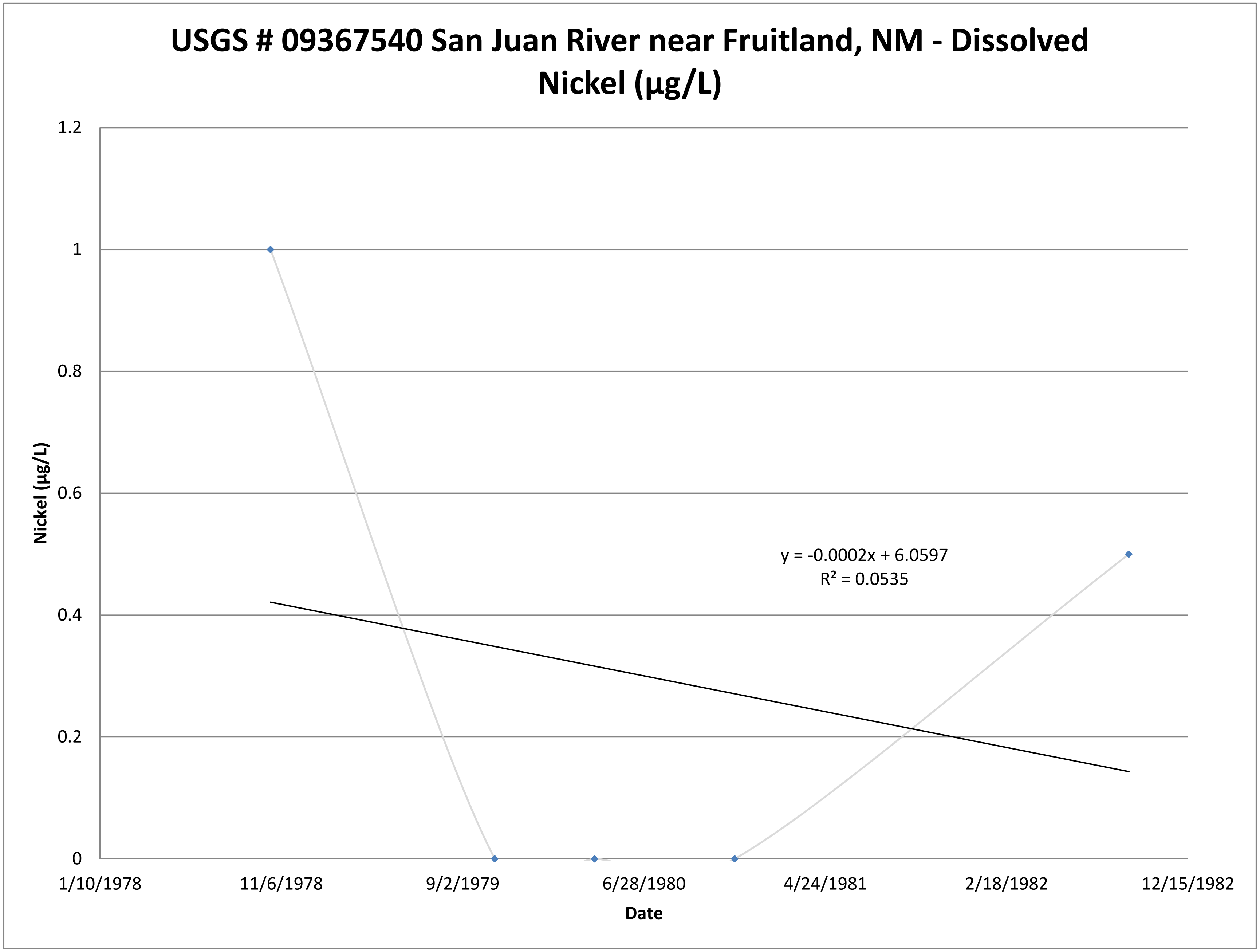

USGS # 09367540 San Juan River near Fruitland, NM - Dissolved Lead
Lead (µg/L)
0
1
2
3
4
5
6
y = -0.0007x + 21.321
R² = 0.058
11/6/1978
9/2/1979
6/28/1980
4/24/1981
2/18/1982
12/15/1982
10/11/1983
8/6/1984
Date

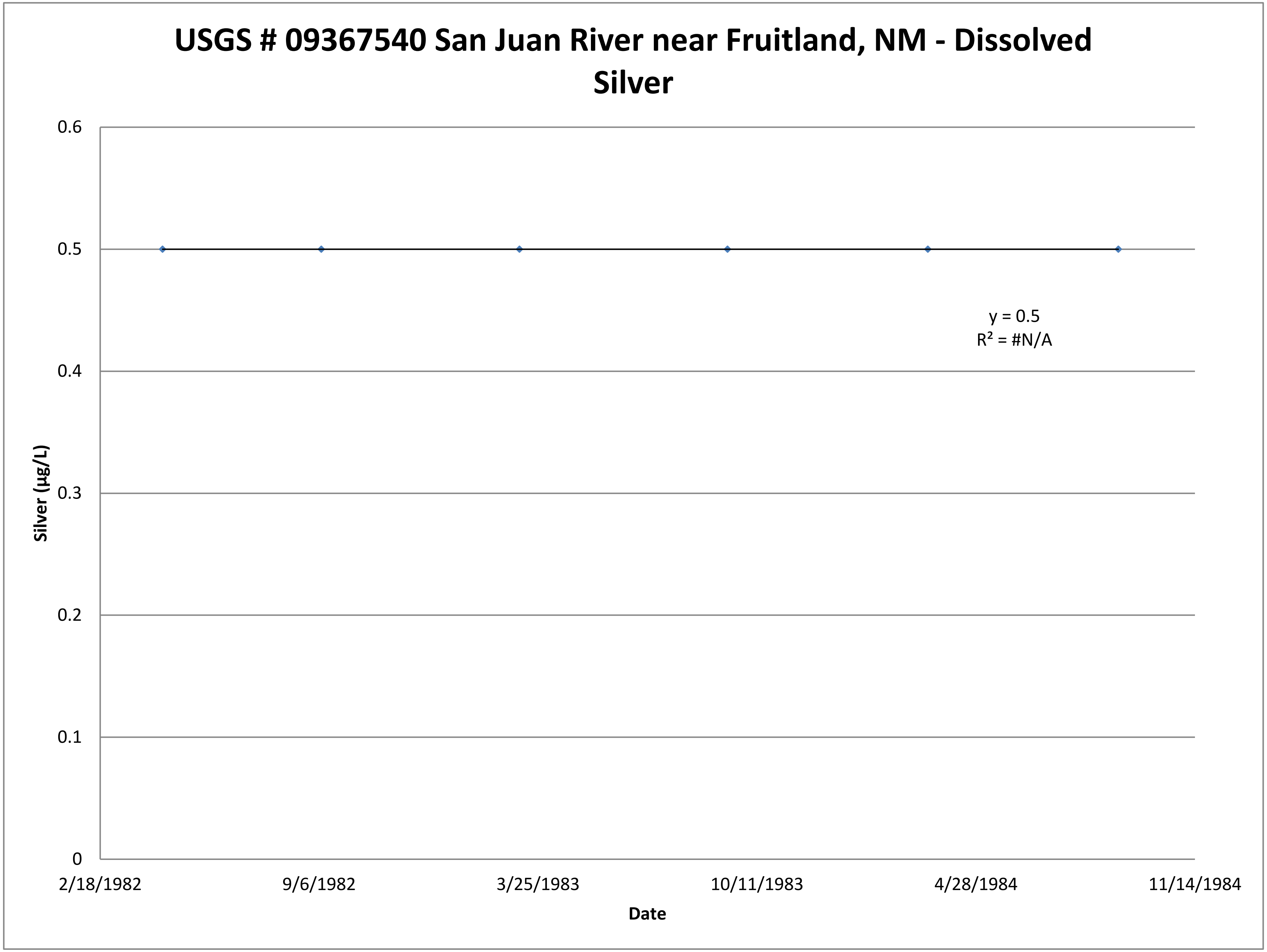

USGS # 09367540 San Juan River near Fruitland, NM - Dissolved Manganese
Manganese (µg/L)
100
90
80
70
60
50
40
30
20
10
0
y = -0.0032x + 112.27
R² = 0.0276
8/28/1976
5/25/1979
2/18/1982
11/14/1984
8/11/1987
5/7/1990
1/31/1993
Date

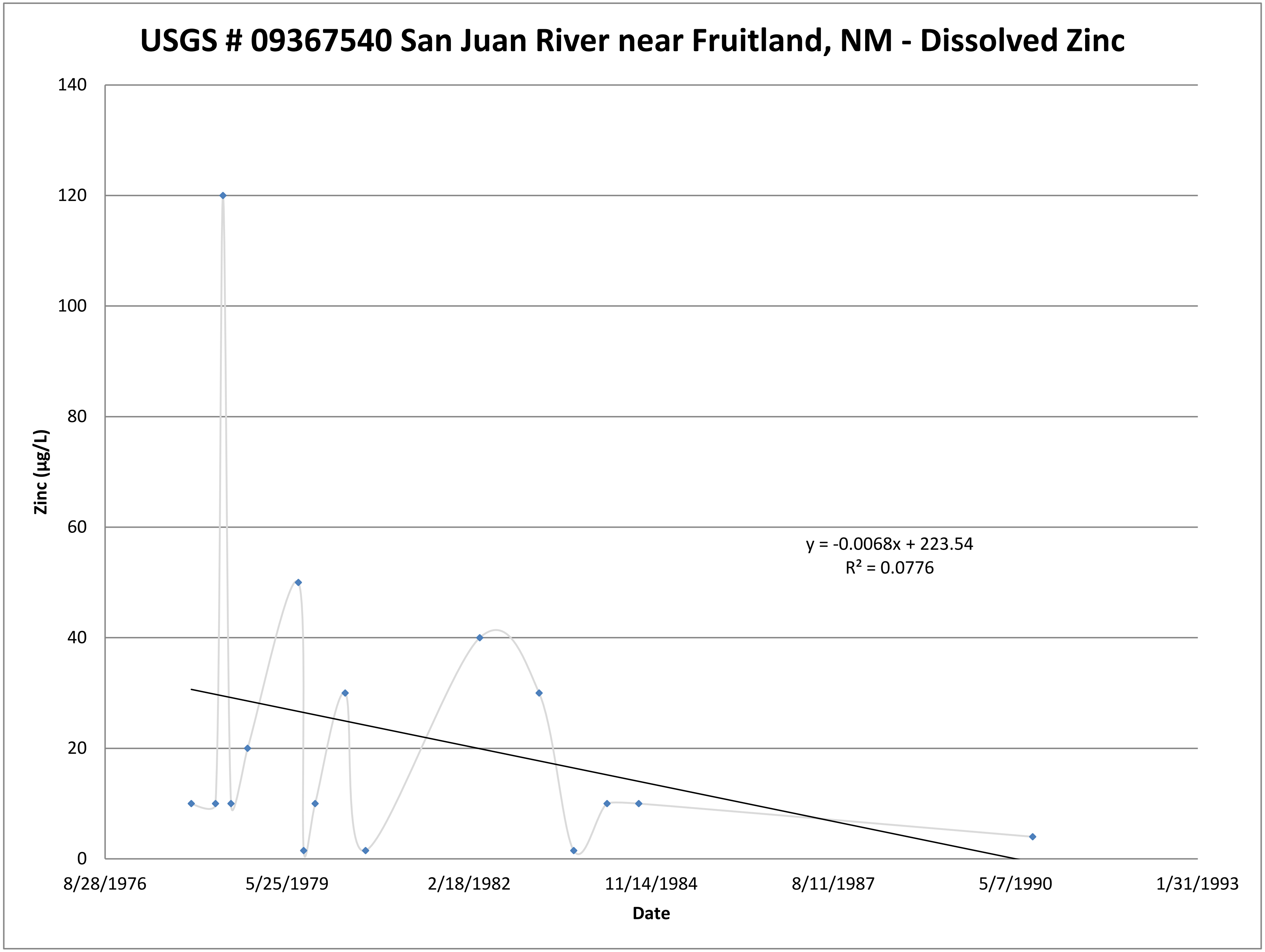

USGS # 09367540 San Juan River near Fruitland, NM - Total Mercury (µg/L)
Mercury (µg/L)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
y = 0.0002x - 4.7597
R² = 0.2446
8/28/1976
1/10/1978
5/25/1979
10/6/1980
2/18/1982
7/3/1983
11/14/1984
3/29/1986
Date

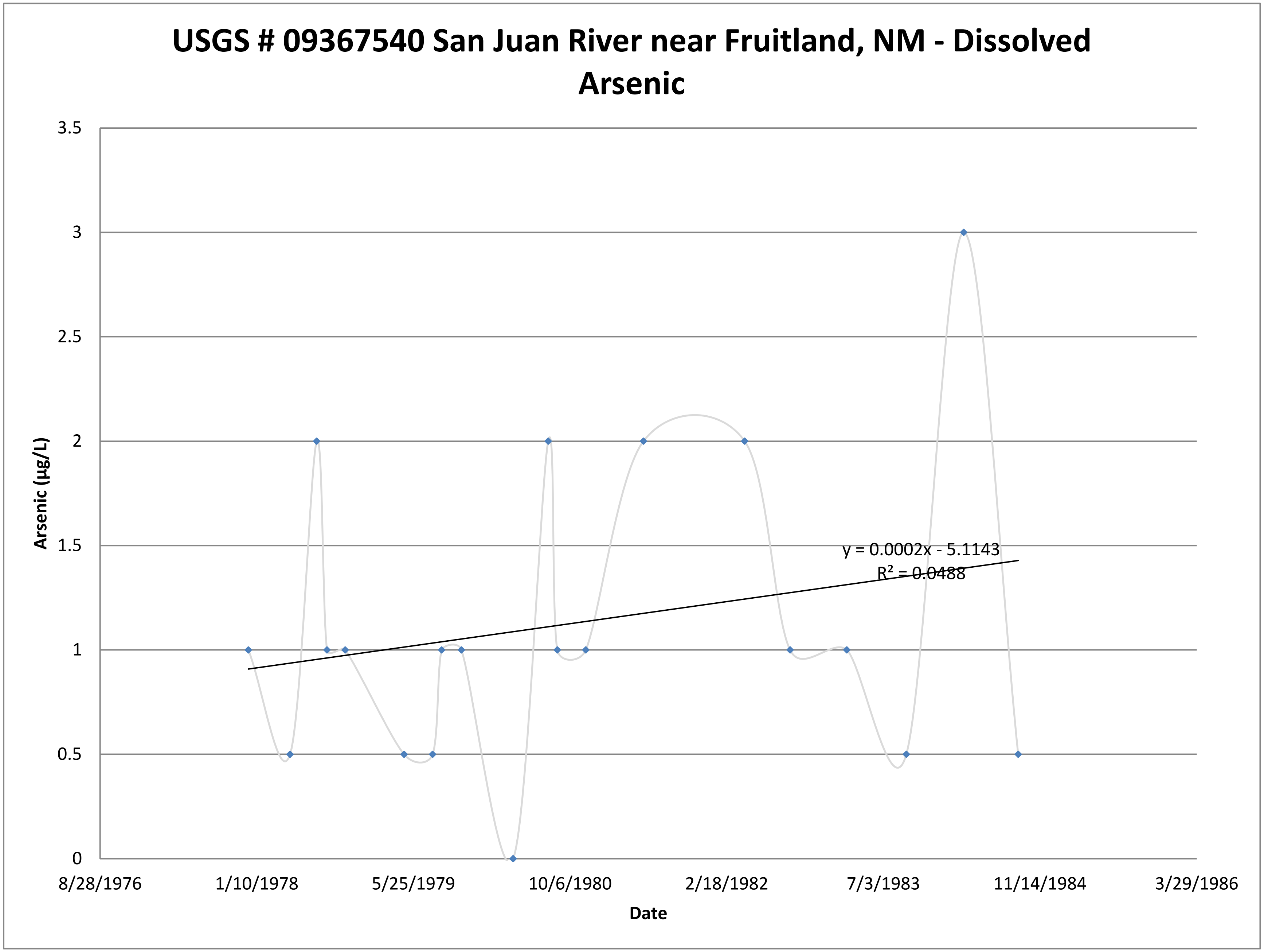

USGS # 09367540 San Juan River near Fruitland, NM - Dissolved Molybdenum (µg/L)
Molybdenum (µg/L)
12
10
8
6
4
2
0
y = 0.0034x - 95.342
R² = 0.1803
10/2/1977
4/20/1978
11/6/1978
5/25/1979
12/11/1979
6/28/1980
1/14/1981
date

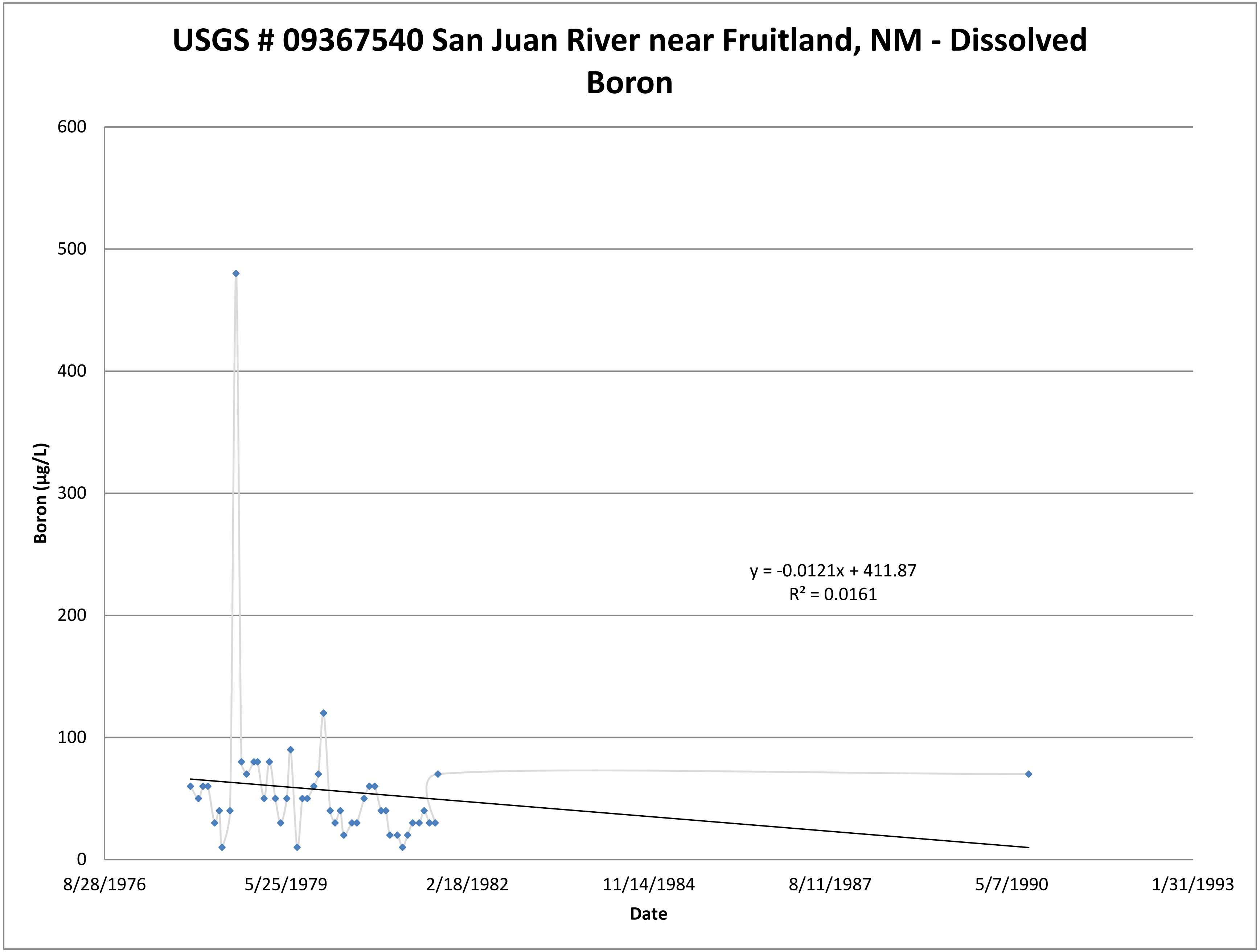
Appendix A - USGS Stations
USGS # 09367540

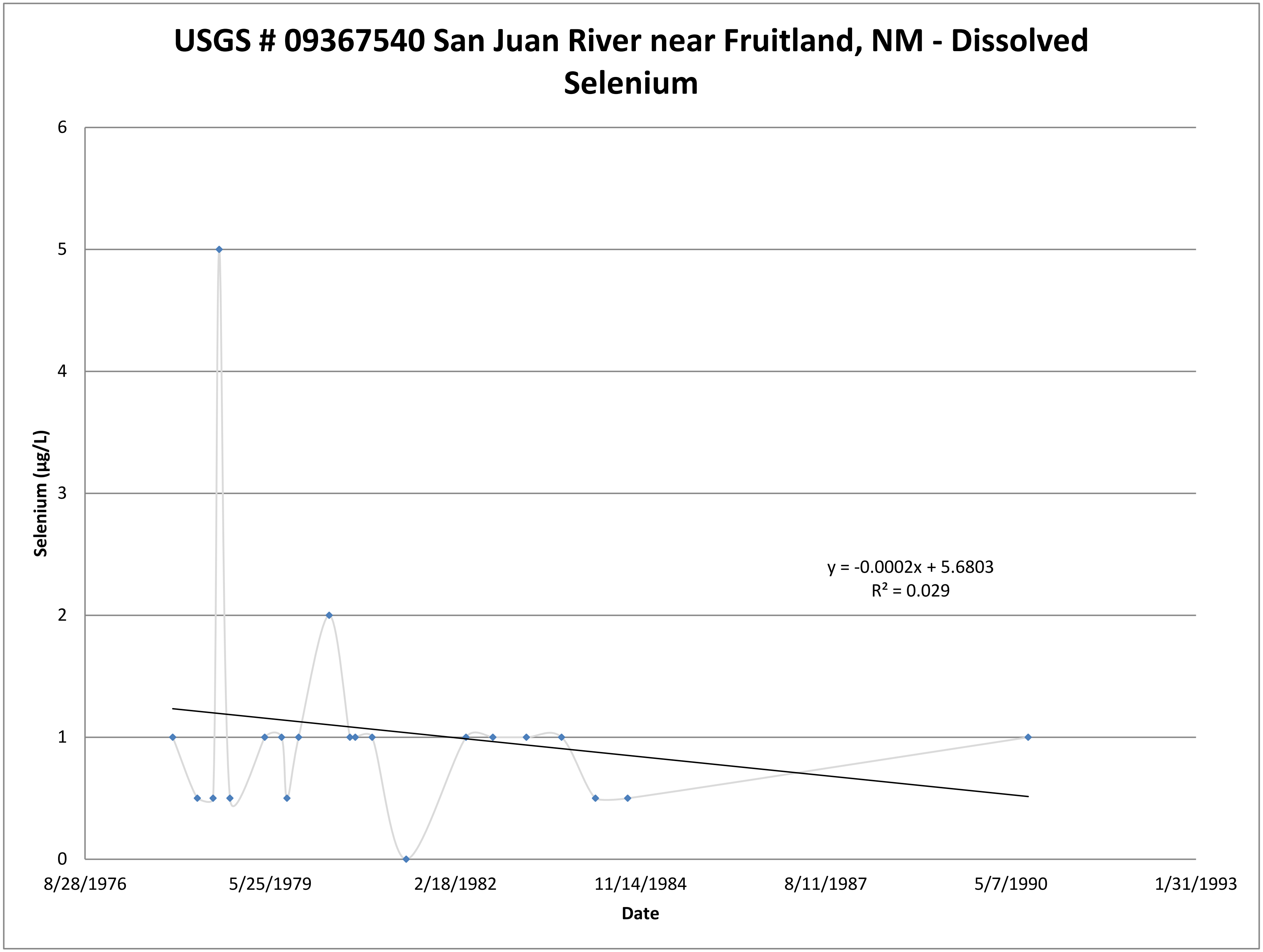



USGS # 09367540 San Juan River near Fruitland, NM - Dissolved Silver
Silver (µg/L)
0.6
0.5
0.4
0.3
0.2
0.1
0
y = 0.5
R² = #N/A
2/18/1982
9/6/1982
3/25/1983
10/11/1983
4/28/1984
11/14/1984
Date


USGS # 09367540 San Juan River near Fruitland, NM - Dissolved Zinc
Zinc (µg/L)
140
120
100
80
60
40
20
0
8/28/1976
5/25/1979
2/18/1982
11/14/1984
8/11/1987
5/7/1990
1/31/1993
Date
y = -0.0068x + 223.54
R² = 0.0776


USGS # 09367540 San Juan River near Fruitland, NM - Dissolved Arsenic
3.5
3
2.5
2
1.5
1
0.5
0
Arsenic (µg/L)
y = 0.0002x - 5.1143
R² = 0.0488
8/28/1976
1/10/1978
5/25/1979
10/6/1980
2/18/1982
7/3/1983
11/14/1984
3/29/1986
Date


USGS # 09367540 San Juan River near Fruitland, NM - Dissolved Boron
600
500
400
300
200
100
0
Boron (µg/L)
y = -0.0121x + 411.87
R² = 0.0161
8/28/1976
5/25/1979
2/18/1982
11/14/1984
8/11/1987
5/7/1990
1/31/1993
Date


USGS # 09367540 San Juan River near Fruitland, NM - Dissolved Selenium
Selenium (µg/L)
0
1
2
3
4
5
6
y = -0.0002x + 5.6803
R² = 0.029
8/28/1976
5/25/1979
2/18/1982
11/14/1984
8/11/1987
5/7/1990
1/31/1993
Date

Appendix B

Table B-1:Groundwater Uses

Site Type	***Site Name*** *(Aliases, # BAI report number)*	***Status***	***Completion***	***Stream Drainage***	***Depth to Water (ft)***	***Total Depth (ft)***	***Primary Use***	***Data Source***
Well	**#41**		Kirtland (Farmingt.)		40	60		[8]
Well	**#46**		Alluvium		70	9		[8]
Well	**#51**	Dry	Alluvium			8		[8]
Spring	**#54**							[8]
Spring	**#56**		PCS					[8]
Well	**#57**		Alluvium	San Juan	7	27		[8]
Well	**#70**		Alluvium		7	9		[8]
Well	**#90**		PCS			131	Stock, Domestic	[8]
Spring	**S-0767**		Improved Spring				Stock Water	[3]
Well	**W-0147**		Well				Stock Water	[3]
Well	**W-0148**		Well				Stock Water	[3]
Well	**W-0202**		Alluvium	Chaco		7	Stock Water	[3]
Well	**W-0313**		Well				Stock Water	[3]
Well	**W-0342**		Well	Chaco			Stock Water	[3]
Well	**W-0344 (#93)**		Alluvium	Pinabete	7	9	Stock Water	[3]
Well	**W-0520 (G-3, #36)**		Well	Chaco			Stock Water	[3]
Well	**W-0593**		Windmill	San Juan			Stock Water	[3]
Well	**W-0603**		Windmill				Stock Water	[3]
Well	**W-0607**		Windmill-Alluvial	Chaco	18	25	Stock Water	[3]
Well	**W-0695 (G-2)**		Alluvium	San Juan			Stock Water	[3]
Well - Permitted	**46 (W-0618,13R-28, #35)**	Destroyed	Alluvium	Cottonwood	5	16	Stock Water	[3], [10]
Well	**W-0203 (13-15-5)**	Unpermit	Alluvium	Chaco		8	Stock Water	[3], [10]
Well	**W-0204 (13-15-6)**	Unpermit	Alluvium	Chaco		14	Stock Water	[3], [10]
Well	**W-0343 (13-5-1, 13-15-2, Stevenson)**	Permitted	Alluvium				Stock Water	[3], [10]
Well	**W-0346 (13R-37, 13-8-4)**	Unpermit	Alluvium	Pinabete	6	7.5	Stock Water	[3], [10]
Well	**W-0348 (13-8-1)**	Unpermit	Alluvium	Pinabete	9	13	Stock Water	[3], [10]
Well	**W-0519 (13R-31 #17, G4, 13-14-7)**	Unpermit	Alluvium	Chaco	16	16	Stock Water	[4], [10]
Well	**W-0691 (13-15-8)**	Unpermit	Alluvium				Stock Water	[3], [10]
Well	**W-0345 (13R-48, 13-15-3)**	Permitted	Alluvium	Pinabete	7	10	Stock Water	[3],[10]
Well	**W-0606 (13-15-1)**	Unpermit	Windmill				Stock Water	[3],[10]

Appendix B
Table B-1:Groundwater Uses

Site Type	*Site Name (Aliases, # BAI report number)*	*Status*	*Completion*	*Stream Drainage*	*Depth to Water (ft)*	*Total Depth (ft)*	*Primary Use*	*Data Source*
Well	**W-0645 (13R-29, 13-14-6, #61)**	Permitted	Alluvium	Chaco	12	16	Stock Water	[3],[10]
Well	**W-0644 (13R-28A, QACW-2B, CWAP-1, #126)**		Alluvium	Cottonwood		22	Stock Water	[3],[10], [8]
Well	**#146**		Qal	San Juan	3	9		[7]
Well	**W-0312**		NTUA Well				Domestic	[2]
Well	**W-0349**			Pinabete			Domestic, Stock Water	[2]
Well	**W-0314**			Brimhall			Stock Water	[3]
Well	**W-0520**			Chaco			Stock Water	[3]
Well	**W-0537**			Brimhall			Stock Water	[3]
Well	**W-0538**		Well	Chaco			Stock Water	[3]
Well	**W-0539**		Well	Chaco			Stock Water	[3]
Well	**W-0540**			Brimhall			Stock Water	[3]
Well	**W-0544**						Stock Water	[3]
Well	**W-0545**						Stock Water	[3]
Well	**W-0624**			Brimhall			Stock Water	[3]
Well	**SJ 00264 (#7)**		Alluvium	San Juan	10	35	Stock Water	[1]
Well	**SJ 00248 (G7, #6)**		Alluvium	San Juan	10	35	DOM	[1], [5]
Well	**G5**		Alluvium	Chaco				[5]
Spring	**Little Geyser Spring (G9)**							[5]
Well	**13-7-2**	Abandoned	PCS	Brimhall				[9], [10]
Well	**#45**		Alluvium	Pinabete	8			[6]
Well	**13-15-4(#60)**	Unpermit	Alluvium		8	11		[10]
Well	**13-7-4**	Permitted		Brimhall				[10]
Well	**13-AW (13T-513, #58)**	Unpermit	Alluvium - Artesian		11	530	OG well converted to Livestock	[10]
Well	**GM-22 (13R-38)**	Permitted	Alluvium	Pinabete	11	47	Monitoring/ Livestock	[10]
Well	**GM-32 (13-15-7)**	Unpermit	Alluvium	Chaco	8	9	Monitoring/ Livestock	[10]
Well	**GM-34**	Unpermit		Chaco				[10]
Well	**GM-35**	Unpermit		Brimhall				[10]
Well	**GM-36 (13-7-5)**	Unpermit		Brimhall				[10]

Data Source:

Appendix B

Table B-1:Groundwater Uses

Site Type	Site Name (Aliases, # BAI report number)	Status	Completion	Stream Drainage	Depth to Water (ft)	Total Depth (ft)	Primary Use	Data Source

[1] NMSEO: (NMOSE 2011.xls)

New Mexico State Engineer's Office Record (NMOSE 2011.xls)

[2] NMSEO: Navajo Hydrographic Survey (2010) - Table D-1

New Mexico State Engineer's Office - Settlements "Notice of Navajo Nation Expedited Inter Se Proceeding" - Navajo Hydrographic Survey (2010) - Table D-1 (http://www.ose.state.nm.us/legal_ose_proposed_settlements_sj_notice2010.html)

[3] NMSEO: Navajo Hydrographic Survey (2010) - Table M-1

New Mexico State Engineer's Office - Settlements "Notice of Navajo Nation Expedited Inter Se Proceeding" - Navajo Hydrographic Survey (2010) - Table M-1 (http://www.ose.state.nm.us/legal_ose_proposed_settlements_sj_notice2010.html)

[4] USGS: OFR 93-84 (Table 2)

Thorn, C.R., 1993, Water-quality data from the San Juan and Chaco Rivers and selected alluvial aquifers, San Juan County, New Mexico: U.S. Geological Survey Open-File Report 93-84, Table 2

[5] USGS: OFR 93-84 (Table 3)

Thorn, C.R., 1993, Water-quality data from the San Juan and Chaco Rivers and selected alluvial aquifers, San Juan County, New Mexico: U.S. Geological Survey Open-File Report 93-84, Table 3

[6] USGS: WRIR 85-4251

Myers, R.G., and Villanueva, E.D., 1986, Geohydrology of the aquifers that may be affected by the surface mining of coal in the Fruitland Formation in the San Juan Basin, northwestern New Mexico: U.S. Geological Survey Water-Resources Investigations Report 85-4251, (#45 in Figure 14 - Table 7)

[7] New Mexico Bureau of Mines and Mineral Resources

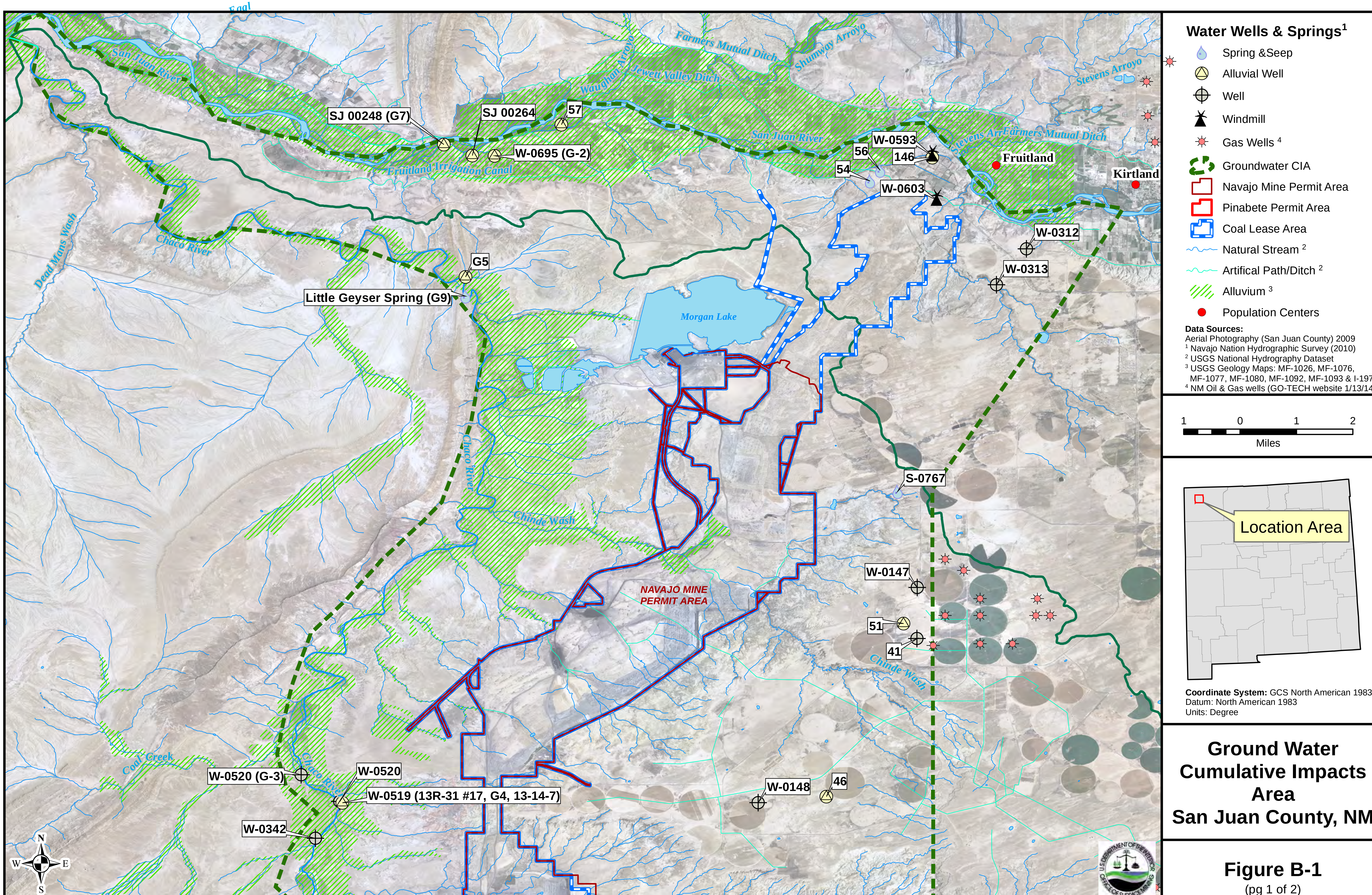
Stone, W. J. Lyford, F. P., Frenzel, P. F., Mizell, N. H., and Padgett, E. T., 1983, Hydrogeology and water resources of the San Juan Basin, New Mexico: New Mexico Bureau of Mines and Mineral Resources, Hydrologic Report 6, Table 1

[8] BHP: Addendum 12-D-A

1985 Reogranization ICR Response 01/89, 12-D-6 (Addendum 12-D-Af, Figure 12- D2)

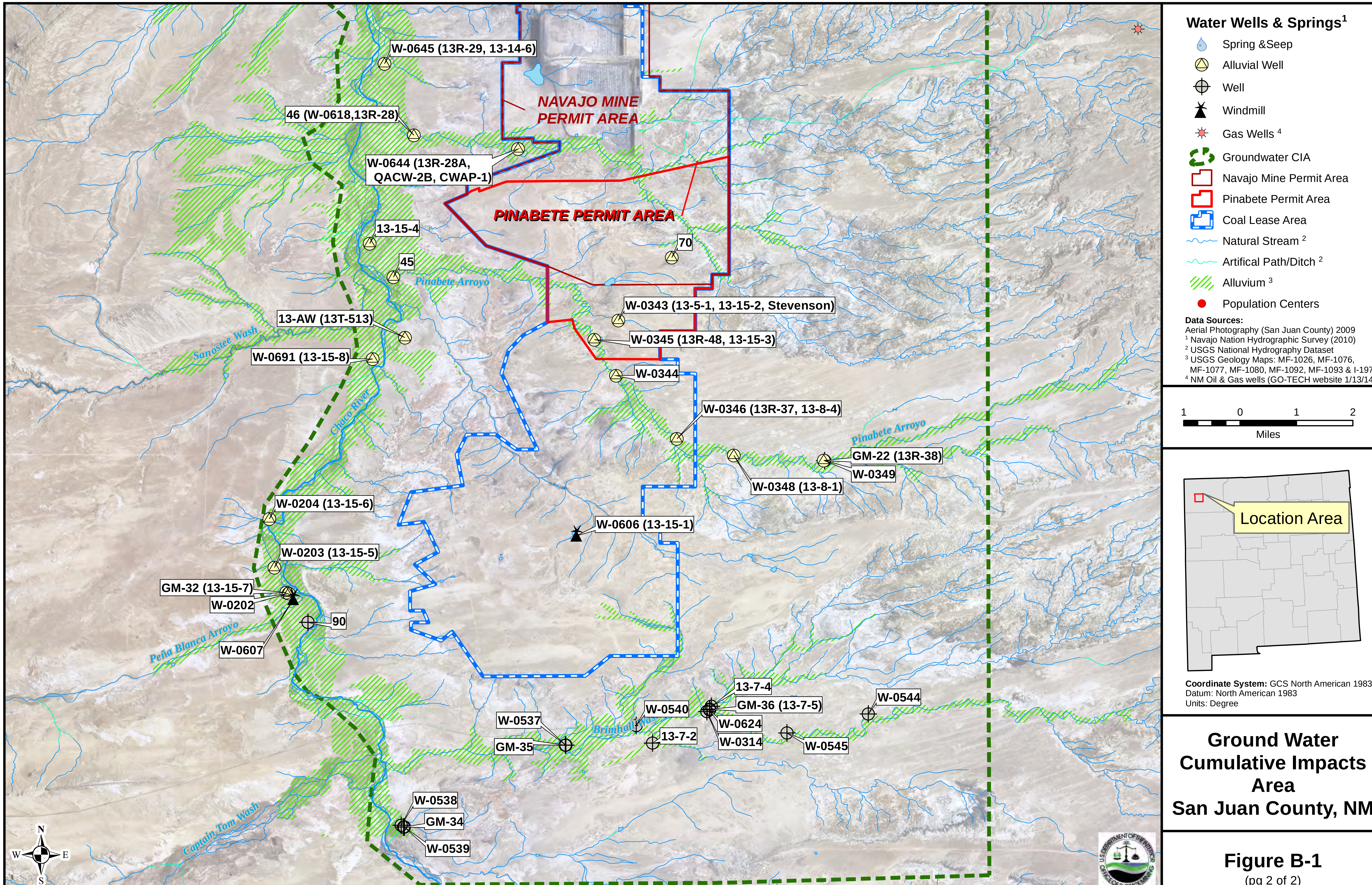
[9] BHP: Wells_Combined_2011.shp

[10] BHP: WW_Springs.shp (NMEP PAP Ex 18.2-1)



Ground Water Cumulative Impacts Area
San Juan County, NM

Figure B-1
(pg 1 of 2)



Ground Water Cumulative Impacts Area San Juan County, NM

Figure B-1
(pg 2 of 2)

Appendix B

Table B-2: Surface Water Uses

Site Number	Primary Use	Impoundment Source	Impoundment Area (Ac)	Acre Feet	X coordinate	Y Coordinate	Data Source
P-0001	Irrigation, Stock Water	In Channel	0.12	0.3	2451511.29	1889412.05	[1]
P-0002	Irrigation, Stock Water	Improved Spring	0.05	0.11	2436054.53	1845725.12	[1]
P-0003	Irrigation, Stock Water	In Channel	1.32	3.2	2436534.58	1748249.09	[1]
P-0004	Irrigation, Stock Water	In Channel	4.35	15.57	2435539.87	1749944.73	[1]
P-0005	Irrigation, Stock Water	In Channel	0.12	0.25	2421175.7	1745916.35	[1]
P-0006	Irrigation, Stock Water	In Channel	0.76	1.89	2422509.66	1745339.91	[1]
P-0007	Irrigation, Stock Water	In Channel	0.54	1.71	2420542.33	1746018.26	[1]
P-0008	Irrigation, Stock Water	In Channel	1.17	1.82	2446014.91	1718449.97	[1]
P-0009	Irrigation, Stock Water	In Channel	0.51	1.23	2487443.8	1714168.45	[1]
P-0010	Irrigation, Stock Water	In Channel, Well	0.67	1.03	2640730.3	1702635.66	[1]
P-0011	Irrigation, Stock Water	In Channel	0.27	0.27	2540845.54	1754986.86	[1]
P-0012	Irrigation, Stock Water	In Channel	1.57	8.99	2437906.49	1701658.72	[1]
P-0013	Irrigation, Stock Water	Well	0.64	2.15	2464629.35	1706566.77	[1]
P-0014	Irrigation, Stock Water	Improved Spring	0.31	1.23	2435995.6	1845658.98	[1]
P-0015	Irrigation, Stock Water	In Channel	3.07	18.72	2436698.98	1848223.60	[1]
P-0016	Industrial, Stock Water, Recreation	San Juan River	1261.02	39000*	2531409.91	2074481.22	[2]
P-0017	Stock Water	In Channel	388.41	2905.4	2626302.47	1853524.17	[3]
P-0018	Stock Water	In Channel	9.49	22.41	2534837.94	1757900.27	[3]
P-0019	Irrigation, Stock Water	In Channel	4.13	10.58	2625133.31	1755222.55	[1]
P-0020	Irrigation, Stock Water	In Channel	2.65	7.83	2604643.28	1718546.32	[1]
P-0021	Irrigation, Stock Water	In Channel	1.88	4.07	2484631.42	1720546.99	[1]
P-0022	Industrial	Industrial	12.86	20.25	2535626.46	2071563.23	[2]
P-0023	Industrial	Industrial	1.45	2.86	2535910.92	2071414.44	[2]
P-0024	Industrial	Industrial	8.91	38.57	2536137.30	2071414.39	[2]
P-0027	Irrigation, Stock Water	In Channel	47.02	101.82	2651957.56	1770806.69	[1]
P-0028	Stock Water	In Channel	0.22	0.21	2554792.19	1761185.83	[3]
P-0029	Irrigation, Stock Water	In Channel	0.66	1.95	2580410.85	1759142.87	[1]
P-0030	Irrigation, Stock Water	In Channel	1.74	3.43	2604075.32	1718735.24	[1]
P-0031	Irrigation, Stock Water	In Channel	0.98	1.74	2604752.78	1719035.81	[1]
P-0032	Irrigation, Stock Water	In Channel	0.65	2.17	2486945.76	1714222.47	[1]
P-0033	Stock Water	In Channel	31.37	135.85	2675304.85	1717997.80	[3]
P-0034	Irrigation, Stock Water	In Channel	10.41	57.38	2748760.88	1750689.24	[1]
P-0036	Irrigation, Stock Water	In Channel	97.57	1056.38	2453304.33	1926914.19	[1]
P-0037	Irrigation, Stock Water	In Channel	4.33	13.62	2397077.23	1894150.34	[1]
P-0039	Stock Water	In Channel, Well	57.94	125.45	2440315.76	1923282.02	[3]
P-0040	Stock Water	In Channel	24.47	250.47	2417393.66	2028566.61	[3]
P-0041	Stock Water	In Channel	28.39	61.48	2422548.94	1825540.27	[3]
P-0042	Stock Water, Recreation	In Channel	300.48	1200.00*	2428800.95	1821300.73	[3]
P-0043	Irrigation, Stock Water, Recreation	In Channel	223.59	8000.00*	2432247.9	1810750.53	[1]
P-0138	Stock Water	In Channel	0.78	8.9	2495763.03	1776357.29	[3]
P-0141	Stock Water	In Channel	2.82	10.28	2542632.09	1779176.25	[3]
P-0142	Stock Water	In Channel	9.23	16.53	2494898.90	1776349.13	[3]
P-0143	Stock Water	In Channel	0.78	4.55	2511683.91	1772220.47	[3]
P-0145	Stock Water	In Channel	2.12	4.43	2540788.56	1765414.57	[3]
P-0146	Stock Water	Well	0.34	1.38	2521349.76	1778358.62	[3]
P-0147	Stock Water	Well	0.13	0.21	2521282.70	1778535.64	[3]
P-0148	Stock Water	Well	0.14	0.42	2521181.09	1778424.71	[3]
P-0149	Stock Water	In Channel	0.77	1.61	2549485.83	1759833.31	[3]
P-0150	Stock Water	In Channel	0.33	1.28	2566776.37	1761133.98	[3]
P-0151	Stock Water	In Channel	0.2	0.27	2550167.93	1744563.73	[3]

Appendix B

Table B-2: Surface Water Uses

Site Number	Primary Use	Impoundment Source	Impoundment Area (Ac)	Acre Feet	X coordinate	Y Coordinate	Data Source
P-0152	Stock Water	In Channel	2.44	25.08	2550846.58	1744565.86	[3]
P-0153	Stock Water	Off Channel	0.43	0.46	2573140.33	1719883.65	[3]
P-0157	Stock Water	In Channel	1.11	2.74	2547535.97	1754151.72	[3]
P-0158	Stock Water	In Channel	3.76	8.51	2538987.14	1747611.40	[3]
P-0159	Sewer Settling	Sewer	0.41	1.66	2565719.30	1749463.82	[4]
P-0160	Irrigation, Stock Water	In Channel	6.54	54.62	2569548.3	1744298.42	[1]
P-0161	Irrigation, Stock Water	In Channel	1.37	8.96	2553774.57	1742127.39	[1]
P-0162	Irrigation, Stock Water	In Channel	1.17	8.01	2553435.09	1741847.33	[1]
P-0163	Stock Water	In Channel	4.05	40.15	2544650.99	1743462.50	[3]
P-0164	Stock Water	In Channel	0.21	0.6	2571254.26	1735828.86	[3]
P-0165	Stock Water	Well	0.11	0.67	2565618.30	1747643.00	[3]
P-0166	Stock Water	Well	0.77	4.36	2565012.49	1747449.79	[3]
P-0167	Stock Water	Well	0.7	2.25	2565527.78	1747470.84	[3]
P-0168	Stock Water	In Channel	1.07	2.33	2510232.17	1798353.70	[3]
P-0169	Stock Water	In Channel	0.71	2.36	2509542.82	1805063.77	[3]
P-0170	Stock Water	In Channel	0.71	3.07	2499752.55	1802015.58	[3]
P-0171	Stock Water	In Channel	1.23	2.67	2499406.27	1790462.41	[3]
P-0172	Stock Water	In Channel	0.57	1.23	2498449.15	1791562.86	[3]
P-0173	Stock Water	Well	0.34	1.08	2490484.35	1789234.22	[3]
P-0174	Stock Water	In Channel	0.46	1.44	2482504.90	1792560.28	[3]
P-0175	Stock Water	Well	0.34	0.68	2482219.12	1803569.79	[3]
P-0176	Stock Water	In Channel	1.96	2.32	2491179.32	1807975.01	[3]
P-0177	Stock Water	In Channel	0.58	1.71	2492588.41	1809573.62	[3]
P-0178	Stock Water	In Channel	17.19	57.52	2564410.82	1851600.14	[3]
P-0179	Stock Water	Well	0.36	0.86	2482198.39	1779041.07	[3]
P-0180	Stock Water	In Channel	0.96	2.47	2520391.48	1784659.65	[3]
P-0181	Stock Water	In Channel	0.33	0.52	2521826.68	1793092.97	[3]
P-0182	Stock Water	In Channel	0.43	1.28	2523610.54	1793767.08	[3]
P-0183	Stock Water	In Channel	1.39	2.2	2523658.94	1793766.66	[3]
P-0184	Stock Water	In Channel	0.88	3.47	2506578.12	1820705.99	[3]
P-0185	Stock Water	Well	0.76	2.25	2508623.19	1827704.80	[3]
P-0187	Stock Water	In Channel	9.12	23.33	2492456.13	1809383.80	[3]
P-0188	Stock Water	In Channel	23.86	89.23	2519355.87	1804017.54	[3]
P-0189	Stock Water	In Channel	0.35	0.69	2518528.85	1807632.06	[3]
P-0190	Stock Water	In Channel	8.49	15.05	2518599.81	1807627.27	[3]
P-0191	Stock Water	In Channel	0.59	2.21	2522914.13	1820817.17	[3]
P-0192	Stock Water	In Channel	8.52	25.17	2523081.11	1820488.26	[3]
P-0193	Stock Water	In Channel	0.35	0.55	2507332.99	1767680.08	[3]
P-0194	Stock Water	In Channel	0.9	4.77	2506883.94	1760785.08	[3]
P-0195	Stock Water	In Channel	4.84	11.81	2515769.35	1759872.15	[3]
P-0196	Stock Water	In Channel	1.44	3.32	2518802.91	1759949.12	[3]
P-0197	Stock Water	Off Channel	0.8	1.87	2532792.50	1758400.76	[3]
P-0198	Stock Water	In Channel	0.5	1.19	2530694.41	1754221.28	[3]
P-0199	Stock Water	In Channel	0.79	3.78	2536301.90	1727150.54	[3]
P-0200	Stock Water	In Channel	1	9.31	2499019.78	1725276.64	[3]
P-0201	Stock Water	In Channel	0.35	1.25	2493003.08	1726082.42	[3]
P-0202	Stock Water	In Channel	22.43	69.75	2483033.79	1727055.32	[3]
P-0203	Irrigation, Stock Water	In Channel	2.59	5.05	2482160.45	1724028.32	[1]
P-0204	Stock Water	Well	0.2	0.41	2491989.65	1758748.12	[3]
P-0205	Stock Water	Well	0.31	1.02	2486471.06	1721697.11	[3]
P-0206	Stock Water	Well	0.13	0.18	2486445.63	1721663.92	[3]
P-0207	Stock Water	In Channel	6.56	31.12	2507093.81	1760808.73	[3]
P-0208	Stock Water	Off Channel	0.37	2.06	2533050.36	1758440.94	[3]

Appendix B
Table B-2: Surface Water Uses

Site Number	Primary Use	Impoundment Source	Impoundment Area (Ac)	Acre Feet	X coordinate	Y Coordinate	Data Source
P-0209	Stock Water	Well	0.11	0.11	2515967.68	1745004.88	[3]
P-0211	Stock Water	In Channel, Well	0.39	0.43	2518776.02	1738502.76	[3]
P-0212	Sewer Settling	Sewer	0.41	0.33	2489786.60	1739686.99	[4]
P-0213	Sewer Settling	Sewer	0.49	0.83	2489780.62	1739671.12	[4]
P-0214	Sewer Settling	Sewer	0.36	0.62	2489766.00	1739687.44	[4]
P-0215	Sewer Settling	Sewer	0.3	0.71	2489730.17	1739533.84	[4]
P-0216	Stock Water	In Channel	0.08	0.19	2481833.78	1726088.71	[3]
P-0217	Stock Water	In Channel	4.99	30.64	2497745.07	1728462.84	[3]
P-0218	Stock Water	In Channel	0.07	0.17	2481833.22	1726063.17	[3]
P-0219	Stock Water	Well	0.12	0.29	2483426.33	1817676.05	[3]
P-0220	Stock Water	In Channel	0.91	2.51	2486075.31	1830250.34	[3]
P-0221	Stock Water	In Channel	0.72	2.85	2483477.87	1833497.57	[3]
P-0222	Stock Water	In Channel	3.07	7.87	2484498.05	1836666.20	[3]
P-0223	Stock Water	Well	0.89	2.82	2486266.33	1839825.90	[3]
P-0225	Stock Water	In Channel	7.96	20.36	2493174.36	1832090.25	[3]
P-0226	Stock Water	In Channel	80.39	648.79	2504149.78	1845641.49	[3]
P-0227	Stock Water	In Channel	16.64	52.42	2507177.70	1844875.33	[3]
P-0228	Stock Water	In Channel	47.45	205.49	2510335.83	1841731.75	[3]
P-0230	Stock Water	In Channel	18.24	61.03	2532201.60	1851283.01	[3]
P-0231	Stock Water	In Channel	0.56	2.22	2531837.84	1837987.84	[3]
P-0232	Stock Water	In Channel	3.77	13.36	2532112.69	1837523.56	[3]
P-0233	Stock Water	In Channel	8.49	31.76	2540305.51	1833740.22	[3]
P-0234	Stock Water	In Channel	25.45	140.29	2533217.21	1820162.37	[3]
P-0235	Stock Water	In Channel	0.54	1.5	2535913.66	1807066.02	[3]
P-0236	Stock Water	In Channel	5.08	17.98	2534533.27	1807519.25	[3]
P-0237	Stock Water	In Channel	1.17	5.78	2534447.87	1807780.18	[3]
P-0238	Stock Water	In Channel	7.93	31.23	2530283.51	1803146.39	[3]
P-0239	Stock Water	Well	1.49	7.06	2541461.47	1797342.75	[3]
P-0240	Stock Water	In Channel	2.93	10.94	2546348.33	1794074.57	[3]
P-0241	Stock Water	In Channel	3.05	9.01	2548401.58	1794434.47	[3]
P-0242	Stock Water	Well	0.07	0.07	2511674.55	1887662.94	[3]
P-0243	Stock Water	In Channel	0.43	1.1	2502317.37	1885135.33	[3]
P-0244	Stock Water	In Channel	0.59	1.29	2483828.40	1905796.22	[3]
P-0245	Stock Water	In Channel	1.76	12.13	2494670.87	1906614.53	[3]
P-0246	Stock Water	In Channel	1.22	3.12	2487187.40	1900326.13	[3]
P-0247	Stock Water	In Channel	41.28	32.5	2492824.53	1898303.59	[3]
P-0248	Stock Water	In Channel	1.81	9.6	2479238.40	1891024.32	[3]
P-0249	Stock Water	In Channel	1.14	2.69	2474039.36	1885857.76	[3]
P-0250	Stock Water	In Channel	1.48	8.45	2474092.53	1885673.22	[3]
P-0251	Stock Water	In Channel	15.49	106.7	2480471.59	1882716.68	[3]
P-0252	Stock Water	Well	0.39	0.31	2492624.71	1888948.42	[3]
P-0253	Stock Water	Well	0.06	0.11	2478841.09	1900437.67	[3]
P-0254	Stock Water	Well	0.16	0.34	2479044.09	1900432.38	[3]
P-0255	Stock Water	Well	0.07	0.2	2479225.93	1900550.00	[3]
P-0256	Stock Water	In Channel	0.37	1.81	2479956.67	1856181.86	[3]
P-0257	Stock Water	In Channel	23.37	104.88	2479897.17	1855766.84	[3]
P-0258	Stock Water	In Channel	1.75	3.38	2475449.76	1873277.47	[3]
P-0259	Stock Water	In Channel	0.64	0.43	2475575.99	1873383.33	[3]
P-0260	Stock Water	In Channel	1.79	5.74	2476568.61	1872372.62	[3]
P-0261	Stock Water	Well	0.06	0.11	2490739.88	1879527.63	[3]
P-0263	Stock Water	In Channel	11.5	28.3	2499574.91	1866625.77	[3]
P-0264	Stock Water	In Channel	3.05	6.07	2503214.71	1868277.37	[3]
P-0265	Stock Water	In Channel	2.05	5.32	2504000.42	1867883.30	[3]

Appendix B
Table B-2: Surface Water Uses

Site Number	Primary Use	Impoundment Source	Impoundment Area (Ac)	Acre Feet	X coordinate	Y Coordinate	Data Source
P-0267	Stock Water	In Channel	2.92	6.72	2492291.92	1855787.04	[3]
P-0268	Stock Water	In Channel	0.25	0.66	2503224.48	1865001.87	[3]
P-0269	Stock Water	In Channel	1.76	5.42	2501680.23	1867083.83	[3]
P-0271	Stock Water	Well	0.13	0.59	2499614.87	1869766.67	[3]
P-0274	Stock Water	Well	0.12	0.09	2499940.72	1869725.67	[3]
P-0278	Stock Water	In Channel	3.25	12.1	2567354.06	1882337.42	[3]
P-0279	Stock Water	Well	0.04	0.04	2527743.15	1898048.75	[3]
P-0280	Stock Water	Well	0.09	0.24	2550828.37	1901731.82	[3]
P-0281	Stock Water	In Channel	1.34	10.66	2541983.34	1869553.23	[3]
P-0282	Stock Water	In Channel	0.73	2.8	2567295.79	1882043.45	[3]
P-0283	Stock Water	In Channel	0.86	4.28	2527452.12	1880583.04	[3]
P-0284	Stock Water	In Channel	0.81	3.03	2569811.82	1861578.50	[3]
P-0285	Stock Water	In Channel	0.91	2.97	2563505.32	1860362.66	[3]
P-0286	Stock Water	In Channel	3.98	13.33	2563182.09	1859896.68	[3]
P-0287	Stock Water	In Channel	7.86	34.64	2524447.71	1853460.15	[3]
P-0288	Stock Water	In Channel	9.85	80.69	2564521.46	1914113.71	[3]
P-0289	Stock Water	In Channel	1.28	1.56	2546718.96	1916625.84	[3]
P-0290	Stock Water	In Channel	1.24	3.17	2512448.56	1968312.58	[3]
P-0291	Stock Water	In Channel	2.24	3.52	2503361.30	1968863.16	[3]
P-0292	Stock Water	In Channel	1.41	3.34	2511685.37	1967669.85	[3]
P-0293	Stock Water	In Channel	7.16	11.28	2495342.07	1987366.96	[3]
P-0294	Stock Water	In Channel	0.94	1.86	2478604.13	1986531.15	[3]
P-0295	Stock Water	In Channel	9.65	11.4	2475082.94	1980020.77	[3]
P-0298	Stock Water	Well	0.07	0.12	2485942.80	1973061.47	[3]
P-0299	Stock Water	In Channel	1.31	1.55	2571732.64	1936415.52	[3]
P-0300	Stock Water	In Channel	1.15	2.71	2567529.95	1932612.65	[3]
P-0301	Stock Water	In Channel	3.12	13.51	2567767.37	1931371.04	[3]
P-0302	Stock Water	In Channel	3.88	15.26	2561395.77	1930096.01	[3]
P-0303	Stock Water	In Channel	1.32	4.15	2552535.13	1929813.92	[3]
P-0304	Stock Water	In Channel	9.1	53.73	2541572.21	1930377.62	[3]
P-0305	Stock Water	In Channel	2.67	8.93	2535246.24	1934601.35	[3]
P-0306	Stock Water	In Channel	2.56	11.08	2522283.70	1924874.67	[3]
P-0307	Stock Water	Well	0.06	0.09	2492768.28	1923204.09	[3]
P-0308	Stock Water	In Channel	0.93	4.78	2481791.50	1925426.47	[3]
P-0309	Stock Water	Well	1.75	5.87	2478884.51	1927339.14	[3]
P-0310	Stock Water	Well	0.05	0.06	2485829.42	1935963.30	[3]
P-0311	Stock Water	Well	0.06	0.1	2477660.69	1944371.48	[3]
P-0312	Stock Water	Well	0.08	0.16	2489554.01	1955260.45	[3]
P-0313	Stock Water	In Channel	11.76	64.8	2491118.81	1960359.80	[3]
P-0314	Stock Water	In Channel	1.21	5.7	2491233.37	1960191.44	[3]
P-0315	Stock Water	In Channel	4.94	10.7	2476070.86	1955694.06	[3]
P-0316	Stock Water	In Channel	0.09	0.31	2522267.34	1800706.03	[3]
P-0317	Stock Water	Well	0.69	2.31	2523176.71	1800462.03	[3]
P-0319	Stock Water	In Channel	1.57	10.85	2559588.73	1796515.76	[3]
P-0321	Stock Water	Well	0.24	0.7	2555805.68	1813831.91	[3]
P-0322	Stock Water	In Channel	4.18	22.24	2564928.00	1814011.24	[3]
P-0323	Stock Water	In Channel	0.61	2.66	2568316.05	1821790.51	[3]
P-0324	Stock Water	In Channel	1.06	4.36	2568490.10	1822202.62	[3]
P-0325	Stock Water	In Channel	4.74	46.69	2563906.16	1832083.28	[3]
P-0328	Stock Water	In Channel	7.44	19.04	2482342.74	1792599.08	[3]
P-0329	Stock Water	In Channel	0.73	2.43	2495291.16	1803860.46	[3]
P-0332	Stock Water	In Channel	11.01	26	2520324.34	1976544.53	[3]
P-0334	Stock Water	In Channel	0.25	0.4	2518650.89	1941887.11	[3]

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Table B-2: Surface Water Uses

Site Number	Primary Use	Impoundment Source	Impoundment Area (Ac)	Acre Feet	X coordinate	Y Coordinate	Data Source
P-0335	Stock Water	In Channel	2.67	9.46	2519055.87	1941886.19	[3]
P-0336	Stock Water	In Channel	18.04	92.31	2524900.75	1944362.22	[3]
P-0337	Stock Water	In Channel	1.48	1.75	2522161.74	1949859.55	[3]
P-0338	Stock Water	In Channel	1.41	3.05	2533501.11	1949806.27	[3]
P-0339	Stock Water	In Channel	2.02	2.39	2525798.60	1954854.51	[3]
P-0341	Stock Water	In Channel	0.95	1.3	2538029.86	1956882.04	[3]
P-0342	Stock Water	In Channel	6.47	44.58	2535066.37	1970153.74	[3]
P-0343	Stock Water	In Channel	3.23	27.38	2561539.93	1973929.76	[3]
P-0344	Stock Water	In Channel	1.84	3.98	2562438.61	1974438.07	[3]
P-0345	Stock Water	In Channel	2.52	10.93	2560323.92	1982855.83	[3]
P-0346	Stock Water	In Channel	2.54	9.01	2563088.91	1985449.24	[3]
P-0348	Stock Water	In Channel	3.98	25.05	2560342.49	1987331.90	[3]
P-0349	Stock Water	In Channel	1.85	10.9	2559148.17	1987537.66	[3]
P-0350	Stock Water	In Channel	2.59	16.81	2557642.09	1988782.95	[3]
P-0352	Stock Water	In Channel	0.14	0.28	2486374.58	2038758.14	[3]
P-0353	Stock Water	In Channel	0.21	0.13	2489347.04	2023571.92	[3]
P-0354	Stock Water	In Channel	1.1	2.17	2553500.31	2040287.28	[3]
P-0355	Stock Water	In Channel	0.59	1.86	2562237.83	2027122.31	[3]
P-0356	Stock Water	In Channel	1.15	0.9	2560667.10	2025728.42	[3]
P-0359	Industrial	Industrial	2.27	3.57	2518450.56	2016893.92	[2]
P-0361	Stock Water	In Channel	2.57	3.55	2541663.85	2026142.87	[3]
P-0365	Stock Water	In Channel	1.41	4.72	2545675.65	2056940.18	[3]
P-0366	Stock Water	In Channel	5.44	11.79	2549077.74	2047587.32	[3]
P-0367	Stock Water	In Channel	1.14	4.04	2553729.32	2040516.28	[3]
P-0368	Stock Water	In Channel	1.25	2.45	2545210.98	2035095.19	[3]
P-0369	Stock Water	Improved Spring	0.19	0.62	2554684.56	2014868.14	[3]
P-0370	Stock Water	In Channel	1.32	2.33	2559233.66	2027221.98	[3]
P-0371	Stock Water	In Channel	0.66	2.6	2502929.24	2056838.80	[3]
P-0372	Stock Water	In Channel	0.13	0.22	2485509.26	2039696.61	[3]
P-0373	Stock Water	In Channel	0.71	0.97	2491442.16	2035412.39	[3]
P-0374	Stock Water	In Channel	1	3.36	2490766.61	2021184.05	[3]
P-0375	Stock Water	In Channel	0.44	0.7	2490231.33	2019693.01	[3]
P-0376	Stock Water	In Channel	1.21	5.7	2489788.97	2019424.82	[3]
P-0377	Stock Water	In Channel	0.6	1.65	2479184.18	2021777.48	[3]
P-0378	Stock Water	In Channel, Well	2.28	10.31	2475160.11	2024570.98	[3]
P-0379	Stock Water	In Channel	0.26	0.46	2494938.31	2002181.40	[3]
P-0381	Stock Water	In Channel	1.82	9.67	2497313.07	1993849.26	[3]
P-0382	Stock Water	In Channel	0.22	0.26	2560788.05	2025743.70	[3]
P-0384	Stock Water	In Channel	1.57	10.18	2512085.05	2005645.97	[3]
P-0404	Stock Water	In Channel	3.05	10.94	2664154.87	1681886.20	[3]
P-0405	Stock Water	In Channel	0.15	0.2	2658297.26	1677957.08	[3]
P-0406	Stock Water	In Channel	0.74	1.79	2658187.63	1679471.45	[3]
P-0407	Stock Water	Well	0.11	0.3	2667489.58	1678513.31	[3]
P-0408	Stock Water	Well	0.03	0.12	2667402.32	1678450.06	[3]
P-0410	Stock Water	In Channel	0.95	5.81	2559757.48	1942432.10	[3]
P-0411	Stock Water	Off Channel	0.83	5.53	2539955.11	1942174.91	[3]
P-0430	Industrial	Power Plant	9.1	37.61	2521956.86	2072274.62	[2]
P-0431	Industrial	Power Plant	3.83	31.67	2521967.04	2071284.04	[2]
P-0432	Industrial	Power Plant	15.34	36.25	2523389.48	2070371.40	[2]
P-0433	Industrial	Power Plant	14.37	33.96	2523433.60	2070182.56	[2]
P-0434	Industrial	Power Plant	11.3	22.24	2523464.63	2068953.34	[2]
P-0435	Industrial	Power Plant	11.06	30.47	2523471.10	2068886.51	[2]
P-0436	Industrial	Power Plant	46.18	118.19	2525310.01	2069480.78	[2]

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Table B-2: Surface Water Uses

Site Number	Primary Use	Impoundment Source	Impoundment Area (Ac)	Acre Feet	X coordinate	Y Coordinate	Data Source
P-0437	Industrial	Power Plant	59.04	499.71	2525601.75	2067941.50	[2]
P-0438	Industrial	Power Plant	15.92	34.48	2526208.92	2070130.01	[2]
P-0439	Industrial	Power Plant	3.62	22.08	2526297.83	2070634.98	[2]
P-0440	Industrial	Power Plant	130.51	1001.97	2526287.14	2070725.33	[2]
P-0441	Stock Water	Well	0.1	0.14	2509504.12	2074106.72	[3]
P-0442	Stock Water	Well	0.07	0.1	2498728.51	2078446.92	[3]
P-0443	Stock Water	In Channel	0.69	3.01	2490492.82	2077806.69	[3]
P-0446	Stock Water	In Channel	0.62	0.61	2477369.40	2063654.24	[3]
P-0447	Stock Water	Well	1.94	4.58	2579503.43	1777426.14	[3]
P-0448	Stock Water	In Channel	1.32	4.93	2593860.90	1777281.37	[3]
P-0449	Stock Water	In Channel	0.58	1.13	2610015.06	1778683.97	[3]
P-0450	Stock Water	In Channel	5.37	28.53	2612244.83	1779658.54	[3]
P-0451	Stock Water	In Channel	0.76	2.68	2623212.73	1779968.58	[3]
P-0452	Stock Water	In Channel	3.39	8	2646189.73	1779694.87	[3]
P-0453	Stock Water	In Channel	0.46	1.17	2639223.85	1775387.75	[3]
P-0454	Stock Water	In Channel	1.04	8.22	2651565.48	1775876.33	[3]
P-0455	Stock Water	In Channel	1.75	6.88	2595589.43	1775440.04	[3]
P-0456	Stock Water	In Channel	0.8	6.63	2634978.40	1768874.13	[3]
P-0457	Stock Water	In Channel	0.79	5.3	2652110.39	1770765.78	[3]
P-0458	Stock Water	Off Channel	0.08	0.1	2655646.36	1769737.84	[3]
P-0459	Stock Water	Well	0.09	0.11	2640990.06	1762267.14	[3]
P-0460	Stock Water	In Channel	0.89	2.98	2635834.90	1759800.63	[3]
P-0461	Stock Water	In Channel	3.46	17.03	2651802.03	1775827.62	[3]
P-0462	Stock Water	Well	0.15	0.2	2638671.88	1774917.86	[3]
P-0463	Stock Water	Well	0.08	0.1	2638655.42	1774960.24	[3]
P-0465	Stock Water	In Channel	17.1	57.22	2634433.14	1769331.28	[3]
P-0466	Stock Water	Well	0.28	0.62	2640920.44	1762326.96	[3]
P-0467	Stock Water	Well	0.61	0.48	2592827.54	1811722.92	[3]
P-0468	Stock Water	In Channel	37.68	103.85	2583469.87	1823327.46	[3]
P-0469	Stock Water	In Channel	1.06	3.56	2576060.81	1809111.44	[3]
P-0470	Stock Water	In Channel	23.89	98.78	2590129.20	1806898.60	[3]
P-0471	Stock Water	In Channel	2.83	8.37	2577769.85	1805693.13	[3]
P-0472	Stock Water	In Channel	32.71	115.89	2579642.21	1795141.57	[3]
P-0473	Stock Water	In Channel	2.47	8.75	2604614.20	1782454.27	[3]
P-0474	Stock Water	In Channel	0.79	2.35	2602560.04	1781470.95	[3]
P-0475	Stock Water	In Channel	0.86	6.09	2583797.63	1823010.68	[3]
P-0479	Stock Water	In Channel	2.83	2.79	2629188.68	1823525.36	[3]
P-0482	Stock Water	In Channel	1.2	5.2	2633658.54	1812410.66	[3]
P-0483	Stock Water	In Channel	1.16	2.52	2642055.87	1810771.13	[3]
P-0484	Stock Water	In Channel	0.81	2.87	2652573.87	1803820.10	[3]
P-0485	Stock Water	In Channel	3.81	16.48	2634076.87	1797241.99	[3]
P-0486	Stock Water	In Channel	2.43	11	2648323.75	1799679.44	[3]
P-0487	Stock Water	In Channel	2.48	10.25	2654457.47	1796909.60	[3]
P-0488	Stock Water	In Channel	6.94	35.5	2633799.86	1790234.67	[3]
P-0489	Stock Water	Well	0.65	2.8	2615365.06	1785899.54	[3]
P-0490	Stock Water	In Channel	0.96	5.68	2626733.05	1784621.15	[3]
P-0491	Stock Water	In Channel	16.56	68.44	2626560.32	1783698.77	[3]
P-0492	Stock Water	In Channel	2.1	10.76	2638131.09	1787864.44	[3]
P-0493	Stock Water	In Channel	3.03	8.36	2638082.81	1787492.14	[3]
P-0494	Stock Water	In Channel	6.97	21.95	2638429.67	1788189.19	[3]
P-0495	Stock Water	In Channel	46.91	221.62	2638662.00	1787860.26	[3]
P-0496	Stock Water	In Channel	24.44	52.92	2639564.13	1786096.60	[3]
P-0499	Stock Water	In Channel	1.81	4.98	2649819.06	1823106.25	[3]

Appendix B
Table B-2: Surface Water Uses

Site Number	Primary Use	Impoundment Source	Impoundment Area (Ac)	Acre Feet	X coordinate	Y Coordinate	Data Source
P-0500	Stock Water	In Channel	0.67	0.79	2638819.14	1822701.33	[3]
P-0501	Stock Water	In Channel	0.74	1.31	2638362.20	1825103.27	[3]
P-0502	Stock Water	Well	0.26	0.61	2637946.87	1825785.38	[3]
P-0503	Stock Water	In Channel	14.78	58.2	2665154.94	1825641.38	[3]
P-0504	Stock Water	In Channel	2.35	13.85	2592488.91	1912123.22	[3]
P-0505	Stock Water	In Channel	8.85	20.91	2644661.40	1904058.09	[3]
P-0506	Stock Water	In Channel	6.11	19.25	2640896.31	1910670.63	[3]
P-0507	Stock Water	In Channel	2.37	7.92	2649228.14	1908147.76	[3]
P-0508	Stock Water	In Channel	2.95	14.54	2587660.51	1915064.13	[3]
P-0509	Stock Water	In Channel	3.04	4.18	2575070.03	1919527.54	[3]
P-0510	Stock Water	In Channel	1.34	2.64	2663687.69	1918354.14	[3]
P-0511	Stock Water	In Channel	11.45	29.31	2573705.42	1918746.70	[3]
P-0512	Stock Water	In Channel	0.9	1.23	2649142.23	1908580.52	[3]
P-0513	Stock Water	In Channel	0.81	5.74	2608057.24	1753033.80	[3]
P-0514	Stock Water	In Channel	7.68	10.58	2607970.33	1752319.25	[3]
P-0515	Stock Water	In Channel	2.61	8.22	2631082.46	1747153.61	[3]
P-0516	Stock Water	In Channel	0.41	2.09	2595915.43	1721727.87	[3]
P-0517	Stock Water	In Channel	0.13	0.21	2584588.40	1713745.22	[3]
P-0518	Stock Water	In Channel	0.81	2.39	2639774.24	1715309.59	[3]
P-0519	Stock Water	In Channel	5.58	18.68	2579164.91	1726947.64	[3]
P-0520	Stock Water	In Channel	1.19	5.64	2643386.96	1749185.03	[3]
P-0521	Stock Water	In Channel	0.92	1.81	2638345.58	1751553.57	[3]
P-0522	Stock Water	In Channel	0.54	1.59	2579078.94	1751761.77	[3]
P-0523	Stock Water	In Channel	1.08	1.49	2612490.31	1747896.01	[3]
P-0524	Stock Water	In Channel	0.76	1.95	2631879.47	1746603.44	[3]
P-0525	Irrigation, Stock Water	In Channel	42.89	177.31	2646175.84	1747542.77	[1]
P-0526	Stock Water	In Channel	5.95	7.03	2644364.62	1739943.85	[3]
P-0527	Stock Water	In Channel	0.88	6.25	2644490.96	1740186.05	[3]
P-0528	Stock Water	Well	0.35	1.39	2631896.97	1739197.15	[3]
P-0529	Irrigation, Stock Water	In Channel	2.07	10.17	2627830.26	1741258.19	[1]
P-0530	Stock Water	In Channel	0.86	6.42	2622662.75	1737989.31	[3]
P-0531	Stock Water	In Channel	0.73	3.73	2617474.43	1742697.67	[3]
P-0532	Stock Water	In Channel	3.1	6.11	2615398.25	1741507.54	[3]
P-0533	Stock Water	In Channel	0.77	3.32	2609871.48	1736841.87	[3]
P-0534	Stock Water	In Channel	3.72	6.59	2584329.12	1732604.93	[3]
P-0535	Stock Water	In Channel	0.8	0.94	2597152.12	1732032.96	[3]
P-0536	Stock Water	In Channel	2.38	2.81	2609024.85	1731119.95	[3]
P-0537	Stock Water	In Channel	0.79	2.32	2600860.14	1729753.89	[3]
P-0538	Stock Water	In Channel	0.97	1.52	2625274.22	1733698.81	[3]
P-0539	Stock Water	In Channel	0.49	2.03	2623146.88	1729314.89	[3]
P-0540	Stock Water	In Channel	0.2	0.2	2640154.42	1733860.73	[3]
P-0541	Stock Water	In Channel	0.34	0.74	2639919.53	1733161.06	[3]
P-0542	Stock Water	In Channel	1.07	6.56	2650126.04	1735014.39	[3]
P-0543	Stock Water	Well	0.75	3.84	2656553.42	1724774.68	[3]
P-0544	Stock Water	In Channel	3.15	9.31	2595505.55	1723590.01	[3]
P-0545	Stock Water	In Channel	0.97	2.49	2587330.93	1725114.93	[3]
P-0546	Stock Water	In Channel	0.7	3.45	2576101.84	1721710.54	[3]
P-0547	Stock Water	In Channel	0.89	1.4	2652218.12	1712703.91	[3]
P-0548	Stock Water	In Channel	1.07	2.1	2626483.97	1711180.24	[3]
P-0549	Stock Water	In Channel	1.61	4.43	2628315.52	1713785.35	[3]
P-0550	Stock Water	In Channel	1.06	4.79	2617494.71	1714247.49	[3]
P-0551	Stock Water	In Channel	1.85	5.11	2616167.85	1712830.13	[3]
P-0552	Stock Water	In Channel	0.16	0.84	2611725.66	1714130.91	[3]

Appendix B
Table B-2: Surface Water Uses

Site Number	Primary Use	Impoundment Source	Impoundment Area (Ac)	Acre Feet	X coordinate	Y Coordinate	Data Source
P-0553	Irrigation, Stock Water	In Channel	0.86	2.36	2601239.8	1715057.82	[1]
P-0554	Stock Water	In Channel	1.06	4.18	2597727.52	1712550.84	[3]
P-0555	Stock Water	In Channel	1.84	14.46	2578256.02	1713270.73	[3]
P-0556	Stock Water	In Channel	1.12	3.32	2633327.46	1708531.19	[3]
P-0557	Stock Water	Well	3.88	21.37	2604852.18	1710146.77	[3]
P-0558	Stock Water	In Channel	1.53	14.48	2601199.51	1707683.11	[3]
P-0559	Irrigation, Stock Water	In Channel	2.13	8.4	2601531.14	1702770.52	[1]
P-0560	Stock Water	In Channel	1.24	4.89	2615138.36	1701828.87	[3]
P-0561	Stock Water	In Channel	5.44	20.34	2654762.78	1702386.77	[3]
P-0562	Stock Water	In Channel	4.47	10.56	2662174.88	1688708.87	[3]
P-0564	Stock Water	Well	0.16	1.07	2633510.03	1714833.98	[3]
P-0565	Stock Water	Well	0.22	0.42	2588176.97	1749112.20	[3]
P-0566	Stock Water	Well	0.15	0.27	2588013.51	1748746.52	[3]
P-0567	Stock Water	In Channel	8.51	31.82	2622717.53	1738245.28	[3]
P-0568	Stock Water	In Channel	2.13	4.19	2617152.48	1742180.08	[3]
P-0569	Stock Water	In Channel	7.98	6.12	2610491.24	1736616.93	[3]
P-0570	Stock Water	In Channel	4.76	15	2596980.81	1732287.75	[3]
P-0571	Stock Water	In Channel	1.02	2.8	2600897.67	1729508.58	[3]
P-0572	Stock Water	In Channel	0.41	0.05	2623054.49	1729303.97	[3]
P-0573	Stock Water	In Channel	1.09	8.15	2595408.62	1723938.14	[3]
P-0574	Stock Water	In Channel	3.53	10.43	2575449.23	1721572.46	[3]
P-0575	Stock Water	Well	0.28	0.38	2589929.92	1719628.67	[3]
P-0576	Stock Water	Well	0.62	0.73	2590092.77	1719493.80	[3]
P-0577	Stock Water	In Channel	0.17	0.23	2626790.83	1711800.27	[3]
P-0578	Stock Water	In Channel	3.53	9.03	2617654.58	1714136.48	[3]
P-0579	Stock Water	In Channel	0.13	0.43	2611688.61	1714120.23	[3]
P-0580	Irrigation, Stock Water	In Channel	0.17	0.16	2601247.4	1715028.08	[1]
P-0581	Stock Water	In Channel	0.6	2.73	2654635.11	1702388.52	[3]
P-0582	Stock Water	In Channel	0.9	2.3	2661771.70	1689068.34	[3]
P-0584	Stock Water	In Channel	1.61	3.81	2584845.05	1930617.21	[3]
P-0585	Stock Water	In Channel	0.83	2.29	2575690.94	1937401.68	[3]
P-0586	Stock Water	In Channel	0.57	1.69	2577403.93	1934552.59	[3]
P-0587	Stock Water	In Channel	3.45	8.82	2588243.32	1934333.89	[3]
P-0588	Stock Water	In Channel	2.33	7.79	2599373.90	1934259.51	[3]
P-0591	Stock Water	In Channel	1.8	4.95	2583494.67	1957776.72	[3]
P-0593	Stock Water	In Channel	0.8	1.73	2587783.53	1964581.74	[3]
P-0594	Stock Water	In Channel	5.97	11.75	2596410.12	1960788.41	[3]
P-0595	Stock Water	In Channel	0.98	3.85	2572908.74	1932224.29	[3]
P-0596	Stock Water	Well	0.07	0.06	2577565.64	1931929.00	[3]
P-0597	Stock Water	Well	0.02	0.03	2577355.79	1931973.84	[3]
P-0598	Stock Water	Well	0.07	0.07	2587179.69	1943803.11	[3]
P-0599	Stock Water	In Channel	0.37	2.16	2625372.47	1766046.70	[3]
P-0600	Stock Water	In Channel	1.91	4.52	2625457.70	1765738.38	[3]
P-0601	Stock Water	In Channel	0.86	3.04	2581499.90	1760384.00	[3]
P-0602	Stock Water	In Channel	2.21	2.61	2581393.32	1760306.00	[3]
P-0603	Stock Water	In Channel	1.38	10.03	2595381.36	1758458.30	[3]
P-0604	Stock Water	In Channel	23.8	93.69	2594870.14	1758376.21	[3]
P-0605	Stock Water	In Channel	0.66	3.12	2603722.02	1756673.62	[3]
P-0606	Stock Water	Well	0.1	0.21	2625220.52	1763432.02	[3]
P-0607	Stock Water	In Channel	3.89	14.56	2620657.92	1767196.27	[3]
P-0608	Stock Water	In Channel	1.22	4.79	2596559.21	1950614.54	[3]
P-0609	Stock Water	In Channel	0.59	1.96	2598285.69	1958831.26	[3]
P-0610	Stock Water	In Channel	0.97	3.06	2597947.46	1963203.30	[3]

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Table B-2: Surface Water Uses

Site Number	Primary Use	Impoundment Source	Impoundment Area (Ac)	Acre Feet	X coordinate	Y Coordinate	Data Source
P-0611	Stock Water	In Channel	0.75	1.62	2597451.50	1961607.91	[3]
P-0612	Stock Water	In Channel	6.37	20.05	2601293.00	1963092.99	[3]
P-0613	Stock Water	In Channel	0.56	1.33	2610324.78	1965625.81	[3]
P-0614	Stock Water	In Channel	0.27	0.32	2608093.31	1964276.02	[3]
P-0615	Stock Water	In Channel	0.44	1.82	2603768.68	1958254.62	[3]
P-0616	Stock Water	In Channel	1.05	3.73	2612152.25	1958258.65	[3]
P-0617	Stock Water	In Channel	4.8	14.16	2607020.60	1951591.82	[3]
P-0618	Stock Water	In Channel	0.22	0.96	2609068.35	1939164.66	[3]
P-0619	Stock Water	In Channel	0.85	4.37	2609927.14	1934696.42	[3]
P-0620	Stock Water	In Channel	1.27	2.75	2618462.68	1950974.42	[3]
P-0621	Stock Water	In Channel	7.18	28.26	2630324.32	1944852.20	[3]
P-0628	Stock Water	In Channel	17.58	48.46	2647387.00	1954918.33	[3]
P-0638	Sewer Settling	Sewer	0.47	2.4	2591121.64	1853045.75	[4]
P-0639	Sewer Settling	Sewer	0.96	3.2	2590995.75	1853272.27	[4]
P-0640	Stock Water	Well	0.11	0.15	2593129.30	1852731.96	[3]
P-0644	Stock Water	In Channel	0.31	0.24	2649833.67	1849080.95	[3]
P-0645	Sewer Settling	Sewer	0.3	0.59	2627360.78	1854007.15	[4]
P-0646	Stock Water	In Channel	6.89	14.92	2627607.73	1841200.86	[3]
P-0647	Irrigation, Stock Water	In Channel	0.84	1.32	2622150.33	1834922.89	[1]
P-0648	Sewer Settling	Sewer	1.89	2.24	2631573.61	1836983.70	[4]
P-0649	Sewer Settling	Sewer	0.55	2.06	2631418.85	1836787.29	[4]
P-0650	Sewer Settling	Sewer	0.43	1.19	2631233.83	1836657.32	[4]
P-0651	Stock Water	In Channel	0.8	0.63	2633687.81	1833425.90	[3]
P-0652	Stock Water	In Channel	1.16	2.73	2614845.19	1862127.45	[3]
P-0655	Stock Water	In Channel	1.33	6.55	2664411.26	1870162.22	[3]
P-0656	Stock Water	In Channel	0.43	0.26	2662613.61	1873056.46	[3]
P-0657	Stock Water	In Channel	2.39	5.18	2593581.87	1874105.76	[3]
P-0658	Stock Water	In Channel	2.32	6.86	2572741.26	1862641.90	[3]
P-0660	Stock Water	Off Channel	0.8	6.34	2571783.16	1855513.54	[3]
P-0661	Stock Water	In Channel	3.91	3	2577200.47	1850954.75	[3]
P-0662	Stock Water	In Channel	0.89	2.45	2618666.56	1847542.22	[3]
P-0663	Sewer Settling	Sewer	0.34	0.67	2627467.39	1854121.09	[4]
P-0664	Sewer Settling	Sewer	0.38	1.12	2627669.35	1853930.10	[4]
P-0665	Stock Water	In Channel	0.85	3.49	2627035.91	1841631.36	[3]
P-0668	Stock Water	In Channel	0.71	1.25	2586049.23	1841832.99	[3]
P-0669	Stock Water	In Channel	1.89	5.57	2572779.13	1843359.26	[3]
P-0670	Stock Water	In Channel	1.07	1.05	2587424.27	1837925.02	[3]
P-0671	Stock Water	In Channel	1.85	25.5	2583811.70	1830160.85	[3]
P-0672	Stock Water	In Channel	0.53	0.52	2618894.40	1831270.57	[3]
P-0673	Stock Water	In Channel	0.59	0.58	2632793.00	1833747.58	[3]
P-0674	Stock Water	In Channel	4.8	15.1	2571208.74	1828267.52	[3]
P-0675	Stock Water	Well	0.19	0.72	2584829.87	1874422.37	[3]
P-0676	Stock Water	Well	0.25	0.44	2577954.40	1854365.00	[3]
P-0677	Stock Water	Well	0.19	0.26	2650613.62	1849678.99	[3]
P-0678	Stock Water	Well	0.13	0.27	2630340.43	1835236.97	[3]
P-0679	Stock Water	Well	0.15	0.12	2577469.00	1834261.71	[3]
P-0680	Stock Water	In Channel	1.45	3.41	2648518.46	1831912.68	[3]
P-0681	Stock Water	In Channel	0.17	0.44	2648723.24	1832157.77	[3]
P-0683	Sewer Settling	Sewer	0.42	1.49	2631191.57	1836671.73	[4]
P-0684	Stock Water	In Channel	3.52	7.61	2591309.66	1974545.02	[3]
P-0685	Stock Water	In Channel	1.44	7.36	2583379.72	1989337.31	[3]
P-0687	Stock Water	In Channel	4.24	10.84	2595131.45	1991949.86	[3]
P-0688	Stock Water	In Channel	2.89	11.96	2595153.66	1995117.93	[3]

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Table B-2: Surface Water Uses

Site Number	Primary Use	Impoundment Source	Impoundment Area (Ac)	Acre Feet	X coordinate	Y Coordinate	Data Source
P-0689	Stock Water	In Channel	3.54	28.54	2589425.68	1980544.98	[3]
P-0690	Stock Water	In Channel	1.39	10.09	2577329.98	2002741.10	[3]
P-0691	Stock Water	In Channel	3.91	16.15	2577834.98	2002126.45	[3]
P-0692	Stock Water	In Channel	0.15	0.55	2594559.09	2001942.88	[3]
P-0695	Stock Water	In Channel	3.14	30.25	2572198.25	2008483.56	[3]
P-0700	Stock Water	In Channel	3.12	16.56	2590443.84	2000837.14	[3]
P-0736	Stock Water	In Channel	1.5	6.78	2601556.44	1976067.27	[3]
P-0737	Stock Water	In Channel	4.29	19.44	2600758.30	1985185.47	[3]
P-0750	Stock Water	In Channel	1.02	7.04	2600476.82	1972629.63	[3]
P-0751	Stock Water	In Channel	1.31	6.18	2601760.07	1979876.26	[3]
P-0752	Stock Water	In Channel	0.67	2.38	2601846.04	1980163.53	[3]
P-0809	Stock Water	In Channel, Well	1.13	1.99	2474468.97	2024666.50	[3]
P-0810	Stock Water	In Channel	12.03	28.43	2526194.44	1852861.34	[3]
P-0811	Stock Water	In Channel	3.42	7.41	2576817.49	1966092.71	[3]
P-0812	Stock Water	In Channel	2.12	4.59	2572991.31	1969181.64	[3]
P-0813	Stock Water	In Channel	4.28	34.51	2573979.04	1968888.43	[3]
P-0827	Stock Water	In Channel	2.13	7.56	2524833.59	1780380.96	[3]
P-0828	Stock Water	In Channel	0.95	4.5	2647244.36	1684581.02	[3]
P-0872	Stock Water	In Channel	0.73	9.26	2706607.59	1903875.45	[3]
P-0873	Stock Water	In Channel	8.98	38.88	2706944.52	1903618.77	[3]
P-0874	Stock Water	In Channel	1.16	2.5	2745294.76	1904339.27	[3]
P-0875	Stock Water	In Channel	1.8	4.97	2728498.95	1900396.35	[3]
P-0876	Stock Water	In Channel	13.22	140.57	2715088.03	1895589.62	[3]
P-0877	Stock Water	In Channel	8.52	75.5	2718398.72	1898365.10	[3]
P-0878	Stock Water	In Channel	1.05	2.07	2725910.32	1888399.27	[3]
P-0879	Stock Water	In Channel	4.51	12.44	2707278.34	1912799.21	[3]
P-0880	Stock Water	In Channel	2.6	7.16	2709889.18	1917180.56	[3]
P-0881	Stock Water	Off Channel	1.55	13.09	2689257.97	1934775.98	[3]
P-0882	Stock Water	In Channel	1.51	4.47	2697120.16	1940506.69	[3]
P-0883	Stock Water	In Channel	0.15	0.32	2698876.40	1936224.31	[3]
P-0884	Stock Water	In Channel	0.24	0.52	2746776.53	1904260.53	[3]
P-0885	Stock Water	In Channel	0.45	1.33	2729008.42	1901732.86	[3]
P-0886	Stock Water	In Channel	1.54	12.74	2668938.63	1915111.77	[3]
P-0887	Stock Water	In Channel	18.77	59.13	2690534.26	1921233.05	[3]
P-0888	Stock Water	In Channel	3.36	8.61	2684626.07	1929743.74	[3]
P-0890	Stock Water	In Channel	1.07	2.74	2747596.65	1911568.69	[3]
P-0891	Stock Water	In Channel	1.18	8.4	2741514.77	1905276.33	[3]
P-0892	Stock Water	In Channel	0.94	3.69	2712721.04	1886501.71	[3]
P-0893	Stock Water	In Channel	6.94	23.22	2712582.29	1886686.99	[3]
P-0894	Stock Water	In Channel	2.42	6.2	2711844.10	1886824.63	[3]
P-0895	Stock Water	In Channel	2.43	10.99	2730887.98	1912697.55	[3]
P-0896	Stock Water	In Channel	3.08	20.6	2737528.50	1916060.19	[3]
P-0907	Stock Water	In Channel	1.22	2.63	2740026.43	1771344.96	[3]
P-0908	Stock Water	In Channel	5.79	17.09	2739795.78	1767430.07	[3]
P-0909	Stock Water	In Channel	1.25	3.7	2745516.50	1761958.96	[3]
P-0910	Stock Water	In Channel	7.71	21.26	2754487.87	1747117.37	[3]
P-0911	Stock Water	Well	0.07	0.08	2727820.68	1809585.13	[3]
P-0912	Stock Water	Well	0.06	0.11	2745811.45	1777356.49	[3]
P-0913	Stock Water	Well	0.08	0.08	2745893.85	1777411.74	[3]
P-0914	Stock Water	In Channel	0.66	1.95	2753794.89	1762382.31	[3]
P-0915	Stock Water	In Channel	14.13	33.38	2753017.65	1763291.15	[3]
P-0916	Stock Water	Well	0.09	0.36	2746930.38	1749986.78	[3]
P-0917	Stock Water	In Channel	0.68	1.6	2709850.07	1876309.40	[3]

Appendix B

Table B-2: Surface Water Uses

Site Number	Primary Use	Impoundment Source	Impoundment Area (Ac)	Acre Feet	X coordinate	Y Coordinate	Data Source
P-0918	Stock Water	In Channel	0.88	1.91	2679296.42	1831586.74	[3]
P-0921	Stock Water	In Channel	10.6	37.55	2665992.90	1879754.76	[3]
P-0922	Stock Water	In Channel	3.09	5.47	2667731.64	1875259.54	[3]
P-0923	Stock Water	In Channel	1.07	8.04	2667593.40	1875004.94	[3]
P-0924	Stock Water	In Channel	7.13	18.25	2699524.87	1866339.98	[3]
P-0925	Stock Water	In Channel	0.46	0.31	2694988.67	1864390.55	[3]
P-0926	Stock Water	In Channel	0.71	3.07	2695032.42	1864341.55	[3]
P-0927	Stock Water	In Channel	0.53	2.19	2689157.03	1856161.12	[3]
P-0928	Stock Water	In Channel	0.4	0.31	2729594.53	1851131.40	[3]
P-0929	Stock Water	In Channel	3.51	6.21	2721752.99	1847672.48	[3]
P-0930	Stock Water	In Channel	0.21	0.51	2712812.52	1851834.43	[3]
P-0931	Stock Water	In Channel	0.47	2.97	2715776.18	1848162.95	[3]
P-0932	Stock Water	In Channel	0.2	0.44	2715722.70	1848445.95	[3]
P-0933	Stock Water	In Channel	1.95	6.53	2741603.92	1844895.15	[3]
P-0934	Stock Water	In Channel	0.4	0.63	2748667.87	1835519.95	[3]
P-0935	Stock Water	In Channel	2.94	10.43	2738018.32	1836475.42	[3]
P-0938	Stock Water	In Channel	0.38	0.29	2713467.67	1837350.63	[3]
P-0939	Stock Water	In Channel	0.65	1.91	2713543.98	1837619.71	[3]
P-0940	Stock Water	In Channel	1.04	0.82	2677461.12	1828462.63	[3]
P-0941	Stock Water	In Channel	0.58	1.02	2735591.92	1828552.03	[3]
P-0942	Stock Water	In Channel	0.75	2.2	2733348.22	1827927.82	[3]
P-0943	Stock Water	In Channel	17.73	101.22	2745760.86	1832374.59	[3]
P-0944	Stock Water	In Channel	1.54	6.06	2745767.57	1822345.93	[3]
P-0945	Stock Water	In Channel	0.64	0.75	2725994.00	1822617.11	[3]
P-0946	Stock Water	In Channel	0.38	1.56	2681590.67	1822688.65	[3]
P-0947	Stock Water	In Channel	0.38	0.59	2681413.73	1822418.19	[3]
P-0950	Stock Water	Well	0.03	0.06	2721590.32	1841159.69	[3]
P-0952	Stock Water	Well	0.12	0.31	2734301.96	1828761.55	[3]
P-0953	Stock Water	Well	0.07	0.29	2734289.24	1829202.13	[3]
P-0954	Stock Water	Well	0.07	0.16	2725112.66	1821385.32	[3]
P-0955	Stock Water	In Channel	1.1	4.1	2669491.51	1824321.80	[3]
P-0958	Stock Water	In Channel	0.16	0.88	2687638.60	1681289.73	[3]
P-0959	Stock Water	In Channel	1.76	1.21	2742230.47	1733961.40	[3]
P-0960	Stock Water	In Channel	1.06	2.92	2676190.07	1683228.66	[3]
P-0961	Stock Water	In Channel	1.45	1.71	2676334.09	1676595.29	[3]
P-0962	Stock Water	In Channel	2.07	4.07	2686489.41	1676795.46	[3]
P-0963	Stock Water	In Channel	1.49	1.17	2688423.48	1682196.75	[3]
P-0964	Stock Water	In Channel	0.72	0.71	2678226.11	1677593.04	[3]
P-0965	Stock Water	Well	0.11	0.42	2695997.38	1684571.83	[3]
P-0966	Stock Water	Well	0.14	0.59	2695850.35	1684597.87	[3]
P-0967	Stock Water	In Channel	6.44	20.29	2672698.51	1700599.58	[3]
P-0968	Stock Water	In Channel	1.08	2.35	2688501.79	1682441.16	[3]
P-0969	Stock Water	In Channel	0.58	0.46	2688703.96	1682317.46	[3]
P-0980	Stock Water	In Channel	7.64	27.09	2770087.88	1838067.02	[3]
P-0982	Stock Water	In Channel	0.85	1	2761575.73	1825320.14	[3]
P-0983	Stock Water	In Channel	0.5	0.39	2762453.10	1824506.40	[3]
P-0984	Stock Water	In Channel	1.43	6.49	2758743.40	1819645.25	[3]
P-0985	Stock Water	In Channel	7.06	15.29	2776727.89	1815126.88	[3]
P-0986	Stock Water	In Channel	87.96	294.35	2772643.68	1813151.83	[3]
P-0987	Stock Water	In Channel	1.43	4.5	2754779.84	1819607.29	[3]
P-0988	Stock Water	In Channel, Well	74.69	529.26	2791554.48	1803881.33	[3]
P-0989	Stock Water	Off Channel	0.23	0.54	2794847.68	1795258.93	[3]
P-0990	Stock Water	In Channel	4.79	15.08	2796791.11	1792158.27	[3]

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Table B-2: Surface Water Uses

Site Number	Primary Use	Impoundment Source	Impoundment Area (Ac)	Acre Feet	X coordinate	Y Coordinate	Data Source
P-0991	Stock Water	In Channel	5.8	11.42	2826988.43	1857001.99	[3]
P-0992	Stock Water	In Channel	35.07	117.35	2825806.99	1849493.74	[3]
P-0993	Stock Water	In Channel	12.03	33.16	2821765.87	1846446.38	[3]
P-0994	Stock Water	In Channel	4.21	4.23	2823946.71	1850665.58	[3]
P-0995	Stock Water	In Channel	0.66	0.78	2823438.31	1851270.16	[3]
P-0996	Stock Water	In Channel	1.04	2.04	2810061.01	1841873.02	[3]
P-0997	Stock Water	In Channel	2.44	9.12	2833217.51	1796305.45	[3]
P-1000	Stock Water	In Channel	0.2	0.32	2829260.56	1863670.75	[3]
P-1001	Stock Water	In Channel	0.23	0.72	2761160.64	1883678.80	[3]
P-1002	Stock Water	In Channel	0.44	0.27	2760577.62	1884154.73	[3]
P-1003	Stock Water	In Channel	1.09	2.78	2770020.60	1892074.47	[3]
P-1004	Stock Water	In Channel	0.93	2.93	2760690.75	1906278.74	[3]
P-1005	Stock Water	In Channel	0.99	4.46	2758903.66	1904907.04	[3]
P-1006	Stock Water	In Channel	1.1	4.97	2751417.93	1899067.98	[3]
P-1007	Stock Water	Well	0.2	0.4	2769478.36	1893181.38	[3]
P-1008	Stock Water	Off Channel	1.09	6.01	2760587.62	1892810.60	[3]
P-1009	Stock Water	In Channel	0.42	1.25	2774924.92	1891499.56	[3]
P-1010	Stock Water	In Channel	2.38	3.27	2810005.54	1881163.31	[3]
P-1011	Stock Water	In Channel	4.45	7	2814015.66	1882149.49	[3]
P-1012	Stock Water	In Channel	13.68	88.84	2761842.76	1874844.11	[3]
P-1013	Stock Water	In Channel	1.22	3.36	2804765.02	1870551.85	[3]
P-1018	Stock Water	In Channel	0.26	0.57	2750205.09	1899661.54	[3]
P-1019	Stock Water	In Channel	0.23	0.32	2796295.28	1873512.64	[3]
P-1021	Stock Water	In Channel	0.14	0.52	2804592.08	1870395.90	[3]
P-1022	Stock Water	In Channel	0.44	2.35	2757177.27	1772022.19	[3]
P-1023	Stock Water	Well	0.15	0.15	2770513.97	1760863.68	[3]
P-1024	Stock Water	In Channel	0.77	1.81	2765303.31	1761316.07	[3]
P-1025	Stock Water	In Channel	0.99	2.33	2803176.07	1785498.61	[3]
P-1026	Stock Water	In Channel	0.31	0.67	2826328.66	1785349.24	[3]
P-1027	Stock Water	In Channel	2.79	3.85	2812797.52	1780085.89	[3]
P-1028	Stock Water	In Channel	0.15	0.3	2804493.80	1778685.54	[3]
P-1029	Stock Water	Well	0.28	0.55	2760014.57	1774479.73	[3]
P-1030	Stock Water	In Channel	1.22	4.07	2757352.08	1772133.83	[3]
P-1031	Stock Water	In Channel	23.45	87.72	2759711.19	1759260.65	[3]
P-1032	Stock Water	In Channel	4.93	18.45	2781808.46	1753307.01	[3]
P-1033	Stock Water	In Channel	1.8	1.77	2777358.50	1752568.13	[3]
P-1034	Stock Water	In Channel	0.51	3.03	2777325.99	1752586.36	[3]
P-1035	Stock Water	In Channel	0.94	1.11	2826066.11	1833956.47	[3]
P-1036	Stock Water	In Channel	1.23	2.65	2840670.34	1856629.02	[3]
P-1037	Stock Water	In Channel	1.43	5.33	2823922.78	1837608.49	[3]
P-1038	Stock Water	In Channel	0.47	1.66	2854600.52	1842782.34	[3]
P-1040	Stock Water	In Channel	1.88	5.56	2858072.45	1845954.17	[3]
P-1042	Stock Water	In Channel	1.71	8.43	2849725.37	1838583.13	[3]
P-1043	Stock Water	In Channel	0.93	4.42	2853517.34	1836730.00	[3]
P-1044	Stock Water	In Channel	1.85	2.92	2854686.52	1833472.90	[3]
P-1045	Stock Water	In Channel	2.77	9.8	2846055.22	1836712.86	[3]
P-1046	Stock Water	In Channel	0.8	0.79	2845582.25	1826892.74	[3]
P-1047	Stock Water	In Channel	2.04	3.62	2714335.43	1883932.93	[3]
P-1048	Stock Water	In Channel	2.59	19.85	2831794.72	1859076.60	[3]
P-1049	Stock Water	In Channel	1.87	4.42	2804252.79	1858557.46	[3]
P-1050	Stock Water	In Channel	0.98	1.16	2845309.15	1808038.87	[3]
P-1055	Stock Water	In Channel	1.21	1.91	2794134.54	1787458.18	[3]
P-1056	Stock Water	In Channel	0.34	0.47	2794297.68	1787407.30	[3]

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Table B-2: Surface Water Uses

Site Number	Primary Use	Impoundment Source	Impoundment Area (Ac)	Acre Feet	X coordinate	Y Coordinate	Data Source
P-1058	Stock Water	In Channel	1.17	1.38	2821550.78	1787343.58	[3]
P-1060	Stock Water	In Channel	25.97	158.45	2543390.35	1924161.23	[3]
P-1061	Stock Water	In Channel	2.18	8.99	2560487.84	1925290.34	[3]
P-1063	Stock Water	In Channel	2.38	9.37	2574303.08	1824173.67	[3]
P-1087	Irrigation, Stock Water	In Channel	14.78	135.30	2379666.76	1940420.73	[1]
P-1127	Stock Water	In Channel	0.29	0.41	2442305.46	1819669.01	[3]
P-1128	Irrigation, Stock Water	In Channel, Spring	0.48	1.15	2450885.85	1808716.10	[1]
P-1129	Stock Water	In Channel, Spring	2.71	14.69	2452612.37	1808399.75	[3]
P-1130	Irrigation, Stock Water	In Channel	0.19	1.25	2462008.84	1844898.67	[1]
P-1131	Stock Water	In Channel	0.73	1.14	2465011.72	1835095.01	[3]
P-1132	Stock Water	In Channel	0.83	1.66	2413895.93	1780617.50	[3]
P-1133	Stock Water	In Channel	8.72	24.88	2413040.47	1780375.94	[3]
P-1134	Stock Water	In Channel	2.53	14.58	2412434.59	1780193.71	[3]
P-1135	Stock Water	In Channel	4.9	12.63	2410183.63	1777576.68	[3]
P-1136	Stock Water	In Channel	0.45	0.53	2457495.30	1796608.48	[3]
P-1137	Stock Water	In Channel	1.66	5.31	2457813.84	1797008.23	[3]
P-1138	Stock Water	In Channel	1.4	7.39	2471276.60	1791783.28	[3]
P-1139	Stock Water	In Channel	1.21	2.27	2477870.78	1820974.78	[3]
P-1140	Stock Water	In Channel	1.04	3.24	2478447.13	1819671.64	[3]
P-1141	Stock Water	In Channel	1.18	6.65	2457946.00	1823054.78	[3]
P-1142	Stock Water	In Channel	0.45	1.49	2476964.53	1816660.16	[3]
P-1143	Stock Water	Well	0.06	0.08	2483161.15	1824025.45	[3]
P-1144	Stock Water	In Channel	1.62	5.91	2456198.05	1827382.27	[3]
P-1146	Stock Water	In Channel	0.23	0.3	2469186.32	1827470.32	[3]
P-1149	Sewer Settling	Sewer	3.57	26.44	2473639.41	1846241.51	[4]
P-1150	Sewer Settling	Sewer	3.48	25.75	2474071.99	1846347.05	[4]
P-1151	Stock Water	In Channel	0.88	3.5	2469655.83	1844438.74	[3]
P-1152	Irrigation, Stock Water	In Channel	1.01	3.06	2469508.1	1845747.69	[1]
P-1153	Stock Water	In Channel	1.68	10.34	2456571.39	1848889.12	[3]
P-1154	Stock Water	In Channel	0.96	1.97	2449865.19	1849901.13	[3]
P-1155	Stock Water	In Channel	2.01	5.45	2452459.01	1853157.20	[3]
P-1156	Stock Water	In Channel	2.35	4.07	2464625.30	1854363.00	[3]
P-1157	Stock Water	In Channel	1.4	5.97	2465709.73	1797072.50	[3]
P-1158	Irrigation, Stock Water	In Channel	1.71	5.81	2433896.84	1707286.09	[1]
P-1159	Irrigation, Stock Water	In Channel	20.88	81.38	2438218.14	1709176.70	[1]
P-1160	Stock Water	Well	0.1	0.14	2477674.58	1795936.39	[3]
P-1161	Stock Water	In Channel	9.5	16.65	2470770.11	1776058.93	[3]
P-1162	Irrigation, Stock Water, Recretation	In Channel	101.16	1200.00*	2456614.71	1764524.14	[1]
P-1163	Sewer Settling	Sewer	1.25	7.27	2454310.23	1763817.20	[4]
P-1164	Sewer Settling	Sewer	1.83	5.21	2453787.08	1763961.72	[4]
P-1165	Sewer Settling	Sewer	2.28	4.44	2453999.91	1763641.02	[4]
P-1166	Sewer Settling	Sewer	4.92	17.44	2451172.51	1763338.84	[4]
P-1167	Sewer Settling	Sewer	6.59	28.28	2451089.59	1762984.37	[4]
P-1168	Sewer Settling	Sewer	4.22	15.37	2450187.37	1763209.31	[4]
P-1169	Stock Water	In Channel	0.38	1.21	2450528.49	1760326.73	[3]
P-1170	Stock Water	Well	0.13	0.32	2442452.97	1756462.11	[3]
P-1171	Stock Water	Off Channel	0.87	1.5	2477305.50	1767715.77	[3]
P-1172	Stock Water	Well	0.34	1	2475557.90	1764163.90	[3]
P-1173	Stock Water	Well	0.11	0.17	2475572.73	1764243.44	[3]
P-1174	Stock Water	In Channel	33.37	36.13	2478349.45	1754071.12	[3]

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Table B-2: Surface Water Uses

Site Number	Primary Use	Impoundment Source	Impoundment Area (Ac)	Acre Feet	X coordinate	Y Coordinate	Data Source
P-1175	Stock Water	In Channel	0.63	2.76	2478431.75	1753871.44	[3]
P-1176	Stock Water	Well	0.07	0.12	2456988.84	1751921.58	[3]
P-1177	Irrigation, Stock Water	Well Chuska	1.93	11.68	2468040.53	1737751.94	[1]
P-1178	Stock Water	In Channel	5.22	22.62	2460464.06	1742696.48	[3]
P-1179	Stock Water	In Channel	0.53	2.01	2460459.23	1742214.69	[3]
P-1180	Stock Water	In Channel	1.34	2.72	2462453.04	1740650.92	[3]
P-1181	Stock Water	In Channel	1.9	6.74	2460609.18	1732337.92	[3]
P-1182	Stock Water	Well	2.18	1.89	2459109.38	1734298.55	[3]
P-1183	Stock Water	In Channel	2.48	4.25	2463747.36	1733718.08	[3]
P-1184	Stock Water	Off Channel	0.39	0.54	2475021.79	1733736.44	[3]
P-1185	Stock Water	In Channel	0.5	2.97	2480794.83	1738636.67	[3]
P-1186	Stock Water	In Channel	2.77	5.84	2481035.17	1738355.80	[3]
P-1187	Stock Water	In Channel	0.28	0.94	2445532.46	1723411.20	[3]
P-1188	Stock Water	In Channel	4.18	15.04	2445476.81	1723875.05	[3]
P-1190	Stock Water	In Channel	1.24	4.39	2459314.10	1722014.19	[3]
P-1191	Stock Water	In Channel	0.64	4.13	2464833.52	1723734.16	[3]
P-1192	Stock Water	In Channel	3.81	13.19	2464145.07	1722784.61	[3]
P-1193	Stock Water	Well	0.12	0.09	2453240.97	1718358.25	[3]
P-1194	Sewer Settling	Sewer	4.01	9.8	2447373.71	1717352.19	[4]
P-1195	Sewer Settling	Sewer	3.8	10.48	2448054.96	1716746.79	[4]
P-1196	Stock Water	Well	0.83	3.16	2434751.31	1715040.24	[3]
P-1197	Stock Water	In Channel	2.03	14.52	2438826.35	1714552.82	[3]
P-1198	Stock Water	In Channel	2.81	9.85	2440763.88	1716708.92	[3]
P-1199	Stock Water	In Channel	2.95	11.23	2436528.53	1722097.82	[3]
P-1200	Irrigation, Stock Water	In Channel, Well	5.16	27.62	2452656.34	1707423.78	[1]
P-1201	Stock Water	In Channel	1.88	3.73	2397355.69	1738070.64	[3]
P-1202	Stock Water	In Channel	2.22	8.34	2420448.09	1741148.25	[3]
P-1203	Stock Water	In Channel	2.99	18.98	2414587.35	1748719.03	[3]
P-1204	Stock Water	In Channel	0.21	0.49	2421463.01	1747362.84	[3]
P-1207	Stock Water	In Channel	0.14	0.32	2423323.58	1746424.85	[3]
P-1208	Stock Water	Well	0.93	3.01	2427318.23	1743420.87	[3]
P-1209	Stock Water	In Channel	0.62	2.98	2429705.73	1743213.05	[3]
P-1210	Sewer Settling	Sewer	1.93	8.3	2429847.92	1742596.53	[4]
P-1211	Sewer Settling	Sewer	1.35	4.38	2429751.21	1742857.83	[4]
P-1212	Irrigation, Stock Water	In Channel	1.08	2.72	2417531.29	1751894.43	[1]
P-1213	Stock Water	In Channel	2.04	6.72	2426847.63	1751968.26	[3]
P-1214	Stock Water	In Channel	2	9.16	2420317.18	1755124.02	[3]
P-1215	Stock Water	In Channel	1.59	6.12	2431039.27	1763665.97	[3]
P-1217	Stock Water	In Channel	11.9	67.24	2439289.69	1753736.63	[3]
P-1218	Stock Water	In Channel	1.62	6.8	2412731.80	1731414.93	[3]
P-1219	Stock Water	In Channel	4.81	21.98	2422710.56	1728857.02	[3]
P-1220	Stock Water	In Channel	1.67	4.38	2414581.20	1726355.50	[3]
P-1221	Stock Water	In Channel	1.2	3	2397849.37	1748069.65	[3]
P-1222	Stock Water	In Channel	2.01	6.44	2427895.58	1750200.09	[3]
P-1223	Sewer Settling	Sewer	0.18	0.52	2434521.62	1731566.15	[4]
P-1224	Sewer Settling	Sewer	0.21	0.62	2434541.76	1731361.94	[4]
P-1225	Stock Water	In Channel	0.58	1.13	2436162.70	1731328.27	[3]
P-1226	Stock Water	In Channel	0.22	0.19	2436827.26	1731530.24	[3]
P-1227	Stock Water	In Channel	0.25	0.38	2436341.92	1729887.28	[3]
P-1228	Stock Water	In Channel	0.37	0.45	2436643.73	1729902.36	[3]
P-1229	Stock Water	In Channel	0.25	0.48	2436978.05	1730481.77	[3]
P-1230	Stock Water	In Channel	0.35	0.62	2437434.23	1730227.08	[3]
P-1231	Stock Water	In Channel	0.49	0.91	2437991.49	1730488.76	[3]

Appendix B

Table B-2: Surface Water Uses

Site Number	Primary Use	Impoundment Source	Impoundment Area (Ac)	Acre Feet	X coordinate	Y Coordinate	Data Source
P-1232	Irrigation, Stock Water	In Channel	6.75	18.46	2434950.8	1746451.45	[1]
P-1233	Stock Water	In Channel	0.05	0.22	2439395.76	1743908.55	[3]
P-1234	Stock Water	In Channel	1.1	2.27	2440460.45	1744730.60	[3]
P-1235	Stock Water	In Channel	1.36	4.53	2408692.00	1773581.66	[3]
P-1236	Stock Water	In Channel	1.24	4.07	2409918.96	1776359.34	[3]
P-1237	Stock Water	In Channel	0.5	0.67	2410087.89	1785029.75	[3]
P-1247	Stock Water	In Channel	1.04	3.26	2417477.39	1865445.66	[3]
P-1249	Stock Water	In Channel	7.83	48.57	2403940.53	1865260.35	[3]
P-1250	Irrigation, Stock Water	In Channel	1.19	6.41	2421467.72	1895432.34	[1]
P-1251	Stock Water	In Channel	7.33	35.34	2396196.45	1900667.09	[3]
P-1252	Stock Water	In Channel	2.18	16.23	2418414.69	1902034.75	[3]
P-1255	Irrigation, Stock Water	Off Channel	0.41	0.71	2414794.41	1907449.05	[1]
P-1256	Irrigation, Stock Water	Off Channel	0.38	1.03	2416202.3	1907530.40	[1]
P-1257	Irrigation, Stock Water	Off Channel	0.93	1.39	2416898.19	1907523.53	[1]
P-1258	Irrigation, Stock Water	In Channel	0.89	1.96	2418662.11	1908728.39	[1]
P-1259	Sewer Settling	Sewer	1.71	4.5	2412009.37	1909470.35	[4]
P-1262	Stock Water	In Channel	0.6	1.52	2433898.28	1858290.60	[3]
P-1263	Irrigation, Stock Water	In Channel	1.19	4.44	2442672.49	1855607.95	[1]
P-1264	Stock Water	In Channel	2.41	18.24	2443848.28	1857315.69	[3]
P-1265	Stock Water	In Channel	0.89	4.49	2444222.24	1854689.79	[3]
P-1266	Stock Water	In Channel	0.74	2.01	2453676.55	1858593.08	[3]
P-1267	Stock Water	In Channel	5.05	15	2444393.80	1864972.69	[3]
P-1268	Stock Water	In Channel	0.85	3.22	2453052.39	1867802.18	[3]
P-1269	Sewer Settling	Sewer	1.51	5.32	2467727.75	1875201.90	[4]
P-1270	Sewer Settling	Sewer	1.44	5.07	2467545.73	1875768.95	[4]
P-1271	Sewer Settling	Sewer	3.94	13.88	2468038.25	1875928.82	[4]
P-1273	Stock Water	In Channel	0.54	1.31	2450941.92	1886494.45	[3]
P-1275	Stock Water	In Channel	2.38	5.3	2469942.70	1889069.68	[3]
P-1277	Stock Water	In Channel	3.31	16.99	2463178.79	1897197.49	[3]
P-1278	Stock Water	In Channel	1.32	0.81	2468916.40	1899812.97	[3]
P-1280	Stock Water	Off Channel	0.39	1.29	2453971.59	1907270.35	[3]
P-1281	Stock Water	In Channel	24.94	66.27	2468513.82	1908360.77	[3]
P-1282	Irrigation, Stock Water	In Channel	1.85	7.66	2426121.45	1916160.76	[1]
P-1283	Irrigation, Stock Water	In Channel	5.51	22.55	2426860.28	1916696.24	[1]
P-1284	Irrigation, Stock Water	Off Channel	1.14	4.01	2415601.33	1910005.60	[1]
P-1285	Irrigation, Stock Water	Off Channel	0.61	1.55	2416149.36	1909417.45	[1]
P-1286	Sewer Settling	Sewer	0.25	0.83	2411417.57	1909157.00	[4]
P-1287	Sewer Settling	Sewer	0.1	0.3	2411550.46	1909234.82	[4]
P-1288	Sewer Settling	Sewer	0.45	1.11	2411371.57	1909047.87	[4]
P-1289	Stock Water	In Channel	2.24	6.97	2415777.43	1916089.57	[3]
P-1292	Stock Water	In Channel	1.61	5.52	2419750.83	1922163.14	[3]
P-1293	Stock Water	In Channel	2.02	7.57	2416255.26	1924670.12	[3]
P-1294	Stock Water	In Channel	3.61	8.68	2417737.14	1924001.03	[3]
P-1296	Irrigation, Stock Water	In Channel	1.06	4.08	2420522.43	1926293.18	[1]
P-1297	Stock Water	In Channel	1.1	5.86	2423143.88	1930617.92	[3]
P-1300	Sewer Settling	Sewer	1.86	2.85	2423117.73	1977403.74	[4]
P-1301	Sewer Settling	Sewer	0.8	1.23	2422856.66	1977904.93	[4]
P-1302	Sewer Settling	Sewer	2.43	1.77	2423266.54	1978130.67	[4]
P-1303	Sewer Settling	Sewer	2.91	4.24	2420229.98	1975486.91	[4]
P-1304	Sewer Settling	Sewer	2.98	10.19	2419696.88	1974884.72	[4]
P-1305	Sewer Settling	Sewer	1.86	6.36	2419352.47	1975282.52	[4]
P-1307	Irrigation, Stock Water	Diversion	1.11	3.04	2413425.66	1977282.35	[1]
P-1308	Irrigation, Stock Water	Diversion	1	2.68	2413372.26	1977305.51	[1]

Appendix B

Table B-2: Surface Water Uses

Site Number	Primary Use	Impoundment Source	Impoundment Area (Ac)	Acre Feet	X coordinate	Y Coordinate	Data Source
P-1309	Stock Water	In Channel	2.68	1.69	2417078.52	1978988.60	[3]
P-1310	Stock Water	In Channel	0.71	2.89	2402099.00	1977307.94	[3]
P-1311	Irrigation, Stock Water	In Channel	0.88	3.96	2392497.12	1975318.94	[1]
P-1312	Irrigation, Stock Water	Well	0.85	4.4	2393645.67	1976909.22	[1]
P-1313	Stock Water	In Channel	2.21	6.79	2408221.96	2001810.59	[3]
P-1314	Stock Water	In Channel	3.61	14.55	2407781.10	2014367.63	[3]
P-1315	Stock Water	Well	0.16	0.36	2416664.47	2017157.46	[3]
P-1316	Stock Water	In Channel	0.28	0.73	2420662.88	2018467.54	[3]
P-1325	Stock Water	In Channel	8.93	11.96	2441753.13	2046889.29	[3]
P-1328	Stock Water	In Channel	5.25	4.13	2450387.57	2045527.51	[3]
P-1329	Stock Water	In Channel	1.14	0.99	2456908.09	2048321.98	[3]
P-1330	Industrial	Off Channel	5.57	8.89	2469513.70	2039133.67	[2]
P-1331	Stock Water	In Channel	0.16	0.23	2467788.94	2037836.48	[3]
P-1332	Stock Water	In Channel	1.41	2.71	2453034.56	2035586.93	[3]
P-1333	Stock Water	In Channel	57.57	452.18	2448988.71	2033878.51	[3]
P-1334	Stock Water	In Channel	0.84	2.31	2468623.60	2014546.08	[3]
P-1335	Stock Water	In Channel	2.24	6.84	2472926.73	2012093.02	[3]
P-1336	Stock Water	In Channel	1.41	2.14	2473176.64	2010941.61	[3]
P-1337	Stock Water	In Channel	0.31	0.68	2465674.08	2006001.78	[3]
P-1338	Stock Water	In Channel	1.74	1.91	2472865.25	2005216.14	[3]
P-1339	Stock Water	Well	0.16	0.17	2414827.26	2007198.28	[3]
P-1340	Stock Water	In Channel	0.33	1.02	2420384.01	2007291.37	[3]
P-1341	Stock Water	In Channel	1.08	4.37	2431037.64	2013403.55	[3]
P-1342	Stock Water	In Channel	5.96	23.72	2436862.37	2009424.49	[3]
P-1343	Stock Water	Well	0.23	0.16	2432426.73	2012062.50	[3]
P-1344	Stock Water	In Channel	0.21	0.26	2437338.04	2025991.84	[3]
P-1345	Stock Water	In Channel	5.93	7.35	2470941.79	2003733.10	[3]
P-1346	Stock Water	In Channel	1.43	2.06	2466207.48	1998633.15	[3]
P-1347	Irrigation, Stock Water	Well Sanostee	0.91	1.79	2442790.55	1999778.67	[1]
P-1348	Stock Water	Well	0.29	0.46	2436155.62	1984546.18	[3]
P-1349	Irrigation, Stock Water	Well Sanostee	0.22	0.45	2436139.71	1984623.20	[1]
P-1350	Irrigation, Stock Water	Well Sanostee	0.14	0.32	2436248.74	1984621.18	[1]
P-1351	Irrigation, Stock Water	Diversion Sanostee	1.38	3.18	2432249.56	1982523.15	[1]
P-1352	Irrigation, Stock Water	Diversion Sanostee	1.12	5.31	2426796.3	1981537.04	[1]
P-1353	Irrigation, Stock Water	Diversion Sanostee	1.21	1.83	2426295.52	1981455.91	[1]
P-1354	Irrigation, Stock Water	Improved Spring	1.23	3.67	2444429.1	1965355.34	[1]
P-1355	Stock Water	Well	0.32	0.31	2444524.24	1963695.54	[3]
P-1356	Stock Water	In Channel	0.6	1.02	2463182.57	1965407.73	[3]
P-1357	Irrigation, Stock Water	In Channel, Well	4.86	19.04	2451096.96	1955470.87	[1]
P-1362	Stock Water	In Channel	0.58	1.13	2451854.45	2041856.92	[3]
P-1363	Stock Water	In Channel	2.43	1.91	2452711.20	2043354.62	[3]
P-1364	Stock Water	In Channel	1.23	2.42	2453963.10	2043686.37	[3]
P-1365	Stock Water	In Channel	1.3	1.05	2454888.42	2044928.59	[3]
P-1366	Stock Water	In Channel	2.34	1.43	2458576.10	2048530.01	[3]
P-1367	Stock Water	In Channel	7.07	18.1	2461102.96	2049769.36	[3]
P-1368	Stock Water	In Channel	2.27	5.37	2461947.19	2049888.05	[3]
P-1369	Stock Water	In Channel	0.77	1.52	2464308.68	2051149.66	[3]
P-1370	Stock Water	In Channel	1.56	1.85	2464854.85	2051645.93	[3]
P-1371	Stock Water	In Channel	1.44	3.97	2465919.87	2051515.92	[3]
P-1372	Stock Water	In Channel	7.79	16.87	2430968.92	2013168.61	[3]

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Table B-2: Surface Water Uses

Site Number	Primary Use	Impoundment Source	Impoundment Area (Ac)	Acre Feet	X coordinate	Y Coordinate	Data Source
P-1373	Stock Water	In Channel	1.83	5.41	2450686.29	2040451.13	[3]
P-1374	Stock Water	In Channel	0.63	0.48	2450542.27	2038840.15	[3]
P-1375	Stock Water	In Channel	2.78	2.13	2465390.21	2051447.01	[3]
P-1376	Stock Water	In Channel	2.01	4.75	2466454.61	2052189.04	[3]
P-1377	Stock Water	In Channel	0.93	4.01	2448636.74	1835607.17	[3]
P-1378	Stock Water	In Channel	0.27	0.43	2459565.02	1835653.51	[3]
P-1379	Stock Water	In Channel	2.46	3.39	2477433.11	1837812.61	[3]
P-1388	Stock Water	In Channel	3.03	9.56	2426651.01	1880725.90	[3]
P-1389	Stock Water	Well	0.07	0.09	2435971.37	1942606.53	[3]
P-1393	Stock Water	In Channel	1.87	10.67	2472574.95	1977490.74	[3]
P-1394	Stock Water	In Channel	4	5.28	2622924.79	1728980.69	[3]
P-1395	Stock Water	In Channel	0.34	0.4	2642567.74	1810223.49	[3]
P-1396	Stock Water	In Channel	45.99	40.74	2686389.27	1700267.09	[3]
P-1398	Stock Water	In Channel	0.17	0.26	2738103.69	1875324.44	[3]
P-1399	Stock Water	In Channel	0.94	1.68	2683290.14	1870509.34	[3]
P-1400	Stock Water	In Channel	0.93	3.89	2495573.59	1794051.84	[3]
P-1407	Stock Water	In Channel	1.27	2.49	2462811.78	2050196.89	[3]
P-1408	Stock Water	In Channel	6.19	25.6	2464607.42	2049853.08	[3]
P-1409	Irrigation, Stock Water	In Channel	0.99	2.53	2424674.78	1922570.07	[1]
P-1410	Irrigation, Stock Water	In Channel	1.17	4.36	2424856.31	1922409.08	[1]
P-1411	Stock Water	In Channel	0.89	1.23	2466632.62	1867329.68	[3]
P-1412	Irrigation, Stock Water	In Channel	0.93	5.11	2444272.89	2003847.73	[1]
P-1414	Stock Water	In Channel, Well	1.54	1.03	2473886.01	2024792.14	[3]
P-1415	Stock Water	In Channel	13.77	45.27	2572375.46	1854192.72	[3]
P-1416	Stock Water	In Channel	2.9	6.11	2461174.69	1705259.83	[3]
P-1417	Stock Water	In Channel	0.78	3.53	2466135.83	1788473.35	[3]
P-1418	Stock Water	In Channel	5.61	7.4	2496095.85	1793581.70	[3]
P-1419	Stock Water	In Channel	0.64	0.98	2473864.67	1732981.02	[3]
P-1420	Stock Water	In Channel	0.26	1.09	2486230.31	1867117.26	[3]
P-1421	Stock Water	In Channel	1.65	1.2	2514038.82	1846874.66	[3]
P-1422	Stock Water	Well	0.45	0.52	2586646.75	1728364.03	[3]
P-1423	Stock Water	In Channel	0.86	4.45	2584835.10	1717016.71	[3]
P-1425	Stock Water	In Channel	8.88	14.69	2530226.98	1777735.26	[3]
P-1426	Stock Water	In Channel	1.21	2.9	2529760.36	1779461.48	[3]
P-1430	Fish Hatchery	NIIP, Off Channel	2.64	13.19	2540340.20	2032523.57	[2]
P-1431	Fish Hatchery	NIIP, Off Channel	2.64	13.2	2540794.51	2032975.11	[2]
P-1432	Fish Hatchery	NIIP, Off Channel	2.62	13.12	2541244.91	2033419.11	[2]
P-1433	Fish Hatchery	NIIP, Off Channel	2.84	14.2	2541545.69	2033107.49	[2]
P-1434	Fish Hatchery	NIIP, Off Channel	2.56	12.81	2541095.63	2032679.73	[2]
P-1435	Fish Hatchery	NIIP, Off Channel	2.75	13.74	2540648.13	2032225.11	[2]
P-1436	Stock Water	In Channel	0.93	2.8	2659852.83	1772404.51	[3]
P-1437	Stock Water	In Channel	3.87	7.3	2658195.82	1769643.63	[3]
P-1438	Stock Water	In Channel	1.33	2.83	2665707.15	1765251.16	[3]
P-1439	Stock Water	In Channel	1.56	2.7	2666473.33	1765609.09	[3]
P-1440	Stock Water	In Channel	0.37	0.74	2669312.92	1759956.37	[3]
P-1441	Stock Water	In Channel	47.31	228.15	2667523.63	1758258.21	[3]
P-1442	Stock Water	In Channel	0.97	2.67	2598914.13	1817552.23	[3]

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Table B-2: Surface Water Uses

Site Number	Primary Use	Impoundment Source	Impoundment Area (Ac)	Acre Feet	X coordinate	Y Coordinate	Data Source
P-1443	Stock Water	In Channel	10.75	42.34	2597070.25	1811243.71	[3]
P-1444	Stock Water	In Channel	3.46	8.17	2602188.05	1814604.26	[3]
P-1445	Stock Water	In Channel	0.82	0.96	2603804.46	1799087.64	[3]
P-1446	Stock Water	In Channel	2.6	6.64	2623838.43	1794000.76	[3]
P-1447	Stock Water	Well	0.15	0.72	2620216.75	1816346.03	[3]
P-1448	Stock Water	Well	0.22	0.69	2620185.51	1816475.28	[3]
P-1449	Stock Water	Well	0.16	0.65	2629993.67	1806532.93	[3]
P-1450	Stock Water	Well	0.15	0.58	2630219.58	1806109.08	[3]
P-1451	Stock Water	Well	1.9	4.87	2630365.33	1806323.41	[3]
P-1452	Stock Water	Well	0.26	0.73	2630218.59	1806808.10	[3]
P-1453	Stock Water	Well	0.48	0.42	2630440.04	1806522.21	[3]
P-1454	Stock Water	In Channel	2.5	3.45	2618110.25	1801505.71	[3]
P-1455	Stock Water	Well	0.15	0.49	2615047.91	1800733.64	[3]
P-1456	Stock Water	In Channel	53.8	169.44	2628628.85	1903215.30	[3]
P-1457	Stock Water	Well	0.39	1.83	2627812.33	1902510.81	[3]
P-1458	Stock Water	In Channel	0.98	4.23	2597231.16	1847926.00	[3]
P-1459	Stock Water	In Channel	10.25	30.26	2665997.49	1818946.45	[3]
P-1460	Stock Water	In Channel	1.52	6.29	2667036.60	1813890.00	[3]
P-1461	Stock Water	In Channel	2.37	6.06	2604262.00	1791400.02	[3]
P-1462	Stock Water	In Channel	3.03	5.96	2605759.69	1788611.87	[3]
P-1463	Stock Water	In Channel	2.77	7.09	2604973.16	1785571.06	[3]
P-1464	Stock Water	Well	0.12	0.21	2658017.07	1814949.71	[3]
P-1465	Stock Water	Well	0.72	3.13	2658244.16	1815098.07	[3]
P-1466	Stock Water	In Channel	5.14	17.2	2660966.68	1816672.38	[3]
P-1467	Stock Water	In Channel	1.11	2.63	2661802.94	1818008.07	[3]
P-1468	Stock Water	Well	0.35	0.82	2606142.26	1796505.14	[3]
P-1469	Stock Water	Well	0.11	0.21	2606287.73	1796742.36	[3]
P-1470	Stock Water	Well	0.11	0.26	2606521.53	1796678.95	[3]
P-1471	Stock Water	In Channel	1.49	4.41	2660662.56	1810478.71	[3]
P-1472	Stock Water	In Channel	1.33	5.74	2664348.30	1808737.07	[3]
P-1473	Stock Water	In Channel	3.99	10.99	2667986.89	1807274.77	[3]
P-1474	Stock Water	In Channel	0.8	2.04	2658193.54	1789127.44	[3]
P-1475	Stock Water	In Channel	11.26	95.35	2657601.44	1794283.05	[3]
P-1476	Stock Water	In Channel	4.2	9.1	2665237.62	1784418.10	[3]
P-1477	Stock Water	In Channel	1.15	4.53	2664188.26	1801295.29	[3]
P-1478	Stock Water	In Channel	1.58	6.22	2658673.97	1799209.44	[3]
P-1479	Stock Water	In Channel	0.71	2.53	2657730.12	1776617.58	[3]
P-1480	Stock Water	In Channel	0.48	0.94	2816130.09	1776211.40	[3]
P-1481	Stock Water	In Channel	1.88	13.72	2825196.65	1775975.14	[3]
P-1485	Stock Water	In Channel	2.51	5.92	2658750.27	1736126.89	[3]
P-1486	Stock Water	In Channel	12.07	21.38	2658931.85	1736048.41	[3]
P-1488	Stock Water	In Channel	1.18	2.79	2667666.22	1739170.20	[3]
P-1490	Stock Water	In Channel	3.05	12.02	2658475.20	1757451.34	[3]
P-1491	Stock Water	In Channel	5.41	14.92	2661241.94	1748943.77	[3]
P-1492	Stock Water	In Channel	2.07	4.88	2668431.38	1747838.22	[3]
P-1493	Sewer Settling	Sewer	0.23	1.29	2658073.95	1759727.73	[4]
P-1494	Stock Water	In Channel	0.28	1.22	2657424.94	1758835.43	[3]
P-1495	Stock Water	In Channel	0.55	1.19	2657388.42	1758824.62	[3]
P-1496	Stock Water	In Channel	16.31	89.89	2656558.27	1759041.87	[3]
P-1497	Stock Water	In Channel	9.42	14.83	2656225.34	1758352.13	[3]
P-1498	Stock Water	In Channel	2.81	3.88	2658345.89	1757157.96	[3]
P-1499	Stock Water	In Channel	3.87	6.1	2658697.16	1758078.49	[3]
P-1500	Stock Water	In Channel	2.24	5.72	2659069.86	1757672.06	[3]

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Table B-2: Surface Water Uses

Site Number	Primary Use	Impoundment Source	Impoundment Area (Ac)	Acre Feet	X coordinate	Y Coordinate	Data Source
P-1501	Stock Water	In Channel	1.52	5.7	2657450.40	1746729.70	[3]
P-1502	Stock Water	Well	0.19	0.19	2730282.98	1776283.44	[3]
P-1503	Stock Water	In Channel	0.72	0.57	2733036.56	1771538.47	[3]
P-1504	Stock Water	In Channel	2.68	4.75	2732746.95	1771977.53	[3]
P-1505	Stock Water	Well	0.72	0.99	2711875.65	1809481.62	[3]
P-1506	Stock Water	In Channel	6.16	42.47	2683600.78	1771249.35	[3]
P-1507	Stock Water	In Channel	3.18	19.4	2677561.18	1765093.02	[3]
P-1508	Stock Water	In Channel	2.62	6.71	2670260.93	1756393.71	[3]
P-1509	Stock Water	In Channel	3.55	19.54	2678935.60	1758310.09	[3]
P-1510	Stock Water	Well	0.08	0.19	2681525.72	1773819.67	[3]
P-1511	Stock Water	In Channel	1.19	2.12	2678247.90	1765951.36	[3]
P-1512	Stock Water	Well	0.11	0.15	2675765.93	1755054.19	[3]
P-1513	Stock Water	In Channel	0.74	0.73	2699379.20	1813982.91	[3]
P-1514	Stock Water	Well	0.12	0.11	2699126.64	1815268.55	[3]
P-1515	Stock Water	In Channel	0.53	1.36	2699195.62	1817399.67	[3]
P-1516	Stock Water	In Channel	0.68	2	2699068.15	1817414.82	[3]
P-1517	Stock Water	In Channel	0.84	3.29	2689982.72	1821704.16	[3]
P-1518	Stock Water	In Channel	1.05	6.01	2688508.44	1818645.48	[3]
P-1519	Stock Water	In Channel	0.26	0.66	2690658.57	1818933.63	[3]
P-1520	Stock Water	In Channel	0.34	0.6	2674211.39	1817808.38	[3]
P-1521	Stock Water	In Channel	0.77	4.67	2677710.89	1810984.43	[3]
P-1522	Stock Water	In Channel	2.43	1.58	2677786.96	1810906.18	[3]
P-1523	Stock Water	In Channel	0.66	1.69	2687303.48	1810693.52	[3]
P-1524	Stock Water	In Channel	0.76	1.5	2686907.49	1810585.99	[3]
P-1526	Stock Water	In Channel	0.11	0.07	2702743.85	1853787.43	[3]
P-1527	Stock Water	In Channel	0.74	0.46	2703562.05	1854249.99	[3]
P-1528	Stock Water	In Channel	0.38	0.32	2704033.02	1854436.70	[3]
P-1529	Stock Water	In Channel	0.09	0.32	2702470.15	1850809.68	[3]
P-1530	Stock Water	In Channel	1.66	2.52	2726940.78	1847615.03	[3]
P-1531	Stock Water	In Channel	3.43	9.92	2729781.52	1839505.39	[3]
P-1532	Stock Water	In Channel	2.55	9.27	2741112.23	1841875.61	[3]
P-1533	Stock Water	In Channel	0.2	0.2	2747105.97	1848087.44	[3]
P-1534	Stock Water	In Channel	1.36	3.44	2751568.88	1850432.69	[3]
P-1535	Stock Water	In Channel	0.24	0.38	2733521.70	1830382.58	[3]
P-1536	Stock Water	In Channel	0.47	0.62	2737371.92	1814658.28	[3]
P-1537	Stock Water	In Channel	0.6	1.36	2741467.96	1815932.30	[3]
P-1538	Stock Water	In Channel	0.55	1.08	2747234.70	1814217.89	[3]
P-1539	Stock Water	In Channel	2.79	4.89	2748445.80	1815562.02	[3]
P-1540	Stock Water	In Channel	0.52	0.91	2762577.98	1815123.49	[3]
P-1541	Stock Water	In Channel	1.88	1.48	2813069.73	1799743.78	[3]
P-1542	Stock Water	In Channel	1.22	2.4	2813708.93	1799521.53	[3]
P-1543	Stock Water	In Channel	0.24	0.7	2813305.12	1799896.85	[3]
P-1544	Stock Water	In Channel	1.14	2.25	2810252.45	1797899.96	[3]
P-1545	Stock Water	In Channel	0.47	0.93	2817806.40	1769661.73	[3]
P-1546	Stock Water	In Channel	1.59	11.56	2818264.11	1764013.70	[3]
P-1547	Stock Water	In Channel	0.17	0.34	2763521.72	1814635.90	[3]
P-1548	Stock Water	Well	0.1	0.31	2758549.94	1816935.33	[3]
P-1549	Stock Water	Well	0.1	0.14	2814458.83	1803694.03	[3]
P-1550	Stock Water	Well	0.06	0.29	2820415.49	1761392.41	[3]
P-1551	Stock Water	Well	0.24	0.74	2733784.34	1739564.72	[3]
P-1552	Stock Water	Well	0.12	0.18	2733757.68	1739732.26	[3]
P-1553	Stock Water	In Channel	1.18	2.09	2677205.98	1729437.31	[3]
P-1554	Stock Water	In Channel	3.06	10.25	2737581.94	1732917.83	[3]

Appendix B
Table B-2: Surface Water Uses

Site Number	Primary Use	Impoundment Source	Impoundment Area (Ac)	Acre Feet	X coordinate	Y Coordinate	Data Source
P-1555	Stock Water	In Channel	1.56	4	2732640.94	1728286.49	[3]
P-1556	Stock Water	In Channel	2.47	3.88	2669089.53	1727633.71	[3]
P-1557	Stock Water	In Channel	0.75	1.33	2734783.81	1728225.26	[3]
P-1558	Stock Water	In Channel	0.35	0.56	2735970.20	1727824.11	[3]
P-1559	Stock Water	In Channel	0.26	0.51	2738594.78	1807401.11	[3]
P-1560	Stock Water	Well	0.04	0.09	2744337.59	1802069.59	[3]
P-1561	Stock Water	Well	0.07	0.16	2744405.07	1802262.94	[3]
P-1562	Stock Water	In Channel	0.17	0.24	2747395.42	1804245.52	[3]
P-1563	Stock Water	In Channel	0.06	0.12	2731214.99	1798577.52	[3]
P-1564	Stock Water	In Channel	1.32	6.52	2722953.09	1803750.86	[3]
P-1565	Stock Water	In Channel	1.08	3.4	2724412.40	1802749.12	[3]
P-1566	Stock Water	In Channel	1.48	4.95	2725295.34	1803171.44	[3]
P-1567	Stock Water	In Channel	0.17	0.9	2752564.51	1792659.58	[3]
P-1568	Stock Water	In Channel	0.21	0.21	2740954.78	1789169.47	[3]
P-1569	Stock Water	In Channel	0.52	1.63	2729753.81	1786268.28	[3]
P-1570	Stock Water	In Channel	0.72	0.99	2756032.50	1779025.43	[3]
P-1571	Stock Water	In Channel	0.16	0.32	2687194.98	1810704.73	[3]
P-1572	Stock Water	In Channel	0.54	0.95	2693782.48	1807814.46	[3]
P-1573	Stock Water	In Channel	0.64	2.02	2688524.07	1804987.19	[3]
P-1574	Stock Water	In Channel	0.28	0.17	2688066.17	1804818.83	[3]
P-1575	Stock Water	In Channel	0.24	0.34	2674096.10	1804439.36	[3]
P-1576	Stock Water	Well	0.09	0.07	2675313.12	1802603.02	[3]
P-1577	Stock Water	Well	0.37	0.37	2675403.31	1802907.00	[3]
P-1578	Stock Water	In Channel	0.09	0.06	2676295.70	1801631.11	[3]
P-1579	Stock Water	Well	0.22	0.53	2721219.68	1794537.90	[3]
P-1580	Stock Water	Well	0.1	0.22	2721375.05	1777820.49	[3]
P-1581	Stock Water	Well	0.13	0.32	2721546.57	1777823.64	[3]
P-1582	Stock Water	In Channel	1.83	3.96	2719549.46	1775185.08	[3]
P-1583	Stock Water	In Channel	4.95	30.18	2712562.41	1772652.42	[3]
P-1584	Stock Water	In Channel	0.27	0.53	2704422.93	1777222.97	[3]
P-1585	Stock Water	Well	0.17	0.13	2706730.69	1779214.37	[3]
P-1586	Stock Water	Well	0.09	0.16	2706739.20	1779340.63	[3]
P-1587	Stock Water	In Channel	0.47	0.64	2706422.11	1767657.19	[3]
P-1588	Stock Water	In Channel	0.82	3.72	2705143.32	1764379.89	[3]
P-1589	Stock Water	In Channel	0.93	1.47	2709513.25	1765267.89	[3]
P-1590	Stock Water	In Channel	0.14	0.09	2709162.33	1763431.25	[3]
P-1591	Stock Water	Well	0.08	0.07	2710566.04	1763286.28	[3]
P-1592	Stock Water	In Channel	2.22	8.3	2725808.30	1770751.68	[3]
P-1593	Stock Water	In Channel	0.79	1.25	2720747.17	1765203.53	[3]
P-1594	Stock Water	Well	0.18	0.46	2721002.83	1763961.16	[3]
P-1595	Stock Water	Well	0.09	0.19	2721022.77	1764036.22	[3]
P-1596	Stock Water	In Channel	0.19	0.19	2720445.41	1767083.14	[3]
P-1597	Stock Water	In Channel	0.63	0.74	2723499.02	1763213.77	[3]
P-1598	Stock Water	In Channel	0.5	0.39	2723943.51	1763071.84	[3]
P-1599	Stock Water	In Channel	0.39	0.54	2723769.17	1762660.48	[3]
P-1600	Stock Water	In Channel	1.14	2.24	2723979.62	1762267.53	[3]
P-1601	Stock Water	In Channel	0.56	0.88	2724148.61	1761744.24	[3]
P-1602	Stock Water	In Channel	0.09	0.23	2727076.61	1763061.02	[3]
P-1603	Stock Water	In Channel	0.09	0.31	2731260.81	1764609.93	[3]
P-1604	Stock Water	In Channel	0.08	0.07	2734169.31	1762678.86	[3]
P-1605	Stock Water	Well	0.73	0.46	2735089.49	1760526.68	[3]
P-1606	Stock Water	Well	0.13	0.13	2734118.33	1759593.67	[3]
P-1607	Stock Water	In Channel	0.96	3.96	2741139.39	1755428.31	[3]

Appendix B
Table B-2: Surface Water Uses

Site Number	Primary Use	Impoundment Source	Impoundment Area (Ac)	Acre Feet	X coordinate	Y Coordinate	Data Source
P-1608	Sewer Settling	Sewer	0.19	0.18	2743885.29	1751846.94	[4]
P-1609	Sewer Settling	Sewer	0.4	0.47	2743981.26	1752008.02	[4]
P-1610	Stock Water	In Channel	1.21	1.43	2728744.77	1752941.95	[3]
P-1611	Stock Water	In Channel	0.27	0.32	2728814.22	1753923.83	[3]
P-1612	Stock Water	In Channel	0.36	0.35	2729135.38	1752200.50	[3]
P-1645	Stock Water	In Channel	14.18	25.13	2819037.85	1791500.97	[3]
P-1651	Stock Water	In Channel	0.15	0.15	2820038.94	1787806.47	[3]
P-1660	Stock Water	In Channel	0.38	1.42	2724809.47	1753862.37	[3]
P-1661	Stock Water	In Channel	0.26	0.31	2723514.23	1755437.32	[3]
P-1662	Stock Water	In Channel	0.2	0.24	2722148.37	1751138.05	[3]
P-1663	Stock Water	In Channel	0.28	0.22	2722137.66	1750815.85	[3]
P-1664	Stock Water	In Channel	0.12	0.08	2721779.39	1750121.79	[3]
P-1665	Stock Water	In Channel	0.24	0.51	2708655.74	1749329.23	[3]
P-1666	Stock Water	In Channel	0.43	1.17	2708181.58	1748910.74	[3]
P-1667	Stock Water	In Channel	1.06	4.18	2705474.73	1747666.61	[3]
P-1668	Stock Water	In Channel	0.85	3.68	2714389.22	1756260.56	[3]
P-1669	Stock Water	In Channel	1.1	4.1	2707038.10	1757196.84	[3]
P-1670	Stock Water	In Channel	0.59	1.05	2724443.67	1760172.14	[3]
P-1671	Stock Water	In Channel	0.28	0.22	2723993.31	1759583.99	[3]
P-1672	Stock Water	In Channel	0.65	1.53	2728564.44	1818196.36	[3]
P-1679	Stock Water	In Channel	1.06	0.84	2694555.17	1740028.60	[3]
P-1680	Stock Water	In Channel	0.45	2.31	2749338.03	1736225.32	[3]
P-1681	Stock Water	In Channel	0.21	1.14	2749263.78	1736168.78	[3]
P-1682	Stock Water	In Channel	1.48	4.36	2756087.26	1750870.07	[3]
P-1683	Sewer Settling	Sewer	1.34	5.27	2775514.67	1808163.32	[4]
P-1684	Sewer Settling	Sewer	1.04	1.22	2775751.12	1807944.75	[4]
P-1685	Stock Water	In Channel	0.53	0.93	2783036.69	1814238.08	[3]
P-1686	Stock Water	In Channel	0.52	1.43	2798892.51	1816656.37	[3]
P-1687	Stock Water	Well	0.13	0.13	2713661.06	1793343.64	[3]
P-1688	Stock Water	Well	0.11	0.1	2713632.28	1793450.27	[3]
P-1689	Stock Water	Well	0.11	0.29	2701153.13	1796712.31	[3]
P-1690	Stock Water	Well	0.05	0.28	2701269.59	1796720.21	[3]
P-1691	Stock Water	In Channel	0.94	2.42	2705045.45	1790281.36	[3]
P-1692	Stock Water	Well	0.17	0.34	2691461.48	1794206.62	[3]
P-1693	Stock Water	In Channel	1.41	1.14	2693247.88	1793576.17	[3]
P-1694	Stock Water	In Channel	0.42	2	2698809.87	1785012.32	[3]
P-1695	Stock Water	In Channel	0.55	1.19	2698734.70	1784813.79	[3]
P-1696	Stock Water	In Channel	0.66	2.07	2698818.43	1787369.62	[3]
P-1697	Stock Water	In Channel	2.8	16.56	2691078.28	1780168.67	[3]
P-1698	Stock Water	In Channel	0.39	1.23	2689999.87	1777741.42	[3]
P-1699	Stock Water	In Channel	2.72	5.89	2686302.87	1778442.12	[3]
P-1700	Stock Water	In Channel	0.96	2.08	2690053.56	1768702.01	[3]
P-1701	Stock Water	Well	0.09	0.19	2693494.29	1770740.90	[3]
P-1702	Stock Water	Well	0.15	0.44	2693377.27	1770633.36	[3]
P-1703	Stock Water	In Channel	0.9	3.9	2675920.99	1779891.78	[3]
P-1704	Stock Water	Well	0.23	0.22	2684368.26	1795798.47	[3]
P-1705	Stock Water	Well	0.13	0.31	2684029.37	1795880.02	[3]
P-1706	Stock Water	Well	0.25	0.2	2680292.76	1794199.55	[3]
P-1707	Stock Water	Well	0.23	0.23	2680250.04	1793949.61	[3]
P-1708	Stock Water	In Channel	0.91	0.72	2672407.32	1793927.71	[3]
P-1709	Stock Water	In Channel	0.44	1.8	2628302.00	1876896.41	[3]
P-1710	Stock Water	In Channel	0.67	0.54	2609654.56	1852453.09	[3]
P-1711	Stock Water	In Channel	4.91	6.76	2616243.77	1846268.15	[3]

Appendix B

Table B-2: Surface Water Uses

Site Number	Primary Use	Impoundment Source	Impoundment Area (Ac)	Acre Feet	X coordinate	Y Coordinate	Data Source
P-1712	Stock Water	In Channel	0.4	0.32	2628294.51	1828791.95	[3]
P-1714	Stock Water	In Channel	3.88	11.45	2634076.10	1828054.02	[3]
P-1715	Stock Water	In Channel	0.66	1.05	2651205.52	1830308.72	[3]
P-1716	Stock Water	In Channel	0.34	0.47	2610479.51	1835393.65	[3]
P-1717	Stock Water	In Channel	0.4	0.31	2687824.34	1690223.15	[3]
P-1718	Stock Water	In Channel	0.7	4.01	2673083.56	1707245.33	[3]
P-1719	Stock Water	In Channel	0.73	0.59	2673257.89	1707027.31	[3]
P-1720	Stock Water	In Channel	3.75	18.48	2690402.81	1672920.53	[3]
P-1721	Stock Water	In Channel	0.39	0.31	2765711.14	1766863.97	[3]
P-1722	Stock Water	Well	0.17	0.44	2763086.74	1750149.79	[3]
P-1723	Stock Water	In Channel	0.24	0.19	2765259.44	1746818.19	[3]
P-1724	Stock Water	In Channel	1.26	2.96	2765215.21	1747085.91	[3]
P-1725	Stock Water	In Channel	1.11	4.35	2770118.58	1751114.31	[3]
P-1726	Stock Water	In Channel	0.46	0.82	2816454.19	1782760.55	[3]
P-1728	Stock Water	In Channel	3.29	2.59	2610734.38	1834773.01	[3]
P-1729	Stock Water	Well	0.35	0.34	2607295.93	1835096.22	[3]
P-1730	Stock Water	In Channel	0.58	1.04	2604463.48	1834214.16	[3]
P-1731	Stock Water	In Channel	1.41	0.86	2583103.06	1829770.71	[3]
P-1732	Stock Water	In Channel	0.46	0.73	2607541.09	1815584.64	[3]
P-1733	Stock Water	In Channel	1.37	8.1	2622012.26	1801066.68	[3]
P-1734	Stock Water	In Channel	0.42	0.74	2621805.78	1783332.19	[3]
P-1735	Stock Water	In Channel	3.19	3.76	2621716.23	1782868.41	[3]
P-1736	Stock Water	Well	0.1	0.13	2625011.90	1772579.09	[3]
P-1737	Stock Water	Well	0.13	0.23	2624975.40	1772525.89	[3]
P-1738	Stock Water	Well	0.19	0.26	2624941.55	1772631.19	[3]
P-1739	Stock Water	In Channel	0.85	2.33	2595245.09	1796928.98	[3]
P-1740	Stock Water	In Channel	0.23	0.23	2592023.07	1788532.03	[3]
P-1741	Stock Water	In Channel	20.8	16.38	2603479.66	1778068.36	[3]
P-1742	Stock Water	In Channel	11.58	36.48	2543514.37	1880434.74	[3]
P-1743	Stock Water	In Channel	1.94	6.48	2550655.60	1864239.40	[3]
P-1744	Stock Water	In Channel	7.44	23.45	2566055.71	1767682.71	[3]
P-1745	Stock Water	In Channel	0.63	0.86	2565139.63	1875123.17	[3]
P-1746	Stock Water	In Channel	3.29	8.41	2565083.33	1875382.11	[3]
P-1747	Stock Water	In Channel	5.34	17.88	2560428.54	1917345.16	[3]
P-1748	Stock Water	In Channel	0.29	0.29	2564485.83	1928532.05	[3]
P-1749	Stock Water	In Channel	0.93	2.19	2559692.35	1932689.68	[3]
P-1750	Stock Water	In Channel	2.54	8.49	2558799.19	1934104.76	[3]
P-1751	Stock Water	In Channel	0.45	1.34	2558651.00	1933935.86	[3]
P-1752	Stock Water	Well	0.26	0.55	2485354.76	1724359.52	[3]
P-1753	Stock Water	In Channel	5.26	14.49	2546420.41	1772076.17	[3]
P-1754	Stock Water	In Channel	0.17	0.57	2524980.17	1713043.87	[3]
P-1755	Stock Water	In Channel	0.87	1.55	2662644.15	1678336.11	[3]
P-1756	Stock Water	Improved Spring	0.1	0.1	2463239.86	2057811.19	[3]
P-1758	Stock Water	In Channel	1.57	8.97	2645742.36	1753901.75	[3]
P-1759	Stock Water	Improved Spring	0.38	0.68	2463504.89	2058326.10	[3]
P-1761	Stock Water	Well	0.4	0.63	2438627.60	2034846.49	[3]
P-1762	Stock Water	Well	0.29	0.29	2458488.83	2014962.99	[3]
P-1765	Stock Water	In Channel	1.95	7.67	2573741.18	1942802.07	[3]
P-1766	Stock Water	In Channel	7.72	30.38	2582987.81	1914286.78	[3]
P-1767	Stock Water	In Channel	3.68	10.15	2580644.26	1933473.92	[3]
P-1768	Stock Water	In Channel	0.64	1.26	2599719.76	1969462.09	[3]
P-1769	Stock Water	In Channel	2.75	22.77	2546287.05	2041980.82	[3]
P-1770	Stock Water	In Channel	0.57	1.13	2502372.14	2066294.31	[3]

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Table B-2: Surface Water Uses

Site Number	Primary Use	Impoundment Source	Impoundment Area (Ac)	Acre Feet	X coordinate	Y Coordinate	Data Source
P-1771	Stock Water	In Channel	0.63	1.73	2499231.82	2036096.30	[3]
P-1772	Stock Water	In Channel	8.89	19.26	2439286.86	1743871.09	[3]
P-1773	Stock Water	In Channel	0.34	1.69	2439626.35	1743650.12	[3]
P-1774	Stock Water	In Channel	3.09	5.47	2464446.15	1901549.75	[3]
P-1775	Stock Water	In Channel	4.32	8.51	2463125.85	1901640.69	[3]
P-1776	Stock Water	In Channel	7.01	15.19	2463634.94	1894287.43	[3]
P-1777	Stock Water	In Channel	1.62	19.82	2458862.85	1866622.82	[3]
P-1778	Stock Water	In Channel	0.84	2.8	2438284.69	1700428.29	[3]
P-1779	Stock Water	In Channel	1.67	4.61	2437136.43	1847451.63	[3]
P-1780	Stock Water	In Channel	3.48	10.97	2437906.07	1849957.17	[3]
P-1781	Stock Water	In Channel	2.11	6.65	2461428.70	1871994.06	[3]
P-1782	Stock Water	In Channel	1.07	9.65	2430923.47	2013458.53	[3]
P-1783	Stock Water	In Channel	1.81	3.55	2645652.11	1753488.64	[3]
P-1784	Stock Water	In Channel	1.52	8.4	2627475.56	1748585.41	[3]
P-1785	Stock Water	In Channel	0.2	0.12	2630062.02	1736909.74	[3]
P-1786	Stock Water	In Channel	1.31	2.58	2643167.37	1734833.07	[3]
P-1787	Stock Water	In Channel	6.41	8.83	2647162.43	1741265.60	[3]
P-1788	Sewer Settling	Sewer	1.16	5.23	2627428.70	1729676.60	[4]
P-1789	Sewer Settling	Sewer	1.15	2.49	2627623.50	1729443.57	[4]
P-1790	Sewer Settling	Sewer	3.87	15.98	2628082.49	1729656.69	[4]
P-1791	Stock Water	In Channel	1.76	5.56	2630486.63	1728700.23	[3]
P-1792	Stock Water	In Channel	0.07	0.13	2629401.10	1730639.98	[3]
P-1793	Sewer Settling	Sewer	3.16	10.59	2590580.97	1720371.43	[4]
P-1794	Sewer Settling	Sewer	0.42	0.99	2590903.75	1720754.25	[4]
P-1795	Sewer Settling	Sewer	0.37	0.79	2590808.19	1720623.39	[4]
P-1796	Sewer Settling	Sewer	0.13	0.34	2590773.52	1720827.99	[4]
P-1797	Sewer Settling	Sewer	5.45	12.88	2634997.47	1709059.16	[4]
P-1798	Sewer Settling	Sewer	5.31	31.38	2635008.17	1709588.54	[4]
P-1799	Sewer Settling	Sewer	5.49	10.8	2635500.96	1709528.27	[4]
P-1800	Sewer Settling	Sewer	5.16	18.3	2635515.29	1710021.00	[4]
P-1801	Sewer Settling	Sewer	8.3	49.04	2635511.88	1710088.96	[4]
P-1803	Stock Water	In Channel	0.77	0.68	2587238.46	1716020.30	[3]
P-1804	Irrigation, Stock Water	Off Channel	0.35	0.84	2411291.22	1922692.34	[1]
P-1805	Stock Water	In Channel	0.51	2.7	2416129.69	1948306.59	[3]
P-1806	Irrigation, Stock Water	Well	1.09	3.66	2436627.54	1939598.49	[1]
P-1807	Irrigation, Stock Water	Well	0.39	0.38	2465333.69	1944675.37	[1]
P-1808	Irrigation, Stock Water	Off Channel	5.75	31.69	2452592.36	1928171.94	[1]
P-1811	Irrigation, Stock Water	Off Channel	2.45	6.74	2464147.2	1932623.95	[1]
P-1812	Irrigation, Stock Water	Off Channel	0.19	0.55	2411960.78	1976144.52	[1]
P-1813	Stock Water	In Channel	4.53	11.59	2660582.59	1817912.03	[3]
P-1814	Stock Water	In Channel	2.06	2.84	2604698.21	1783837.91	[3]
P-1815	Irrigation, Stock Water	In Channel	8.23	17.83	2480338.25	1861864.52	[1]
P-1816	Irrigation, Stock Water	In Channel	5.67	5.58	2633524.98	1832855.43	[1]
P-1817	Stock Water	Well	1.04	2.24	2565791.03	1747680.85	[3]
P-1818	Irrigation, Stock Water	In Channel	0.14	1.37	2416035.61	1948166.81	[1]
P-1819	Stock Water	Well	0.58	0.46	2444680.72	1966880.29	[3]
P-1820	Stock Water	Well	7.31	12.94	2469074.83	1718069.10	[3]
P-1821	Stock Water	In Channel	2.64	23.88	2426595.40	1743986.08	[3]
P-1822	Stock Water	In Channel	1.93	12.53	2426667.43	1743972.43	[3]
P-1823	Stock Water	Well	4.83	6.65	2468692.29	1718375.22	[3]
P-5001	Stock Water	In Channel	1.38	6.53	2436284.08	1702583.40	[3]
P-5002	Stock Water	Well	0.15	0.38	2600024.95	1723141.59	[3]
P-5003	Stock Water	In Channel	2.22	9.44	2458594.68	1721522.74	[3]

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Table B-2: Surface Water Uses

Site Number	Primary Use	Impoundment Source	Impoundment Area (Ac)	Acre Feet	X coordinate	Y Coordinate	Data Source
P-5004	Stock Water	Well	0.13	0.54	2578863.82	1730312.07	[3]
P-5005	Stock Water	Well	0.09	0.16	2530687.73	1738642.09	[3]
P-5006	Stock Water	Well	0.04	0.04	2443477.37	1736423.10	[3]
P-5008	Stock Water	In Channel	2.02	6.19	2422030.22	1745523.51	[3]
P-5009	Stock Water	In Channel	1.82	7.22	2420177.74	1746459.08	[3]
P-5010	Stock Water	In Channel	10.38	21.8	2548997.77	1760856.89	[3]
P-5011	Stock Water	In Channel	2.79	10.39	2433954.53	1758525.47	[3]
P-5012	Stock Water	In Channel	5.59	15.43	2546972.72	1762755.92	[3]
P-5013	Stock Water	In Channel	2.52	5.89	2546426.25	1764123.25	[3]
P-5014	Stock Water	Well	0.22	0.65	2558077.37	1769919.03	[3]
P-5015	Stock Water	Well	0.19	0.42	2639188.38	1774494.55	[3]
P-5016	Stock Water	In Channel	0.48	1.01	2528947.18	1777806.96	[3]
P-5017	Stock Water	In Channel	1.05	7.53	2541867.58	1778856.12	[3]
P-5018	Stock Water	In Channel	0.21	0.89	2630541.36	1786756.71	[3]
P-5019	Stock Water	In Channel	0.66	1.57	2588353.94	1787938.21	[3]
P-5020	Stock Water	In Channel	0.89	1.72	2600115.86	1800608.66	[3]
P-5021	Stock Water	In Channel	12.52	12.77	2562780.03	1804270.08	[3]
P-5022	Stock Water	Well	0.32	0.63	2600788.55	1805778.33	[3]
P-5023	Stock Water	Well	0.1	0.24	2600943.41	1806070.74	[3]
P-5024	Stock Water	In Channel	1.03	1.17	2573644.22	1805549.98	[3]
P-5025	Stock Water	Well	0.12	0.21	2563255.99	1806428.21	[3]
P-5026	Stock Water	In Channel	0.51	2.39	2617777.47	1808515.47	[3]
P-5028	Stock Water	Well	0.12	0.17	2641127.17	1809744.67	[3]
P-5029	Stock Water	Well	0.58	1.08	2504768.18	1809278.35	[3]
P-5030	Stock Water	In Channel	0.16	0.25	2527657.47	1811235.95	[3]
P-5031	Stock Water	In Channel	0.79	1.79	2630302.42	1815584.30	[3]
P-5032	Stock Water	In Channel	0.2	0.52	2599507.71	1817836.13	[3]
P-5033	Stock Water	In Channel	18.44	90.74	2628000.74	1821481.91	[3]
P-5034	Stock Water	Well	0.31	0.56	2548760.36	1819406.27	[3]
P-5035	Stock Water	In Channel	0.73	0.52	2627165.69	1823244.02	[3]
P-5036	Stock Water	In Channel	0.18	0.2	2669493.02	1825858.71	[3]
P-5037	Stock Water	In Channel	0.1	0.38	2669513.96	1827626.60	[3]
P-5038	Stock Water	In Channel	0.85	3.28	2627195.73	1826327.24	[3]
P-5039	Stock Water	In Channel	3.81	11.89	2733057.60	1829247.30	[3]
P-5040	Stock Water	In Channel	0.13	0.1	2668991.43	1828113.20	[3]
P-5041	Stock Water	In Channel	1.11	6.58	2631791.05	1827115.23	[3]
P-5042	Stock Water	In Channel	0.4	0.5	2634521.57	1827687.42	[3]
P-5043	Stock Water	In Channel	0.69	1.91	2669710.00	1828759.45	[3]
P-5044	Stock Water	In Channel	0.27	0.47	2633945.43	1827912.66	[3]
P-5045	Stock Water	Well	0.29	1.42	2470337.73	1826044.51	[3]
P-5046	Stock Water	In Channel	0.17	0.35	2728769.75	1833871.22	[3]
P-5047	Stock Water	In Channel	0.89	7.97	2469821.94	1826634.97	[3]
P-5048	Stock Water	In Channel	3.61	9.31	2469732.58	1827041.04	[3]
P-5049	Stock Water	In Channel	4.69	19.41	2456512.56	1826583.77	[3]
P-5050	Stock Water	In Channel	0.15	0.2	2443332.14	1828562.74	[3]
P-5051	Stock Water	In Channel	0.96	3.39	2745130.54	1838774.06	[3]
P-5052	Stock Water	In Channel	0.35	0.73	2555218.69	1833110.65	[3]
P-5053	Stock Water	In Channel	0.07	0.08	2727349.01	1839182.86	[3]
P-5054	Stock Water	In Channel	0.26	0.41	2724823.21	1839225.09	[3]
P-5055	Stock Water	In Channel	0.8	6.5	2492797.42	1832614.76	[3]
P-5056	Stock Water	In Channel	2.96	6.74	2718046.80	1840062.93	[3]
P-5057	Stock Water	In Channel	1.59	3.15	2772836.62	1843007.06	[3]
P-5058	Stock Water	In Channel	1.38	3.47	2570059.27	1837150.08	[3]

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Table B-2: Surface Water Uses

Site Number	Primary Use	Impoundment Source	Impoundment Area (Ac)	Acre Feet	X coordinate	Y Coordinate	Data Source
P-5059	Stock Water	In Channel	0.72	2.17	2586623.61	1837740.58	[3]
P-5060	Stock Water	In Channel	0.51	0.64	2732456.68	1842137.64	[3]
P-5061	Stock Water	In Channel	0.05	0.09	2737013.22	1843548.65	[3]
P-5062	Stock Water	In Channel	0.34	1.01	2705926.96	1842881.40	[3]
P-5063	Stock Water	In Channel	1.3	11.27	2457273.85	1838219.90	[3]
P-5064	Stock Water	In Channel	1.02	3.61	2586198.50	1842355.94	[3]
P-5065	Stock Water	In Channel	0.39	1.15	2726621.09	1847296.48	[3]
P-5066	Stock Water	In Channel	0.58	0.77	2600690.50	1843501.98	[3]
P-5067	Stock Water	In Channel	0.82	5.92	2600426.72	1843772.67	[3]
P-5068	Stock Water	In Channel	0.27	0.38	2600630.80	1843905.26	[3]
P-5069	Stock Water	Well	0.23	0.27	2564803.63	1846400.04	[3]
P-5070	Stock Water	In Channel	0.36	1.62	2843022.64	1856580.51	[3]
P-5071	Stock Water	Well	0.09	0.09	2512222.59	1849307.66	[3]
P-5072	Stock Water	Well	0.22	0.64	2593039.93	1853913.05	[3]
P-5073	Irrigation, Stock Water	In Channel	1.09	2.55	2831589.89	1861549.32	[1]
P-5074	Stock Water	Well	0.11	0.1	2499275.01	1851835.55	[3]
P-5075	Stock Water	In Channel	1.21	2.9	2592343.48	1854572.12	[3]
P-5076	Stock Water	Well	0.24	0.95	2578092.12	1854613.59	[3]
P-5077	Stock Water	In Channel	1.5	7.58	2464946.39	1854026.39	[3]
P-5080	Stock Water	In Channel	3.68	13.25	2483121.84	1857272.94	[3]
P-5086	Stock Water	In Channel	0.38	0.32	2435430.97	1859201.89	[3]
P-5087	Stock Water	In Channel	0.98	0.82	2435441.13	1860532.38	[3]
P-5088	Stock Water	In Channel	40.52	63.21	2397617.01	1861038.39	[3]
P-5089	Stock Water	In Channel	0.6	6.64	2475956.30	1864449.04	[3]
P-5090	Stock Water	In Channel	0.95	5.74	2476022.41	1864528.42	[3]
P-5091	Stock Water	In Channel	3.74	13.45	2475869.24	1864610.11	[3]
P-5092	Stock Water, Recreation	In Channel	9.22	60.99	2401769.10	1864891.81	[3]
P-5093	Stock Water	In Channel	0.6	0.97	2420016.81	1867257.21	[3]
P-5094	Stock Water	Well	0.05	0.05	2499680.72	1869602.38	[3]
P-5095	Stock Water	Well	0.12	0.19	2499671.27	1869694.04	[3]
P-5097	Stock Water	In Channel	0.97	6.86	2593586.81	1874432.26	[3]
P-5098	Stock Water	In Channel	0.13	0.19	2423310.42	1869848.63	[3]
P-5100	Stock Water	In Channel	0.28	0.33	2420617.59	1871189.36	[3]
P-5103	Stock Water	In Channel	0.53	0.93	2588307.15	1879374.24	[3]
P-5104	Stock Water	Diversion	1.07	4.3	2588092.70	1880113.71	[3]
P-5105	Stock Water	In Channel	1.57	11.9	2471945.52	1878108.73	[3]
P-5106	Stock Water	In Channel	0.51	0.55	2473523.72	1878966.47	[3]
P-5109	Stock Water	In Channel	1.38	7.12	2499685.91	1880233.66	[3]
P-5110	Stock Water	In Channel	6.21	49.94	2426423.11	1879478.96	[3]
P-5111	Stock Water	In Channel	0.61	0.85	2660178.68	1886342.99	[3]
P-5112	Stock Water	In Channel	0.8	3.01	2581098.13	1884030.05	[3]
P-5114	Stock Water	In Channel	0.16	0.1	2660255.87	1889998.28	[3]
P-5116	Stock Water	In Channel, Well	0.35	0.36	2466941.17	1889117.57	[3]
P-5117	Stock Water	Well	0.12	0.22	2449533.70	1889074.82	[3]
P-5118	Stock Water	In Channel	0.96	3.35	2620993.43	1895588.20	[3]
P-5119	Stock Water	In Channel	2.33	7.82	2662328.82	1897405.15	[3]
P-5120	Stock Water	In Channel	4.35	5.75	2470992.02	1892133.95	[3]
P-5121	Stock Water	In Channel	1.67	2.81	2634023.91	1898482.77	[3]
P-5122	Stock Water	Well	0.05	0.06	2609569.74	1899567.08	[3]
P-5123	Stock Water	Diversion	0.69	3.18	2424245.38	1895327.29	[3]
P-5124	Stock Water	Diversion	1.48	9.43	2424224.03	1896099.27	[3]
P-5125	Stock Water	In Channel	0.48	1.1	2500602.20	1898954.68	[3]

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Table B-2: Surface Water Uses

Site Number	Primary Use	Impoundment Source	Impoundment Area (Ac)	Acre Feet	X coordinate	Y Coordinate	Data Source
P-5126	Stock Water	Diversion	0.63	2.55	2429687.58	1897478.41	[3]
P-5127	Stock Water	Well	0.77	1.15	2441982.81	1898143.61	[3]
P-5128	Stock Water	In Channel	1.17	1.4	2621158.42	1903358.86	[3]
P-5129	Stock Water	In Channel	0.28	0.92	2423653.41	1897997.40	[3]
P-5130	Stock Water	In Channel	0.78	1.44	2425323.51	1898384.07	[3]
P-5131	Stock Water	In Channel	0.81	1.26	2609770.48	1904253.59	[3]
P-5133	Stock Water	Diversion	0.54	1.26	2444939.45	1900001.24	[3]
P-5134	Stock Water	In Channel	1.62	5.45	2477194.58	1901368.63	[3]
P-5135	Stock Water	In Channel	0.22	0.27	2707119.65	1908175.54	[3]
P-5136	Stock Water	In Channel	1.1	3.1	2427444.19	1900119.73	[3]
P-5137	Stock Water	In Channel	0.36	1.51	2424321.42	1899954.36	[3]
P-5139	Stock Water	In Channel	0.15	0.18	2569725.61	1905033.46	[3]
P-5140	Stock Water	In Channel	6.3	12.47	2462497.29	1902223.35	[3]
P-5141	Stock Water	In Channel	2.57	7.71	2433598.54	1901666.24	[3]
P-5142	Stock Water	In Channel	0.13	0.34	2428922.22	1901861.59	[3]
P-5143	Stock Water	In Channel	0.2	0.78	2428748.98	1902097.10	[3]
P-5144	Stock Water	In Channel	0.76	1.63	2635409.43	1908255.44	[3]
P-5146	Stock Water	In Channel	0.88	1.8	2570764.63	1908191.34	[3]
P-5147	Stock Water	In Channel	0.14	0.37	2551159.12	1908636.95	[3]
P-5148	Stock Water	Well	0.07	0.1	2704980.78	1915370.19	[3]
P-5149	Stock Water	Well	0.54	3.09	2410565.66	1907606.06	[3]
P-5150	Stock Water	Well	0.44	2.48	2410399.38	1907786.61	[3]
P-5152	Stock Water	In Channel	0.84	0.91	2466111.30	1914023.41	[3]
P-5153	Stock Water	In Channel	0.62	0.52	2456564.73	1915101.47	[3]
P-5154	Stock Water	In Channel	0.67	1.94	2459456.99	1918044.24	[3]
P-5155	Stock Water	Well	0.26	0.59	2432853.46	1919701.98	[3]
P-5157	Stock Water	In Channel	4	7.92	2549077.29	1926761.58	[3]
P-5158	Stock Water	In Channel	9.99	34.75	2577025.66	1926766.04	[3]
P-5160	Stock Water	In Channel	1.31	8.51	2420464.18	1925605.05	[3]
P-5162	Stock Water	In Channel	0.1	0.13	2549272.90	1929860.36	[3]
P-5163	Stock Water	In Channel	0.91	1.09	2557196.49	1930619.83	[3]
P-5165	Stock Water	In Channel	5.92	14.92	2533286.25	1933273.58	[3]
P-5166	Stock Water	Well	0.55	2.03	2434017.98	1931329.23	[3]
P-5167	Stock Water	In Channel	12.91	33.3	2525355.46	1934731.81	[3]
P-5168	Stock Water	In Channel	0.37	0.87	2548152.04	1936047.88	[3]
P-5169	Stock Water	In Channel	0.11	0.33	2550872.94	1937534.33	[3]
P-5170	Stock Water	In Channel	0.1	0.13	2550531.26	1937498.52	[3]
P-5171	Stock Water	In Channel	0.59	1	2551293.51	1937748.40	[3]
P-5172	Stock Water	Well	0.1	0.26	2604357.60	1939778.19	[3]
P-5173	Stock Water	In Channel	7.33	18.02	2579820.13	1938496.28	[3]
P-5174	Stock Water	Well	0.04	0.1	2604396.45	1939898.52	[3]
P-5176	Stock Water	In Channel	2.18	3.67	2588582.73	1941488.15	[3]
P-5177	Stock Water	In Channel	0.43	0.62	2516212.81	1939749.97	[3]
P-5178	Stock Water	In Channel	0.28	0.85	2531167.00	1942035.35	[3]
P-5179	Stock Water	In Channel	1.2	4.24	2530827.33	1942333.97	[3]
P-5180	Stock Water	In Channel	0.83	1.9	2584722.51	1945421.36	[3]
P-5182	Stock Water	Well	0.06	0.06	2606927.28	1957503.28	[3]
P-5183	Stock Water	In Channel	0.32	1.12	2593538.95	1957653.42	[3]
P-5184	Stock Water	In Channel	2.09	3.63	2533440.49	1955601.34	[3]
P-5185	Stock Water	In Channel	1.63	1.76	2599328.57	1958036.09	[3]
P-5187	Stock Water	In Channel	0.21	0.41	2556259.59	1959933.51	[3]
P-5188	Stock Water	In Channel	0.08	0.13	2599784.76	1961228.27	[3]
P-5189	Stock Water	In Channel	1.48	7.82	2582742.42	1960772.57	[3]

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Table B-2: Surface Water Uses

Site Number	Primary Use	Impoundment Source	Impoundment Area (Ac)	Acre Feet	X coordinate	Y Coordinate	Data Source
P-5190	Stock Water	In Channel	1.08	4.29	2556228.27	1960045.65	[3]
P-5192	Stock Water	In Channel	11.24	50.88	2528374.87	1960183.99	[3]
P-5195	Stock Water	In Channel	5.95	37.5	2575053.59	1964474.54	[3]
P-5197	Stock Water	Diversion	0.24	0.65	2416519.19	1963839.80	[3]
P-5200	Stock Water	In Channel	0.65	0.94	2487183.33	1967334.06	[3]
P-5201	Stock Water	In Channel	0.77	2.07	2466900.44	1969039.64	[3]
P-5204	Stock Water	In Channel	1.67	9.93	2419359.77	1968881.48	[3]
P-5205	Stock Water	Well	1.81	2.28	2521869.77	1972011.53	[3]
P-5206	Stock Water	Well	0.72	2.3	2521790.06	1972117.04	[3]
P-5208	Stock Water	In Channel	1.91	1.95	2470683.92	1971062.56	[3]
P-5209	Stock Water	In Channel	0.19	0.26	2561137.12	1973730.74	[3]
P-5210	Stock Water	Well	0.06	0.07	2485838.09	1973112.62	[3]
P-5213	Stock Water	In Channel	0.18	0.23	2566673.01	1976805.28	[3]
P-5217	Stock Water	Well	0.22	0.17	2417561.47	1975474.24	[3]
P-5219	Stock Water	Diversion	0.85	2.67	2412148.29	1976510.97	[3]
P-5220	Stock Water	Diversion	2.47	5.77	2417990.13	1977131.39	[3]
P-5221	Stock Water	Diversion	1.72	3	2416113.87	1976888.59	[3]
P-5222	Stock Water	Diversion	1.58	5.68	2418145.67	1977194.78	[3]
P-5224	Stock Water	Diversion	2.16	3.24	2410896.02	1977333.33	[3]
P-5226	Stock Water	In Channel	0.3	0.56	2407903.00	1978062.04	[3]
P-5228	Stock Water	In Channel	0.31	0.5	2462067.06	1979835.13	[3]
P-5232	Stock Water	In Channel	0.4	0.26	2545969.04	1983709.73	[3]
P-5233	Stock Water	In Channel	6.6	26.52	2546041.21	1983883.90	[3]
P-5234	Stock Water	In Channel	0.24	0.3	2474546.47	1981988.86	[3]
P-5236	Stock Water	Diversion	2.36	10.89	2410353.66	1980769.99	[3]
P-5238	Stock Water	In Channel	3.63	13.72	2419771.74	1981908.51	[3]
P-5240	Stock Water	Diversion	3.85	10.61	2421199.87	1982227.13	[3]
P-5241	Stock Water	In Channel	4.34	26.04	2561823.42	1985923.90	[3]
P-5243	Stock Water	Diversion	1.57	6.42	2415528.96	1982511.47	[3]
P-5247	Stock Water	Well	0.12	0.29	2458923.26	1984962.78	[3]
P-5248	Stock Water	Well	0.11	0.17	2458936.10	1985015.05	[3]
P-5250	Stock Water	In Channel	0.41	0.52	2596883.54	1989642.49	[3]
P-5251	Stock Water	In Channel	0.36	0.57	2478859.45	1986964.42	[3]
P-5253	Stock Water	Diversion	1.12	3.37	2418448.46	1985611.45	[3]
P-5261	Stock Water	In Channel	4.65	11.43	2525389.79	1992137.08	[3]
P-5262	Stock Water	In Channel	4.16	18.71	2568334.71	1993619.73	[3]
P-5274	Stock Water	In Channel	15.9	83.01	2524198.67	1995571.38	[3]
P-5277	Stock Water	In Channel	3.71	13.79	2412374.38	1993985.85	[3]
P-5278	Stock Water	Well	0.09	0.24	2490910.43	1996570.97	[3]
P-5279	Stock Water	Well	0.04	0.06	2490821.40	1996590.77	[3]
P-5280	Stock Water	In Channel	0.59	2.03	2574267.28	1999469.75	[3]
P-5293	Stock Water	In Channel	0.26	0.3	2472644.40	2004013.56	[3]
P-5294	Stock Water	In Channel	0.27	0.28	2513929.19	2006176.80	[3]
P-5297	Stock Water	In Channel	0.21	0.25	2464810.21	2005901.29	[3]
P-5298	Stock Water	In Channel	0.16	0.51	2404516.00	2004772.73	[3]
P-5299	Stock Water	In Channel	0.31	0.53	2462689.41	2006524.76	[3]
P-5305	Stock Water	In Channel	0.48	1.37	2513951.76	2014263.31	[3]
P-5306	Stock Water	In Channel	0.91	2.41	2532727.96	2014949.77	[3]
P-5309	Stock Water	In Channel	0.63	3.94	2527678.07	2015454.10	[3]
P-5311	Stock Water	In Channel	0.63	1.84	2566637.04	2018982.52	[3]
P-5316	Stock Water	In Channel	2.17	5.21	2528069.42	2020899.73	[3]
P-5318	Stock Water	In Channel	0.58	1.4	2534950.07	2021699.97	[3]
P-5319	Stock Water	In Channel	0.37	1.02	2477838.96	2020395.51	[3]

Appendix B
Table B-2: Surface Water Uses

Site Number	Primary Use	Impoundment Source	Impoundment Area (Ac)	Acre Feet	X coordinate	Y Coordinate	Data Source
P-5320	Stock Water	In Channel	1.38	3.24	2529227.25	2022085.45	[3]
P-5323	Stock Water	In Channel	1	1.38	2528211.12	2024349.68	[3]
P-5324	Stock Water	In Channel	1.19	2	2528060.58	2024735.80	[3]
P-5325	Stock Water	In Channel	0.3	0.29	2527210.69	2024699.06	[3]
P-5330	Stock Water	In Channel	2.74	6.57	2546977.52	2026939.87	[3]
P-5333	Stock Water	Well	4.08	26.41	2456954.19	2025291.16	[3]
P-5334	Stock Water	Well	0.37	0.62	2472671.56	2026472.39	[3]
P-5342	Stock Water	Well	0.19	0.29	2472040.38	2029327.09	[3]
P-5344	Stock Water	In Channel	0.75	5.11	2530465.26	2031334.61	[3]
P-5352	Stock Water	In Channel	9.34	15.69	2542299.33	2036005.68	[3]
P-5353	Stock Water	In Channel	0.78	1.72	2538891.44	2036209.45	[3]
P-5354	Stock Water	In Channel	3.94	6.85	2516330.81	2035657.25	[3]
P-5357	Stock Water	In Channel	0.25	1.21	2568150.55	2039198.81	[3]
P-5358	Stock Water	In Channel	1.16	1.67	2511628.74	2038458.87	[3]
P-5362	Stock Water	Well	0.1	0.1	2486912.44	2040307.77	[3]
P-5366	Stock Water	In Channel	0.24	0.43	2444734.82	2043026.26	[3]
P-5367	Stock Water	In Channel	6.55	18.07	2446787.00	2043338.88	[3]
P-5368	Stock Water	Well	0.09	0.21	2428055.50	2044986.60	[3]
P-5374	Stock Water	In Channel	0.07	0.1	2428782.46	2053422.63	[3]
P-5378	Stock Water	In Channel	1.27	4.04	2547781.49	2060487.02	[3]
P-5380	Stock Water	In Channel	0.78	2.94	2515124.68	2064448.83	[3]
P-5383	Stock Water	In Channel	1.15	2	2515093.78	2066593.34	[3]
P-5384	Stock Water	In Channel	1.04	3.18	2514786.85	2066597.67	[3]
P-5386	Stock Water	In Channel	1.18	7.39	2513978.39	2068060.67	[3]
P-5388	Stock Water	In Channel	7.53	50.43	2481683.31	2067433.02	[3]
P-5389	Stock Water	In Channel	0.14	0.22	2476182.07	2069650.39	[3]
P-5391	Stock Water	In Channel	0.12	0.23	2515536.36	2071392.89	[3]
P-5392	Stock Water	In Channel	4.23	5.07	2530023.87	2074139.48	[3]
P-5394	Stock Water	In Channel	2.03	3.29	2479164.59	2082712.11	[3]

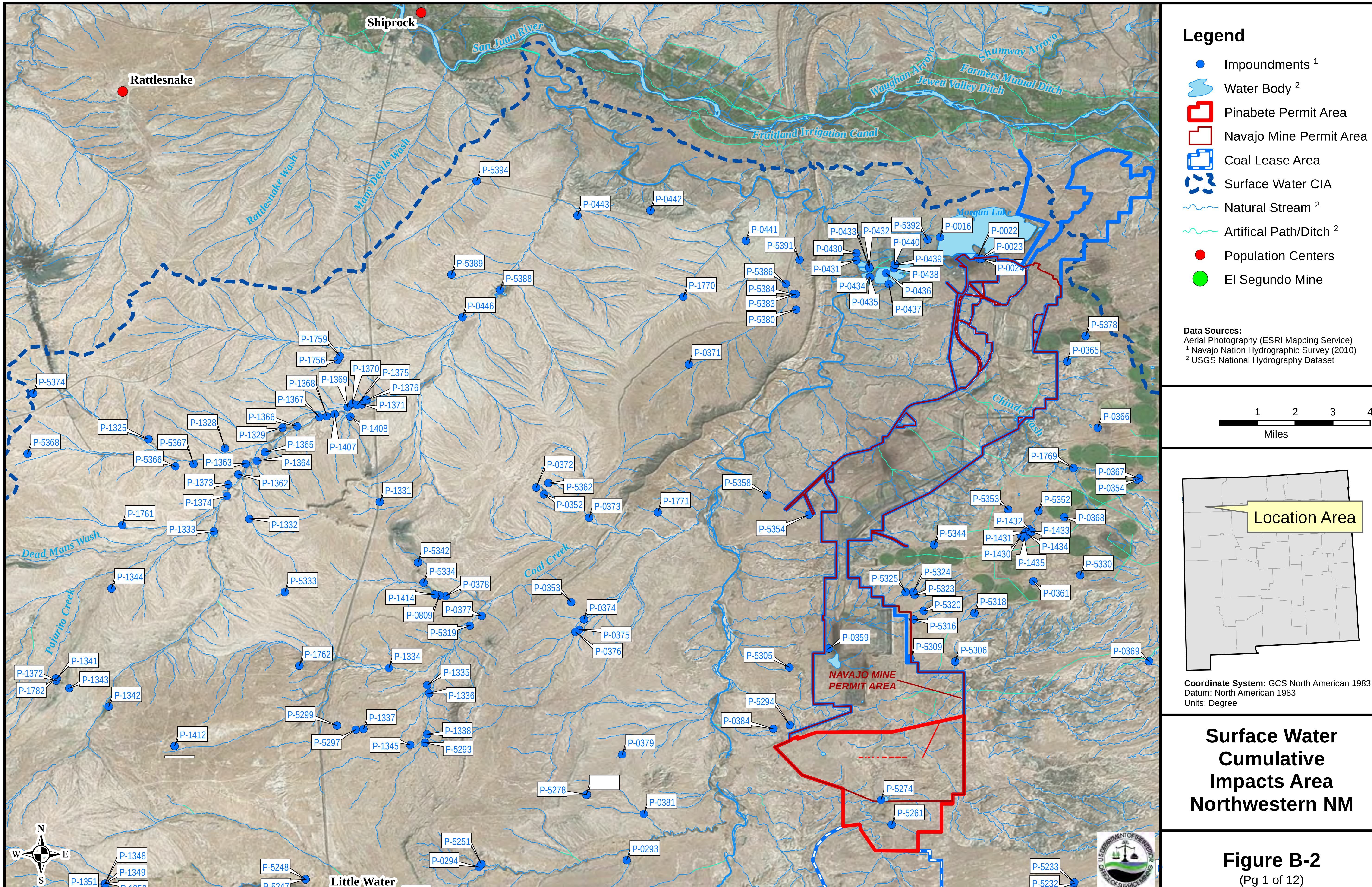
Data Source:

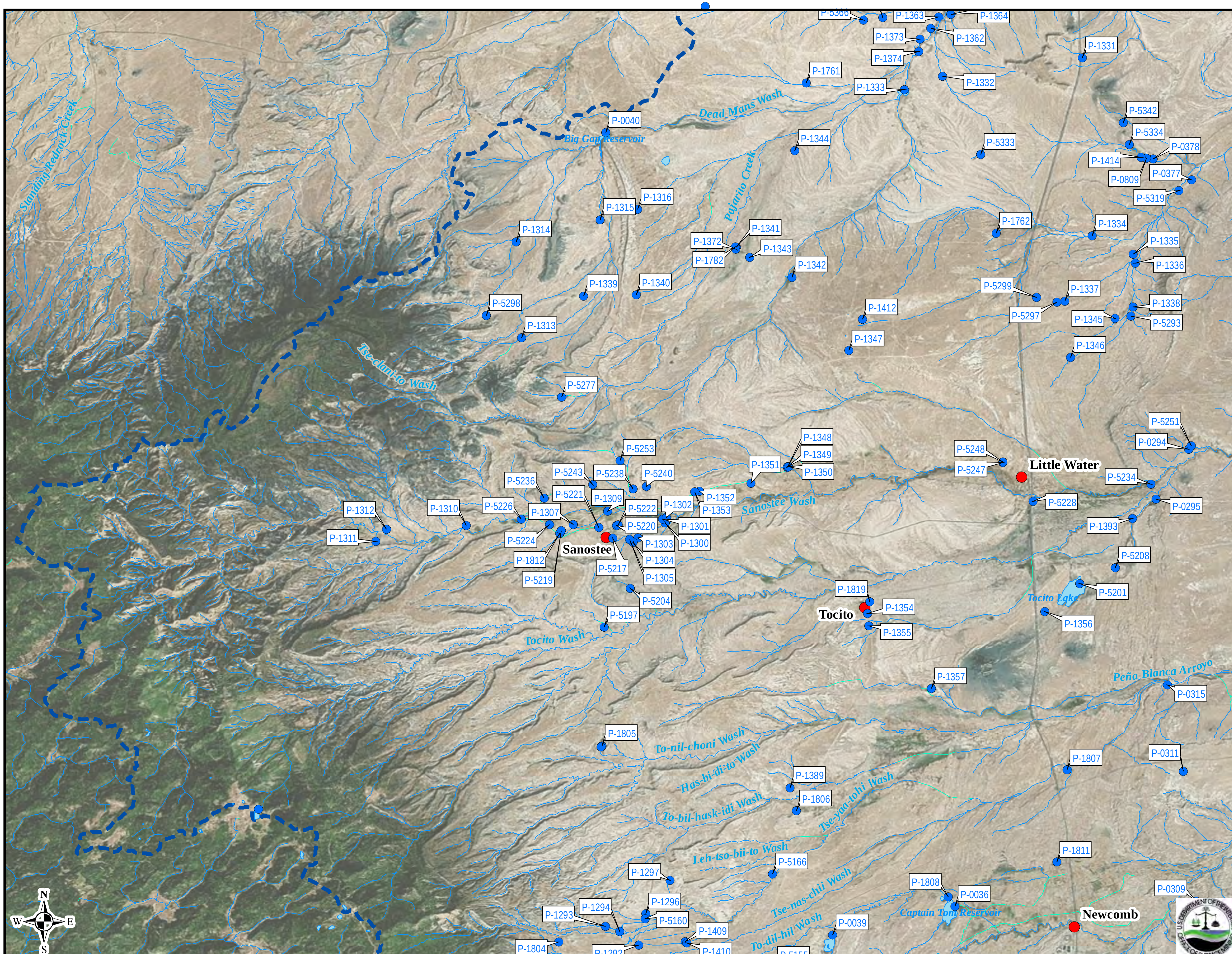
[1] NMSEO: Navajo Hydrographic Survey (2010) - Table F-3
New Mexico State Engineer's Office - Settlements "Notice of Navajo Nation Expedited Inter Se Proceeding" - Navajo Hydrographic Survey (2010) - Table F-3 (http://www.ose.state.nm.us/legal_ose_proposed_settlements_sj_notice2010.html)

[2] NMSEO: Navajo Hydrographic Survey (2010) - Table K-1
New Mexico State Engineer's Office - Settlements "Notice of Navajo Nation Expedited Inter Se Proceeding" - Navajo Hydrographic Survey (2010) - Table K-1

[3] NMSEO: Navajo Hydrographic Survey (2010) - Table M-3
New Mexico State Engineer's Office - Settlements "Notice of Navajo Nation Expedited Inter Se Proceeding" - Navajo Hydrographic Survey (2010) - Table M-3 (http://www.ose.state.nm.us/legal_ose_proposed_settlements_sj_notice2010.html)

[4] NMSEO: Navajo Hydrographic Survey (2010) - Table D-3
New Mexico State Engineer's Office - Settlements "Notice of Navajo Nation Expedited Inter Se Proceeding" - Navajo Hydrographic Survey (2010) - Table D-3 (http://www.ose.state.nm.us/legal_ose_proposed_settlements_sj_notice2010.html)


Shiprock
Rattlesnake
Little Water
San Juan River
Shumway Arroyo
Farmers Mutual Ditch
Waughan Arroyo
Jewett Valley Ditch
Fruitland Irrigation Canal
Morgan Lake
Rattlesnake Wash
Many Devils Wash
Dead Mans Wash
Pajarito Creek
Coal Creek
Chinde Wash
NAVAJO MINE PERMIT AREA
Legend
Impoundments 1
Water Body 2
Pinabete Permit Area
Navajo Mine Permit Area
Coal Lease Area
Surface Water CIA
Natural Stream 2
Artifical Path/Ditch 2
Population Centers
El Segundo Mine
Data Sources:
Aerial Photography (ESRI Mapping Service)
1 Navajo Nation Hydrographic Survey (2010)
2 USGS National Hydrography Dataset
1 2 3 4
Miles
Location Area
Coordinate System: GCS North American 1983
Datum: North American 1983
Units: Degree
Surface Water Cumulative Impacts Area Northwestern NM
Figure B-2
(Pg 1 of 12)



Legend

- Impoundments [1]
- Water Body [2]
- Pinabete Permit Area
- Navajo Mine Permit Area
- Coal Lease Area
- Surface Water CIA
- Natural Stream [2]
- Artifical Path/Ditch [2]
- Population Centers
- El Segundo Mine

Data Sources:
Aerial Photography (ESRI Mapping Service)
[1] Navajo Nation Hydrographic Survey (2010)
[2] USGS National Hydrography Dataset

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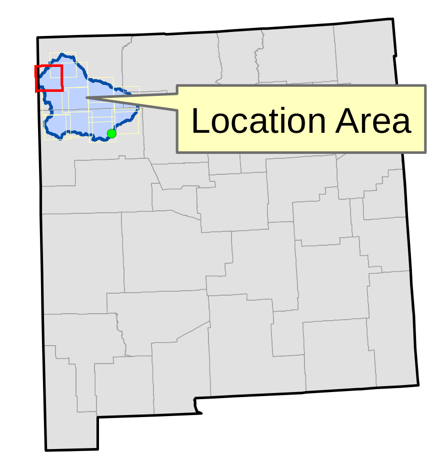
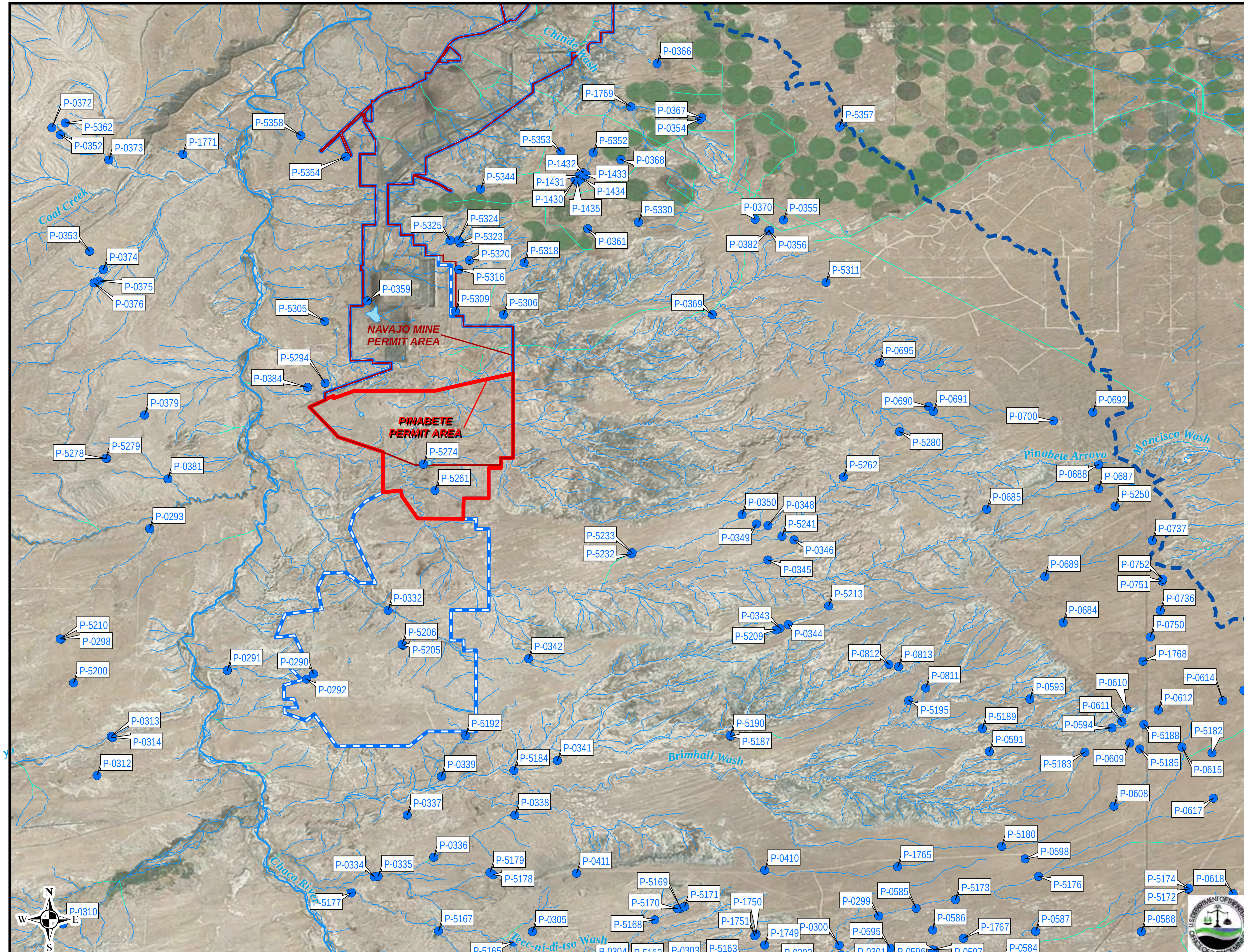


Coordinate System: GCS North American 1983
Datum: North American 1983
Units: Degree

Surface Water Cumulative Impacts Area Northwestern NM

Figure B-2

(Pg 2 of 12)



Legend

- Impoundments [1]
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- Coal Lease Area
- Surface Water CIA
- Natural Stream [2]
- Artifical Path/Ditch [2]
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Data Sources:
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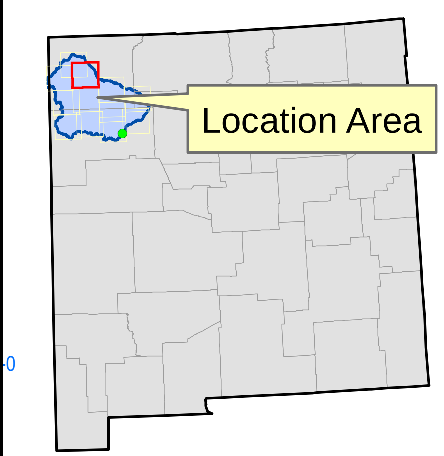
[1] Navajo Nation Hydrographic Survey (2010)
[2] USGS National Hydrography Dataset

1 0 1 2 3 4
Miles



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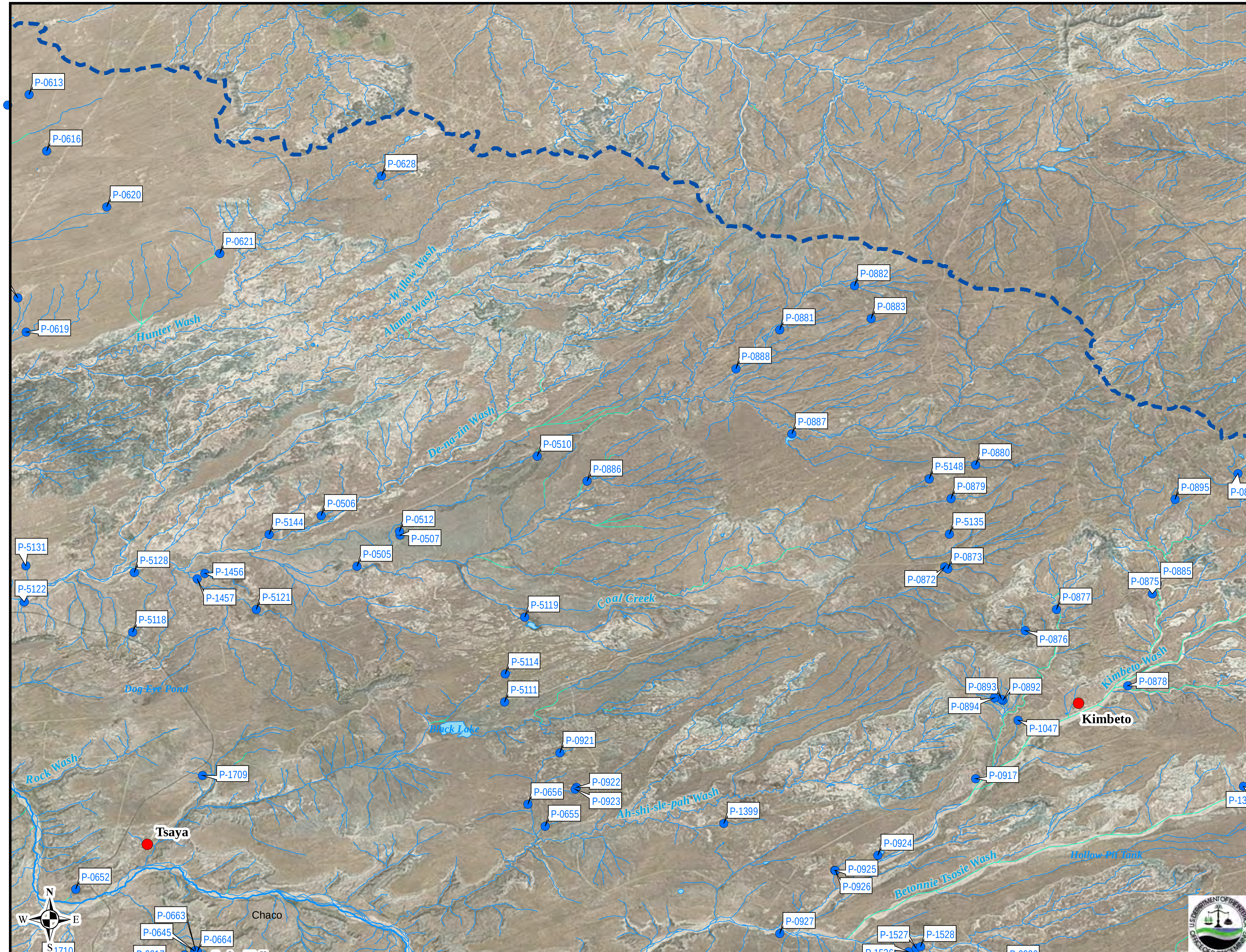
Datum: North American 1983
Units: Degree

Surface Water Cumulative Impacts Area Northwestern NM

Figure B-2

(Pg 3 of 12)



Legend

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Data Sources:
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[1] Navajo Nation Hydrographic Survey (2010)
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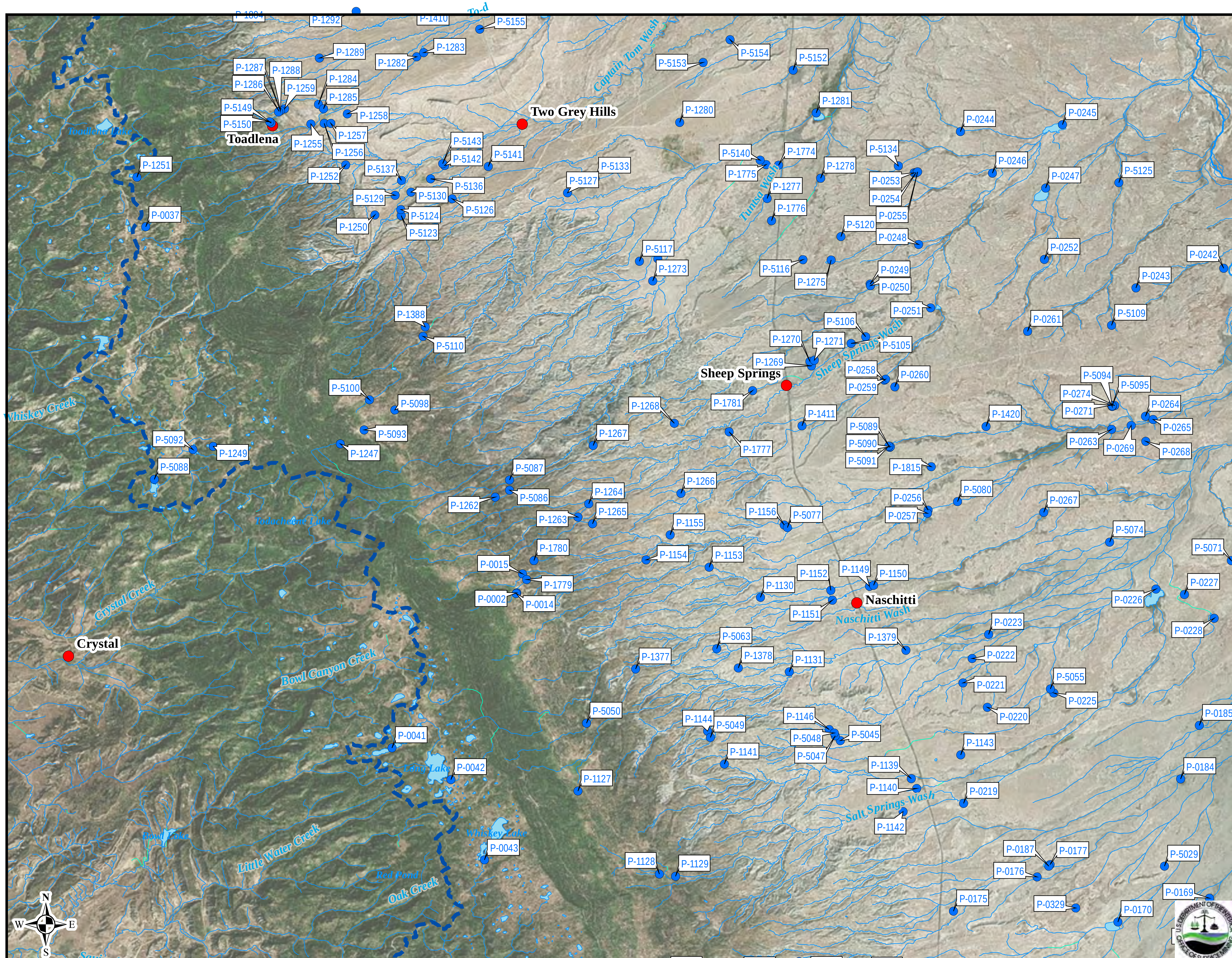
1 0 1 2 3 4
Miles

Coordinate System: GCS North American 1983
Datum: North American 1983
Units: Degree

Surface Water Cumulative Impacts Area Northwestern NM

Figure B-2
(Pg 4 of 12)



Legend

- Impoundments [1]
- Water Body [2]
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- Navajo Mine Permit Area
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- Surface Water CIA
- Natural Stream [2]
- Artifical Path/Ditch [2]
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Data Sources:
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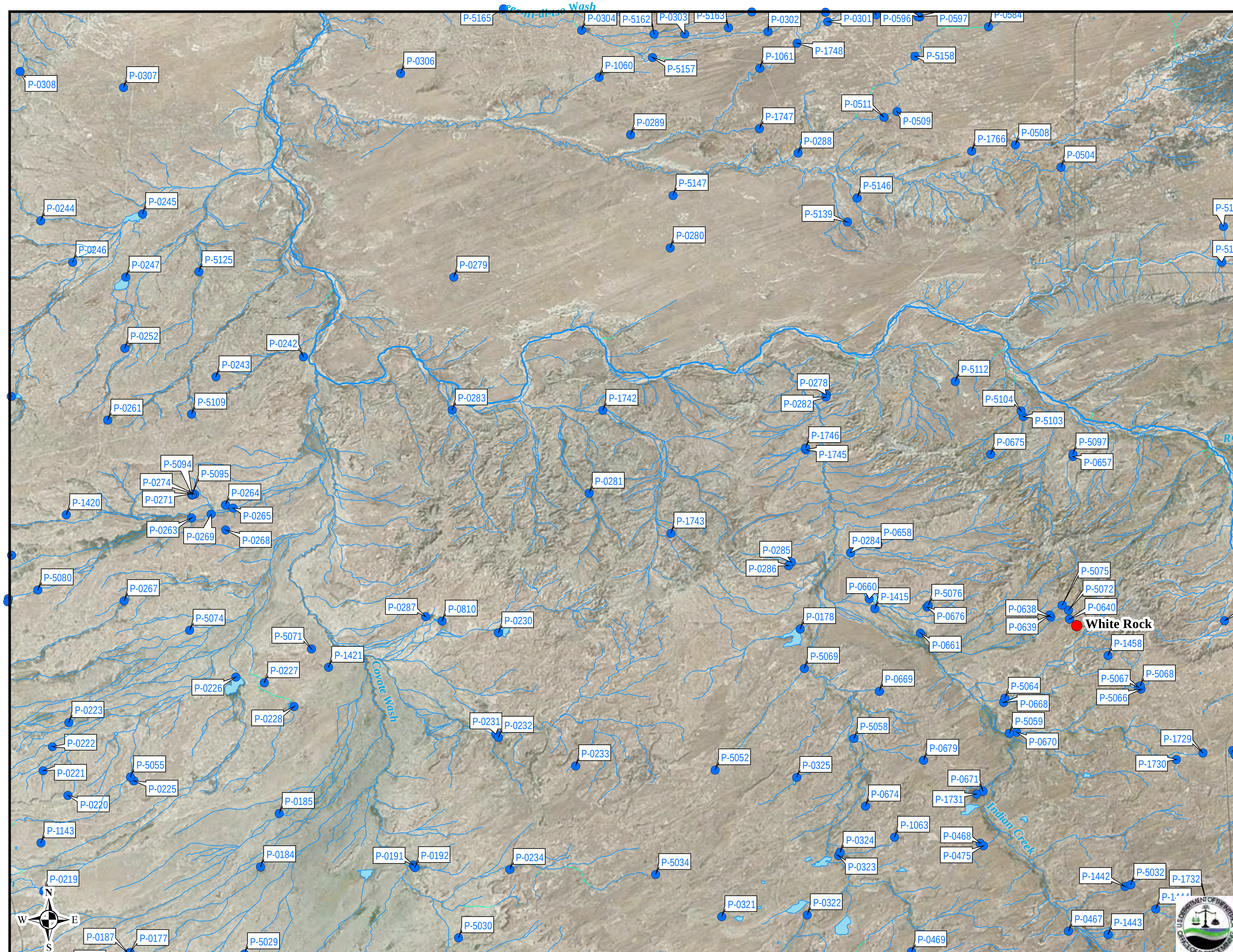
1 0 1 2 3 4
Miles

Location Area

Coordinate System: GCS North American 1983
Datum: North American 1983
Units: Degree

Surface Water Cumulative Impacts Area Northwestern NM

Figure B-2
(Pg 5 of 12)



Legend

- Impoundments [1]
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- Surface Water CIA
- Natural Stream [2]
- Artifical Path/Ditch [2]
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Data Sources:
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[2] USGS National Hydrography Dataset

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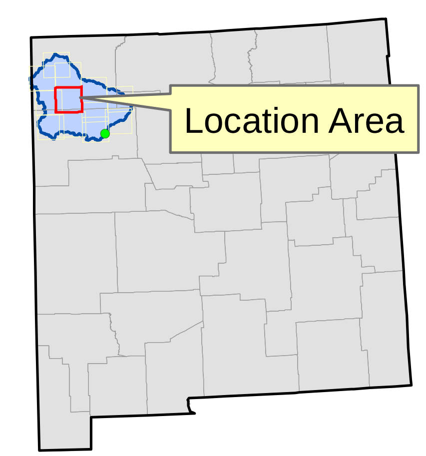

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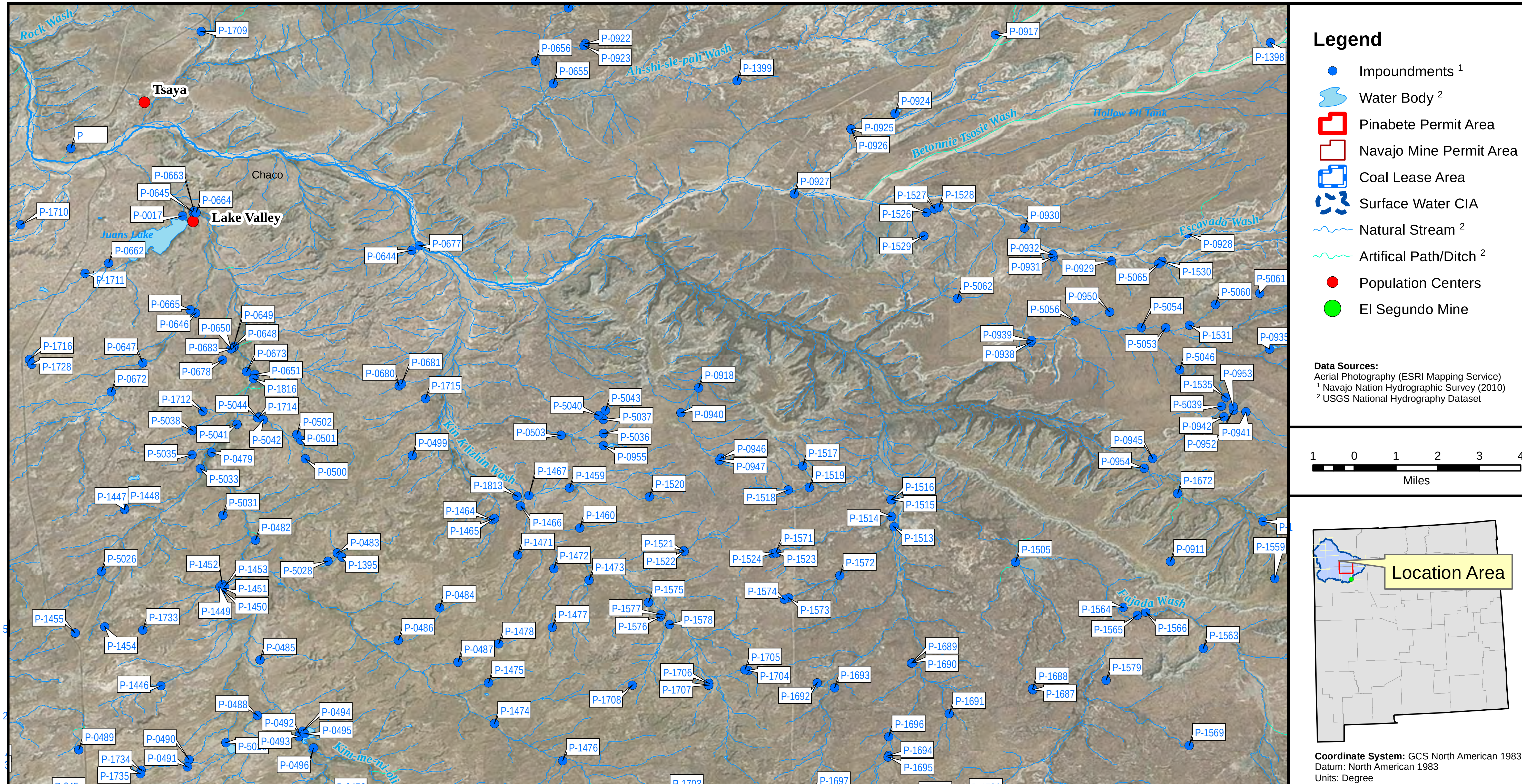
Datum: North American 1983
Units: Degree

Surface Water Cumulative Impacts Area Northwestern NM

Figure B-2

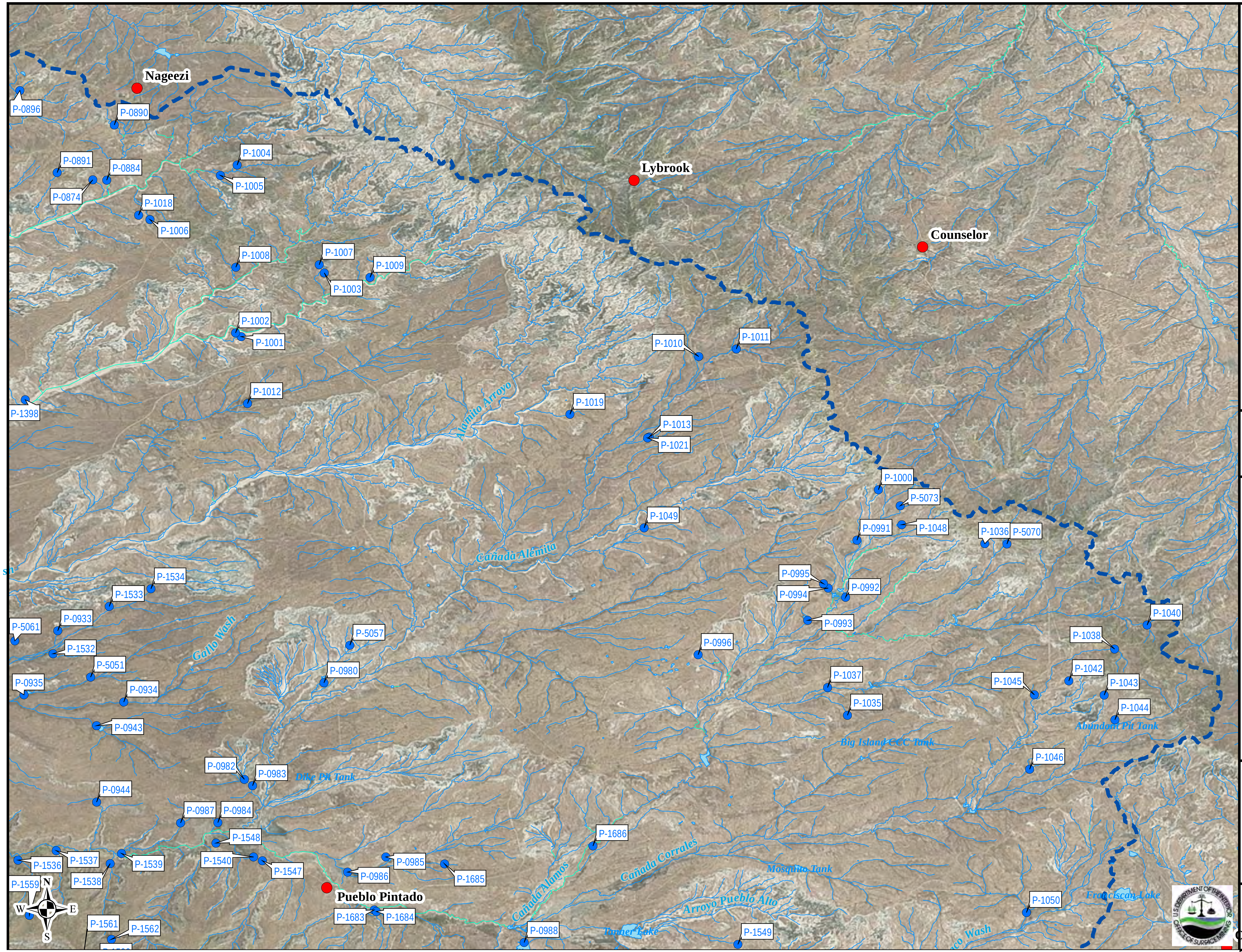
(Pg 6 of 12)



Surface Water Cumulative Impacts Area Northwestern NM

Figure B-2

(Pg 7 of 12)



Legend

- Impoundments [1]
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- Artifical Path/Ditch [2]
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- El Segundo Mine

Data Sources:
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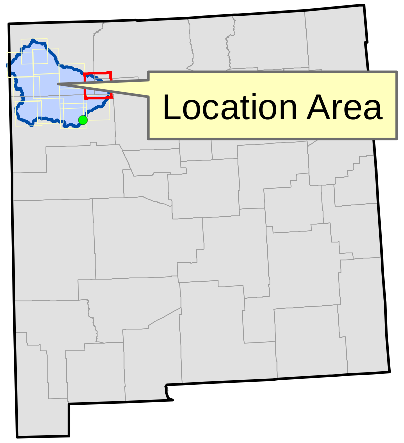
[1] Navajo Nation Hydrographic Survey (2010)
[2] USGS National Hydrography Dataset

1 0 1 2 3 4
Miles



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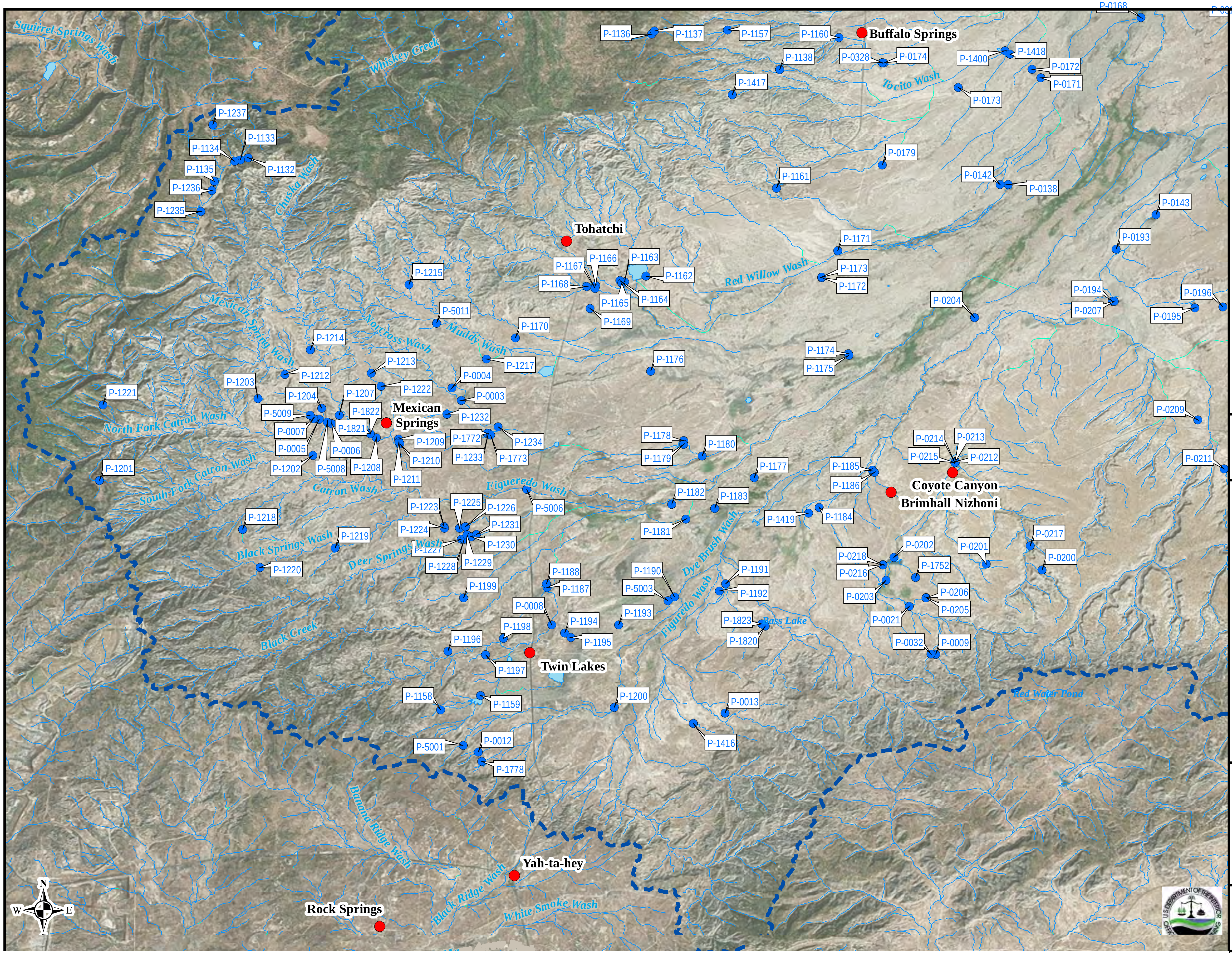
Datum: North American 1983
Units: Degree

Surface Water Cumulative Impacts Area Northwestern NM

Figure B-2
(Pg 8 of 12)



Legend

- Impoundments [1]
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- Population Centers
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Data Sources:
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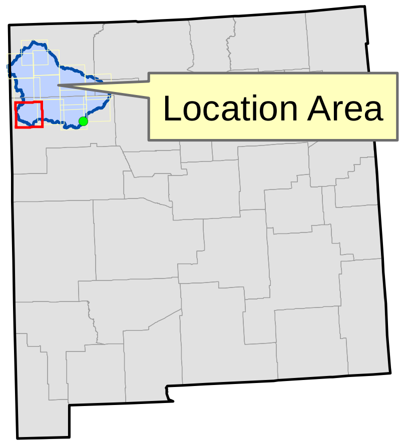
1 0 1 2 3 4
Miles



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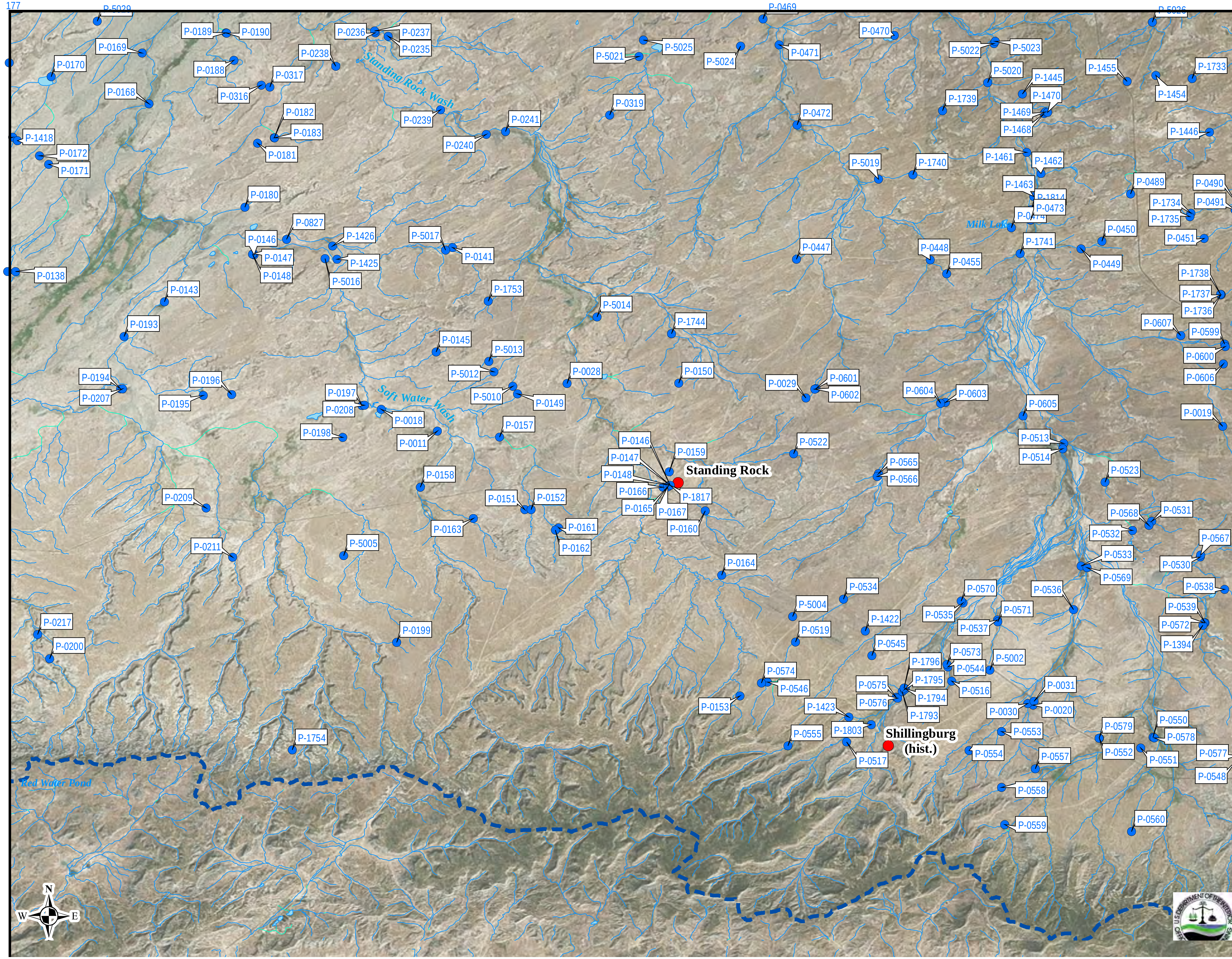
Surface Water Cumulative Impacts Area Northwestern NM

Figure B-2
(Pg 9 of 12)



Legend

- Impoundments [1]
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- Natural Stream [2]
- Artifical Path/Ditch [2]
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Data Sources:
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[2] USGS National Hydrography Dataset

1 0 1 2 3 4
Miles

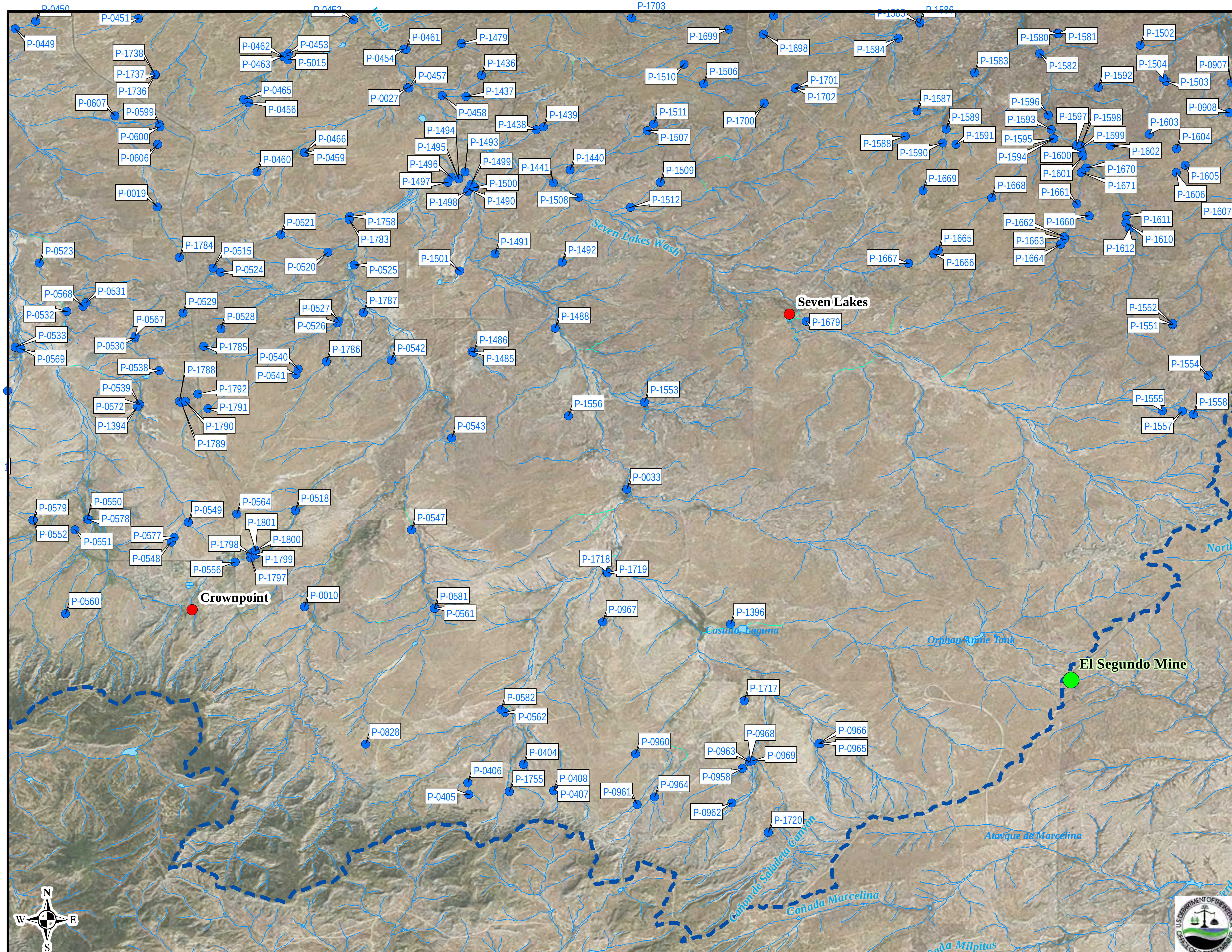
Location Area

Coordinate System: GCS North American 1983
Datum: North American 1983
Units: Degree

Surface Water Cumulative Impacts Area Northwestern NM

Figure B-2

(Pg 10 of 12)



Legend

- Impoundments [1]
- Water Body [2]
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- Natural Stream [2]
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Data Sources:
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[1] Navajo Nation Hydrographic Survey (2010)
[2] USGS National Hydrography Dataset

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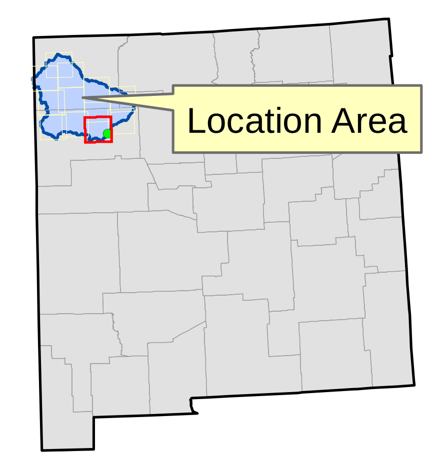
Miles



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Datum: North American 1983
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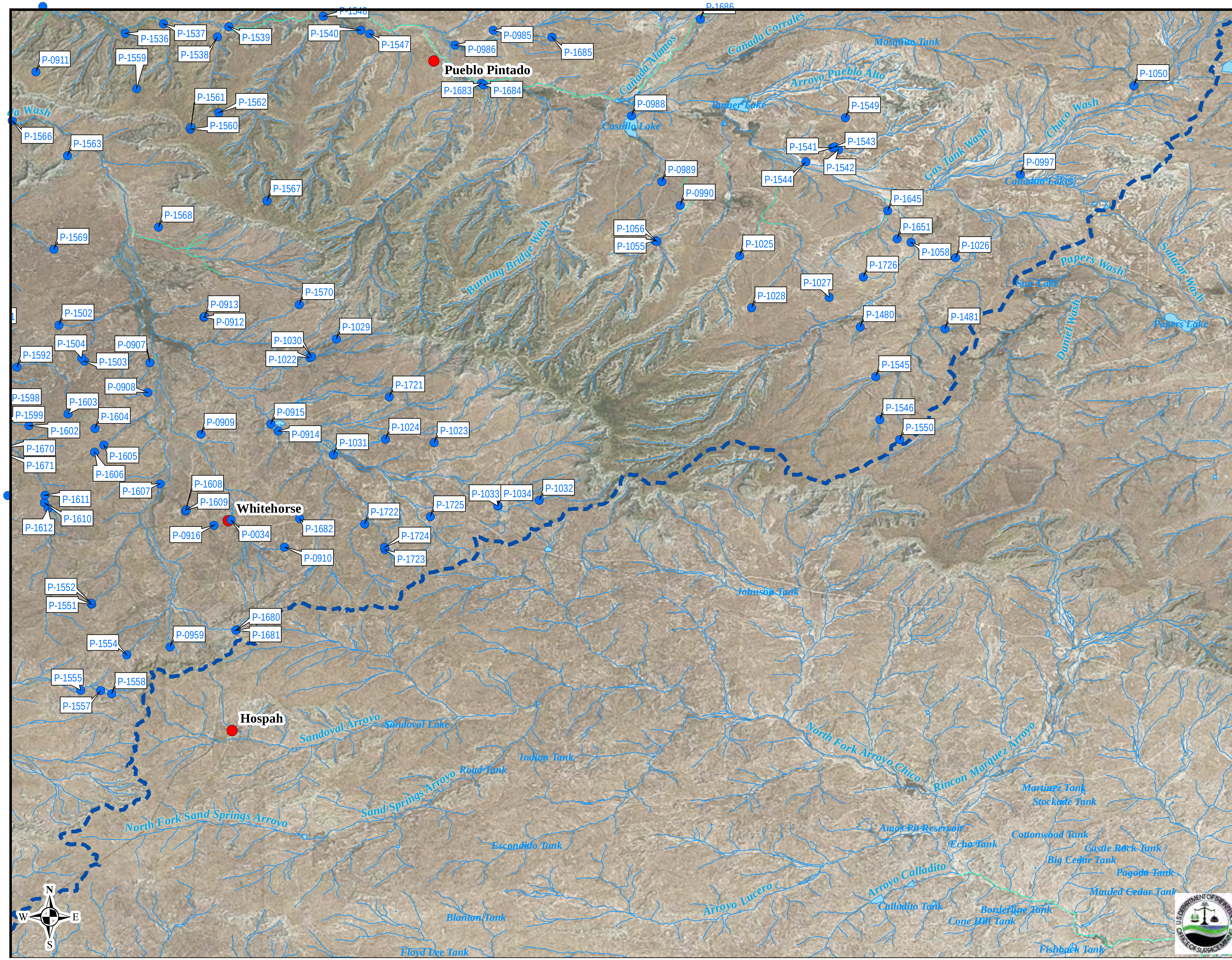
Surface Water Cumulative Impacts Area Northwestern NM

Figure B-2

(Pg 11 of 12)



Legend

- Impoundments [1]
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1 0 1 2 3 4
Miles

Location Area

Coordinate System: GCS North American 1983
Datum: North American 1983
Units: Degree

Surface Water Cumulative Impacts Area Northwestern NM

Figure B-2

Appendix C

NTEC Water Management Structures

Subwatershed (HUC12 code)	Total Watershed Acreage	Drainage	Navajo Mine Area	Impoundment Name	Type	Navajo Mine Pit	Intended Life Span	Watershed Area (acres)	Design Storm Event	Peak Discharge (cfs)	Runoff Volume (acre-feet)	Status	Percent Drainage Area Disturbed
Morgan Lake-Chaco River 140801062008	**32,637**	Morgan Lake Tributary	I	**Emma's Pond**	Sediment	Pinto	Will be removed in 2025	91.50	100-yr, 6-hr	76.22	3.34	Active	0.28%
			I	**North Pond Cell A, B & C (combined)**	Sediment	Facilities	Will be removed in 2025	214.90	100-yr, 6-hr	138.4	11.39	Active	0.66%
			I	**North Pond 1 Cell A**	Sediment	Facilities	Will be removed in 2025	See Table 11-5U North Pond 1 Cells A, B & C	100-yr, 6-hr	See Table 11-5U North Pond 1 Cells A, B & C	See Table 11-5U North Pond 1 Cells A, B & C	Active	
			I	**North Pond 1 Cell A2**	Sediment	Facilities	Will be removed in 2025	51.90	100-yr, 6-hr	16.3	2.67	Active	
			I	**North Pond 1 Cell B**	Sediment	Facilities	Will be removed in 2025	See Table 11-5U North Pond 1 Cells A, B & C	100-yr, 6-hr	See Table 11-5U North Pond 1 Cells A, B & C	See Table 11-5U North Pond 1 Cells A, B & C	Active	
			I	**North Pond 1 Cell C**	Sediment	Facilities	Will be removed in 2025	See Table 11-5U North Pond 1 Cells A, B & C	100-yr, 6-hr	See Table 11-5U North Pond 1 Cells A, B & C	See Table 11-5U North Pond 1 Cells A, B & C	Active	
Total								**306.4**		**214.6**	**14.7**		**0.94%**
Chinde Wash-Chaco River 140801062007	**14,225**	Hosteen Wash	II	**North Pinto Pond**	Sediment	Pinto	Will be removed in 2025	76.90	100-yr, 6-hr	42.2	3.6	Active	0.54%
			II	**North Sewer Pond**	Sediment	Facilities	Will be removed in 2025	2.20	100-yr, 6-hr	6.43	0.38	Active	0.02%
			II	**Pond 5**	Sediment		Will be removed in 2025	41.90	100-yr, 6-hr	36.53	1.92	Active	0.29%
		Barber Arroyo	II	**Vinnel Pond**	Sediment	Bighan	Will be removed in 2006	276.50	10-yr, 24-hr	11.06	4.78	Active	1.94%
			II	**Hosteen Stockpile Pond 1**	Sediment	Hosteen	Will be removed in 2025	155.54	10-yr, 24-hr	22.17	4.01	Active	1.09%
			II	**Hosteen Stockpile Pond 2**	Sediment	Hosteen	Will be removed in 2025	122.80	10-yr, 24-hr	26.55	4.36	Active	0.86%
			II	**Hosteen Stockpile Pond 3**	Sediment	Hosteen	Will be removed in 2025	135.20	100-yr, 6-hr	68.03	6.76	Active	0.95%
			II	**Barber Loadout**	Sediment	Barber	Will be removed in 2025	3.60	100-yr, 6-hr	8.01	0.33	Active	0.03%
			II	**Barber Stockpile Pond 2**	Sediment (I)	Barber	Will be removed in 2025	106.60	100-yr, 6-hr	82.12	5.72	Active	0.75%
			II	**Barber Stockpile Pond 3**	Detention	Barber	Will be removed in 2025	59.80	10-yr, 24-hr	4.28	1.13	Active	0.42%
		South Barber Arroyo	III	**Block-C Pond 1**	Sediment	Block C	Will be removed in 2015	49.48	100-yr, 6-hr	38.54	2.49	Active	0.35%
			III	**Block-C Pond 2**	Sediment	Block C	Will be removed in 2015	66.64	100-yr, 6-hr	62.1	4.42	Active	0.47%
			III	**Block-C Pond 3**	Sediment	Block C	Will be removed in 2015	269.20	10-yr, 24-hr	74.52	10.48	Active	1.89%
			III	**Block-C Pond 4**	Sediment	Block C	Will be removed in 2015	262.64	100-yr, 6-hr	128.27	13.19	Active	1.85%
Total								**1,629.0**		**610.8**	**63.6**		**11.45%**
Coal Creek-Chaco River 140801062005	**28,235**	Neck Arroyo	II	**Area III Sewer Pond**	Sewage	Facilities	Will be removed in 2025	1.20	100-yr, 6-hr	2.67	0.11	Active	0.00%
		Lowe Arroyo	III	**Area III Sewage Pond-2**	Sediment	Facilities	Will be removed in 2025	N/A	N/A	N/A	N/A		
			III	**Mason Pond**	Sediment	Barber	Will be removed in 2015	133.20	100-yr, 6-hr	96.4	7.2	Active	0.47%
			III	**South Barber Pond**	Sediment	Barber	2016	157.40	100-yr, 6-hr	70	5.43	Active	0.56%
			III	**Employee Coal Dump**	Sediment	Barber	2015	6.20	100-yr, 6-hr	12.12	0.53	Active	0.02%
			III	**Lowe Highwall Pond 304**	Highwall Impoundment	Lowe		416.70					1.48%
			III	**Lowe Highwall Pond 305**	Highwall Impoundment	Lowe		933.00					3.30%
			III	**Lowe Hole 3 Pond 2**	Highwall Impoundment	Lowe	Will be removed in 2025	628.37	2-yr, 6-hr	23.8	7.7	Active	2.23%
			III	**Lowe Hole 3 Pond 3**	Highwall Impoundment	Lowe	Will be removed in 2009	39.61	100-yr, 6-hr	32.45	2.01	Active	0.14%
			III	**Lowe Impoundment 1**	Highwall Impoundment	Lowe	Permanent	1642	25-yr, 6-hr	241.9	50.04	Active	5.82%
			III	**Lowe Loadout**	Sediment	Lowe	Will be removed in 2025	3.40	100-yr, 6-hr	7.57	0.31	Active	0.01%
			III	**Lowe Railroad Impoundment #1**	Sediment	Lowe	This pond will be reclaimed in 2015	105.73	100-yr, 6-hr	39.73	6.84	Active	0.37%
			III	**Lowe Railroad Impoundment #2**	Sediment	Lowe	Will be removed in 2025	133.27	10-yr, 24-hr	103.67	6.65	Active	0.47%
			III	**Lowe Stockpile Pond**	Sediment	Lowe	Will be removed in 2025	51.80	10-yr, 24-hr	13.35	2.99	Active	0.18%
Total								**4,251.9**		**643.7**	**89.8**		**15.06%**

Appendix C

NTEC Water Management Structures

Subwatershed (HUC12 code)	Total Watershed Acreage	Drainage	Navajo Mine Area	Impoundment Name	Type	Navajo Mine Pit	Intended Life Span	Watershed Area (acres)	Design Storm Event	Peak Discharge (cfs)	Runoff Volume (acre-feet)	Status	Percent Drainage Area Disturbed
Cottonwood Arroyo 140801062002	**29,845**	North Fork Cottonwood Arroyo	III	**Lowe-Dixon Diversion North Pond**	Sediment	Lowe	Will be mined out in Lowe Strip 66	7.40	100-yr, 6-hr	10.06	0.81	Removed	0.02%
			III	**Lowe-Dixon Diversion South Pond**	Sediment	Lowe	Will be mined out in Dixon Strip 68	33.30	100-yr, 6-hr	40.46	3.64	Active	0.11%
			III	**Northwest Dixon**	Sediment	Dixon	Will be removed in 2025	62.20	100-yr, 6-hr	47.84	4.42	Active	0.21%
			III	**North Fork Pond**	Impoundment	Dixon		198.70				Active	0.67%
			III	**Pond 302**	Sediment	Dixon	2016	41.70	100-yr, 6-hr	Refer to Appendix 11-AA	3.8	Active	0.14%
		Cottonwood Arroyo	III	**Collyer Road Pond #4**	Sediment	Dixon	Will be removed in 2009	142.1 – AOC topo (72.3– Current topo)	100-yr, 6-hr	81.9/(40.1)	10.0/(2.4)	Active	0.00%
			III	**Pond 301**	Sediment	Dixon	2016	32.90	100-yr, 6-hr	Refer to Appendix 11-AA	2.4	Active	0.11%
			III	**South Dixon Pond 1**	Sediment	Dixon	Will be removed in 2009	296.46	10-yr, 24-hr	73.11	6.63	Active	0.99%
			III	**South Dixon Pond 2**	Sediment	Dixon	Will be removed in 2009	28.40	100-yr, 6-hr	23.15	1.33	Active	0.10%
			III	**South Dixon Pond 3**	Sediment	Dixon	Will be removed in 2009	28.18	100-yr, 6-hr	22.6	1.05	Active	0.09%
			III	**South Dixon Pond 7**	Sediment	Dixon	Will be removed in 2009	82.00	10-yr, 24-hr	54.34	5.62	Active	0.27%
			III	**Southwest Dixon Pond**	Sediment	Dixon	Will be removed in 2009	37.80	100-yr, 6-hr	33.33	2.01	Active	0.13%
			IVN	**Area 4 North Pond 1**	Sediment		2016	40.40	100-yr, 6-hr	44	3.92		0.14%
			IVN	**Area 4 North Pond 2**	Sediment		2016	35.50	100-yr, 6-hr	49.6	3.44		0.12%
			IVN	**Area 4 North Pond 3**	Sediment		Until completion of final reclamation	8.60	100-yr, 6-hr	Refer to Appendix 11-AA	0.8	Active	0.03%
			IVN	**Area 4 North Pond 4**	Sediment		Until completion of final reclamation	46.30	100-yr, 6-hr	Refer to Appendix 11-AA	4.5	Active	0.16%
			IVN	**Area 4 North Pond 5**	Sediment		2016	254.03	10-yr, 24-hr	103.9	13.75		0.85%
			IVN	**Area 4 North Pond 6**	Sediment		2016	356.60	100-yr, 6-hr	50.8	14.73		1.19%
			IVN	**Area 4 North Pond 7**	Sediment		2016	84.10	100-yr, 6-hr	90	5.68		0.28%
			IVN	**Area 4 North Pond 401**	Sediment		Until completion of final reclamation	20.80	100-yr, 6-hr	Refer to Appendix 11-AA	1.4	Active	0.07%
			IVN	**Area 4 North Pond 402**	Sediment		Until completion of final reclamation	96.80	100-yr, 6-hr	Refer to Appendix 11-AA	6.8	Active	0.32%
			IVN	**Area 4 North Pond 404**	Sediment		2016	11.70	100-yr, 6-hr	Refer to Appendix 11-AA	1	Active	0.04%
			IVN	**Area 4 North Pond 405**	Sediment		2016	90.60	100-yr, 6-hr	Refer to Appendix 11-AA	6.3	Active	0.30%
			IVN	**Area 4 North Pond 406**	Highwall Impoundment			238.10				Active	0.80%
			IVN	**Area 4 North Pond 407**	Highwall Impoundment			124.80				Active	0.42%
			IVN	**Area 4 North Pond 408**	Sediment		Until completion of final reclamation	6.18	100-yr, 6-hr	Refer to Appendix 11-AA	0.4	Active	0.02%
			IVN	**Area 4 North Pond 409**	Sediment		Until completion of final reclamation	2.83	100-yr, 6-hr	Refer to Appendix 11-AA	0.2	Active	0.01%
			IVN	**Area 4 North Pond 410**	Sediment		Until completion of final reclamation	2.37	100-yr, 6-hr	Refer to Appendix 11-AA	0.17	Active	0.01%
			IVN	**Area 4 North Pond 411**	Sediment		Until completion of final reclamation	12.50	100-yr, 6-hr	Refer to Appendix 11-AA	1.2	Active	0.04%
			IVN	**Area 4 North Pond 412**	Sediment		Until completion of final reclamation	30.60	100-yr, 6-hr	Refer to Appendix 11-AA	3	Active	0.10%
			IVN	**Area 4 North Pond 413**	Sediment		Until completion of final reclamation	6.80	100-yr, 6-hr	Refer to Appendix 11-AA	0.6	Active	0.02%
Total								**2,460.8**		**725.1**	**109.6**		**8.25%**

Appendix D: Surface Water Quality Data Summary Tables

(all Values are dissolved (mg/L) unless otherwise indicated)

Chaco Downstream (USGS 09367950)	Dates	n	Range	Median	MAD	Average	Standard Deviation	Percent Relative Standard Deviation	Q3	95th Percentile	Exceedance of Criteria											
											Livestock		Aquatic & Wildlife Acute		Aquatic & Wildlife Chronic		Secondary Human Contact		Fish Consumption		Baseline Median + 2MAD	
											n	%	n	%	n	%	n	%	n	%	n	%
Aluminum	(04/28/1977-04/28/1977)	**1**	(0.05-0.05)	**0.05**	0	**0.050**			0.05	**0.05**												
Arsenic	(12/11/1975-08/10/1989)	**44**	(0.0005-0.02)	**0.0020**	0.0010	**0.0033**	0.0046	**142**	0.003	**0.0154**											4	9
Barium	(12/11/1975-05/19/1981)	**34**	(0.05-0.5)	**0.085**	0.035	**0.14**	0.13	**91**	0.2	**0.37**											12	35
Boron	(11/13/1975-08/10/1989)	**94**	(0.08-25.)	**2.5**	1.9	**3.551**	4.214	**119**	4.6	**9.3**	22	**23.4**									90	96
Cadmium	(04/28/1977-08/10/1989)	**13**	(0.0005-2.)	**0.0005**	0	**0.1544**	0.5545	**359**	0.001	**0.8006**	1	**8**	1	**8**	1	8	13	**100**	1	**8**	4	31
Chloride	(10/08/1969-08/10/1989)	**72**	(12.-720.)	**78**	42	**106**	102	**96**	130	174.5	1	**1**									68	**94**
Chromium	(04/28/1977-08/10/1989)	**13**	(0.001-0.01)	**0.01**	0	**0.009**	0.003	**39**	0.01	**0.01**			13	**100**								
Copper	(12/20/1978-08/10/1989)	**4**	(0.005-0.031)	**0.009**	0.0025	**0.0135**	0.011846	**88**	0.015	**0.02785**			1	**25**			1	**25**				
Fluoride	(04/27/1970-08/10/1989)	72	(0.1-13.)	**1.55**	0.85	**2.7**	2.5	**91**	3.825	**7.29**	33	46									39	**54**
Lead	(12/20/1978-08/10/1989)	**5**	(0.0005-0.0025)	**0.001**	0.0005	**0.0014**	0.0010	**73**	0.003	**0.0025**							1	**8**				
Mercury	(12/11/1975-08/10/1989)	**54**	(0.00005-	**0.0003**	0.0003	**0.00104**	0.001116	**108**	0.002	**0.0031**			9	**17**	54	**100**			46	**85**		
Nitrate	(04/27/1970-04/27/1970)	**1**	(15.-15.)	**15.0**	0	**15.0**			15.0	**15.0**												
pH	(10/08/1969-08/10/1989)	**174**	(6.8-11.3)	**7.85**	0.4	**7.8**	0.6	**7**	8.2	**8.5**											1	1
Radium (pCi/l)	(11/29/1977-08/10/1989)	**24**	(0.01-0.27)	**0.115**	0.03	**0.1196**	0.0536	**45**	0.15	**0.1800**											9	38
Selenium	(12/11/1975-08/10/1989)	**26**	(0.001-0.047)	**0.0065**	0.004	**0.0110**	0.0123	**112**	0.012	**0.039**			2	8	22	**85**					15	58
Silver																						
Sulfate	(10/08/1969-08/10/1989)	**72**	(240.-7600.)	**700**	250	**965**	1095	**113**	1000	**1946**	17	**24**									72	100
TDS - 180°C	(10/08/1969-08/10/1989)	**73**	(517.5-12750.)	**1305**	444	**1701**	1727	**102**	1790	**3196**	4	**5**									70	96
Zinc	(12/11/1975-08/10/1989)	**24**	(0.0015-0.072)	**0.01**	0.0025	**0.016**	0.015	**96**	0.02	**0.039**			2	**8**	2	**8**					2	8
TSS																						
Conductivity (umho/cm)	(10/08/1969-08/10/1989)	**177**	(310.-12600.)	**1700**	500	**1926**	1320	**69**	2200	**3500**											157	89
Iron (total)	(12/11/1975-07/13/1984)	**83**	(0.23-800.)	**19**	16	**117.17**	176.03	**150**	190	**445**											5	6
Manganese	(12/11/1975-08/24/1982)	**41**	(0.0005-0.15)	**0.005**	0.0045	**0.018**	0.030	**163**	0.02	**0.08**											6	15

Appendix D: Surface Water Quality Data Summary Tables

(all Values are dissolved (mg/L) unless otherwise indicated)

Composite Chinde Baseline (CD-1 & CD-1A)	Dates	n	Range	Median	MAD	Average	Standard Deviation	Percent Relative Standard Deviation	Q3	95th Percentile	Exceedance of Criteria: Livestock		Aquatic & Wildlife Acute		Aquatic & Wildlife Chronic		Secondary Human Contact		Fish Consumption	
											n	%	n	%	n	%	n	%	n	%
Aluminum	(09/05/2000-09/25/2008)	45	(0.036-0.5)	0.05	0	0.112	0.125	112	0.1	0.45					12	27				
Arsenic	(07/21/1986-07/02/1997)	289	(0.0005-0.092)	0.0005	0	0.0017	0.0055	325	0.003	0.0025									1	0
Barium	(07/21/1986-07/02/1997)	287	(0.02-1.1)	0.5	0	0.37	0.20	53	0.5	0.5										
Boron	(07/21/1986-09/21/2010)	376	(0.005-1.89)	0.16	0.08	0.228	0.225	98	0.28	0.6									11	21
Cadmium	(07/21/1986-07/02/1997)	289	(0.0005-0.005)	0.0025	0	0.002	0.001	54	0.003	0.003			12	4	289	100				
Chloride	(07/21/1986-09/21/2010)	381	(0.84-373.)	31	19.2	46.48	43.65	94	63	129										
Chromium	(07/21/1986-07/02/1997)	289	(0.001-0.1)	0.01	0	0.009	0.006	71	0.01	0.01			289	100	7	2				
Copper																				
Fluoride	(08/24/1988-09/21/2010)	153	(0.005-3.5)	1	0.37	1.25	0.80	64	1.6	3	25	16								
Lead	(07/21/1986-07/02/1997)	289	(0.0005-0.16)	0.01	0	0.009	0.012	131	0.01	0.013	1	0.3	1	0	188	65	13	4		
Mercury																				
Nitrate	(08/12/1988-07/02/1997)	117	(0.5-239.)	6.9	2.6	11.5	24.4	212	10.3	21										
pH	(07/21/1986-09/21/2010)	257	(6.7-8.86)	7.9	0.23	7.90	0.36	5	8.15	8.4										
Radium (pCi/l)	(07/21/1986-06/28/1989)	11	(0.3-1.2)	0.4	0.1	0.5	0.3	56	0.6	0.9										
Selenium	(07/21/1986-09/21/2010)	346	(0.0005-0.1)	0.0028	0.0013	0.0051	0.0074	146	0.006	0.013	1	0.3	3	1	263	76				
Silver	(07/21/1986-07/02/1997)	288	(0.0005-0.09)	0.005	0	0.0056	0.0055	98	0.005	0.01			5	2						
Sulfate	(07/21/1986-09/21/2010)	378	(40.-4050.)	560	240	674	506	75	820	1653	61	16								
TDS - 180°C	(07/21/1986-09/21/2010)	371	(150.-7000.)	1020	424	1257	837	67	1585	2880	16	4								
Zinc	(07/21/1986-07/02/1997)	289	(0.005-1.01)	0.07	0.055	0.081	0.082	102	0.125	0.125			184	64	184	64				
TSS	(07/21/1986-09/21/2010)	375	(1.-108000.)	884	865	4541	11211	247	3280	22380										
Conductivity (umho/cm)	(07/21/1986-09/21/2010)	380	(105.-7600.)	1425	542	1674	977	58	2200	3502.5										
Iron (total)	(12/29/1992-09/21/2010)	243	(0.05-412.)	1.44	1.33	19.78	53.72	272	10.45	116.9										
Manganese	(07/21/1986-09/21/2010)	377	(0.0025-2.85)	0.1	0.028	0.099	0.215	218	0.1	0.152										

Appendix D: Surface Water Quality Data Summary Tables

(all Values are dissolved (mg/L) unless otherwise indicated)

Chinde Baseline (CD-1)	Dates	n	Range	Median	MAD	Average	Standard Deviation	Percent Relative Standard Deviation	Q3	95th Percentile	Exceedance of Criteria: Livestock		Aquatic & Wildlife Acute		Aquatic & Wildlife Chronic		Secondary Human Contact		Fish Consumption	
											n	%	n	%	n	%	n	%	n	%
Aluminum																				
Arsenic	(07/21/1986-05/23/1997)	287	(0.0005-0.092)	0.0005	0	0.0017	0.0055	327	0.003	0.0025									1	0
Barium	(07/21/1986-05/23/1997)	285	(0.025-1.1)	0.5	0	0.37	0.19	53	0.5	0.5										
Boron	(07/21/1986-05/23/1997)	285	(0.005-1.89)	0.15	0.06	0.193	0.202	104	0.22	0.5										
Cadmium	(07/21/1986-05/23/1997)	287	(0.0005-0.005)	0.0025	0	0.002	0.001	53	0.003	0.003			12	4	287	100				
Chloride	(07/21/1986-05/23/1997)	289	(0.84-373.)	29	16	44.48	44.81	101	54.9	135.8										
Chromium	(07/21/1986-05/23/1997)	287	(0.001-0.1)	0.01	0	0.009	0.006	71	0.01	0.01			287	100	7	2				
Copper																				
Fluoride	(08/24/1988-06/21/1996)	113	(0.005-3.3)	0.97	0.24	1.05	0.52	49	1.25	1.994	6	5								
Lead	(07/21/1986-05/23/1997)	287	(0.0005-0.16)	0.01	0	0.009	0.012	131	0.01	0.0135	1	0.3	1	0	188	66	13	5		
Mercury																				
Nitrate	(08/12/1988-07/02/1997)	115	(0.5-239.)	6.9	2.6	11.7	24.6	211	10.35	21.5										
pH	(07/21/1986-09/21/2010)	203	(6.7-8.8)	7.84	0.2	7.83	0.34	4	8.015	8.3										
Radium (pCi/l)	(07/21/1986-06/28/1989)	11	(0.3-1.2)	0.4	0.1	0.5	0.3	56	0.6	0.9										
Selenium	(07/21/1986-05/23/1997)	287	(0.0005-0.046)	0.003	0.001	0.0044	0.0046	103	0.005	0.012			1	0	209	73				
Silver	(07/21/1986-05/23/1997)	286	(0.0005-0.03)	0.005	0	0.0053	0.0023	43	0.005	0.01			4	1						
Sulfate	(07/21/1986-05/23/1997)	286	(40.-4050.)	558	262	729	554	76	880	1715	59	21								
TDS - 180°C	(07/21/1986-05/23/1997)	288	(260.-7000.)	1005	400	1301	894	69	1573	3053	16									
Zinc	(07/21/1986-05/23/1997)	287	(0.005-1.01)	0.08	0.045	0.081	0.082	102	0.125	0.125			184	64	184	64				
TSS	(07/21/1986-05/23/1997)	284	(2.5-108000.)	1610	1410	5945	12565	211	4950	26195										
Conductivity (umho/cm)	(07/21/1986-05/23/1997)	288	(105.-7600.)	1400	500	1696	1031	61	2100	3636.5										
Iron (total)	(12/29/1992-05/23/1997)	152	(0.1-412.)	3.75	3.575	29.83	65.58	220	29.08	142.35										
Manganese	(07/21/1986-05/23/1997)	286	(0.0025-2.85)	0.1	0	0.119	0.242	203	0.1	0.29										

Appendix D: Surface Water Quality Data Summary Tables

(all Values are dissolved (mg/L) unless otherwise indicated)

Chinde Baseline (CD-1A)	Dates	**n**	Range	**Median**	MAD	**Average**	Standard Deviation	**Percent Relative Standard Deviation**	Q3	**95th Percentile**	**Exceedance of Criteria: Livestock**		**Aquatic & Wildlife Acute**		**Aquatic & Wildlife Chronic**		**Secondary Human Contact**		**Fish Consumption**	
											n	**%**	n	**%**	n	**%**	n	**%**	n	**%**
Aluminum	(09/05/2000-09/25/2008)	**45**	(0.036-0.5)	**0.05**	0	**0.112**	0.125	**112**	0.1	**0.45**					12	**27**				
Arsenic	(09/14/1996-07/02/1997)	**2**	(0.0025-0.0025)	**0.0025**	0	**0.0025**	0	**0**	0.003	**0.0025**										
Barium	(09/14/1996-07/02/1997)	**2**	(0.02-0.03)	**0.025**	0.005	**0.03**	0.01	**28**	0.028	**0.0295**										
Boron	(09/14/1996-09/21/2010)	**91**	(0.025-1.1)	**0.25**	0.2	**0.338**	0.256	**76**	0.595	**0.71**										
Cadmium	(09/14/1996-07/02/1997)	**2**	(0.0005-0.0005)	**0.0005**	0	**0.001**	0	**0**	0.001	**0.001**					2	**100**				
Chloride	(09/14/1996-09/21/2010)	**92**	(3.-159.)	**40.5**	32.5	**52.78**	39.38	**75**	82.25	**117.7**										
Chromium	(09/14/1996-07/02/1997)	**2**	(0.005-0.005)	**0.005**	0	**0.005**	0	**0**	0.005	**0.005**			2	**100**						
Copper																				
Fluoride	(05/06/2002-09/21/2010)	**40**	(0.1-3.5)	**2**	1	**1.81**	1.12	**62**	2.9	**3.5**	19	**48**								
Lead	(09/14/1996-07/02/1997)	**2**	(0.0025-0.0025)	**0.0025**	0	**0.003**	0	**0**	0.003	**0.0025**										
Mercury																				
Nitrate	(09/14/1996-07/02/1997)	**2**	(0.5-7.9)	**4.2**	3.7	**4.2**	5.2	**125**	6.05	**7.53**										
pH	(07/02/1997-09/21/2010)	**54**	(6.9-8.7)	**8.21**	0.155	**8.16**	0.33	**4**	8.368	**8.4635**										
Radium (pCi/l)																				
Selenium	(09/14/1996-09/21/2010)	**59**	(0.0005-0.1)	**0.0025**	0.002	**0.0084**	0.0146	**174**	0.009	**0.025**	1	**1.7**	2	**3**	54	**92**				
Silver	(09/14/1996-07/02/1997)	**2**	(0.005-0.09)	**0.0475**	0.0425	**0.0475**	0.0601	**127**	0.069	**0.08575**			1	**50**						
Sulfate	(09/14/1996-09/21/2010)	**92**	(46.-1060.)	**563**	179.5	**502**	246	**49**	700.5	**818.35**	2	**2**								
TDS - 180°C	(09/14/1996-09/21/2010)	**83**	(150.-2240.)	**1130**	520	**1103**	577	**52**	1635	**1900**										
Zinc	(09/14/1996-07/02/1997)	**2**	(0.025-0.03)	**0.0275**	0.0025	**0.028**	0.004	**13**	0.029	**0.02975**										
TSS	(09/14/1996-09/21/2010)	**91**	(1.-3490.)	**20.3**	17.8	**160**	452	**282**	92.5	**1040**										
Conductivity (umho/cm)	(09/14/1996-09/21/2010)	**92**	(260.-3060.)	**1620**	690	**1607**	787	**49**	2333	**2693.5**										
Iron (total)	(09/14/1996-09/21/2010)	**91**	(0.05-69.)	**0.38**	0.29	**2.98**	9.25	**311**	1.32	**14.75**										
Manganese	(09/14/1996-09/21/2010)	**91**	(0.0025-0.461)	**0.02**	0.015	**0.036**	0.061	**171**	0.037	**0.103**										

Appendix D: Surface Water Quality Data Summary Tables

(all Values are dissolved (mg/L) unless otherwise indicated)

Composite Chinde Downstream (CD-2 & CD-2A)	Dates	n	Range	Median	MAD	Average	Standard Deviation	Percent Relative Standard Deviation	Q3	95th Percentile	Exceedance of Criteria: Livestock		Aquatic & Wildlife Acute		Aquatic & Wildlife Chronic		Secondary Human Contact		Fish Consumption		Baseline Median + 2MAD	
											n	%	n	%	n	%	n	%	n	%	n	%
Aluminum	(09/05/2000-03/26/2008)	24	(0.05-0.5)	0.065	0.015	0.148	0.151	102	0.175	0.5					11	46					12	50
Arsenic	(05/13/1986-05/23/1997)	168	(0.0005-0.012)	0.0008	0.0003	0.0015	0.0014	89	0.003	0.0025											84	50
Barium	(05/13/1986-05/23/1997)	168	(0.04-1.)	0.5	0.25	0.36	0.20	57	0.5	0.5											6	4
Boron	(05/13/1986-03/24/2010)	219	(0.005-5.4)	0.15	0.07	0.222	0.399	180	0.245	0.513	1	0.5									32	15
Cadmium	(05/13/1986-05/23/1997)	168	(0.0005-0.005)	0.0025	0.0015	0.0018	0.0011	61	0.003	0.0025											7	4
Chloride	(05/13/1986-03/24/2010)	221	(5.-6150.)	56	33	184	670	364	120	550	10	5									86	39
Chromium	(05/13/1986-05/23/1997)	168	(0.001-0.025)	0.01	0	0.009	0.004	44	0.01	0.01			168	100	5	3					5	3
Copper																						
Fluoride	(05/06/2002-03/24/2010)	16	(0.3-1.7)	1.2	0.2	1.2	0.4	29	1.5	1.7												
Lead	(05/13/1986-05/23/1997)	168	(0.0005-0.09)	0.01	0.0015	0.0084	0.0100	120	0.01	0.0107							7	4			9	5
Mercury																						
Nitrate	(08/12/1988-05/23/1997)	166	(0.5-340.)	9.5	3.8	15.2	31.3	205	14.2	31.4											58	35
pH	(04/05/1996-05/23/1997)	44	(7.2-8.4)	8.2	0.1	8.1	0.3	4	8.3	8.4											4	9
Radium (pCi/l)	(05/13/1986-08/27/1992)	14	(0.2-9.9999)	0.4	0.1	1.0786	2.5700	238	0.5	3.8900											1	7
Selenium	(05/13/1986-03/24/2010)	220	(0.0005-0.1)	0.0025	0.0015	0.0048	0.0087	179	0.005	0.0125	1	0.5	3	1	153	70					52	24
Silver	(05/13/1986-05/23/1997)	168	(0.0005-0.05)	0.005	0	0.0053	0.0040	75	0.005	0.01											10	6
Sulfate	(05/13/1986-03/24/2010)	219	(49.-5580.)	580	280	743	678	91	900	1761	51	23									47	21
TDS - 180°C	(05/13/1986-03/24/2010)	213	(250.-18300.)	1080	470	1561	2022	130	1660	3612	13	6									46	22
Zinc	(05/13/1986-05/23/1997)	168	(0.005-0.64)	0.05	0.045	0.080	0.079	99	0.125	0.128											4	2
TSS	(05/13/1986-03/24/2010)	206	(2.5-335000.)	726	717.5	8306.7	30325.8	365	4418	35125											66	32
Conductivity (umho/cm)	(05/13/1986-03/24/2010)	221	(17.-25300.)	1550	650	2212	2858	129	2310	4950											48	22
Iron (total)	(12/29/1992-03/24/2010)	157	(0.05-325.)	1.4	1.25	21.40	54.07	253	9.54	123.4											51	32
Manganese	(05/13/1986-03/24/2010)	220	(0.002-3.75)	0.1	0.0685	0.139	0.356	256	0.1	0.904											21	10

Appendix D: Surface Water Quality Data Summary Tables

(all Values are dissolved (mg/L) unless otherwise indicated)

Chinde Downstream (CD-2)	Dates	n	Range	Median	MAD	Average	Standard Deviation	Percent Relative Standard Deviation	Q3	95th Percentile	Exceedance of Criteria											
											Livestock		Aquatic & Wildlife Acute		Aquatic & Wildlife Chronic		Secondary Human Contact		Fish Consumption		Baseline Median + 2MAD	
											n	%	n	%	n	%	n	%	n	%	n	%
Aluminum																						
Arsenic	(05/13/1986-05/23/1997)	**168**	(0.0005-0.012)	**0.0008**	0.0003	**0.0015**	0.0014	**89**	0.003	**0.0025**											84	**50**
Barium	(05/13/1986-05/23/1997)	**168**	(0.04-1.)	**0.5**	0.25	**0.36**	0.20	**57**	0.5	**0.5**											6	4
Boron	(05/13/1986-05/23/1997)	**167**	(0.005-5.4)	**0.12**	0.06	**0.213**	0.451	**212**	0.2	**0.561**	1	**0.6**									21	13
Cadmium	(05/13/1986-05/23/1997)	**168**	(0.0005-0.005)	**0.0025**	0.0015	**0.0018**	0.0011	**61**	0.003	**0.0025**											7	4
Chloride	(05/13/1986-05/23/1997)	**168**	(5.-6150.)	**50**	27.5	**217**	765	**353**	122.3	651.55	10	**6**									59	**35**
Chromium	(05/13/1986-05/23/1997)	**168**	(0.001-0.025)	**0.01**	0	**0.009**	0.004	**44**	0.01	**0.01**			168	**100**	5	**3**					5	3
Copper																						
Fluoride																						
Lead	(05/13/1986-05/23/1997)	**168**	(0.0005-0.09)	**0.01**	0.0015	**0.0084**	0.0100	**120**	0.01	**0.0107**								**4**			9	5
Mercury																						
Nitrate	(05/13/1986-05/23/1997)	**166**	(0.5-340.)	**9.5**	3.8	**15.2**	31.3	**205**	14.2	**31.4**											58	**35**
pH	(04/05/1996-05/23/1997)	**23**	(7.2-8.4)	**7.9**	0.2	**7.9**	0.3	**4**	8.25	**8.4**											2	9
Radium (pCi/l)	(05/13/1986-08/27/1992)	**14**	(0.2-9.9999)	**0.4**	0.1	**1.0786**	2.5700	**238**	0.5	**3.8900**											1	7
Selenium	(05/13/1986-05/23/1997)	**168**	(0.0005-0.019)	**0.0025**	0.0005	**0.0034**	0.0030	**87**	0.004	**0.009**						**108**	64				32	19
Silver	(05/13/1986-05/23/1997)	**168**	(0.0005-0.05)	**0.005**	0	**0.0053**	0.0040	**75**	0.005	**0.01**											10	6
Sulfate	(05/13/1986-05/23/1997)	**166**	(49.-5580.)	**495**	226.5	**697**	732	**105**	837.5	**1794**	30	**18**									27	16
TDS - 180°C	(05/13/1986-05/23/1997)	**168**	(367.-18300.)	**1005**	395	**1536**	2235	**146**	1593	**3884.8**	12	**7**									28	17
Zinc	(05/13/1986-05/23/1997)	**168**	(0.005-0.64)	**0.05**	0.045	**0.080**	0.079	**99**	0.125	**0.128**											4	2
TSS	(05/13/1986-05/23/1997)	**166**	(5.-335000.)	**1705**	1605	**10290.2**	33499.3	**326**	6570	**37400**											66	**40**
Conductivity (umho/cm)	(05/13/1986-05/23/1997)	**168**	(17.-25300.)	**1410**	540	**2207**	3232	**146**	2123	**5677**											28	17
Iron (total)	(12/29/1992-05/23/1997)	**105**	(0.1-325.)	**3**	2.85	**31.26**	63.93	**205**	30.1	**155**											45	**43**
Manganese	(05/13/1986-05/23/1997)	**168**	(0.002-3.75)	**0.1**	0	**0.174**	0.399	**230**	0.1	**1.086**											19	11

Appendix D: Surface Water Quality Data Summary Tables

(all Values are dissolved (mg/L) unless otherwise indicated)

Chinde Downstream (CD-2A)	Dates	**n**	Range	**Median**	MAD	**Average**	Standard Deviation	**Percent Relative Standard Deviation**	Q3	**95th Percentile**	**Exceedance of Criteria: Livestock**		**Aquatic & Wildlife Acute**		**Aquatic & Wildlife Chronic**		**Secondary Human Contact**		**Fish Consumption**		**Baseline Median + 2MAD**	
											n	**%**	n	**%**	n	**%**	n	**%**	n	**%**	n	**%**
Aluminum	(09/05/2000-03/26/2008)	**24**	(0.05-0.5)	**0.065**	0.015	**0.148**	0.151	**102**	0.175	**0.5**					11	**46**					12	**50**
Arsenic																						
Barium																						
Boron	(08/06/1997-03/24/2010)	**52**	(0.05-0.76)	**0.215**	0.085	**0.253**	0.136	**54**	0.3	**0.468**											11	**21**
Cadmium																						
Chloride	(08/06/1997-03/24/2010)	**53**	(5.-174.)	**75**	46	**80**	50	**63**	120	162.2											27	**51**
Chromium																						
Copper																						
Fluoride	(05/06/2002-03/24/2010)	16	(0.3-1.7)	**1.2**	0.2	**1.2**	0.4	**29**	1.5	**1.7**												
Lead																						
Mercury																						
Nitrate																						
pH	(08/06/1997-03/24/2010)	**21**	(7.8-8.39)	**8.27**	0.1	**8.2**	0.1	**2**	8.32	**8.4**											2	10
Radium (pCi/l)																						
Selenium	(08/06/1997-03/24/2010)	**52**	(0.0005-0.1)	**0.005**	0.0025	**0.0095**	0.0163	**172**	0.009	**0.03625**	1	**1.9**	3	**6**	45	**87**					20	**38**
Silver																						
Sulfate	(08/06/1997-03/24/2010)	**53**	(87.-1970.)	**820**	390	**887**	450	**51**	1260	**1550**	21	**40**									20	**38**
TDS - 180°C	(08/06/1997-03/24/2010)	**45**	(250.-3870.)	**1520**	810	**1656**	858	**52**	2360	**2816**	1	**2**									18	**40**
Zinc																						
TSS	(08/06/1997-03/24/2010)	**40**	(2.5-840.)	**21**	14.15	**74.9**	150.5	**201**	59.5	**286.9**												
Conductivity (umho/cm)	(08/06/1997-03/24/2010)	**53**	(390.-5010.)	**2230**	880	**2228**	1007	**45**	3100	**3648**											20	**38**
Iron (total)	(08/06/1997-03/24/2010)	**52**	(0.05-10.4)	**0.425**	0.315	**1.49**	2.21	**148**	1.715	**6.0105**											6	**12**
Manganese	(08/06/1997-03/24/2010)	**52**	(0.0025-0.503)	**0.005**	0.0025	**0.028**	0.073	**261**	0.025	**0.089**											2	4

Appendix D: Surface Water Quality Data Summary Tables

(all Values are dissolved (mg/L) unless otherwise indicated)

Composite Cottonwood Baseline (CN-1, CNS-1, CS-1)	Dates	n	Range	Median	MAD	Average	Standard Deviation	Percent Relative Standard Deviation	Q3	95th Percentile	Exceedance of Criteria: Livestock		Aquatic & Wildlife Acute		Aquatic & Wildlife Chronic		Secondary Human Contact		Fish Consumption	
											n	%	n	%	n	%	n	%	n	%
Aluminum																				
Arsenic	(07/18/1990-09/01/1997)	222	(0.0005-0.347)	0.002	0.001	0.0036	0.023	639	0.003	0.005	1	0	1	0	1	0	1	0	1	0
Barium	(07/18/1990-09/01/1997)	227	(0.005-4.9)	0.5	0.2	0.52	0.54	105	0.5	1.221										
Boron	(07/18/1990-09/02/1999)	282	(0.005-1.1)	0.11	0.06	0.162	0.175	108	0.19	0.5										
Cadmium	(07/18/1990-09/01/1997)	226	(0.0005-0.009)	0.0025	0	0.002	0.0011	57	0.003	0.003			4	2	226	100			1	0
Chloride	(07/18/1990-09/02/1999)	284	(0.52-197.)	13	5	16.89	16.50	98	19	41										
Chromium	(07/18/1990-09/01/1997)	226	(0.005-0.17)	0.01	0	0.010	0.0126	132	0.01	0.0175			226	100	12	5			1	0
Copper																				
Fluoride																				
Lead	(07/18/1990-09/01/1997)	226	(0.0025-1.13)	0.01	0	0.024	0.091	384	0.01	0.06075	6	2.7	3	1	177	78	45	20		
Mercury																				
Nitrate	(07/18/1990-09/01/1997)	219	(0.5-180.)	7.5	3.4	15.6	25.7	165	14.45	47.53										
pH	(06/22/1996-11/12/1997)	41	(5.3-9.)	8.4	0.2	8.13	0.72	9	8.5	8.8	2	5								
Radium (pCi/l)																				
Selenium	(07/18/1990-09/02/1999)	282	(0.0005-0.032)	0.0025	0.0005	0.0029	0.0030	105	0.003	0.006					180	64				
Silver	(07/18/1990-09/01/1997)	226	(0.005-0.03)	0.005	0	0.0052	0.0018	35	0.005	0.005			2	1						
Sulfate	(07/18/1990-09/02/1999)	283	(50.-1760.)	285	105	353	249	70	430	840	8	3								
TDS - 180°C	(07/18/1990-09/02/1999)	287	(290.-15600.)	692	203	1041	1488	143	952.5	2167	12	4								
Zinc	(07/18/1990-09/01/1997)	226	(0.005-1.82)	0.125	0.025	0.173	0.275	159	0.125	0.735			173	77	173	77				
TSS	(07/18/1990-09/02/1999)	279	(920.-1120000.)	73600	32500	113627	142466	125	1E+05	372030										
Conductivity (umho/cm)	(07/18/1990-09/02/1999)	292	(250.-11809.)	853	247	1013	831	82	1190	1918										
Iron (total)	(12/29/1992-09/02/1999)	203	(0.01-4350.)	203	196.9	494.07	737.66	149	638.5	2030										
Manganese	(07/18/1990-09/02/1999)	281	(0.0025-4.23)	0.1	0.08	0.373	0.724	194	0.265	1.83										

Appendix D: Surface Water Quality Data Summary Tables

(all Values are dissolved (mg/L) unless otherwise indicated)

Cottonwood Baseline (CN-1)	Dates	n	Range	Median	MAD	Average	Standard Deviation	Percent Relative Standard Deviation	Q3	95th Percentile	Exceedance of Criteria									
											Livestock		Aquatic & Wildlife Acute		Aquatic & Wildlife Chronic		Secondary Human Contact		Fish Consumption	
											n	%	n	%	n	%	n	%	n	%
Aluminum																				
Arsenic	(07/18/1990-09/01/1997)	64	(0.0005-0.347)	0.0015	0.001	0.0072	0.043	597	0.003	0.0057	1	2	1	2	1	2	1	2	1	2
Barium	(07/18/1990-09/01/1997)	67	(0.005-2.4)	0.5	0	0.44	0.38	87	0.5	1.05										
Boron	(07/18/1990-09/02/1999)	92	(0.005-0.78)	0.08	0.03	0.128	0.139	108	0.16	0.4115										
Cadmium	(07/18/1990-09/01/1997)	66	(0.0005-0.008)	0.0025	0	0.002	0.0011	59	0.003	0.003			1	2	66	100				
Chloride	(07/18/1990-09/02/1999)	94	(3.-77.)	16	6	19.62	14.94	76	22.75	48.7										
Chromium	(07/18/1990-09/01/1997)	66	(0.005-0.09)	0.01	0.0025	0.009	0.0107	113	0.01	0.0175			66	100	4	6				
Copper																				
Fluoride																				
Lead	(07/18/1990-09/01/1997)	66	(0.0025-1.13)	0.01	0	0.028	0.138	492	0.01	0.0335	1	1.5	1	2	51	77	10	15		
Mercury																				
Nitrate	(07/18/1990-09/01/1997)	63	(0.5-116.)	7	3.5	11.5	15.9	138	13.15	29.36										
pH	(06/27/1996-11/12/1997)	10	(5.3-8.6)	7.95	0.45	7.77	0.96	12	8.4	8.51	1	10								
Radium (pCi/l)																				
Selenium	(07/18/1990-09/02/1999)	92	(0.0005-0.032)	0.0025	0.0005	0.0035	0.0048	135	0.003	0.007					57	62				
Silver	(07/18/1990-09/01/1997)	66	(0.005-0.005)	0.005	0	0.0050	0.0000	0	0.005	0.005										
Sulfate	(07/18/1990-09/02/1999)	94	(50.-1760.)	385.5	168	451	303	67	567.5	1009	5	5								
TDS - 180°C	(07/18/1990-09/02/1999)	94	(290.-6220.)	780	250	972	712	73	1195	1895	1	1								
Zinc	(07/18/1990-09/01/1997)	66	(0.005-1.7)	0.125	0.0025	0.154	0.318	206	0.125	0.2075			46	70	46	70				
TSS	(07/18/1990-09/02/1999)	92	(14400.-	87500	37600	131005	127328	97	1E+05	378690										
Conductivity (umho/cm)	(07/18/1990-09/02/1999)	96	(390.-3350.)	1035	320	1151	567	49	1413	2177.5										
Iron (total)	(08/14/1993-09/02/1999)	62	(0.01-4350.)	174	172.1	631.36	876.58	139	1087	2082.5										
Manganese	(07/18/1990-09/02/1999)	90	(0.0025-2.9)	0.1	0.064	0.258	0.546	211	0.1	1.629										

Appendix D: Surface Water Quality Data Summary Tables

(all Values are dissolved (mg/L) unless otherwise indicated)

Cottonwood Baseline (CNS-1)	Dates	n	Range	Median	MAD	Average	Standard Deviation	Percent Relative Standard Deviation	Q3	95th Percentile	Exceedance of Criteria: Livestock		Aquatic & Wildlife Acute		Aquatic & Wildlife Chronic		Secondary Human Contact		Fish Consumption	
											n	%	n	%	n	%	n	%	n	%
Aluminum																				
Arsenic	(07/18/1990-05/22/1997)	81	(0.0005-0.024)	0.002	0.0005	0.0023	0.003	146	0.003	0.005										
Barium	(07/18/1990-05/22/1997)	82	(0.04-2.)	0.5	0.055	0.50	0.35	70	0.5	1.195										
Boron	(07/18/1990-08/03/1999)	100	(0.005-1.02)	0.13	0.08	0.168	0.172	103	0.223	0.5315										
Cadmium	(07/18/1990-05/22/1997)	82	(0.0005-0.005)	0.0025	0	0.002	0.0010	53	0.003	0.003			2	2	82	100				
Chloride	(07/18/1990-08/03/1999)	99	(0.52-47.)	13	3.48	14.07	8.85	63	15	30.6										
Chromium	(07/18/1990-05/22/1997)	82	(0.005-0.03)	0.01	0	0.009	0.0039	46	0.01	0.01			82	100	3	4				
Copper																				
Fluoride																				
Lead	(07/18/1990-05/22/1997)	82	(0.0025-0.12)	0.01	0	0.015	0.020	134	0.01	0.05865	1	1.2			60	73	17	21		
Mercury																				
Nitrate	(07/18/1990-05/22/1997)	80	(0.5-155.)	8	3.25	15.6	25.6	164	15.55	34.72										
pH	(06/22/1996-11/12/1997)	16	(5.9-8.9)	8.3	0.3	8.16	0.68	8	8.525	8.75	1	6								
Radium (pCi/l)																				
Selenium	(07/18/1990-08/03/1999)	100	(0.0005-0.011)	0.0025	0.0005	0.0025	0.0014	57	0.003	0.00505					66	66				
Silver	(07/18/1990-05/22/1997)	82	(0.005-0.03)	0.005	0	0.0054	0.0028	52	0.005	0.005			1	1						
Sulfate	(07/18/1990-08/03/1999)	98	(50.-1050.)	257.5	82	292	179	61	338	718.3	2	2								
TDS - 180°C	(07/18/1990-08/03/1999)	103	(315.-15600.)	610	160	1099	2049	187	880	2062	4	4								
Zinc	(07/18/1990-05/22/1997)	82	(0.005-1.1)	0.125	0.045	0.158	0.221	140	0.125	0.7355			60	73	60	73				
TSS	(07/18/1990-08/02/1999)	98	(920.-1120000.)	65300	28300	95335	134569	141	96100	209900										
Conductivity (umho/cm)	(07/18/1990-08/03/1999)	104	(370.-2300.)	760	178.5	861	374	43	973.5	1649.5										
Iron (total)	(12/29/1992-08/03/1999)	79	(0.07-3720.)	203	189.7	444.66	731.51	165	526.5	2073										
Manganese	(07/18/1990-08/03/1999)	101	(0.005-4.02)	0.1	0.09	0.340	0.600	176	0.332	1.47										

Appendix D: Surface Water Quality Data Summary Tables

(all Values are dissolved (mg/L) unless otherwise indicated)

Cottonwood Baseline (CS-1)	Dates	n	Range	Median	MAD	Average	Standard Deviation	Percent Relative Standard Deviation	Q3	95th Percentile	Exceedance of Criteria									
											Livestock		Aquatic & Wildlife Acute		Aquatic & Wildlife Chronic		Secondary Human Contact		Fish Consumption	
											n	%	n	%	n	%	n	%	n	%
Aluminum																				
Arsenic	(07/18/1990-08/05/1997)	**77**	(0.0005-0.014)	**0.002**	0.001	**0.0021**	0.002	**93**	0.003	**0.0052**										
Barium	(07/18/1990-08/05/1997)	**78**	(0.025-4.9)	**0.5**	0.245	**0.61**	0.77	**126**	0.5	**1.5**										
Boron	(07/18/1990-08/05/1999)	**90**	(0.005-1.1)	**0.12**	0.07	**0.189**	0.206	**109**	0.22	**0.5275**										
Cadmium	(07/18/1990-08/05/1997)	**78**	(0.0005-0.009)	**0.0025**	0	**0.002**	0.0012	**59**	0.003	**0.003**			1	**1**	78	**100**			1	**1**
Chloride	(07/18/1990-08/05/1999)	**91**	(4.-197.)	**12.8**	5.2	**17.14**	22.88	**133**	17	**39**										
Chromium	(07/18/1990-08/05/1997)	**78**	(0.005-0.17)	**0.01**	0	**0.011**	0.0186	**176**	0.01	**0.02**			78	**100**	5	**6**			1	**1**
Copper																				
Fluoride																				
Lead	(07/18/1990-08/05/1997)	**78**	(0.0025-0.753)	**0.01**	0	**0.030**	0.088	**298**	0.01	**0.08615**	4	**5.1**	2	**3**	66	**85**	18	**23**		
Mercury																				
Nitrate	(07/18/1990-08/05/1997)	**76**	(0.5-180.)	**7.65**	3.95	**18.9**	31.7	**168**	14.88	**102**										
pH	(06/27/1996-11/12/1997)	**15**	(6.9-9.)	**8.4**	0.2	**8.35**	0.48	**6**	8.6	**8.86**										
Radium (pCi/l)																				
Selenium	(07/18/1990-08/05/1999)	**90**	(0.0005-0.011)	**0.0025**	0.0005	**0.0026**	0.0015	**59**	0.003	**0.005**					57	**63**				
Silver	(07/18/1990-08/05/1997)	**78**	(0.005-0.015)	**0.005**	0	**0.0051**	0.0011	**22**	0.005	**0.005**			1	**1**						
Sulfate	(07/18/1990-08/05/1999)	**91**	(85.-1500.)	**275**	86	**317**	222	**70**	355.5	**828.5**	1	**1**								
TDS - 180°C	(07/18/1990-08/05/1999)	**90**	(305.-9060.)	**675**	207	**1048**	1329	**127**	910	**3558.5**	7	**8**								
Zinc	(07/18/1990-08/05/1997)	**78**	(0.005-1.82)	**0.125**	0.02	**0.204**	0.288	**141**	0.129	**0.7185**			67	**86**	67	**86**				
TSS	(07/18/1990-08/05/1999)	**89**	(2110.-	**59400**	28300	**115804**	163401	**141**	1E+05	**366900**										
Conductivity (umho/cm)	(07/18/1990-08/05/1999)	**92**	(250.-11809.)	**817**	213	**1041**	1292	**124**	1030	**1800**										
Iron (total)	(12/29/1992-08/05/1999)	**62**	(1.5-2350.)	**225.5**	211.15	**419.74**	566.88	**135**	557.3	**1813.5**										
Manganese	(07/18/1990-08/05/1999)	**90**	(0.005-4.23)	**0.1**	0.08	**0.524**	0.953	**182**	0.425	**3.139**										

Appendix D: Surface Water Quality Data Summary Tables

(all Values are dissolved (mg/L) unless otherwise indicated)

Composite Baseline (Pinabete & No Name)	Dates	n	Range	Median	MAD	Average	Standard Deviation	Percent Relative Standard Deviation	Q3	95^{th} Percentile	Exceedance of Criteria: Livestock		Aquatic & Wildlife Acute		Aquatic & Wildlife Chronic		Secondary Human Contact		Fish Consumption	
											n	%	n	%	n	%	n	%	n	%
Aluminum	(08/28/2007-08/12/2008)	**29**	(0.005-2.3)	**0.05**	0.045	**0.261**	0.506	**194**	0.25	**1.214**			2	**7**	12	**41**				
Arsenic	(08/28/2007-08/12/2008)	**29**	(0.0009-0.0204)	**0.0027**	0.0016	**0.0052**	0.0048	**92**	0.006	**0.01432**										
Barium	(08/28/2007-08/12/2008)	**29**	(0.0247-0.2193)	**0.0528**	0.0157	**0.07**	0.04	**63**	0.071	**0.13716**										
Boron	(07/29/1998-08/12/2008)	**44**	(0.025-0.9)	**0.095**	0.045	**0.169**	0.201	**119**	0.2	**0.5**										
Cadmium	(08/28/2007-08/12/2008)	**26**	(0.000025-	**3E-05**	0	**0.003**	0.013	**407**	0.000	**0.008**	1	**4**	2	**8**	6	**23**			2	**8**
Chloride	(07/29/1998-08/12/2008)	**44**	(5.-34.)	**8**	3	**10.05**	7.20	**72**	11	**26.55**										
Chromium	(08/28/2007-08/12/2008)	**28**	(0.0005-0.005)	**0.0005**	0	**0.002**	0.002	**99**	0.003	**0.005**			13	**46**						
Copper	(08/28/2007-08/12/2008)	**29**	(0.0042-0.0261)	**0.0076**	0.0019	**0.00882**	0.004344	**49**	0.01	**0.01522**					2	**7**				
Fluoride	(07/29/1998-08/12/2008)	**41**	(0.1-1.19)	**0.2**	0.1	**0.35**	0.31	**90**	0.6	**0.9**										
Lead	(08/28/2007-08/12/2008)	**29**	(0.00005-	**0.0002**	0.0002	**0.001**	0.002	**241**	5E-04	**0.0036**					1	**3**				
Mercury	(08/28/2007-12/03/2007)	**7**	(0.0001-0.0001)	**0.0001**	0	**0.0001**	1.46E-20	**0**	1E-04	**0.0001**					7	**100**				
Nitrate	(08/28/2007-08/12/2008)	**28**	(0.01-3.4)	**0.405**	0.355	**0.9**	1.0	**116**	1.67	**2.94**										
pH	(07/29/1998-08/12/2008)	**46**	(7.-8.56)	**8.005**	0.2	**7.90**	0.35	**4**	8.16	**8.3875**										
Radium (pCi/l)																				
Selenium	(07/29/1998-08/12/2008)	**43**	(0.0005-0.007)	**0.0025**	0.0005	**0.0023**	0.0016	**71**	0.003	**0.005**					24	**56**				
Silver	(08/28/2007-08/12/2008)	**26**	(0.000025-	**3E-05**	0	**0.0001**	0.0003	**193**	2E-04	**0.00025**										
Sulfate	(07/29/1998-08/12/2008)	**44**	(5.-840.)	**175**	152	**252**	229	**91**	365	**731.6**										
TDS - 180°C	(07/29/1998-08/12/2008)	**46**	(100.-28400.)	**550**	272.5	**1599**	4531	**283**	1006	**4327.5**	3	**7**								
Zinc	(08/28/2007-08/12/2008)	**29**	(0.001-14.2)	**0.004**	0.002	**0.501**	2.635	**526**	0.01	**0.108**			2	**7**	2	**7**			1	**3**
TSS	(07/29/1998-08/12/2008)	**44**	(367.-521000.)	**49750**	40000	**93912**	119354	**127**	1E+05	**380650**										
Conductivity (umho/cm)	(07/29/1998-08/12/2008)	**47**	(150.-1940.)	**666**	329	**777**	460	**59**	1020	**1607**										
Iron (total)	(07/29/1998-08/12/2008)	**42**	(1.26-6020.)	**272**	265.49	**592.99**	1004.03	**169**	826.8	**1547**										
Manganese	(07/29/1998-08/12/2008)	**42**	(0.0025-3.76)	**0.0145**	0.012	**0.277**	0.669	**241**	0.227	**0.89335**										

Appendix D: Surface Water Quality Data Summary Tables

(all Values are dissolved (mg/L) unless otherwise indicated)

Baseline (Upper Pinabete)	Dates	n	Range	Median	MAD	Average	Standard Deviation	Percent Relative Standard Deviation	Q3	95th Percentile	Exceedance of Criteria: Livestock		Aquatic & Wildlife Acute		Aquatic & Wildlife Chronic		Secondary Human Contact		Fish Consumption	
											n	%	n	%	n	%	n	%	n	%
Aluminum	(10/08/2007-08/12/2008)	5	(0.05-0.42)	0.25	0.17	0.210	0.160	76	0.28	0.392					3	60				
Arsenic	(10/08/2007-08/12/2008)	5	(0.0009-0.0204)	0.0084	0.0066	0.0094	0.0083	89	0.015	0.01932										
Barium	(10/08/2007-08/12/2008)	5	(0.0313-0.112)	0.0433	0.012	0.06	0.03	56	0.069	0.1033										
Boron	(07/29/1998-08/12/2008)	9	(0.05-0.9)	0.09	0.02	0.196	0.275	140	0.1	0.66										
Cadmium	(12/03/2007-08/12/2008)	4	(0.000025-	3E-05	0	0.000	0.000	107	0.000	0.000										
Chloride	(07/29/1998-08/12/2008)	9	(5.-32.)	10	1	13.44	8.66	64	11	28.8										
Chromium	(12/03/2007-08/12/2008)	4	(0.0005-0.002)	0.0005	0	0.001	0.001	86	9E-04	0.001775			1	25						
Copper	(10/08/2007-08/12/2008)	5	(0.008-0.0261)	0.0096	0.0016	0.01284	0.007522	59	0.012	0.02318					1	20				
Fluoride	(07/29/1998-08/12/2008)	8	(0.1-1.19)	0.44	0.34	0.55	0.49	90	0.948	1.155										
Lead	(10/08/2007-08/12/2008)	5	(0.00005-	0.0001	5E-05	0.000	0.000	105	2E-04	0.00044										
Mercury	(12/03/2007-12/03/2007)	1	(0.0001-0.0001)	0.0001	0	0.0001			1E-04	0.0001					1	100				
Nitrate	(10/08/2007-08/12/2008)	4	(0.06-2.48)	1.195	0.795	1.2	1.1	86	1.858	2.3555										
pH	(07/29/1998-08/12/2008)	9	(7.48-8.24)	7.99	0.21	7.89	0.30	4	8.11	8.224										
Radium (pCi/l)																				
Selenium	(07/29/1998-08/12/2008)	9	(0.001-0.005)	0.0025	0.0005	0.0026	0.0011	42	0.003	0.0042					6	67				
Silver	(12/03/2007-08/12/2008)	4	(0.000025-	3E-05	0	0.0000	0.0000	86	4E-05	8.875E-05										
Sulfate	(07/29/1998-08/12/2008)	9	(180.-840.)	390	191	500	240	48	740	816										
TDS - 180°C	(07/29/1998-08/12/2008)	9	(610.-5300.)	1060	225	1425	1479	104	1270	3688	1	11								
Zinc	(10/08/2007-08/12/2008)	5	(0.001-0.004)	0.002	0.001	0.002	0.001	61	0.002	0.0036										
TSS	(07/29/1998-08/12/2008)	8	(26600.-	124500	56900	179213	161955	90	2E+05	445400										
Conductivity (umho/cm)	(07/29/1998-08/12/2008)	9	(584.-1810.)	1460	350	1250	417	33	1520	1742										
Iron (total)	(07/29/1998-08/12/2008)	8	(5.96-1220.)	428.5	396.02	568.75	527.53	93	1143	1195.5										
Manganese	(07/29/1998-08/12/2008)	8	(0.0025-0.453)	0.005	0.0025	0.104	0.187	180	0.095	0.4194										

Appendix D: Surface Water Quality Data Summary Tables

(all Values are dissolved (mg/L) unless otherwise indicated)

Baseline (Lower Pinabete)	Dates	n	Range	Median	MAD	Average	Standard Deviation	Percent Relative Standard Deviation	Q3	95th Percentile	Exceedance of Criteria: Livestock		Aquatic & Wildlife Acute		Aquatic & Wildlife Chronic		Secondary Human Contact		Fish Consumption	
											n	%	n	%	n	%	n	%	n	%
Aluminum	(09/18/2007-07/21/2008)	11	(0.005-2.3)	0.05	0.045	0.305	0.667	219	0.21	1.28			1	9	5	45				
Arsenic	(09/18/2007-07/21/2008)	11	(0.0013-0.0133)	0.0025	0.0012	0.0056	0.0043	77	0.01	0.0117										
Barium	(09/18/2007-07/21/2008)	11	(0.0247-0.2193)	0.0528	0.0182	0.07	0.06	78	0.074	0.1776										
Boron	(07/29/1998-07/21/2008)	17	(0.025-0.9)	0.1	0.05	0.189	0.221	117	0.2	0.58										
Cadmium	(09/18/2007-07/21/2008)	9	(0.000025-	3E-05	0	0.008	0.023	281	0.000	0.042	1	11	1	11					1	11
Chloride	(07/29/1998-07/21/2008)	17	(5.-34.)	8	3	11.18	8.11	73	13	28.4										
Chromium	(09/18/2007-07/21/2008)	11	(0.0005-0.005)	0.001	0.0005	0.002	0.002	90	0.004	0.005			7	64						
Copper	(09/18/2007-07/21/2008)	11	(0.006-0.0171)	0.009	0.0019	0.0094	0.003149	33	0.011	0.0144					1	9				
Fluoride	(07/29/1998-07/21/2008)	15	(0.1-0.75)	0.1	0	0.31	0.27	87	0.525	0.75										
Lead	(09/18/2007-07/21/2008)	11	(0.00005-0.004)	0.0005	0.0004	0.001	0.001	143	8E-04	0.0035										
Mercury	(09/18/2007-12/03/2007)	4	(0.0001-0.0001)	0.0001	0	0.0001	0		1E-04	0.0001					4	100				
Nitrate	(09/18/2007-07/21/2008)	11	(0.04-3.4)	0.85	0.54	1.1	1.0	89	1.76	2.665										
pH	(07/29/1998-07/21/2008)	19	(7.-8.56)	8.07	0.28	7.95	0.41	5	8.205	8.416										
Radium (pCi/l)																				
Selenium	(07/29/1998-07/21/2008)	17	(0.0005-0.007)	0.0025	0.0005	0.0026	0.0019	73	0.003	0.007					11	65				
Silver	(09/18/2007-07/21/2008)	9	(0.000025-	6E-05	4E-05	0.0001	0.0001	91	3E-04	0.00025										
Sulfate	(07/29/1998-07/21/2008)	17	(100.-684.)	170	40	248	168	68	295	609.6										
TDS - 180°C	(07/29/1998-07/21/2008)	19	(295.-28400.)	570	200	2808	6878	245	1175	15080	2	11								
Zinc	(09/18/2007-07/21/2008)	11	(0.002-0.16)	0.006	0.004	0.021	0.046	223	0.013	0.088			1	9	1	9				
TSS	(07/29/1998-07/21/2008)	18	(10200.-	59900	30600	77678	63856	82	95600	174450										
Conductivity (umho/cm)	(07/29/1998-08/12/2008)	20	(396.-1940.)	660.5	103	773	376	49	798.5	1550.5										
Iron (total)	(07/29/1998-07/21/2008)	16	(125.-1940.)	674.5	435.5	805.19	552.74	69	1155	1647.5										
Manganese	(07/29/1998-07/21/2008)	16	(0.0025-3.76)	0.0635	0.061	0.526	1.023	194	0.541	2.5225										

Appendix D: Surface Water Quality Data Summary Tables

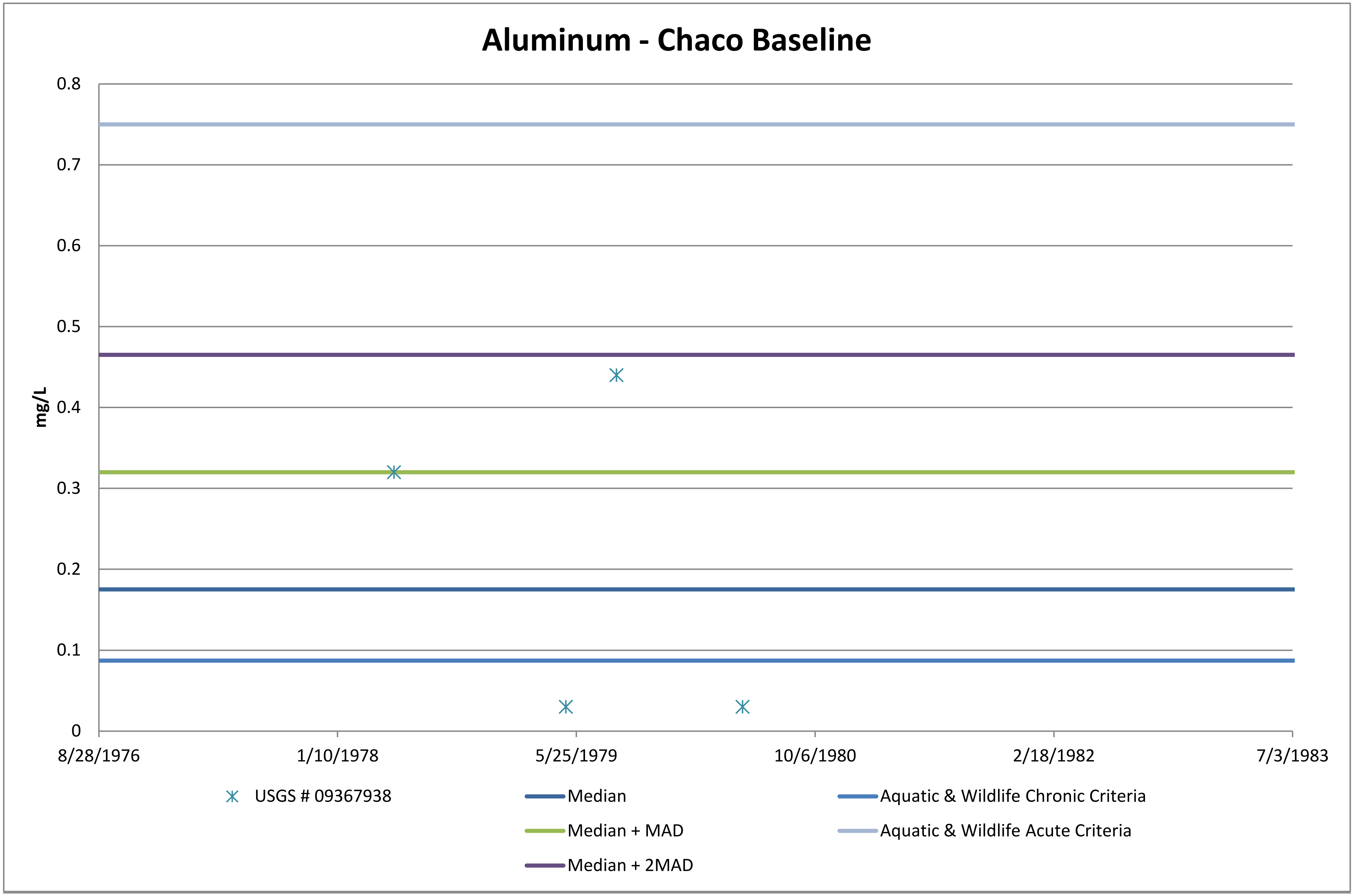
(all Values are dissolved (mg/L) unless otherwise indicated)

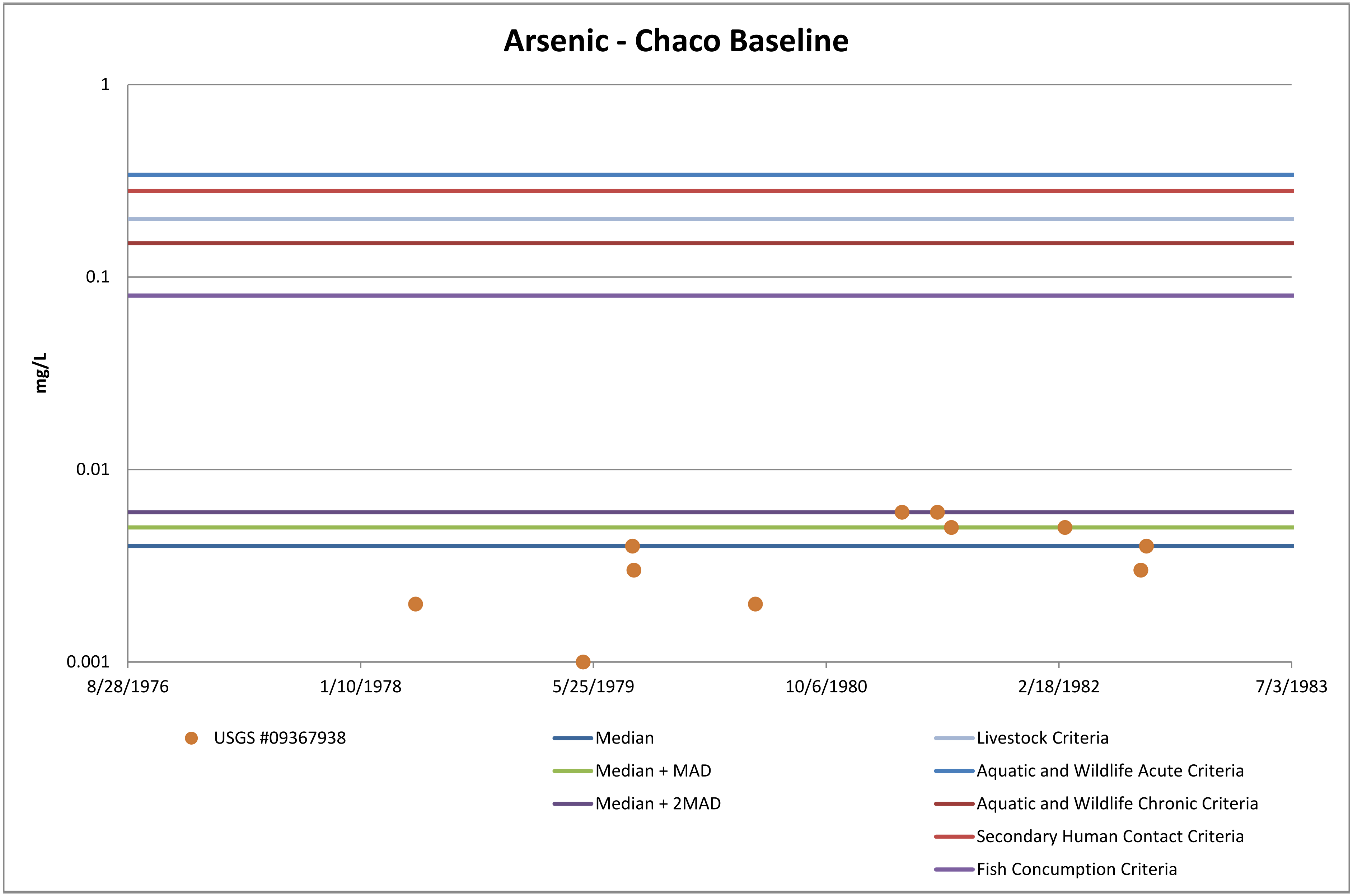
Baseline (Upper No Name)	Dates	n	Range	Median	MAD	Average	Standard Deviation	Percent Relative Standard Deviation	Q3	95th Percentile	Exceedance of Criteria: Livestock		Aquatic & Wildlife Acute		Aquatic & Wildlife Chronic		Secondary Human Contact		Fish Consumption	
											n	%	n	%	n	%	n	%	n	%
Aluminum	(02/13/2008-08/12/2008)	**8**	(0.005-1.65)	**0.1**	0.095	**0.374**	0.563	**151**	0.53	**1.2685**			1	**13**	4	**50**				
Arsenic	(02/13/2008-08/12/2008)	**8**	(0.0019-0.0046)	**0.0026**	0.0005	**0.0029**	0.0009	**30**	0.003	**0.00432**										
Barium	(02/13/2008-08/12/2008)	**8**	(0.0287-0.0658)	**0.0515**	0.008	**0.05**	0.01	**25**	0.059	**0.06398**										
Boron	(07/29/1998-08/12/2008)	**10**	(0.025-0.5)	**0.05**	0.0125	**0.150**	0.179	**119**	0.238	**0.455**										
Cadmium	(02/13/2008-08/12/2008)	**8**	(0.000025-	**0.0001**	0.0001	**0.001**	0.003	**228**	0.001	**0.007**			1	**13**	3	**38**			1	**13**
Chloride	(07/29/1998-08/12/2008)	**10**	(5.-19.)	**5**	0	**6.90**	4.38	**64**	6.5	**14.05**										
Chromium	(02/13/2008-08/12/2008)	**8**	(0.0005-0.005)	**0.0025**	0.002	**0.002**	0.002	**78**	0.004	**0.005**			5	**63**						
Copper	(02/13/2008-08/12/2008)	**8**	(0.0042-0.0124)	**0.0069**	0.0025	**0.00713**	0.002925	**41**	0.008	**0.011525**										
Fluoride	(07/29/1998-08/12/2008)	**10**	(0.1-0.3)	**0.23**	0.07	**0.22**	0.09	**41**	0.3	**0.3**										
Lead	(02/13/2008-08/12/2008)	**8**	(0.00005-	**8E-05**	3E-05	**0.000**	0.000	**111**	2E-04	**0.000495**										
Mercury																				
Nitrate	(02/13/2008-08/12/2008)	**8**	(0.01-0.4)	**0.06**	0.04	**0.1**	0.2	**105**	0.278	**0.3755**										
pH	(07/29/1998-08/12/2008)	**10**	(7.83-8.4)	**8.085**	0.075	**8.07**	0.17	**2**	8.15	**8.292**										
Radium (pCi/l)																				
Selenium	(07/29/1998-08/12/2008)	**9**	(0.0005-0.005)	**0.0005**	0	**0.0019**	0.0019	**99**	0.003	**0.005**					4	**44**				
Silver	(02/13/2008-08/12/2008)	**8**	(0.000025-	**5E-05**	2E-05	**0.0001**	0.0001	**98**	2E-04	**0.00025**										
Sulfate	(07/29/1998-08/12/2008)	**10**	(5.-30.)	**5**	0	**10**	8	**85**	13.75	**23.7**										
TDS - 180°C	(07/29/1998-08/12/2008)	**10**	(100.-490.)	**185**	30	**215**	113	**52**	213.8	**413.5**										
Zinc	(02/13/2008-08/12/2008)	**8**	(0.001-0.03)	**0.0045**	0.003	**0.010**	0.013	**125**	0.013	**0.03**										
TSS	(07/29/1998-08/12/2008)	**10**	(367.-19400.)	**7090**	3055	**7571**	6042	**80**	8153	**17825**										
Conductivity (umho/cm)	(07/29/1998-08/12/2008)	**10**	(150.-337.)	**229**	36.5	**241**	55	**23**	282	**315.85**										
Iron (total)	(07/29/1998-08/12/2008)	**10**	(3.24-6020.)	**50.3**	46.215	**645.82**	1888.85	**292**	103	**3366.35**										
Manganese	(07/29/1998-08/12/2008)	**10**	(0.0025-0.24)	**0.024**	0.0203	**0.055**	0.076	**138**	0.078	**0.18375**										

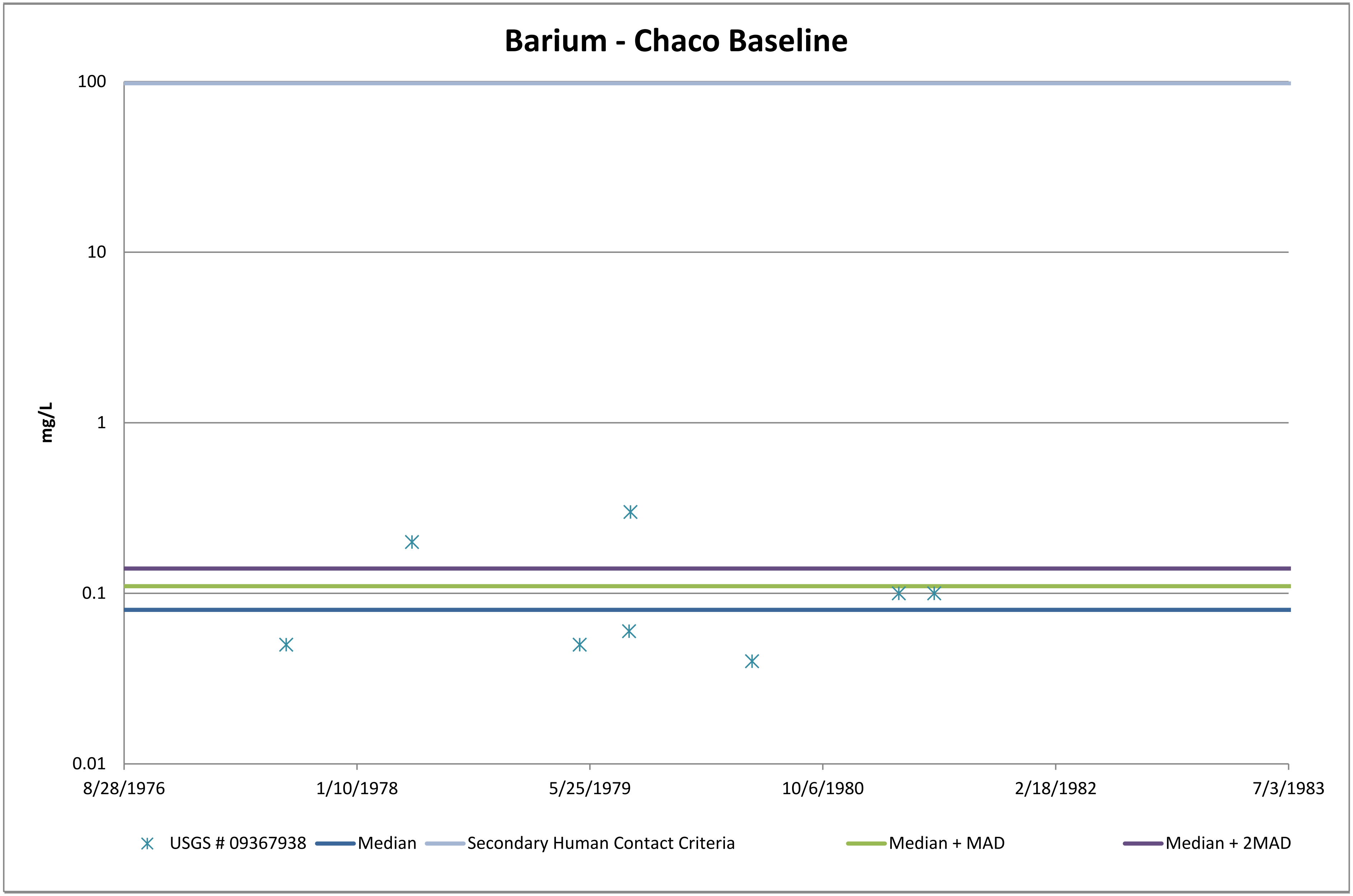
Appendix D: Surface Water Quality Data Summary Tables

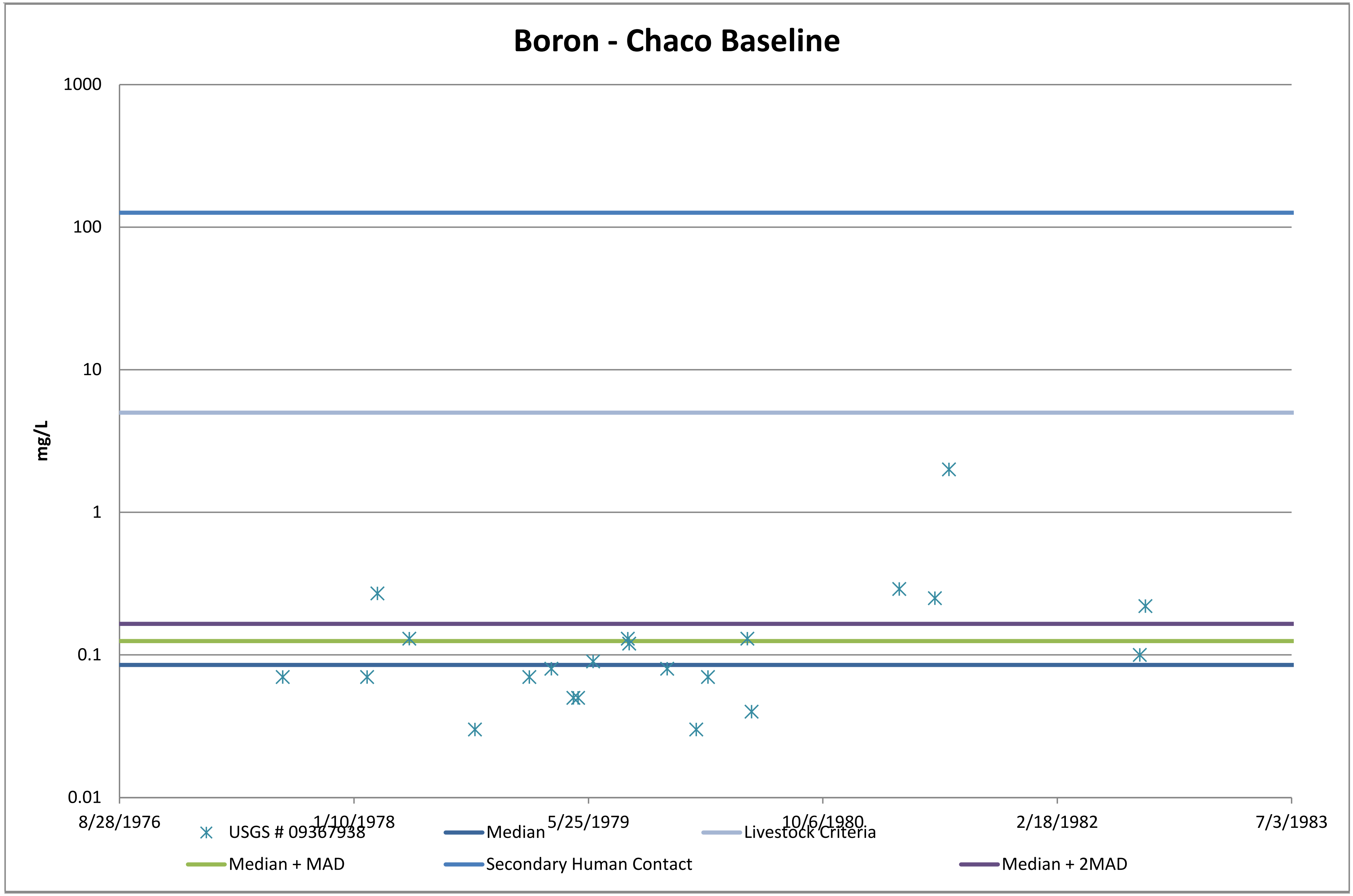
(all Values are dissolved (mg/L) unless otherwise indicated)

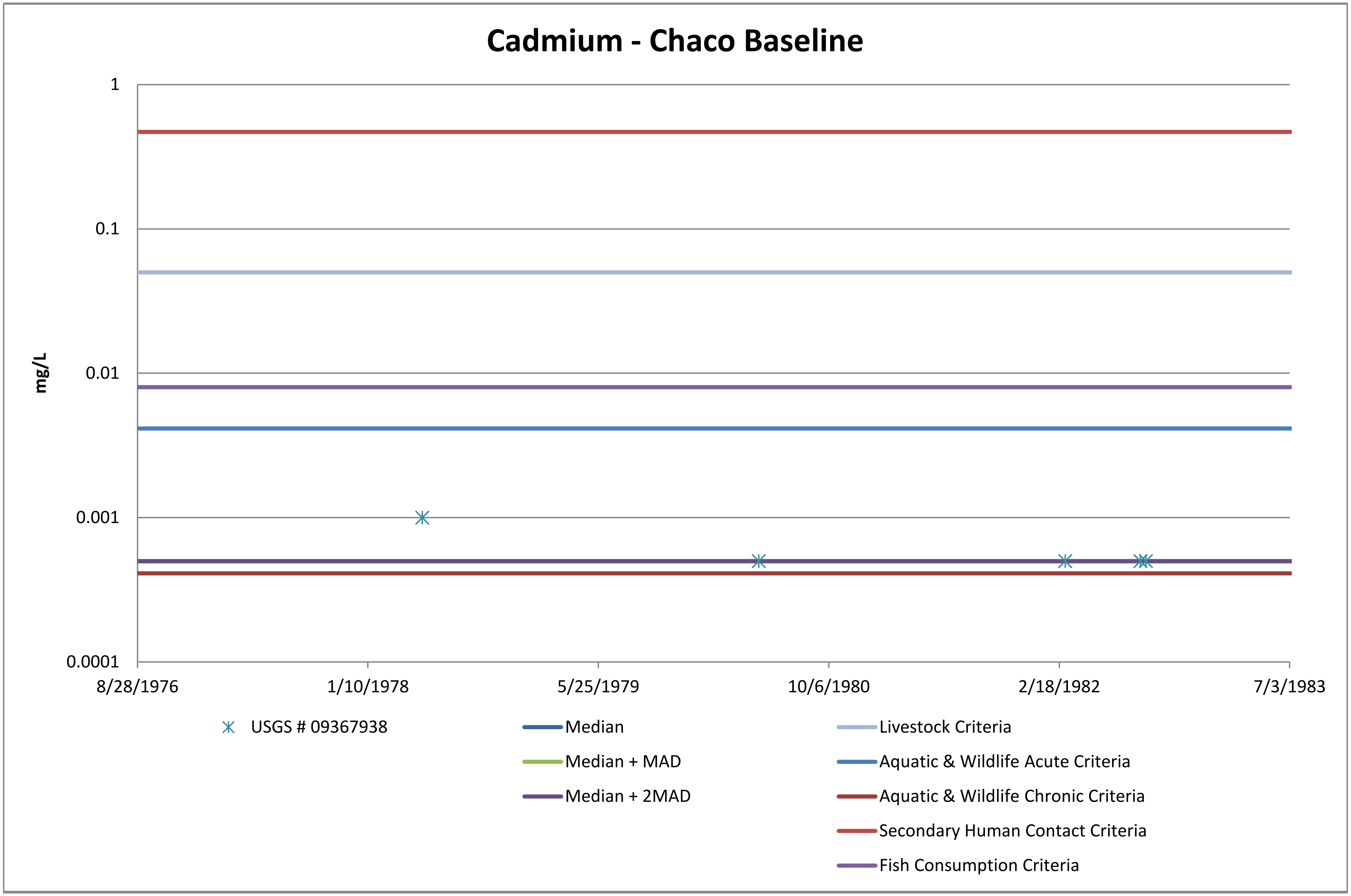
Baseline (Lower No Name)	Dates	n	Range	Median	MAD	Average	Standard Deviation	Percent Relative Standard Deviation	Q3	95th Percentile	Exceedance of Criteria: Livestock		Aquatic & Wildlife Acute		Aquatic & Wildlife Chronic		Secondary Human Contact		Fish Consumption	
											n	%	n	%	n	%	n	%	n	%
Aluminum	(08/28/2007-08/12/2008)	5	(0.005-0.05)	0.05	0	0.032	0.025	77	0.05	0.05										
Arsenic	(08/28/2007-08/12/2008)	5	(0.0011-0.0058)	0.0045	0.0013	0.0035	0.0023	64	0.005	0.00566										
Barium	(08/28/2007-08/12/2008)	5	(0.0474-0.138)	0.111	0.027	0.09	0.04	45	0.122	0.1348										
Boron	(08/13/1998-08/12/2008)	8	(0.05-0.2)	0.14	0.06	0.124	0.066	53	0.17	0.2										
Cadmium	(08/28/2007-08/12/2008)	5	(0.000025-	3E-05	0	0.000	0.000	197	0.000	0.001										
Chloride	(08/13/1998-08/12/2008)	8	(5.-17.)	5	0	7.75	4.40	57	9.5	14.9										
Chromium	(08/28/2007-08/12/2008)	5	(0.0005-0.0005)	0.0005	0	0.001	0.000		5E-04	0.0005										
Copper	(08/28/2007-08/12/2008)	5	(0.0056-0.0072)	0.0063	0.0006	0.00622	0.000638	10	0.006	0.00702										
Fluoride	(08/13/1998-08/12/2008)	8	(0.1-0.89)	0.35	0.25	0.40	0.31	76	0.65	0.8165										
Lead	(08/28/2007-08/12/2008)	5	(0.00005-	0.0002	0.0002	0.002	0.004	209	2E-04	0.0074										
Mercury	(08/28/2007-08/28/2007)	2	(0.0001-0.0001)	0.0001	0	0.0001	0		1E-04	0.0001					2	100				
Nitrate	(08/28/2007-08/12/2008)	5	(0.06-2.94)	0.41	0.35	1.3	1.5	118	2.94	2.94										
pH	(08/13/1998-08/12/2008)	8	(7.17-8.)	7.65	0.29	7.61	0.32	4	7.903	7.9685										
Radium (pCi/l)																				
Selenium	(08/13/1998-08/12/2008)	8	(0.001-0.0025)	0.001	0	0.0016	0.0008	50	0.003	0.0025					3	38				
Silver	(08/28/2007-08/12/2008)	5	(0.000025-	3E-05	0	0.0003	0.0006	204	3E-05	0.001085										
Sulfate	(08/13/1998-08/12/2008)	8	(131.-600.)	242.5	106	284	162	57	380.8	524.05										
TDS - 180°C	(08/13/1998-08/12/2008)	8	(385.-1030.)	600	182.5	654	224	34	817.5	963.5										
Zinc	(08/28/2007-08/12/2008)	5	(0.001-14.2)	0.004	0.003	2.844	6.348	223	0.01	11.362			1	20	20	1			1	20
TSS	(08/13/1998-08/12/2008)	8	(16700.-	57600	36200	153063	166392	109	3E+05	394650										
Conductivity (umho/cm)	(08/13/1998-08/12/2008)	8	(498.-1330.)	1010	220	926	286	31	1080	1274										
Iron (total)	(08/13/1998-08/12/2008)	8	(1.26-419.)	16.7	13.82	126.78	168.31	133	266	373.85										
Manganese	(08/13/1998-08/12/2008)	8	(0.0025-0.786)	0.12	0.113	0.231	0.296	128	0.317	0.7097										

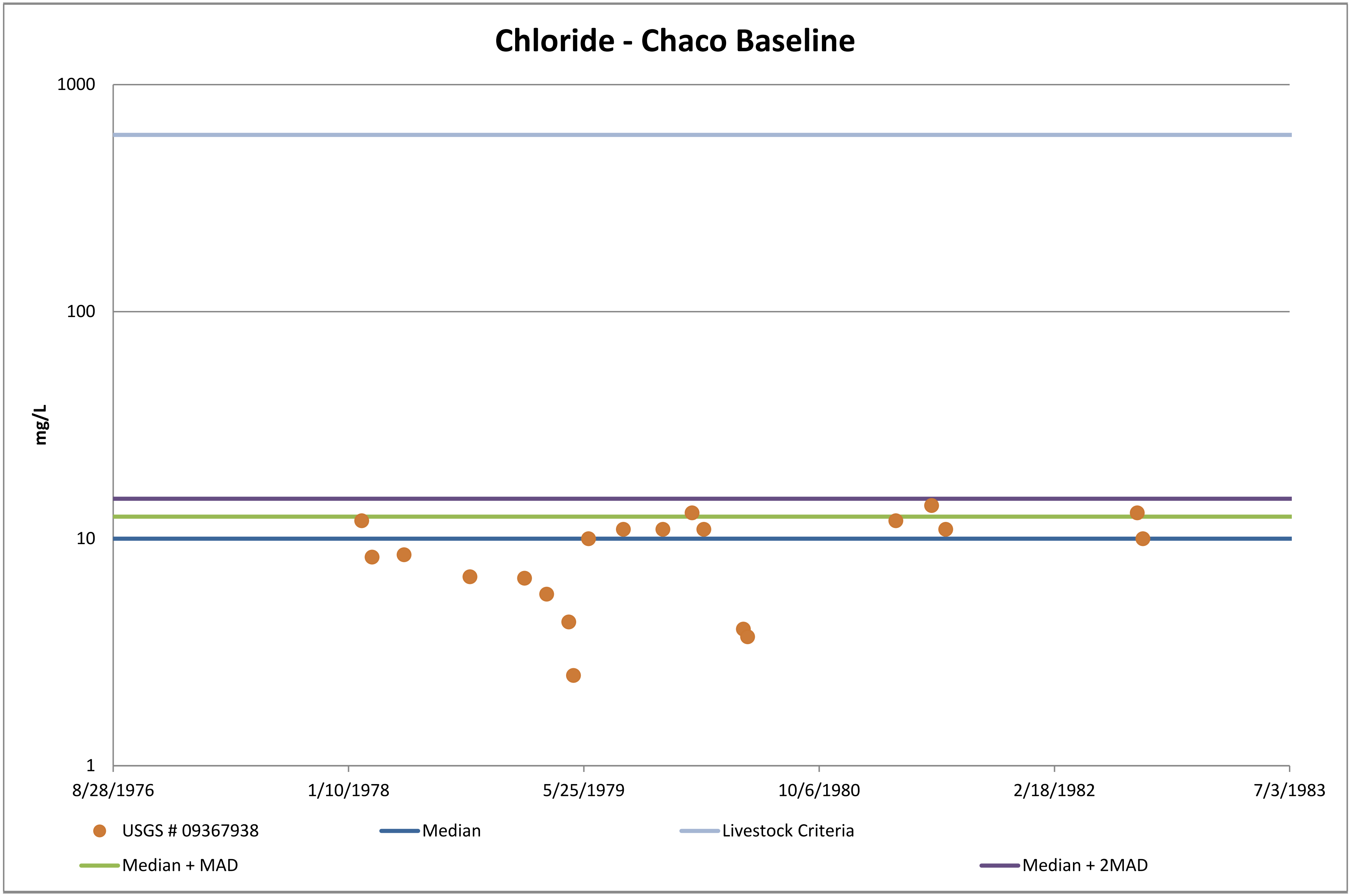

Aluminum - Chaco Baseline
mg/L
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
8/28/1976
1/10/1978
5/25/1979
10/6/1980
2/18/1982
7/3/1983
USGS # 09367938
Median
Aquatic & Wildlife Chronic Criteria
Median + MAD
Aquatic & Wildlife Acute Criteria
Median + 2MAD

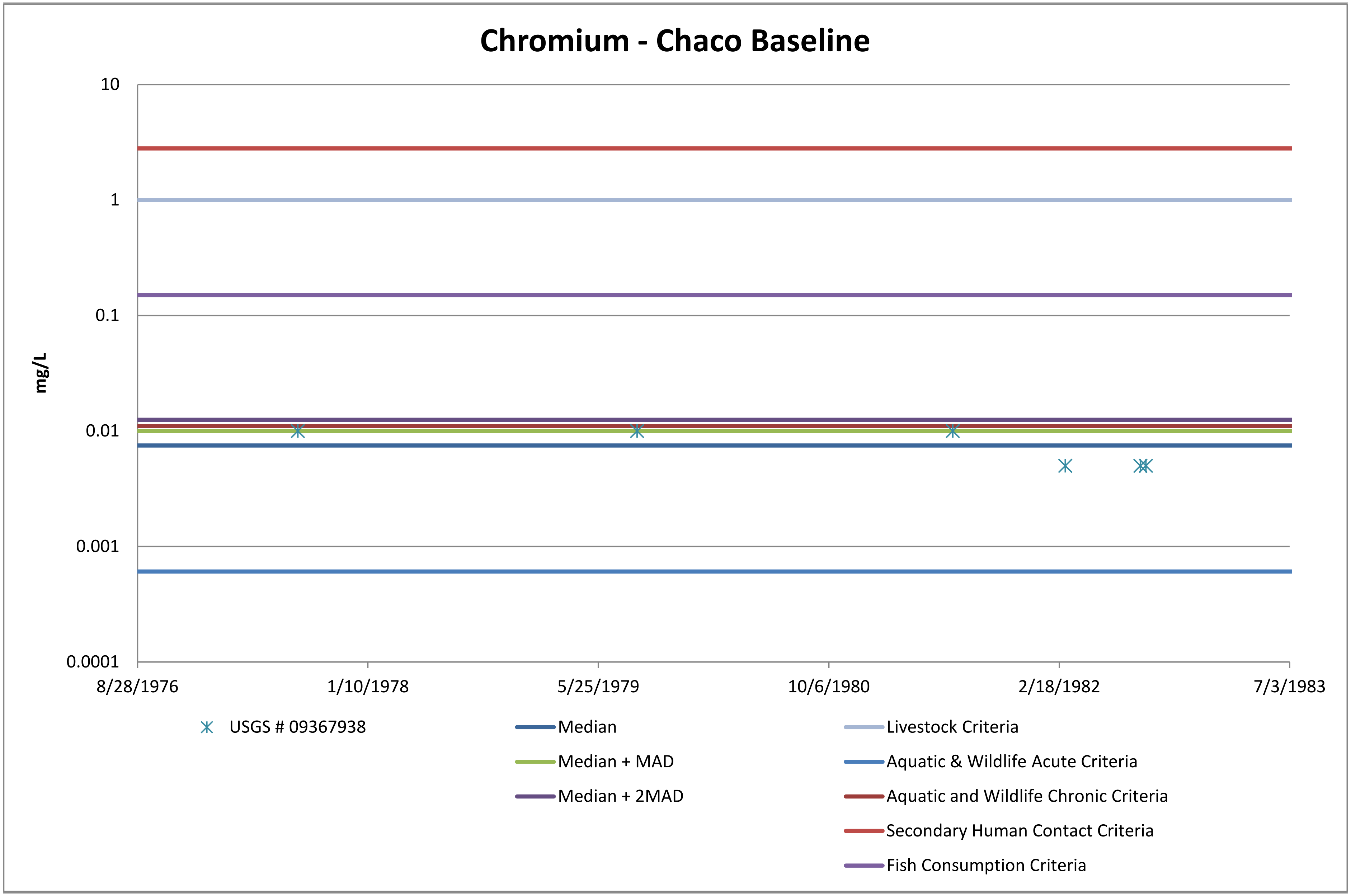

Arsenic - Chaco Baseline
mg/L
1
0.1
0.01
0.001
8/28/1976
1/10/1978
5/25/1979
10/6/1980
2/18/1982
7/3/1983
USGS #09367938
Median
Median + MAD
Median + 2MAD
Livestock Criteria
Aquatic and Wildlife Acute Criteria
Aquatic and Wildlife Chronic Criteria
Secondary Human Contact Criteria
Fish Concumption Criteria

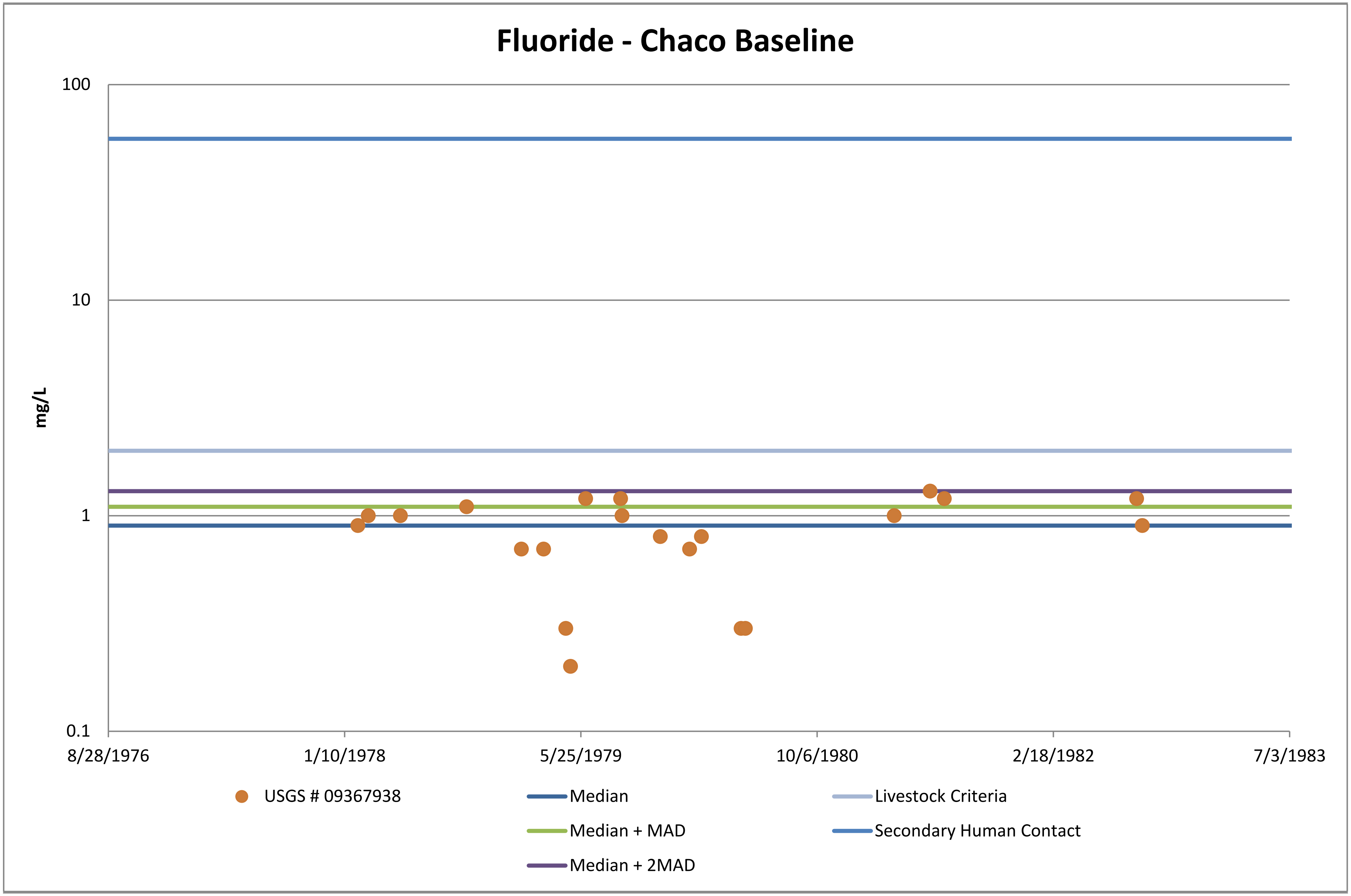

Barium - Chaco Baseline
mg/L
100
10
1
0.1
0.01
8/28/1976
1/10/1978
5/25/1979
10/6/1980
2/18/1982
7/3/1983
USGS # 09367938
Median
Secondary Human Contact Criteria
Median + MAD
Median + 2MAD

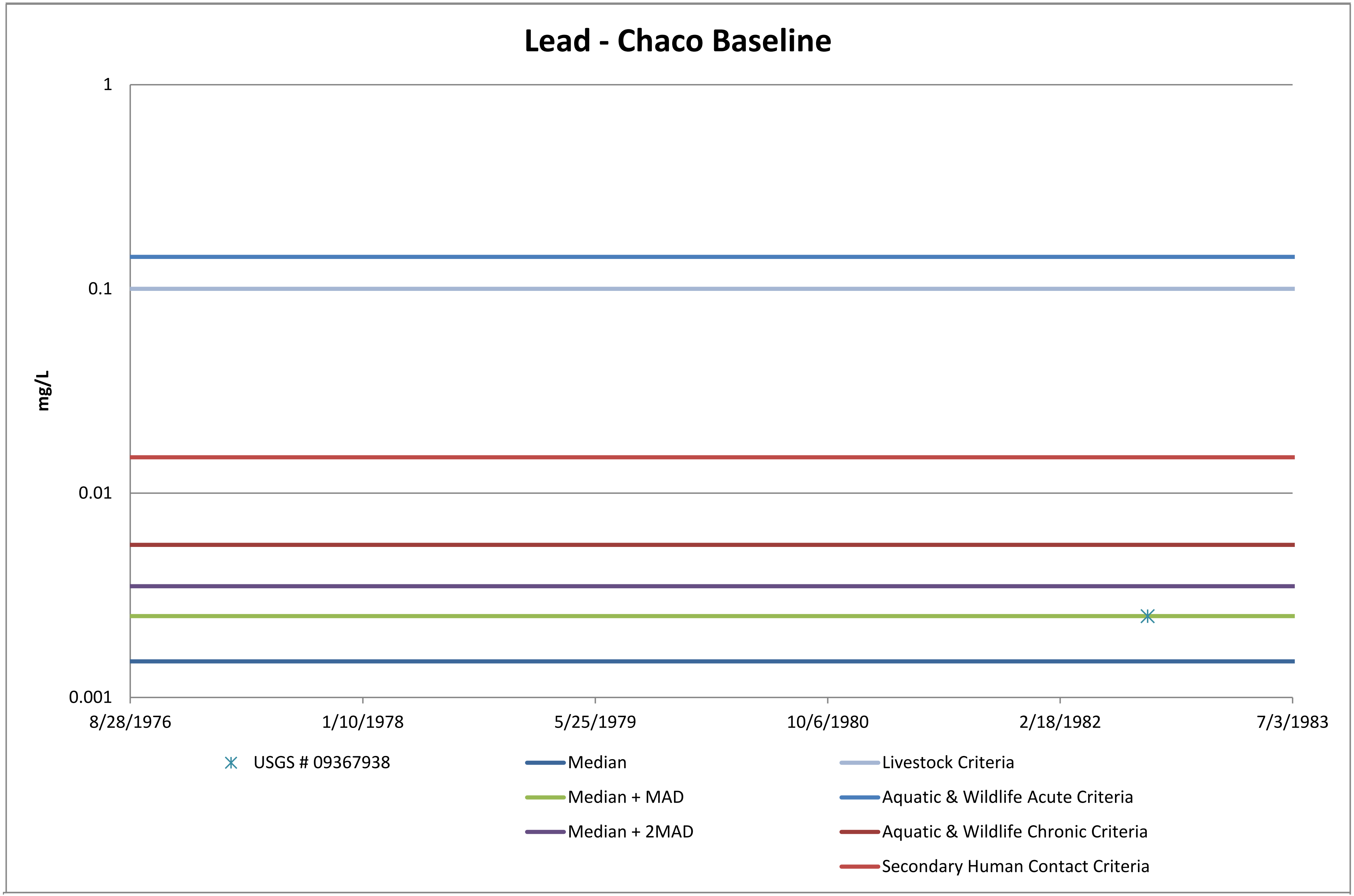

Boron - Chaco Baseline
1000
100
10
1
0.1
0.01
mg/L
8/28/1976
1/10/1978
5/25/1979
10/6/1980
2/18/1982
7/3/1983
USGS # 09367938
Median
Livestock Criteria
Median + MAD
Secondary Human Contact
Median + 2MAD

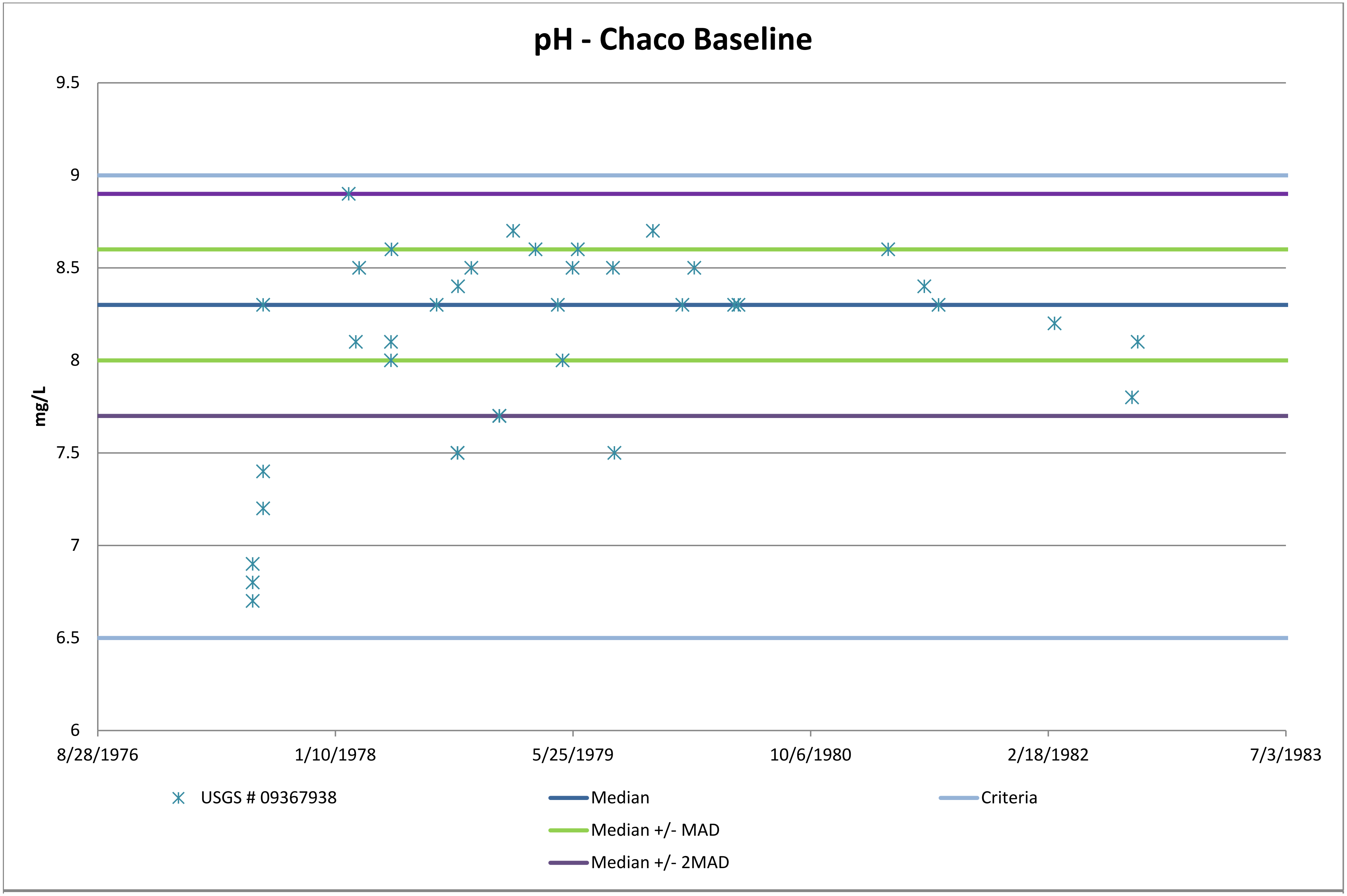

Cadmium - Chaco Baseline
mg/L
1
0.1
0.01
0.001
0.0001
8/28/1976
1/10/1978
5/25/1979
10/6/1980
2/18/1982
7/3/1983
USGS # 09367938
Median
Median + MAD
Median + 2MAD
Livestock Criteria
Aquatic & Wildlife Acute Criteria
Aquatic & Wildlife Chronic Criteria
Secondary Human Contact Criteria
Fish Consumption Criteria

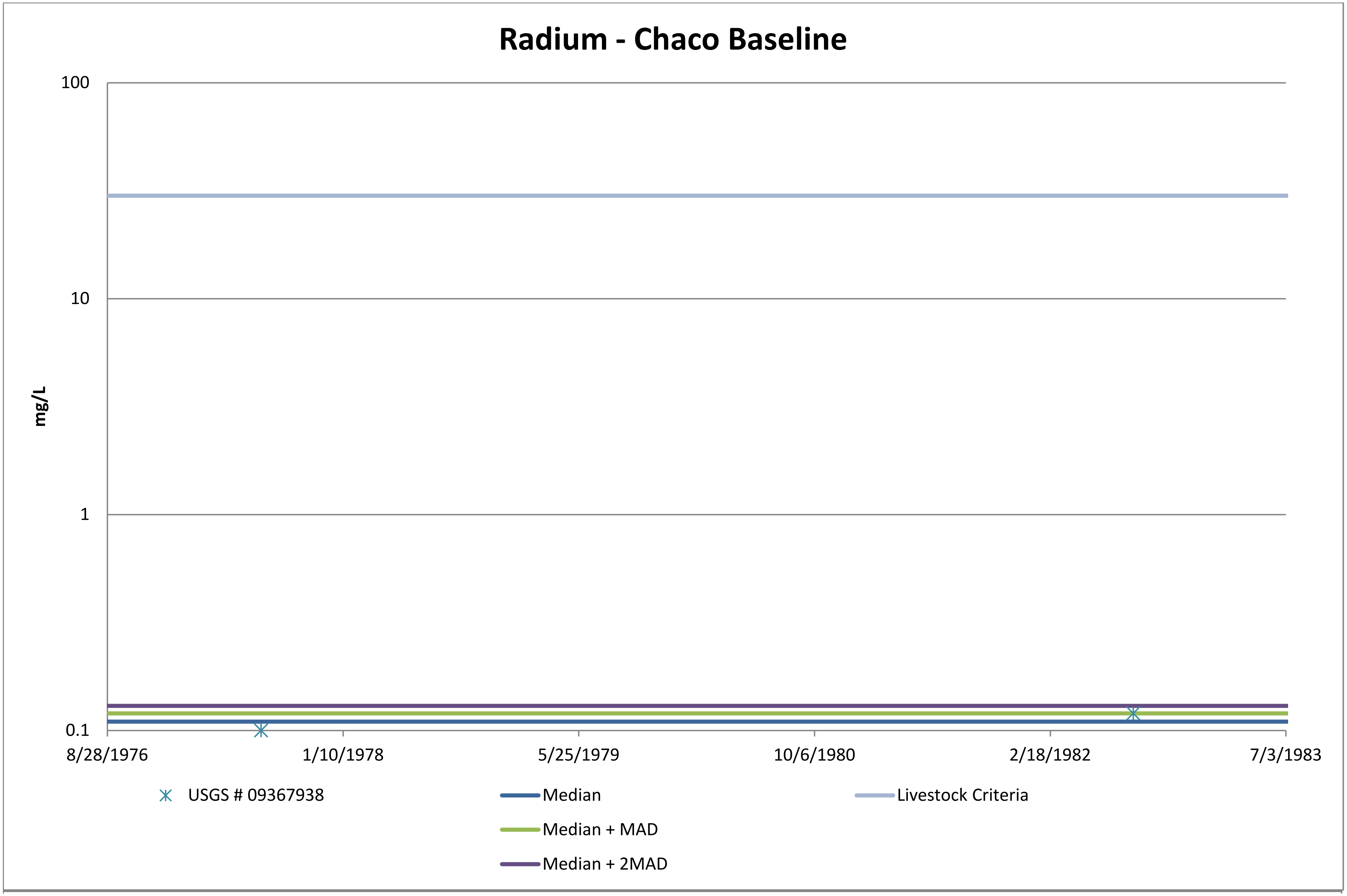

Chloride - Chaco Baseline
mg/L
1000
100
10
1
8/28/1976
1/10/1978
5/25/1979
10/6/1980
2/18/1982
7/3/1983
USGS # 09367938
Median
Livestock Criteria
Median + MAD
Median + 2MAD

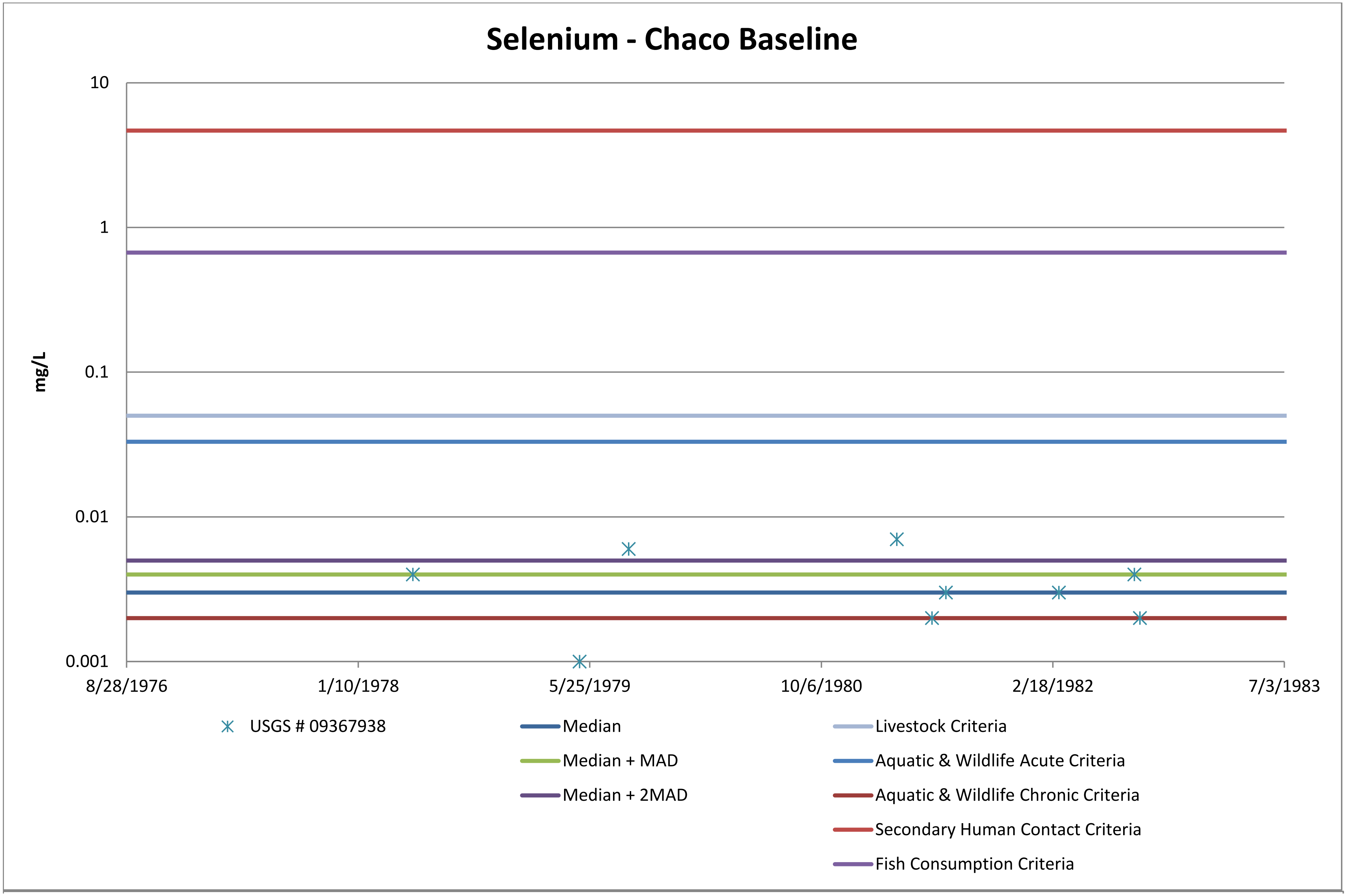

Chromium - Chaco Baseline
mg/L
10
1
0.1
0.01
0.001
0.0001
8/28/1976
1/10/1978
5/25/1979
10/6/1980
2/18/1982
7/3/1983
USGS # 09367938
Median
Median + MAD
Median + 2MAD
Livestock Criteria
Aquatic & Wildlife Acute Criteria
Aquatic and Wildlife Chronic Criteria
Secondary Human Contact Criteria
Fish Consumption Criteria

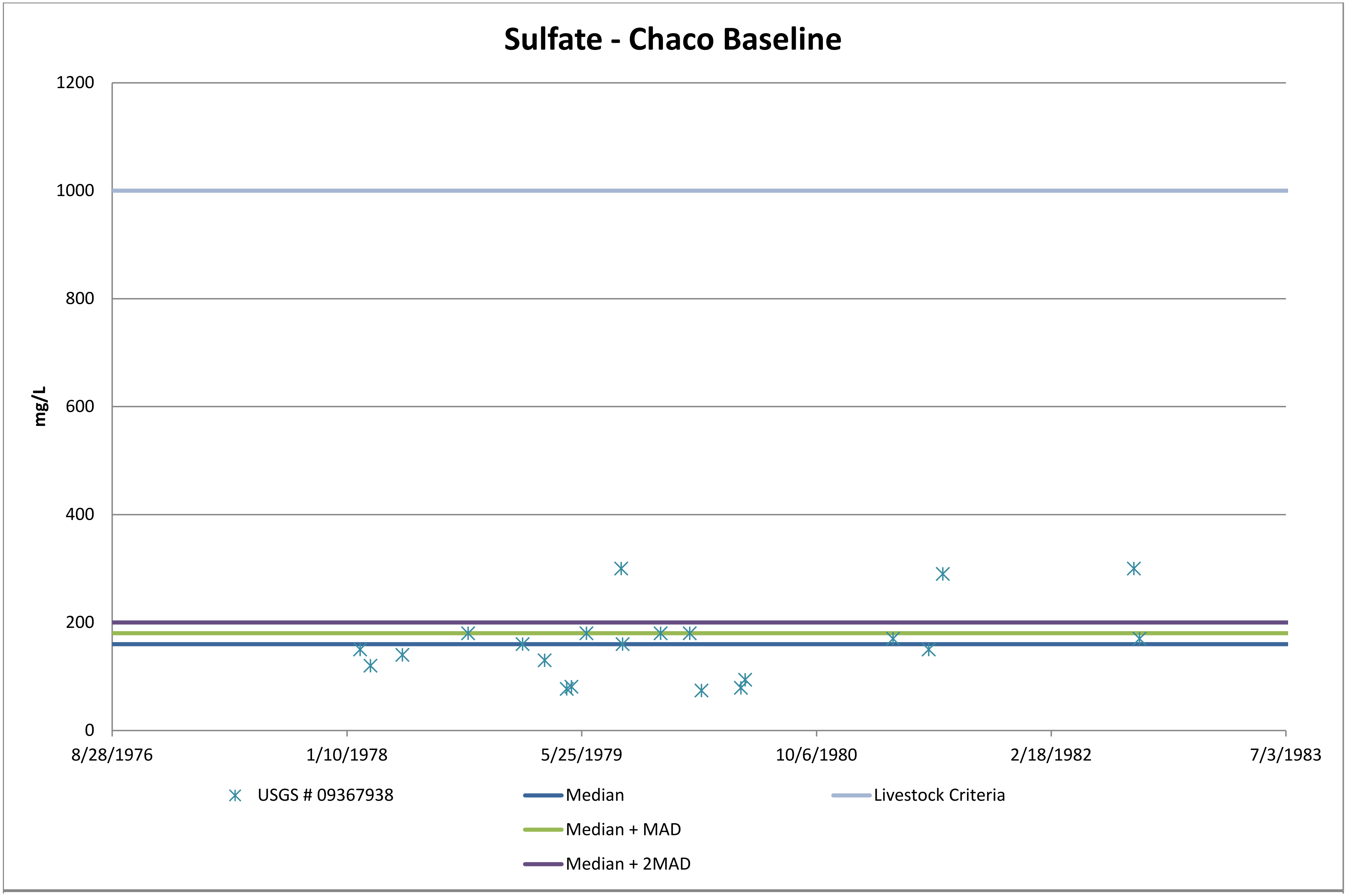

Fluoride - Chaco Baseline
100
10
1
0.1
mg/L
8/28/1976
1/10/1978
5/25/1979
10/6/1980
2/18/1982
7/3/1983
USGS # 09367938
Median
Median + MAD
Median + 2MAD
Livestock Criteria
Secondary Human Contact

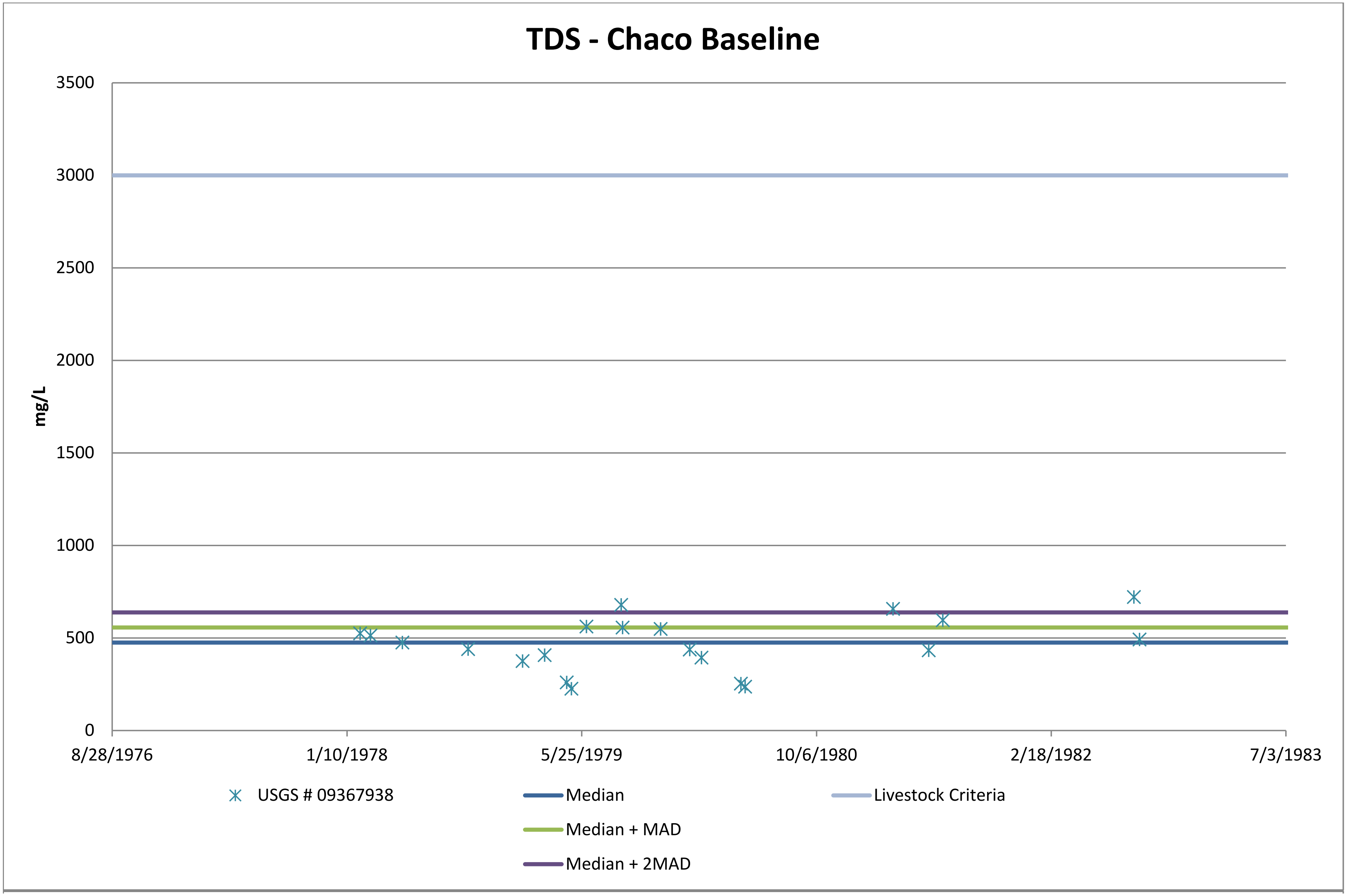

Lead - Chaco Baseline
mg/L
1
0.1
0.01
0.001
8/28/1976
1/10/1978
5/25/1979
10/6/1980
2/18/1982
7/3/1983
USGS # 09367938
Median
Median + MAD
Median + 2MAD
Livestock Criteria
Aquatic & Wildlife Acute Criteria
Aquatic & Wildlife Chronic Criteria
Secondary Human Contact Criteria

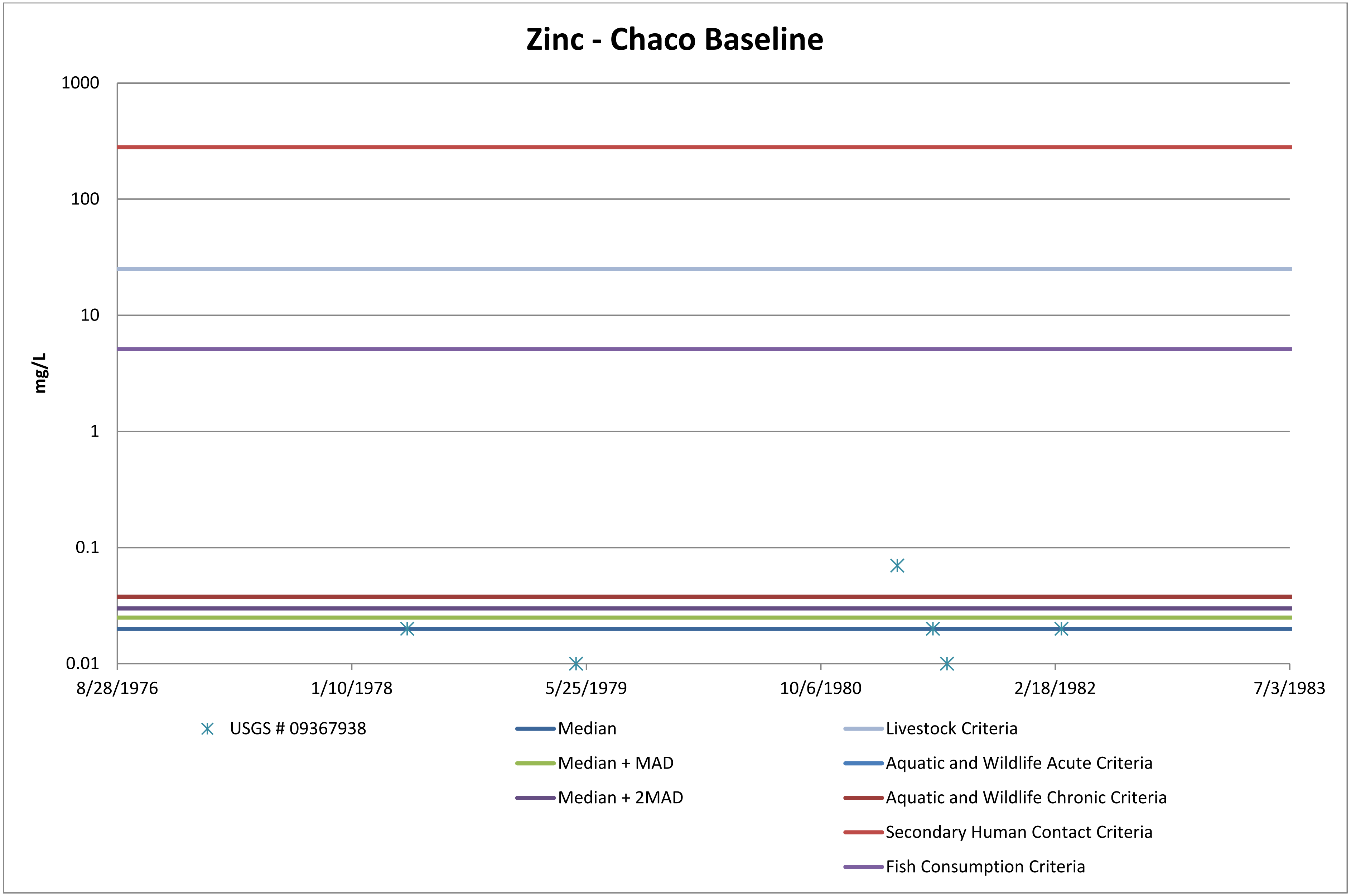

pH - Chaco Baseline
9.5
9
8.5
8
7.5
7
6.5
6
mg/L
8/28/1976
1/10/1978
5/25/1979
10/6/1980
2/18/1982
7/3/1983
USGS # 09367938
Median
Median +/- MAD
Median +/- 2MAD
Criteria

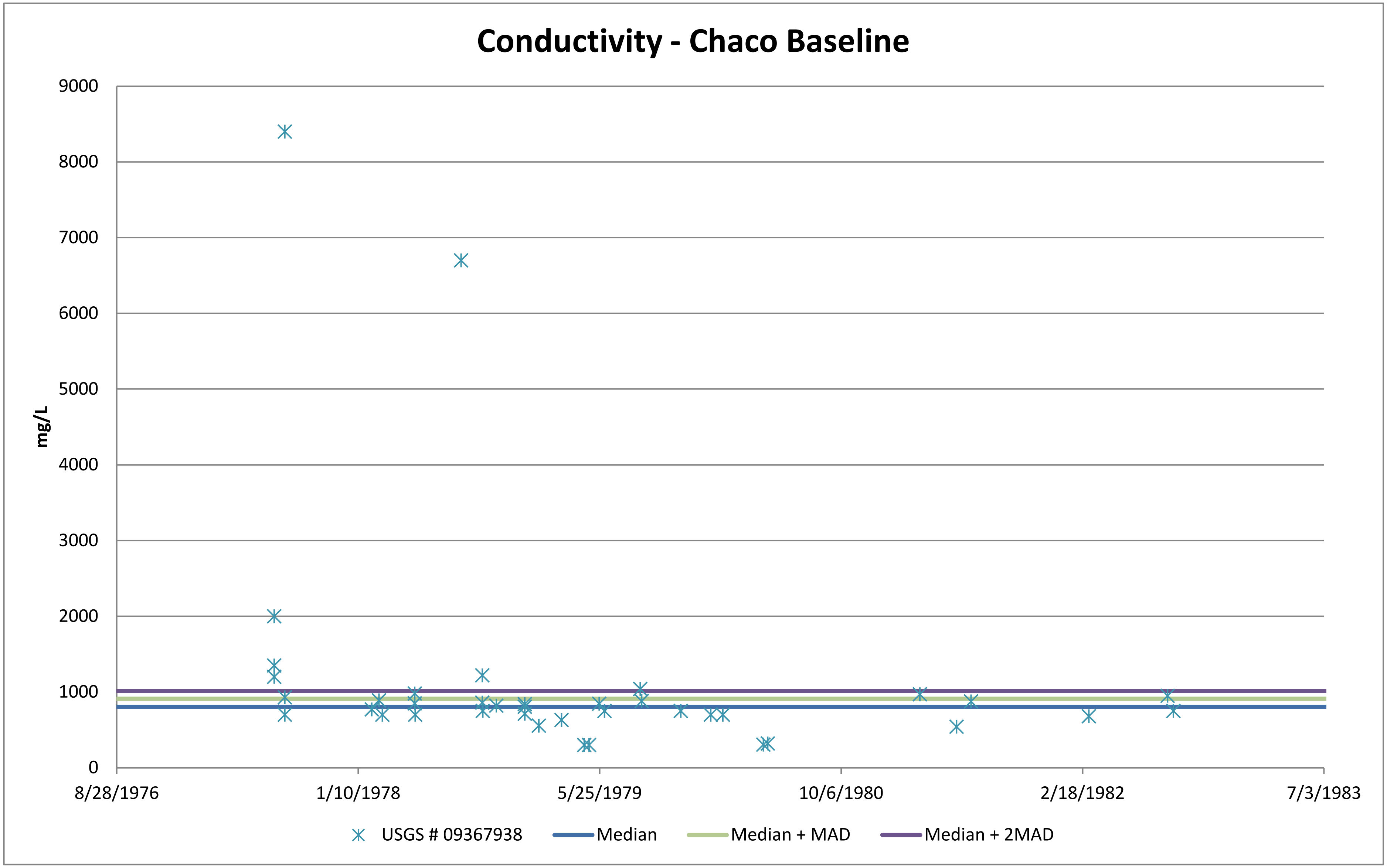

Radium - Chaco Baseline
100
10
1
0.1
mg/L
8/28/1976
1/10/1978
5/25/1979
10/6/1980
2/18/1982
7/3/1983
USGS # 09367938
Median
Median + MAD
Median + 2MAD
Livestock Criteria

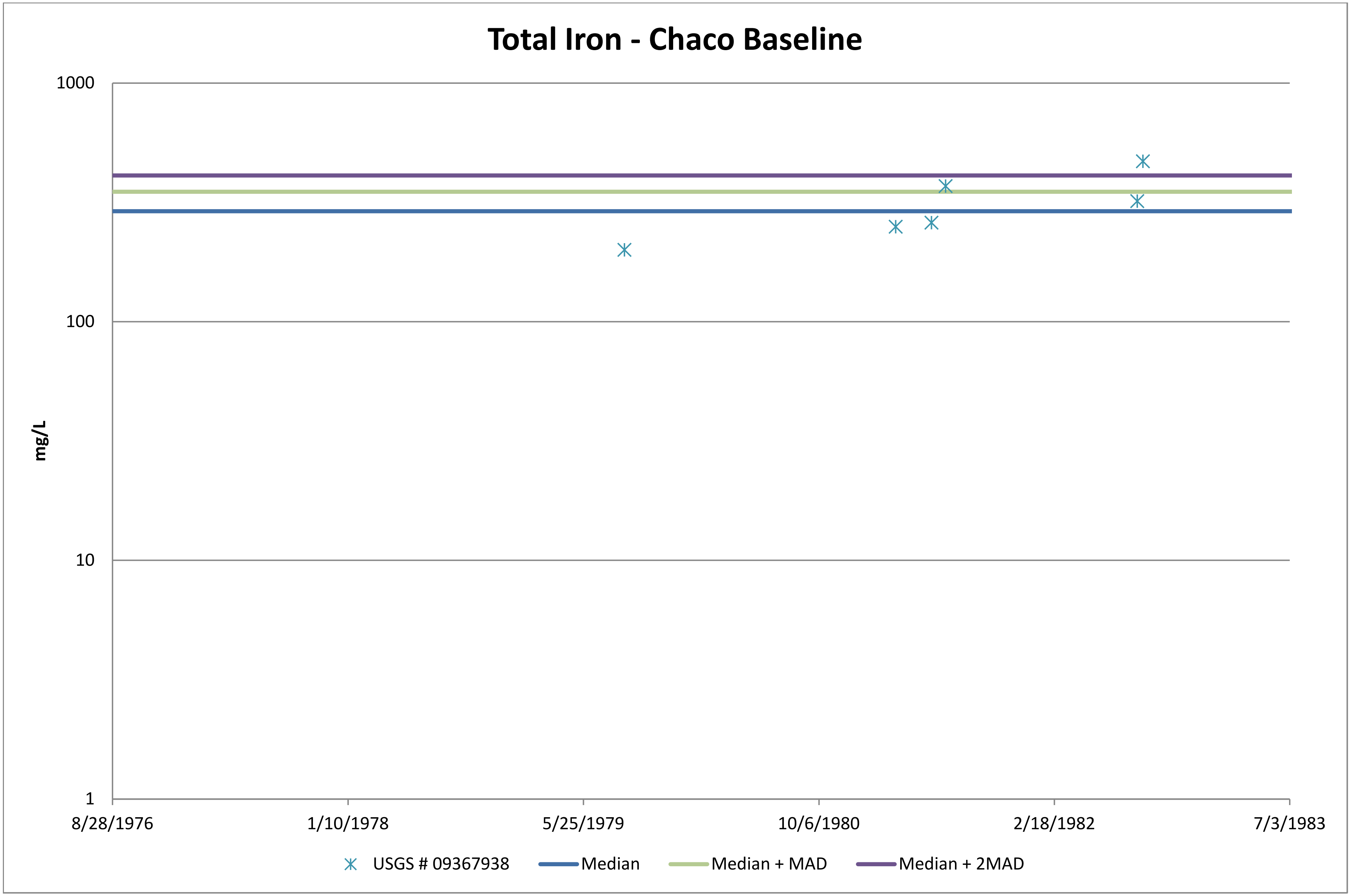

Selenium - Chaco Baseline
mg/L
10
1
0.1
0.01
0.001
8/28/1976
1/10/1978
5/25/1979
10/6/1980
2/18/1982
7/3/1983
USGS # 09367938
Median
Median + MAD
Median + 2MAD
Livestock Criteria
Aquatic & Wildlife Acute Criteria
Aquatic & Wildlife Chronic Criteria
Secondary Human Contact Criteria
Fish Consumption Criteria

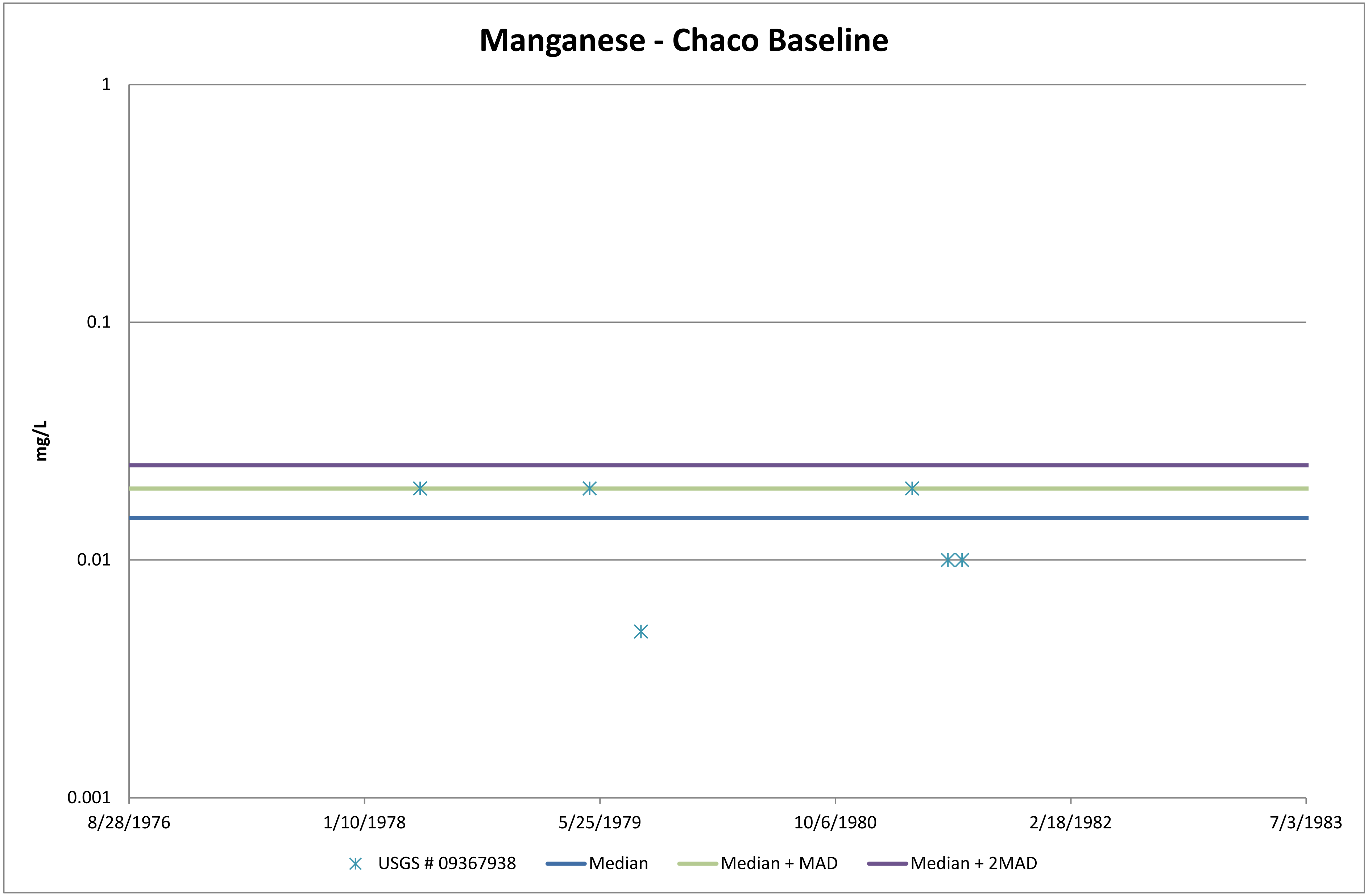

Sulfate - Chaco Baseline
mg/L
1200
1000
800
600
400
200
0
8/28/1976
1/10/1978
5/25/1979
10/6/1980
2/18/1982
7/3/1983
USGS # 09367938
Median
Median + MAD
Median + 2MAD
Livestock Criteria

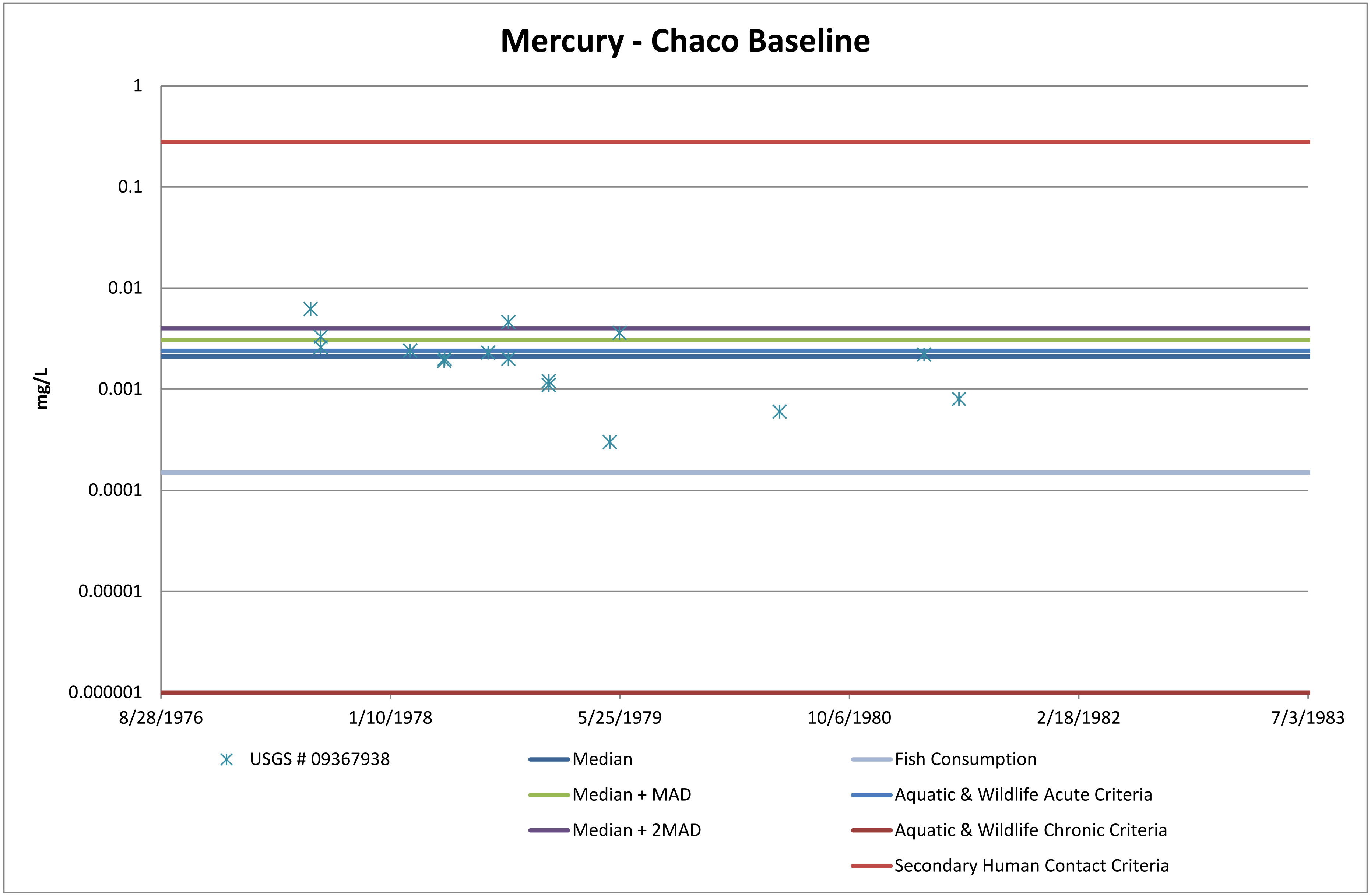

TDS - Chaco Baseline
mg/L
3500
3000
2500
2000
1500
1000
500
0
8/28/1976
1/10/1978
5/25/1979
10/6/1980
2/18/1982
7/3/1983
USGS # 09367938
Median
Livestock Criteria
Median + MAD
Median + 2MAD

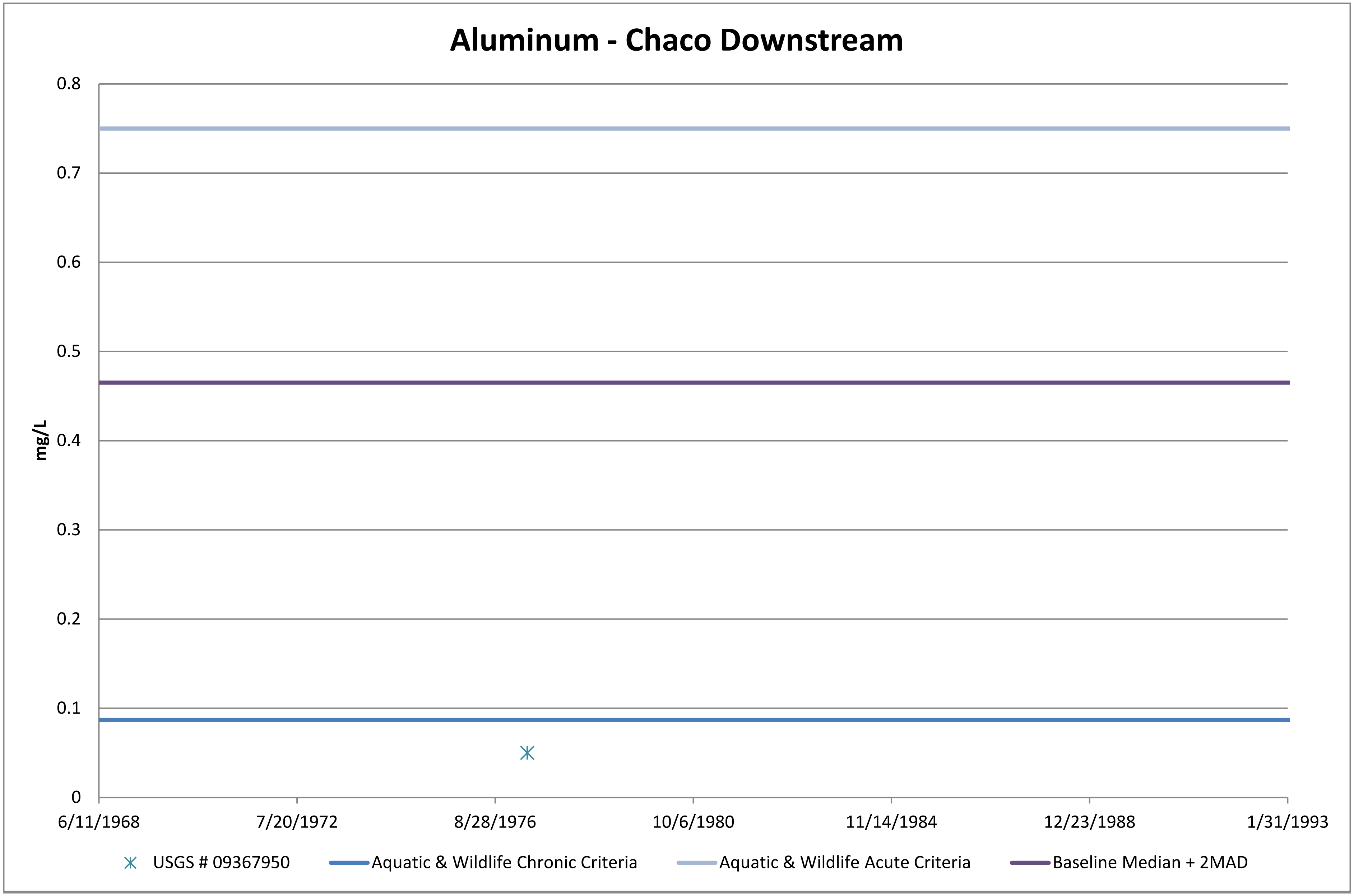

Zinc - Chaco Baseline
mg/L
1000
100
10
1
0.1
0.01
8/28/1976
1/10/1978
5/25/1979
10/6/1980
2/18/1982
7/3/1983
USGS # 09367938
Median
Median + MAD
Median + 2MAD
Livestock Criteria
Aquatic and Wildlife Acute Criteria
Aquatic and Wildlife Chronic Criteria
Secondary Human Contact Criteria
Fish Consumption Criteria

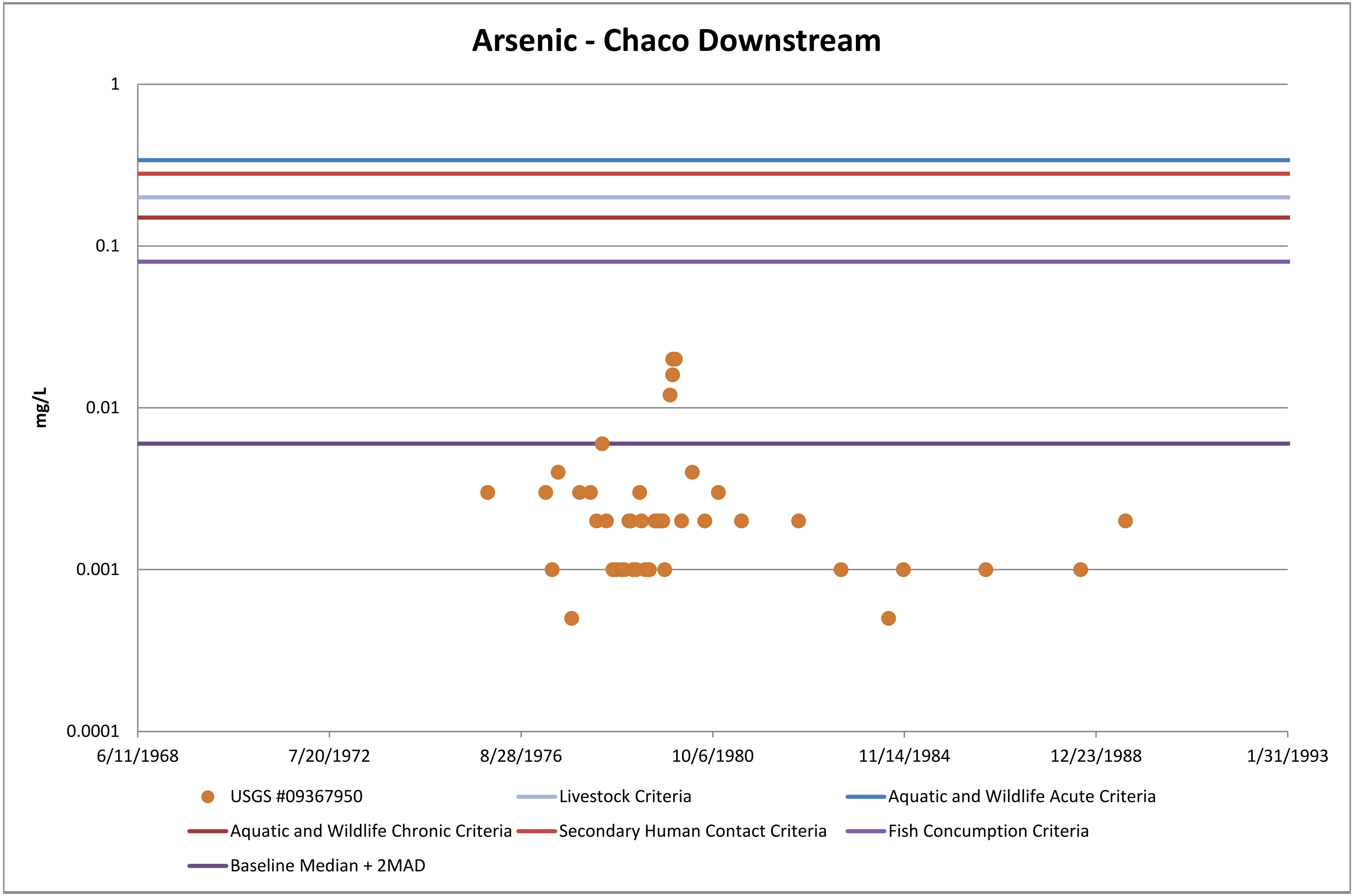

Conductivity - Chaco Baseline
mg/L
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
8/28/1976
1/10/1978
5/25/1979
10/6/1980
2/18/1982
7/3/1983
USGS # 09367938
Median
Median + MAD
Median + 2MAD

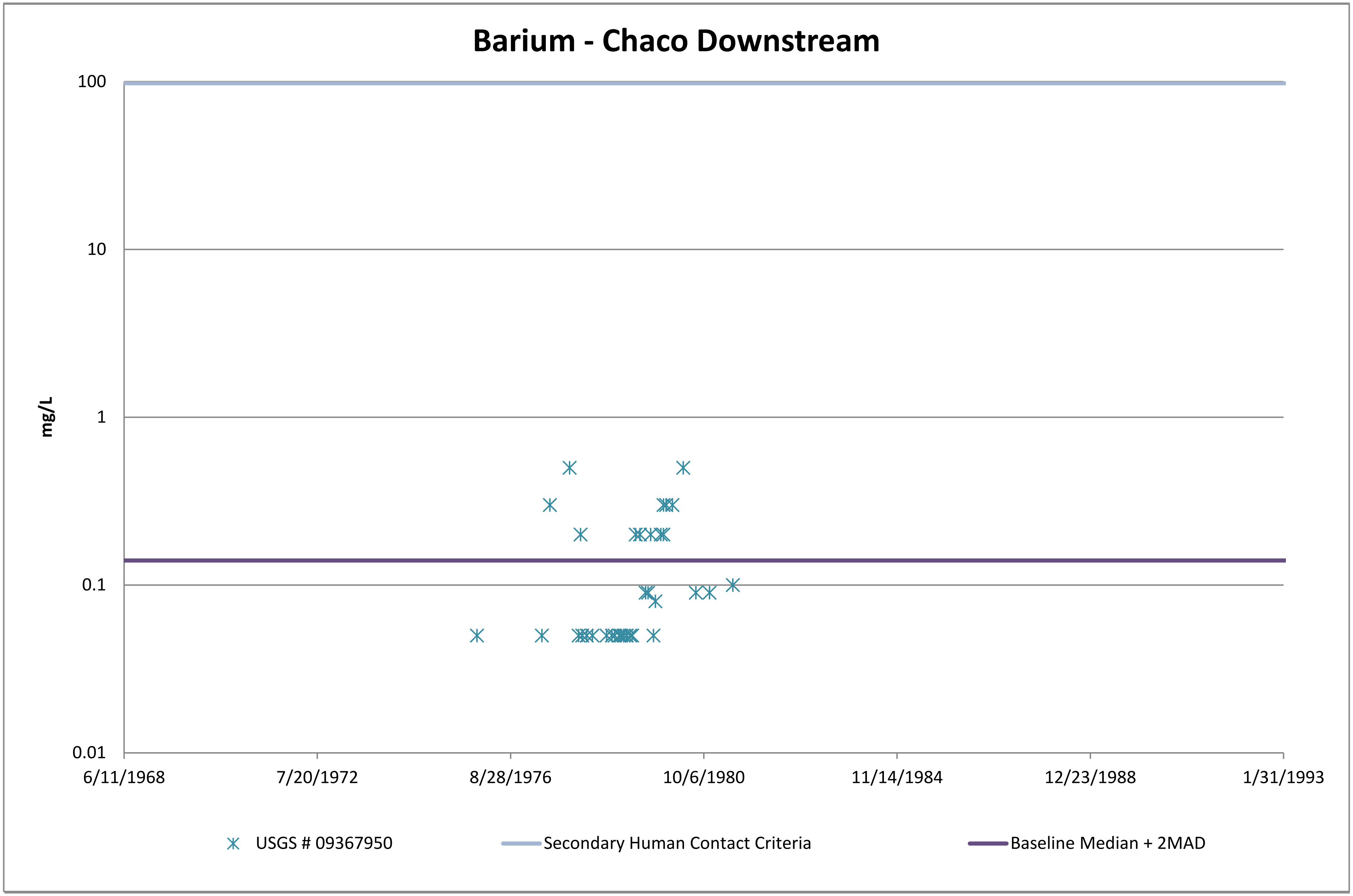

Total Iron - Chaco Baseline
1000
100
10
1
mg/L
8/28/1976
1/10/1978
5/25/1979
10/6/1980
2/18/1982
7/3/1983
USGS # 09367938
Median
Median + MAD
Median + 2MAD

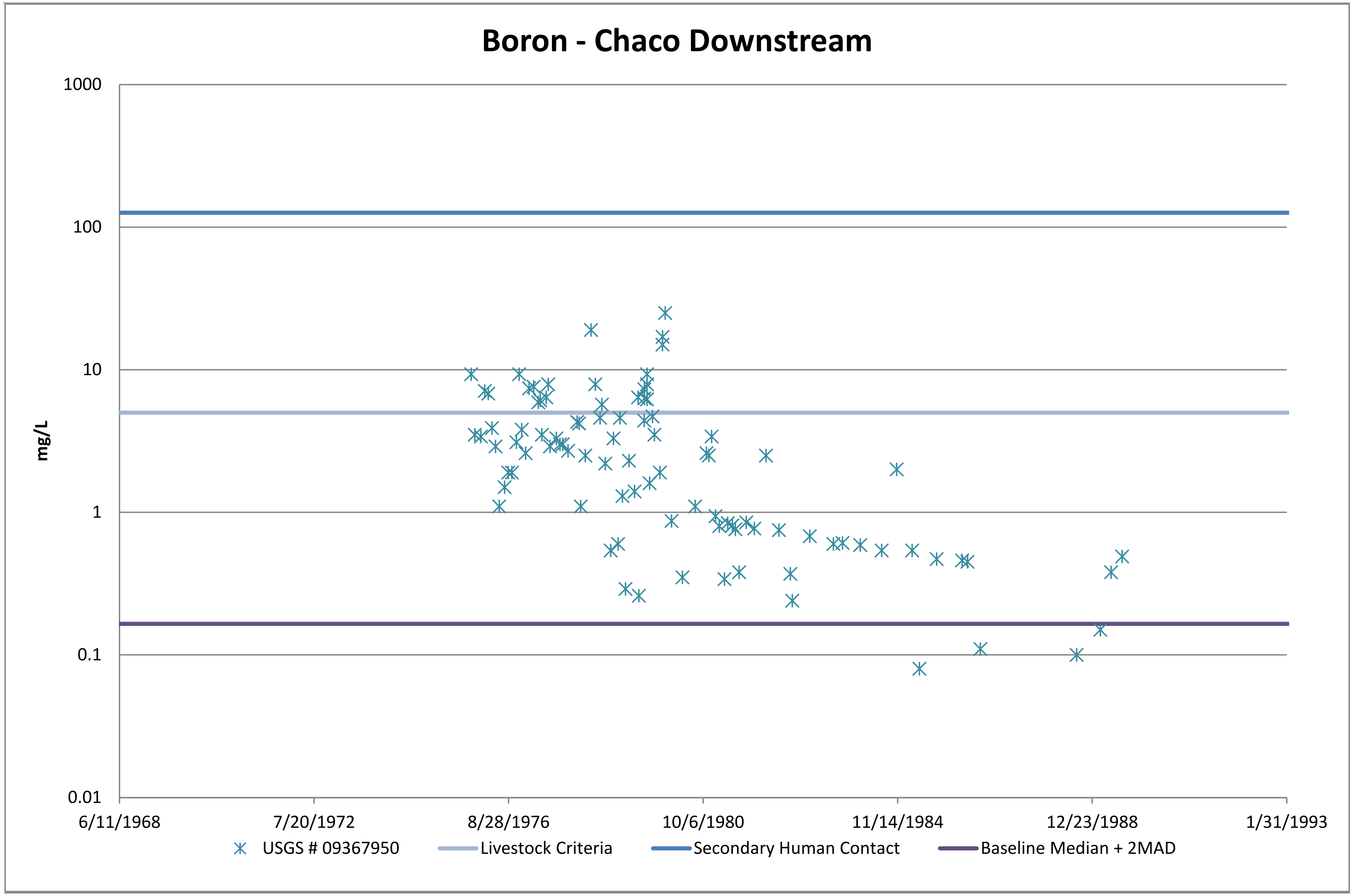

Manganese - Chaco Baseline
mg/L
1
0.1
0.01
0.001
8/28/1976
1/10/1978
5/25/1979
10/6/1980
2/18/1982
7/3/1983
USGS # 09367938
Median
Median + MAD
Median + 2MAD

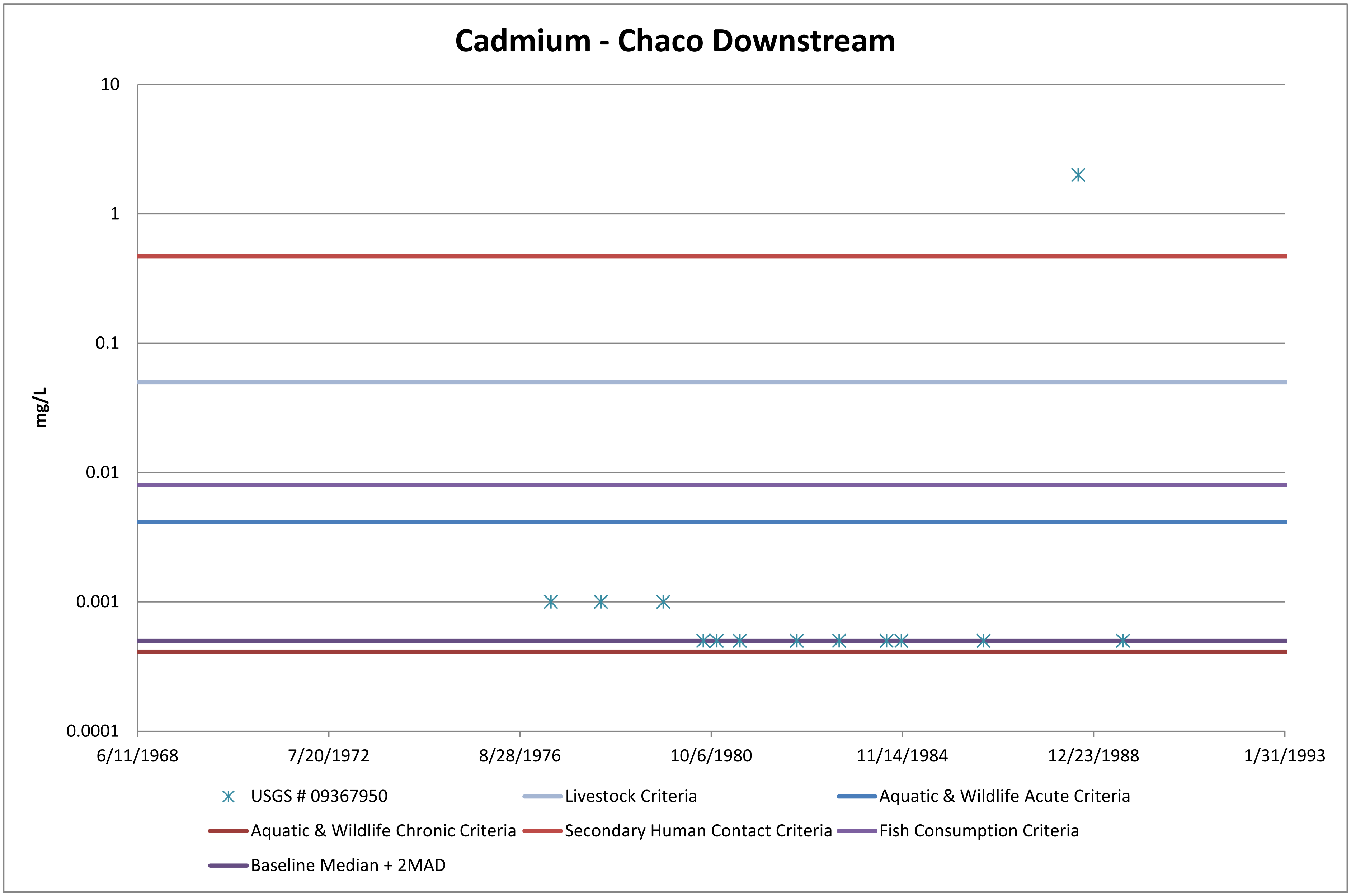

Mercury - Chaco Baseline
mg/L
1
0.1
0.01
0.001
0.0001
0.00001
0.000001
8/28/1976
1/10/1978
5/25/1979
10/6/1980
2/18/1982
7/3/1983
USGS # 09367938
Median
Median + MAD
Median + 2MAD
Fish Consumption
Aquatic & Wildlife Acute Criteria
Aquatic & Wildlife Chronic Criteria
Secondary Human Contact Criteria

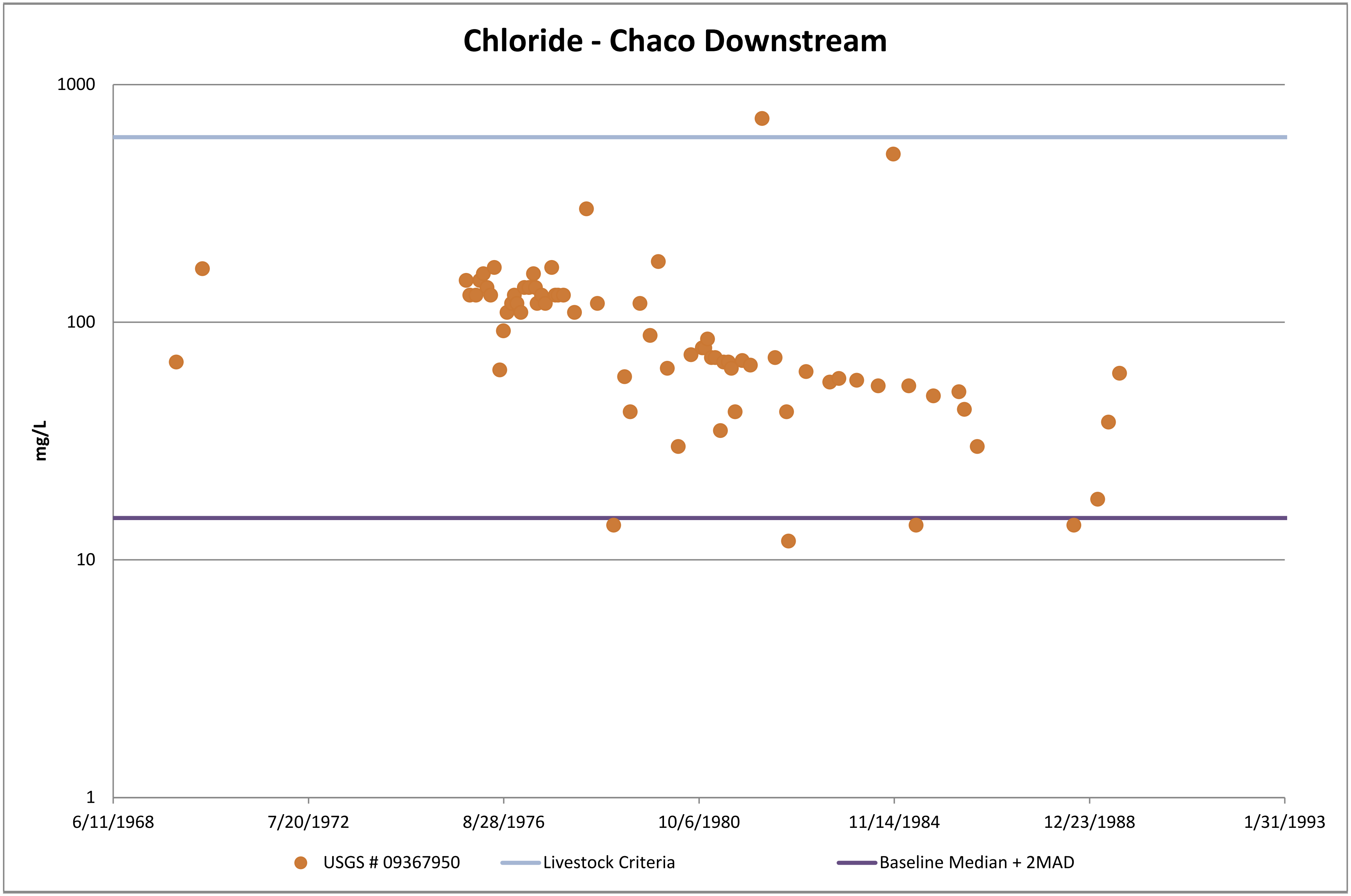

Aluminum - Chaco Downstream
mg/L
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
6/11/1968
7/20/1972
8/28/1976
10/6/1980
11/14/1984
12/23/1988
1/31/1993
USGS # 09367950
Aquatic & Wildlife Chronic Criteria
Aquatic & Wildlife Acute Criteria
Baseline Median + 2MAD

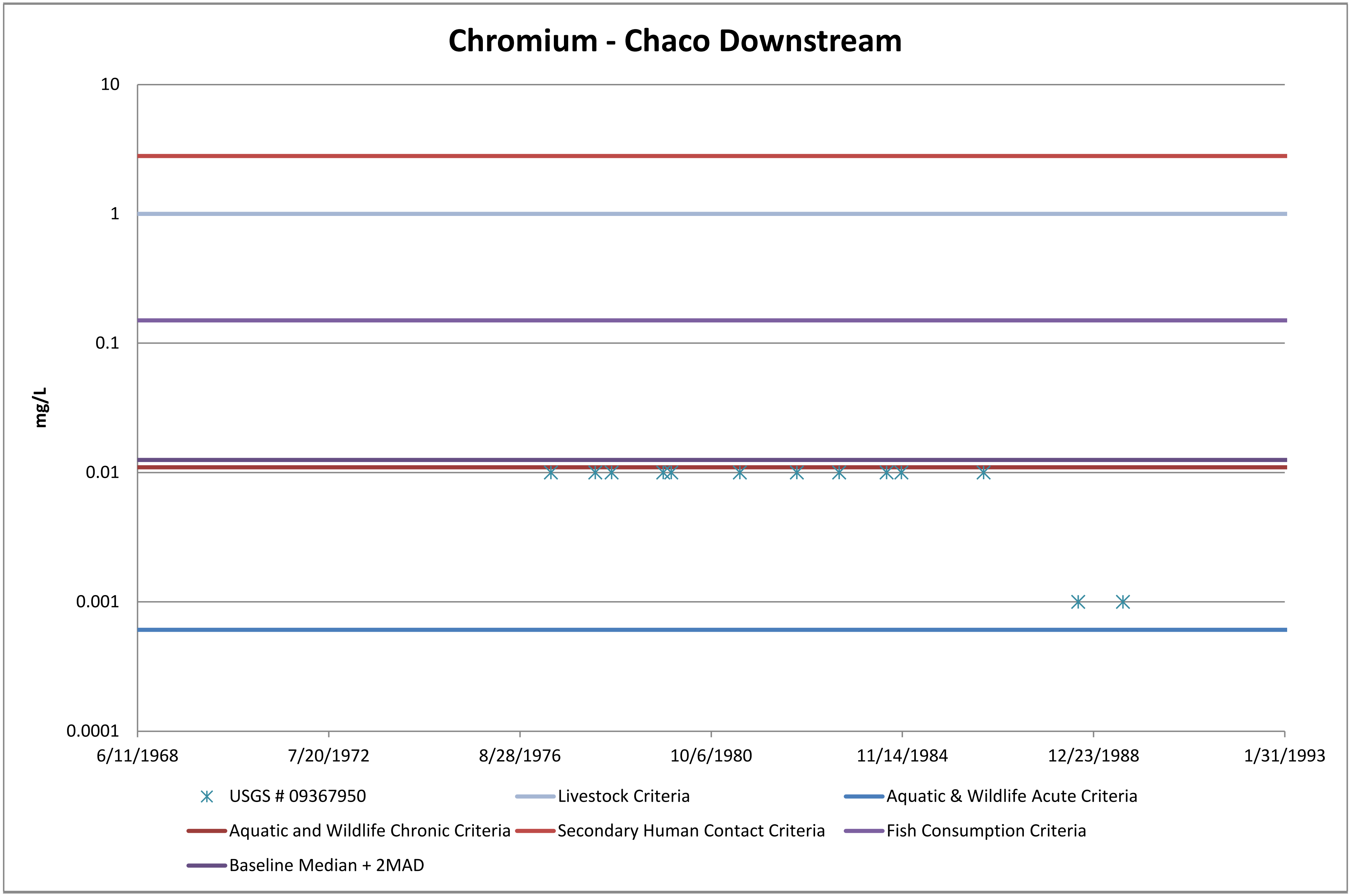

Arsenic - Chaco Downstream
mg/L
1
0.1
0.01
0.001
0.0001
6/11/1968
7/20/1972
8/28/1976
10/6/1980
11/14/1984
12/23/1988
1/31/1993
USGS #09367950
Livestock Criteria
Aquatic and Wildlife Acute Criteria
Aquatic and Wildlife Chronic Criteria
Secondary Human Contact Criteria
Fish Concumption Criteria
Baseline Median + 2MAD

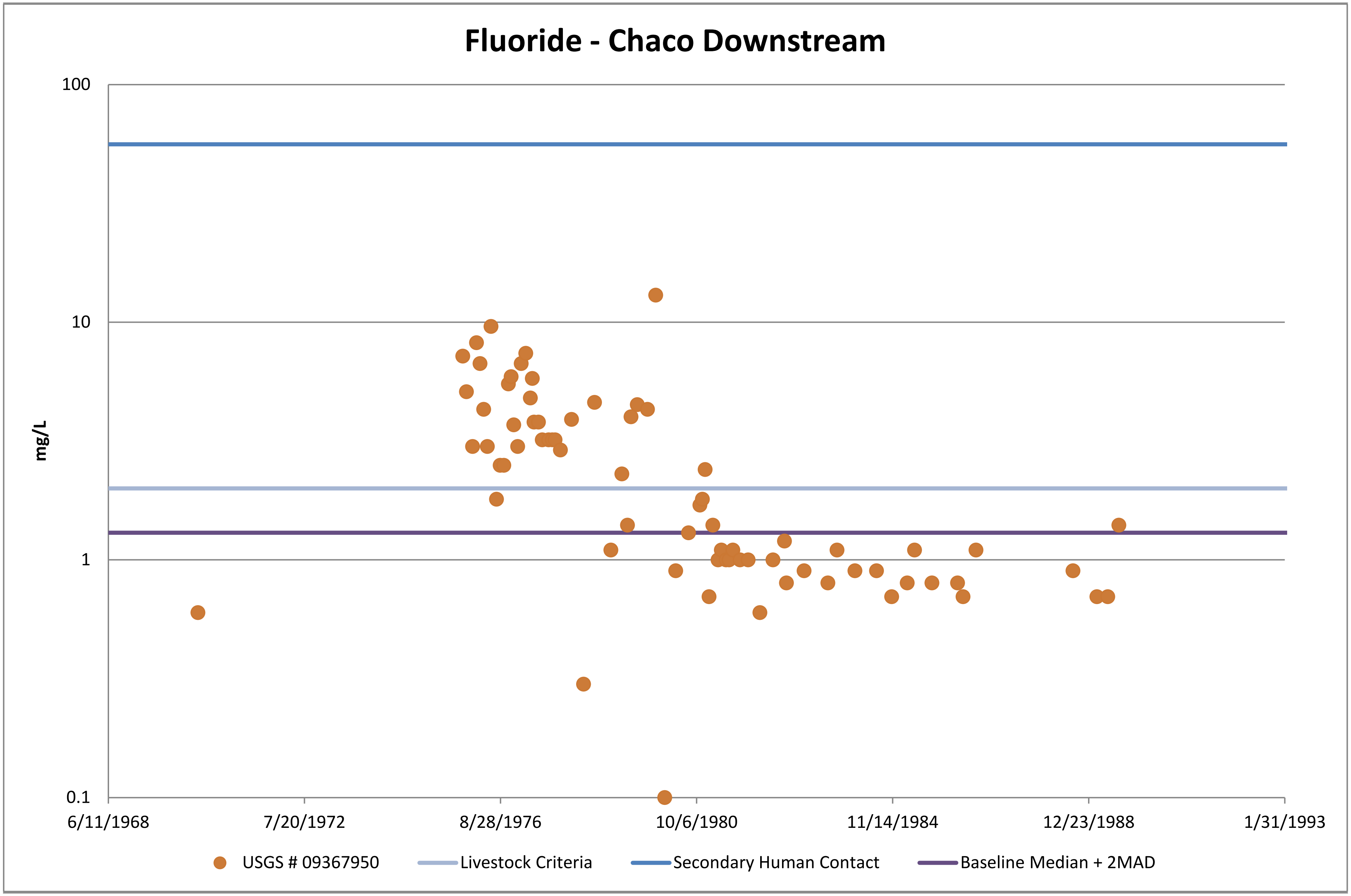

Barium - Chaco Downstream
mg/L
100
10
1
0.1
0.01
6/11/1968
7/20/1972
8/28/1976
10/6/1980
11/14/1984
12/23/1988
1/31/1993
USGS # 09367950
Secondary Human Contact Criteria
Baseline Median + 2MAD

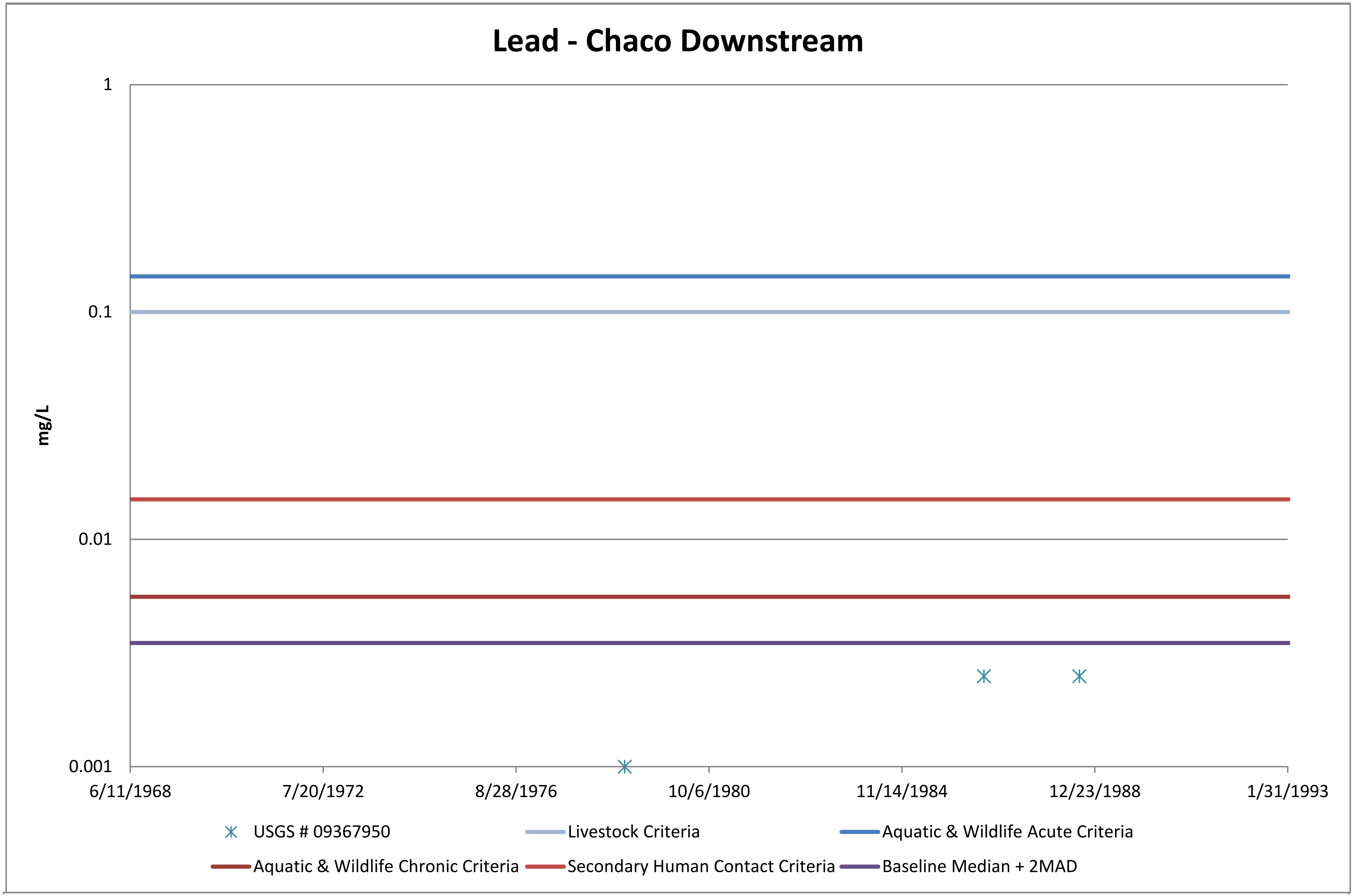

Boron - Chaco Downstream
1000
100
10
1
0.1
0.01
mg/L
6/11/1968
7/20/1972
8/28/1976
10/6/1980
11/14/1984
12/23/1988
1/31/1993
USGS # 09367950
Livestock Criteria
Secondary Human Contact
Baseline Median + 2MAD

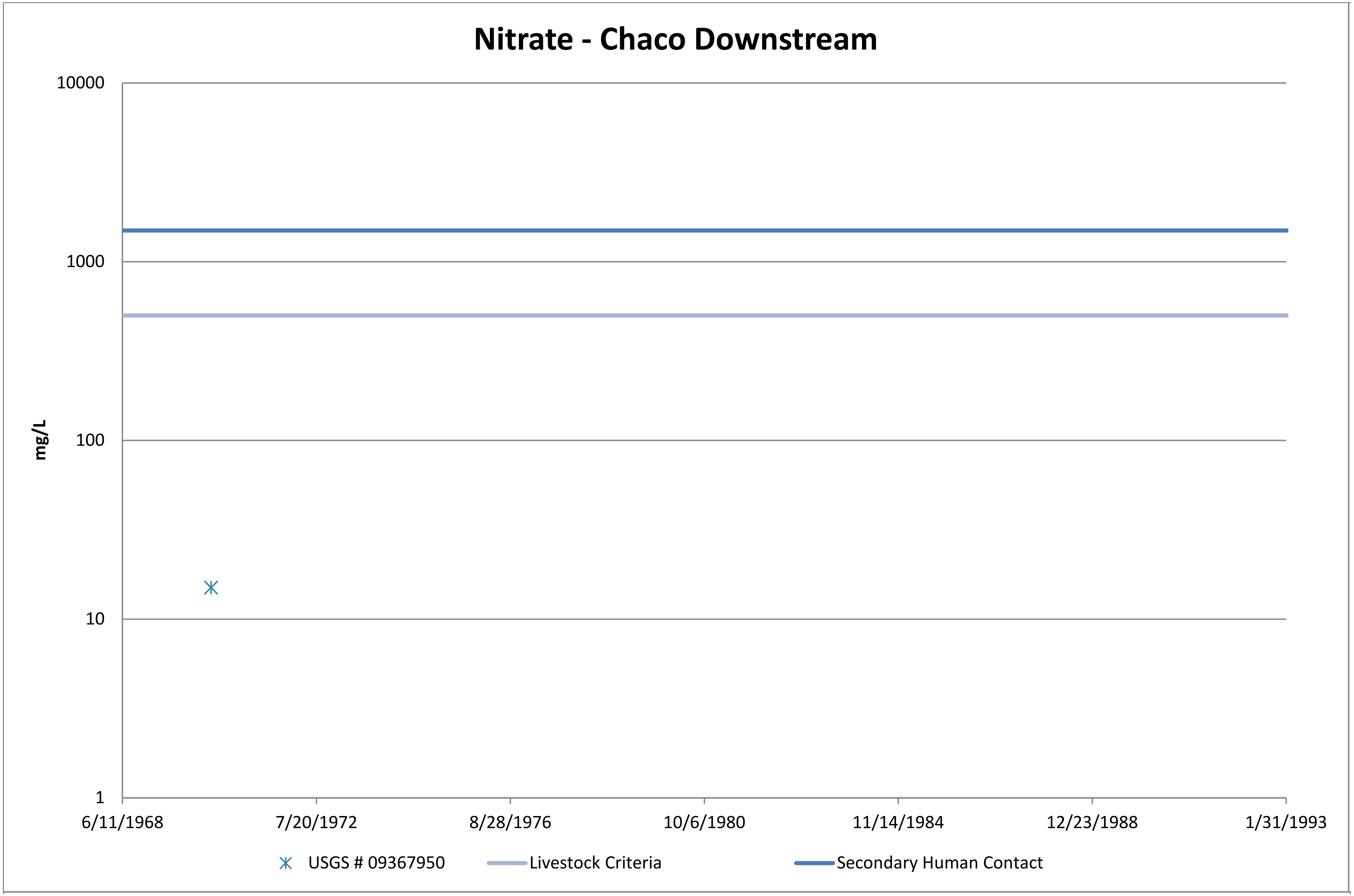

Cadmium - Chaco Downstream
mg/L
10
1
0.1
0.01
0.001
0.0001
6/11/1968
7/20/1972
8/28/1976
10/6/1980
11/14/1984
12/23/1988
1/31/1993
USGS # 09367950
Livestock Criteria
Aquatic & Wildlife Acute Criteria
Aquatic & Wildlife Chronic Criteria
Secondary Human Contact Criteria
Fish Consumption Criteria
Baseline Median + 2MAD

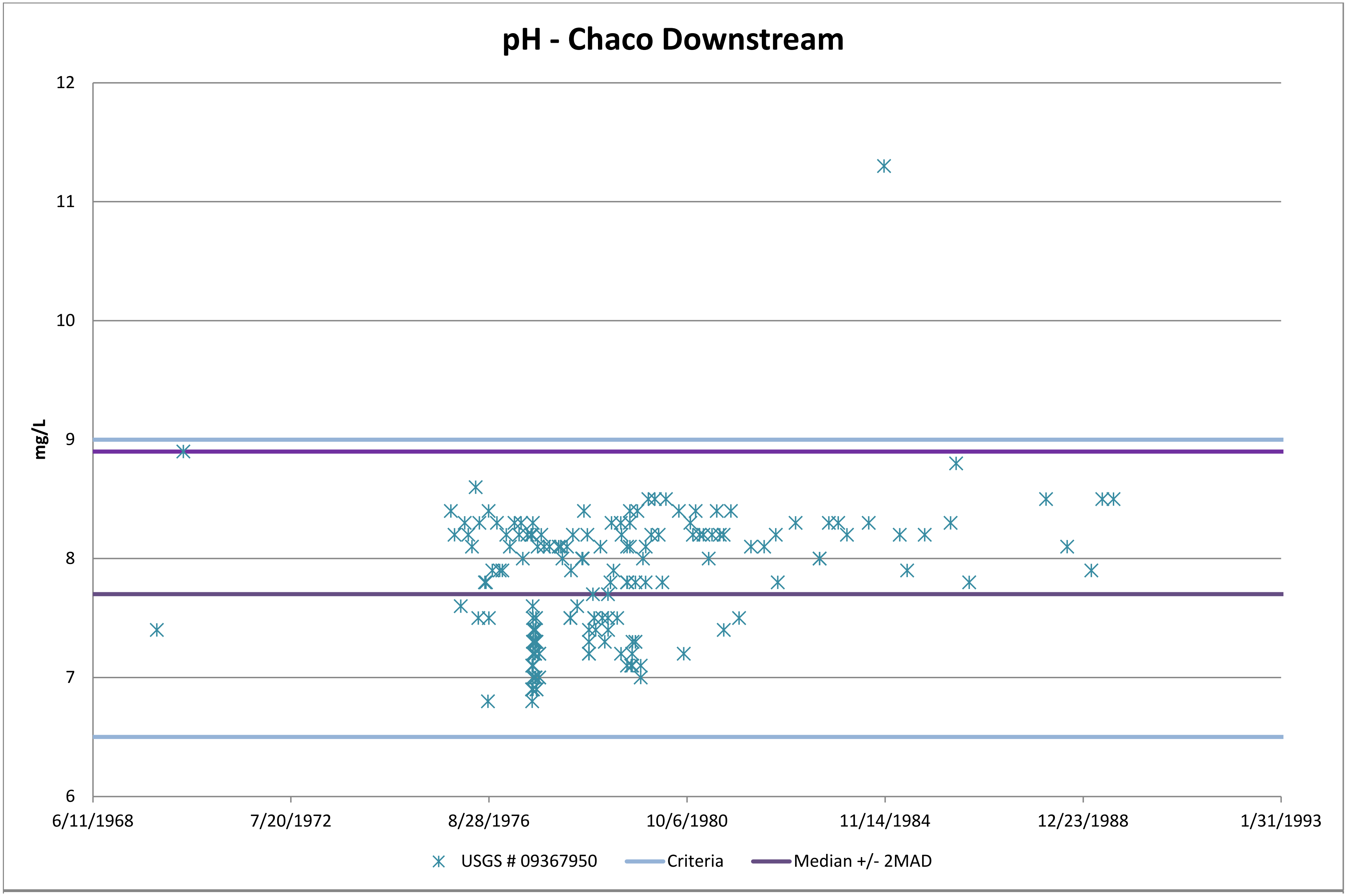

Chloride - Chaco Downstream
1000
100
10
1
mg/L
6/11/1968
7/20/1972
8/28/1976
10/6/1980
11/14/1984
12/23/1988
1/31/1993
USGS # 09367950
Livestock Criteria
Baseline Median + 2MAD

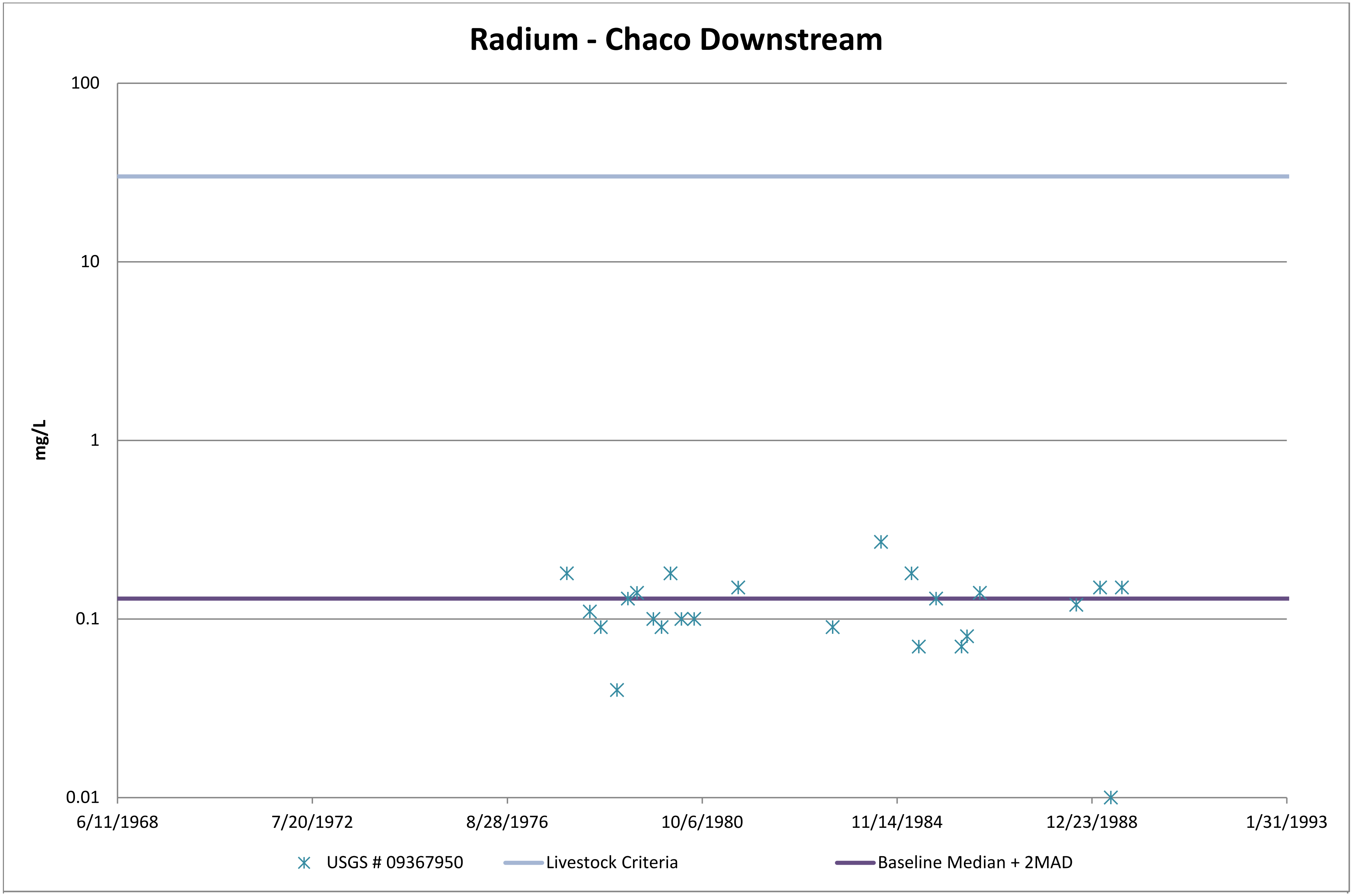

Chromium - Chaco Downstream
mg/L
10
1
0.1
0.01
0.001
0.0001
6/11/1968
7/20/1972
8/28/1976
10/6/1980
11/14/1984
12/23/1988
1/31/1993
USGS # 09367950
Livestock Criteria
Aquatic & Wildlife Acute Criteria
Aquatic and Wildlife Chronic Criteria
Secondary Human Contact Criteria
Fish Consumption Criteria
Baseline Median + 2MAD

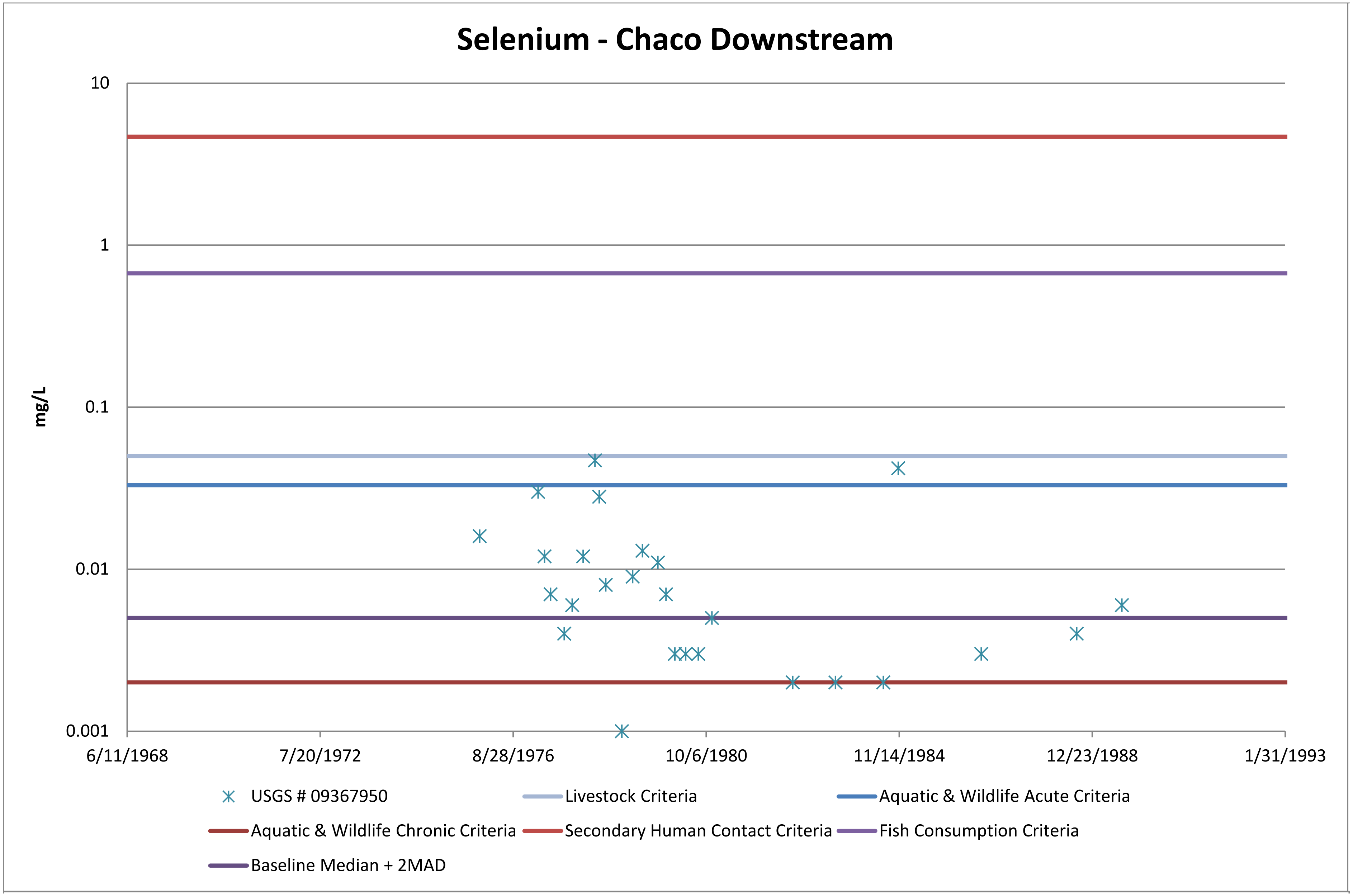

Fluoride - Chaco Downstream
mg/L
100
10
1
0.1
6/11/1968
7/20/1972
8/28/1976
10/6/1980
11/14/1984
12/23/1988
1/31/1993
USGS # 09367950
Livestock Criteria
Secondary Human Contact
Baseline Median + 2MAD

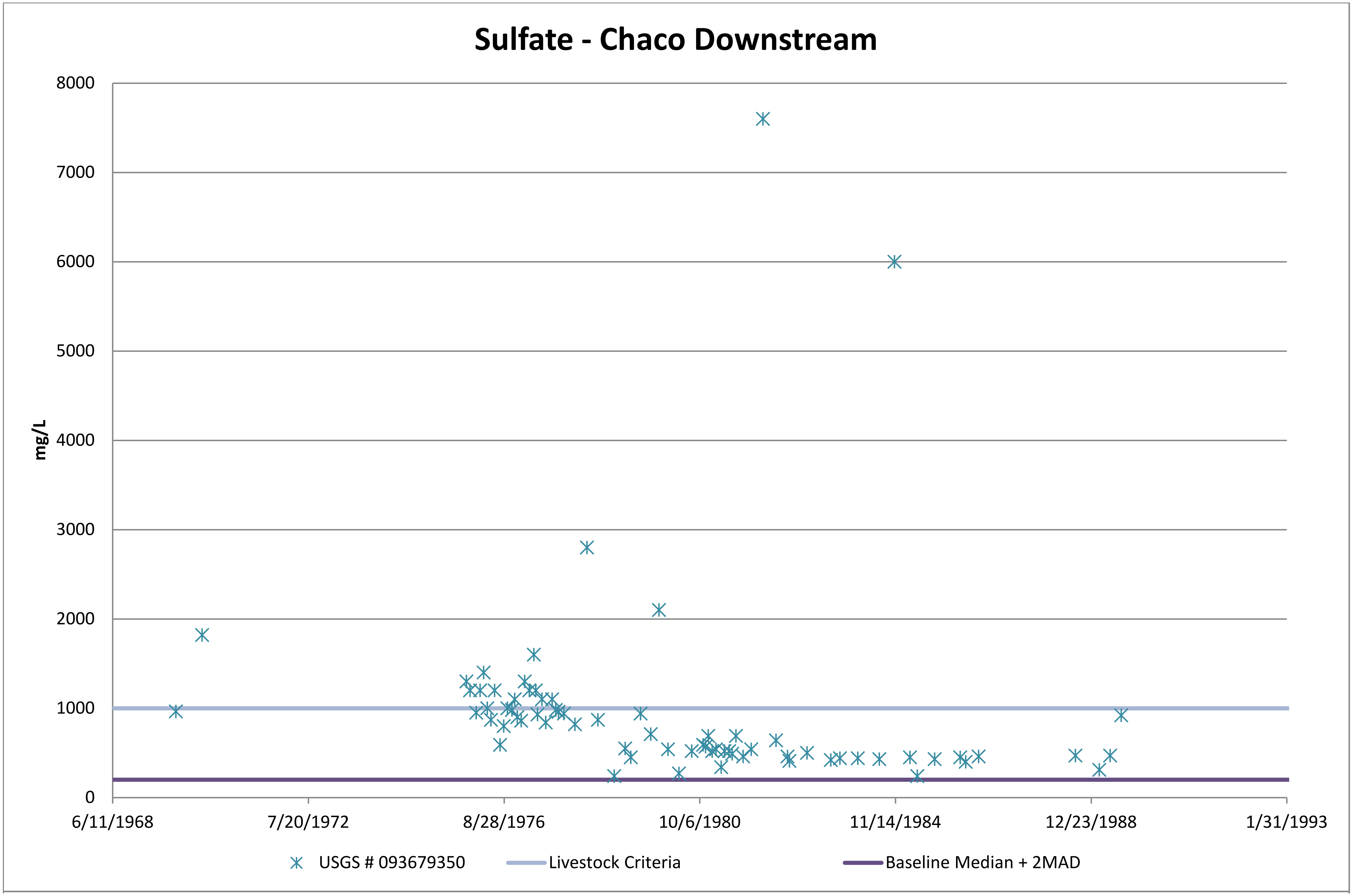

Lead - Chaco Downstream
mg/L
1
0.1
0.01
0.001
6/11/1968
7/20/1972
8/28/1976
10/6/1980
11/14/1984
12/23/1988
1/31/1993
USGS # 09367950
Livestock Criteria
Aquatic & Wildlife Acute Criteria
Aquatic & Wildlife Chronic Criteria
Secondary Human Contact Criteria
Baseline Median + 2MAD

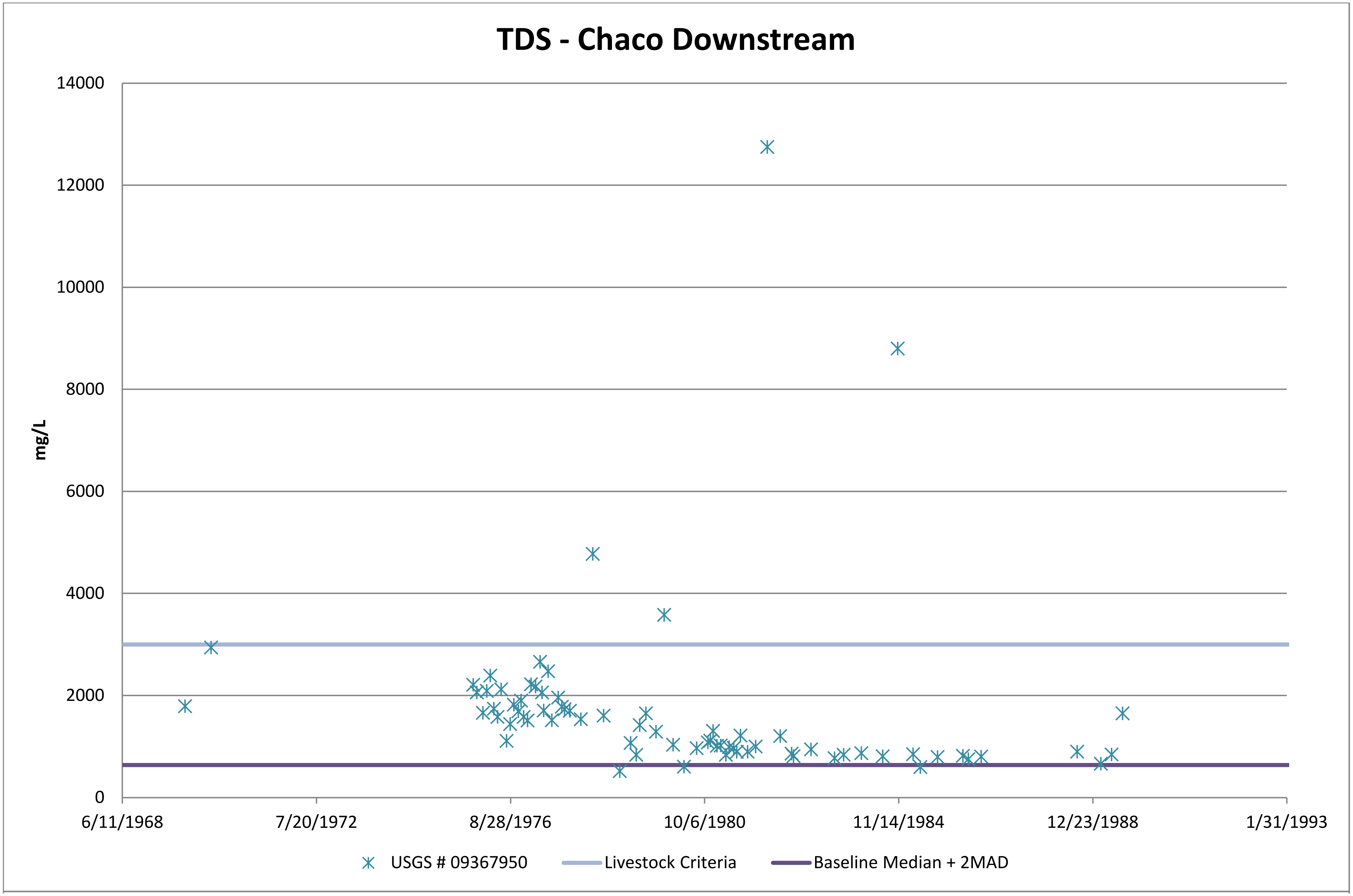

Nitrate - Chaco Downstream
mg/L
10000
1000
100
10
1
6/11/1968
7/20/1972
8/28/1976
10/6/1980
11/14/1984
12/23/1988
1/31/1993
USGS # 09367950
Livestock Criteria
Secondary Human Contact

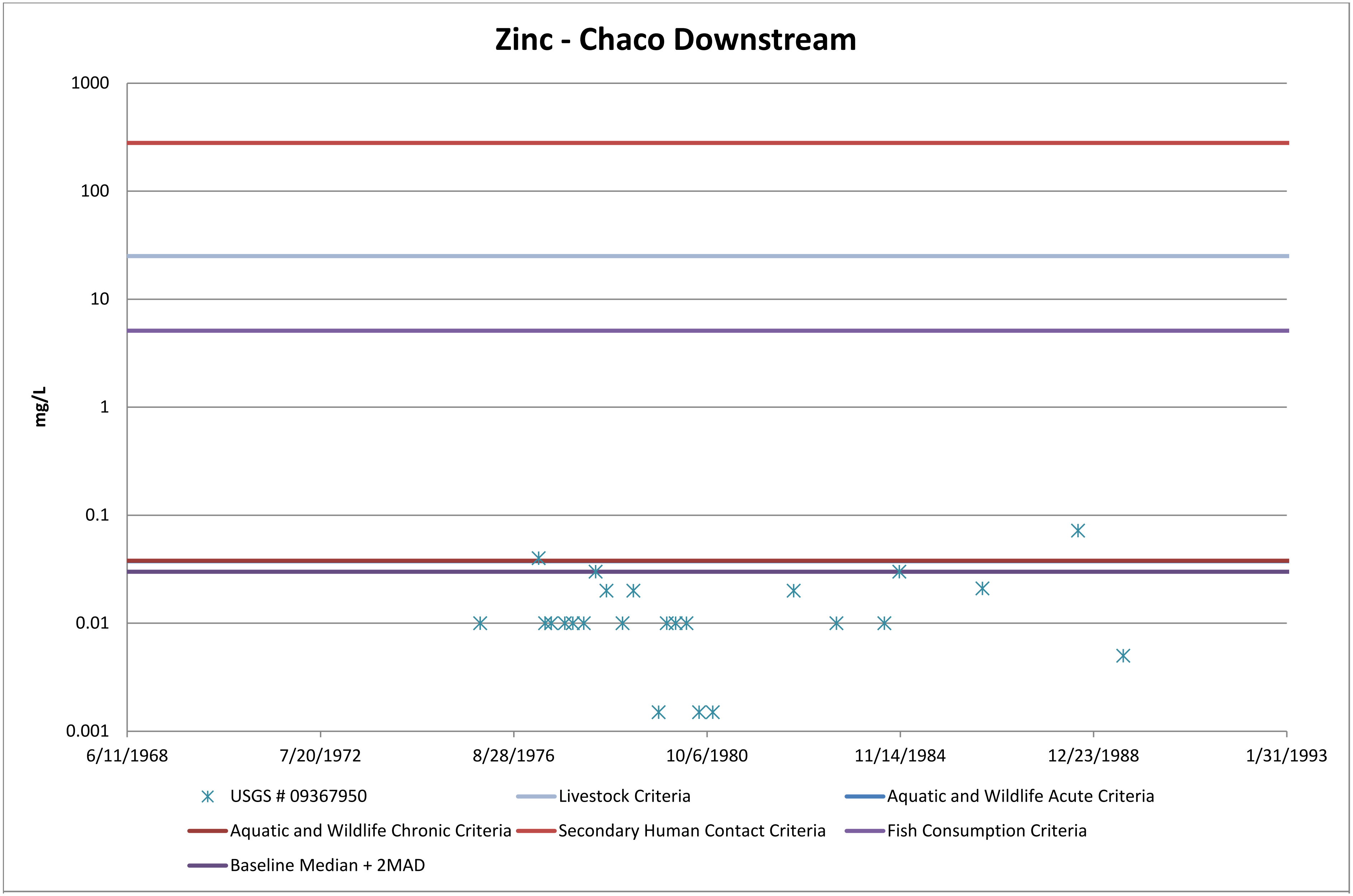

pH - Chaco Downstream
mg/L
12
11
10
9
8
7
6
6/11/1968
7/20/1972
8/28/1976
10/6/1980
11/14/1984
12/23/1988
1/31/1993
USGS # 09367950
Criteria
Median +/- 2MAD

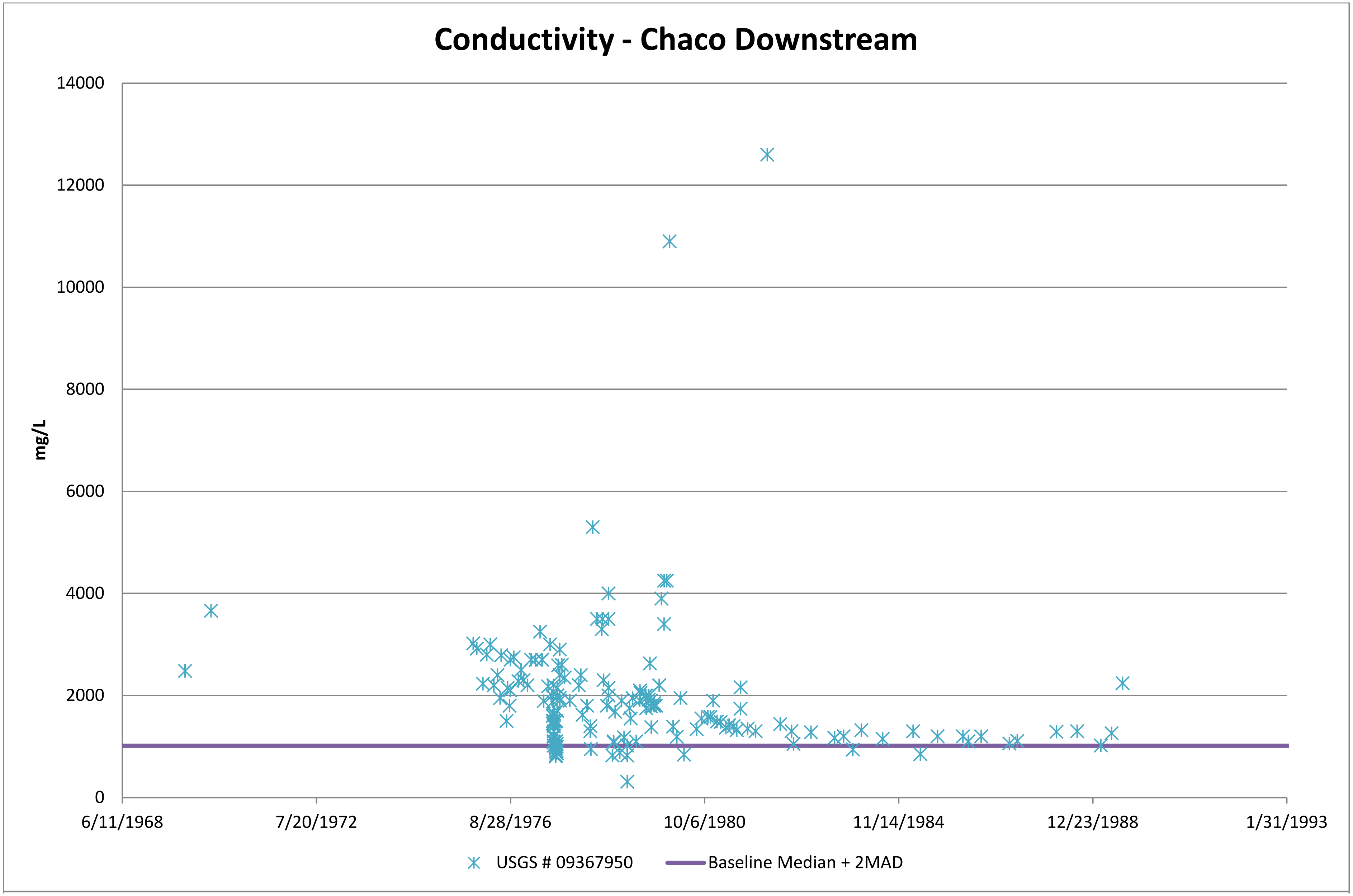

Radium - Chaco Downstream
mg/L
100
10
1
0.1
0.01
6/11/1968
7/20/1972
8/28/1976
10/6/1980
11/14/1984
12/23/1988
1/31/1993
USGS # 09367950
Livestock Criteria
Baseline Median + 2MAD

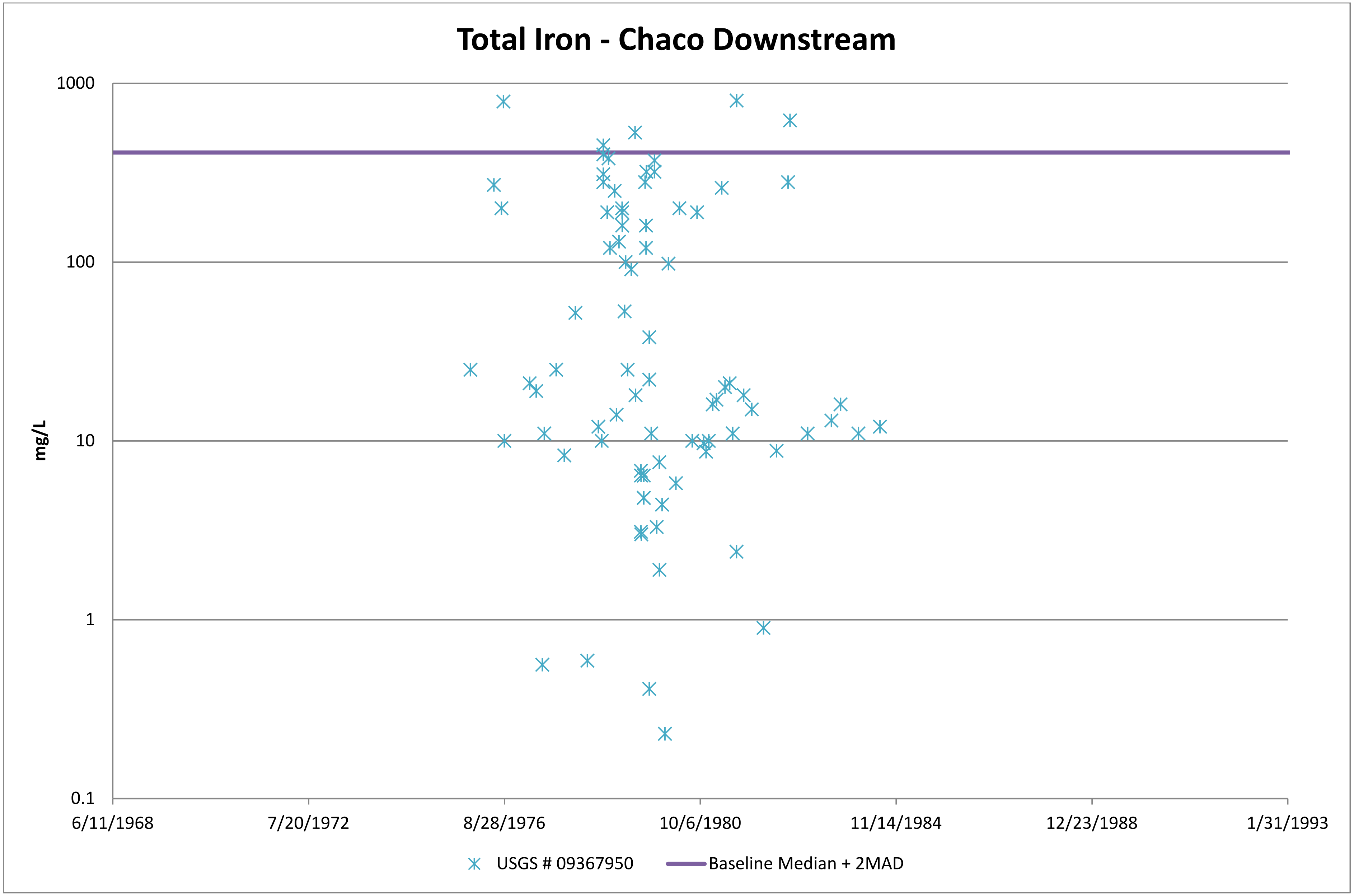

Selenium - Chaco Downstream
mg/L
10
1
0.1
0.01
0.001
6/11/1968
7/20/1972
8/28/1976
10/6/1980
11/14/1984
12/23/1988
1/31/1993
USGS # 09367950
Livestock Criteria
Aquatic & Wildlife Acute Criteria
Aquatic & Wildlife Chronic Criteria
Secondary Human Contact Criteria
Fish Consumption Criteria
Baseline Median + 2MAD

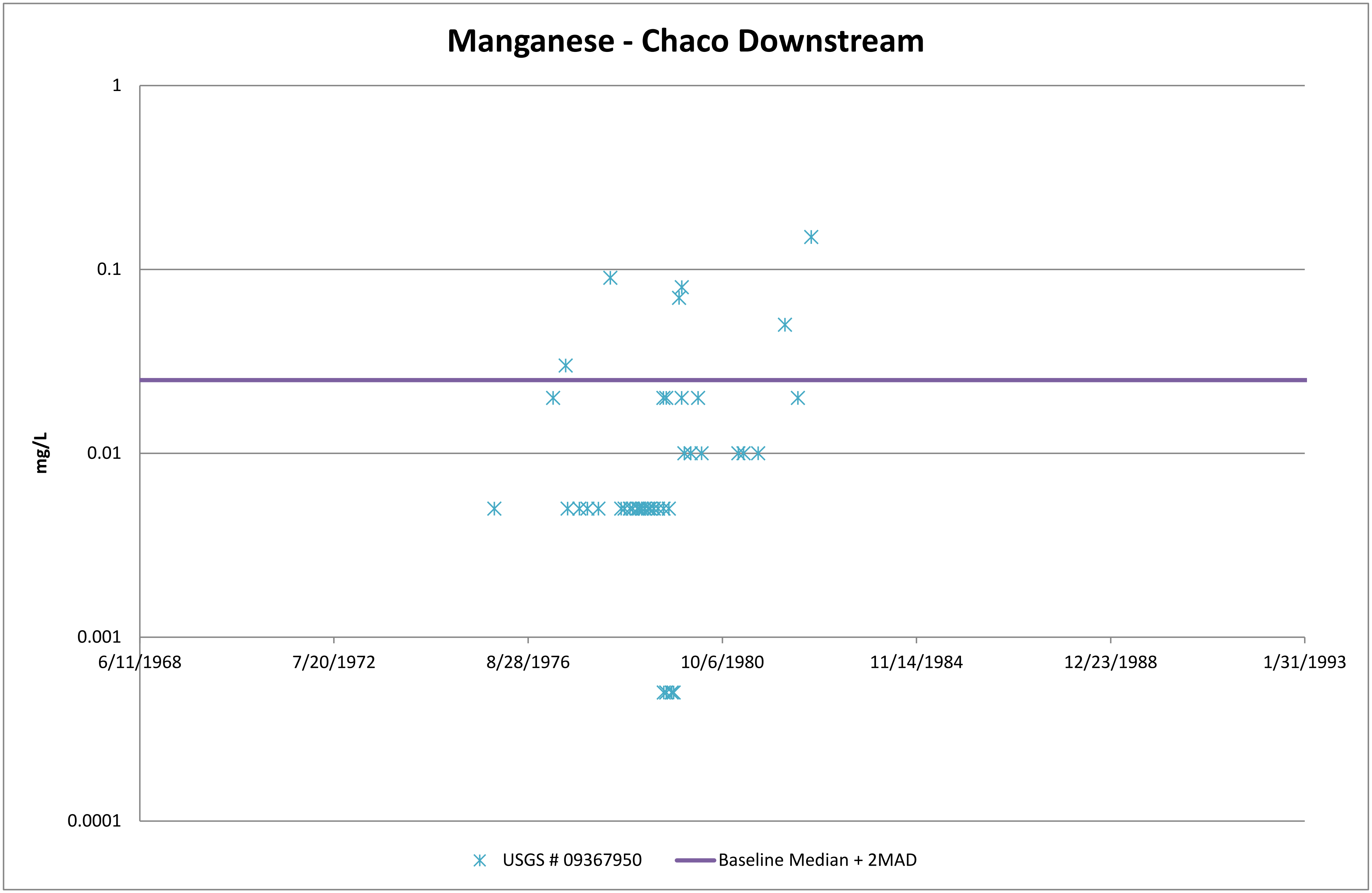

Sulfate - Chaco Downstream
mg/L
8000
7000
6000
5000
4000
3000
2000
1000
0
6/11/1968
7/20/1972
8/28/1976
10/6/1980
11/14/1984
12/23/1988
1/31/1993
USGS # 093679350
Livestock Criteria
Baseline Median + 2MAD

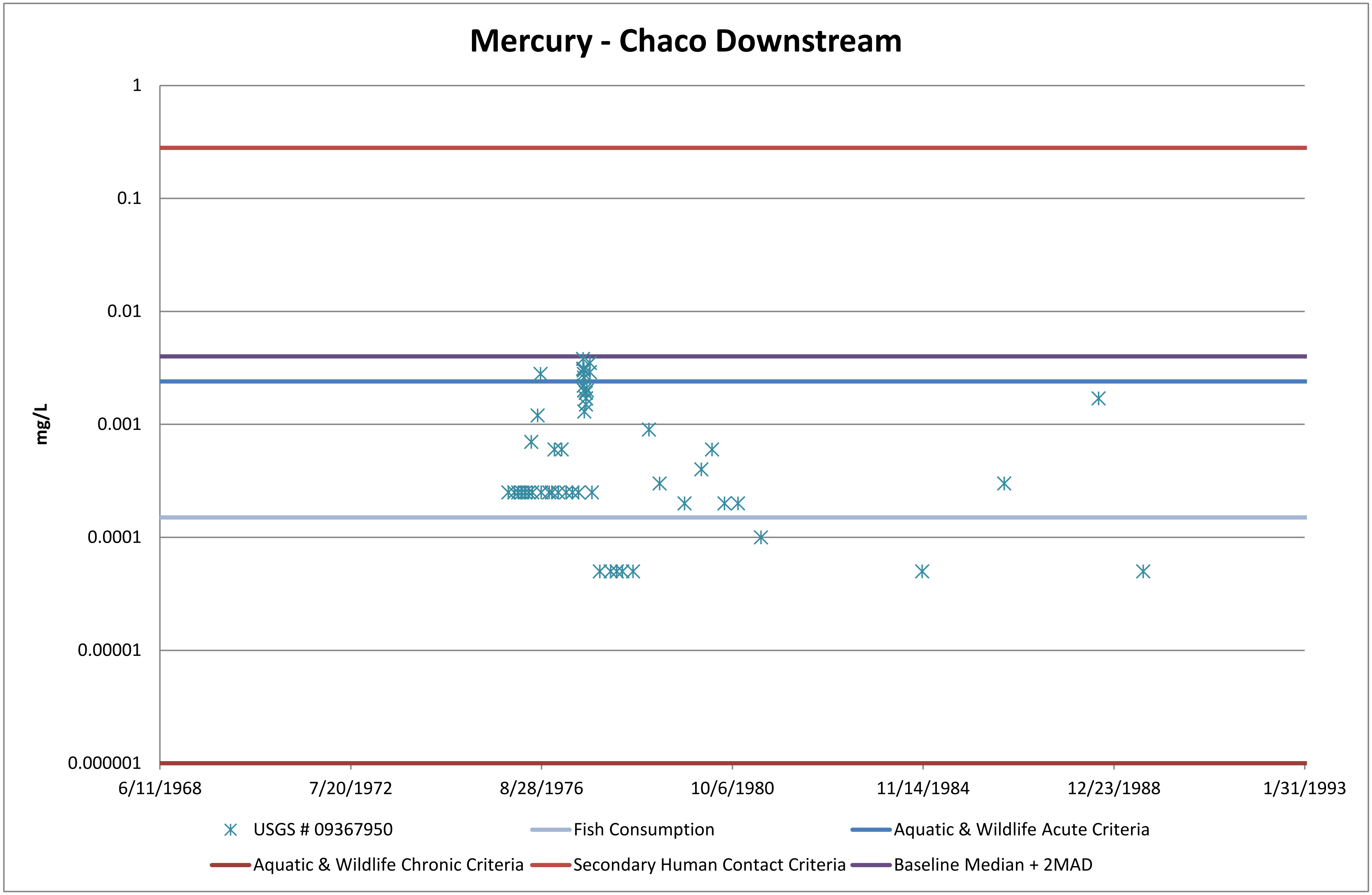

TDS - Chaco Downstream
mg/L
14000
12000
10000
8000
6000
4000
2000
0
6/11/1968
7/20/1972
8/28/1976
10/6/1980
11/14/1984
12/23/1988
1/31/1993
USGS # 09367950
Livestock Criteria
Baseline Median + 2MAD

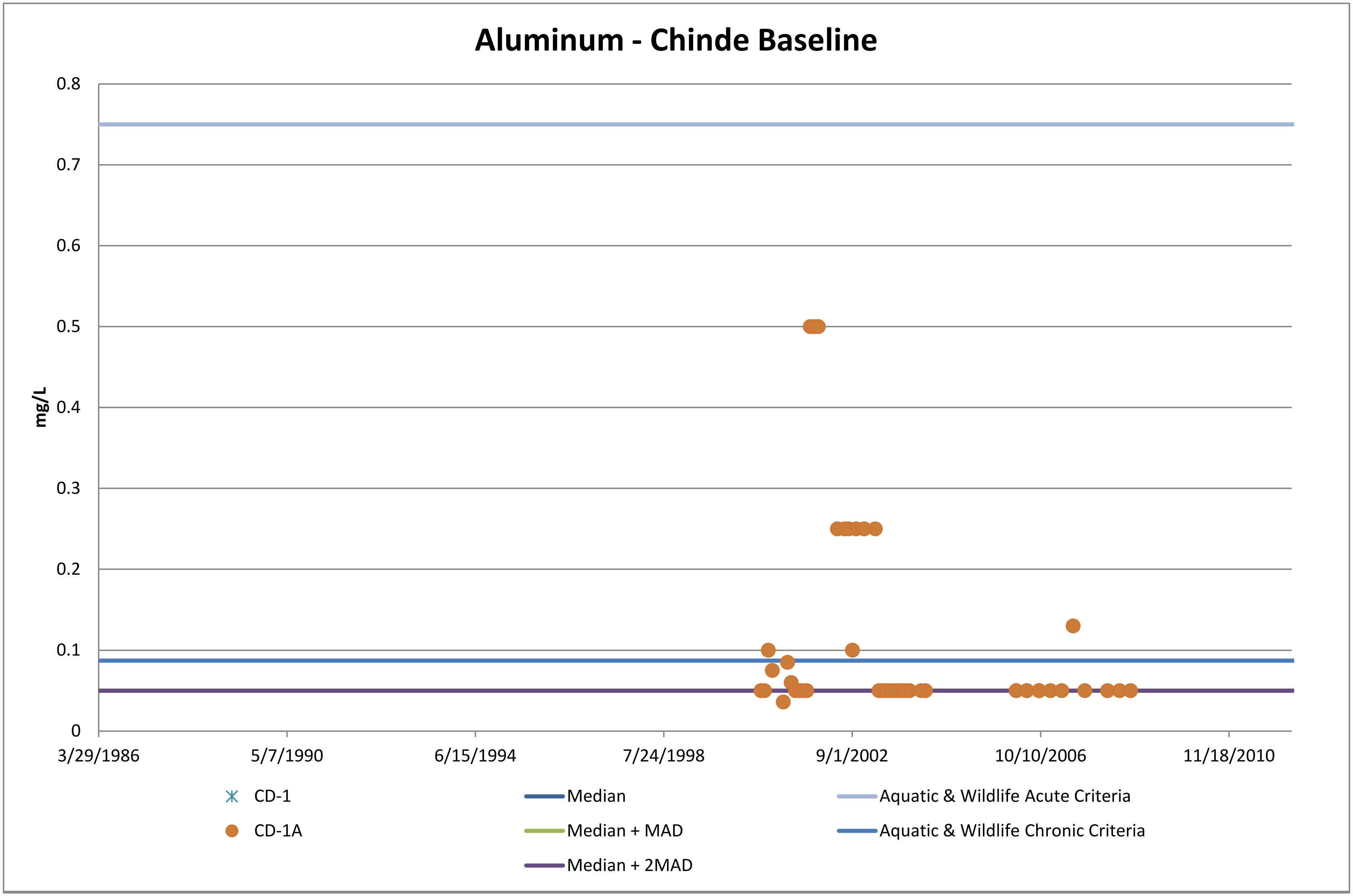

Zinc - Chaco Downstream
mg/L
1000
100
10
1
0.1
0.01
0.001
6/11/1968
7/20/1972
8/28/1976
10/6/1980
11/14/1984
12/23/1988
1/31/1993
USGS # 09367950
Livestock Criteria
Aquatic and Wildlife Acute Criteria
Aquatic and Wildlife Chronic Criteria
Secondary Human Contact Criteria
Fish Consumption Criteria
Baseline Median + 2MAD

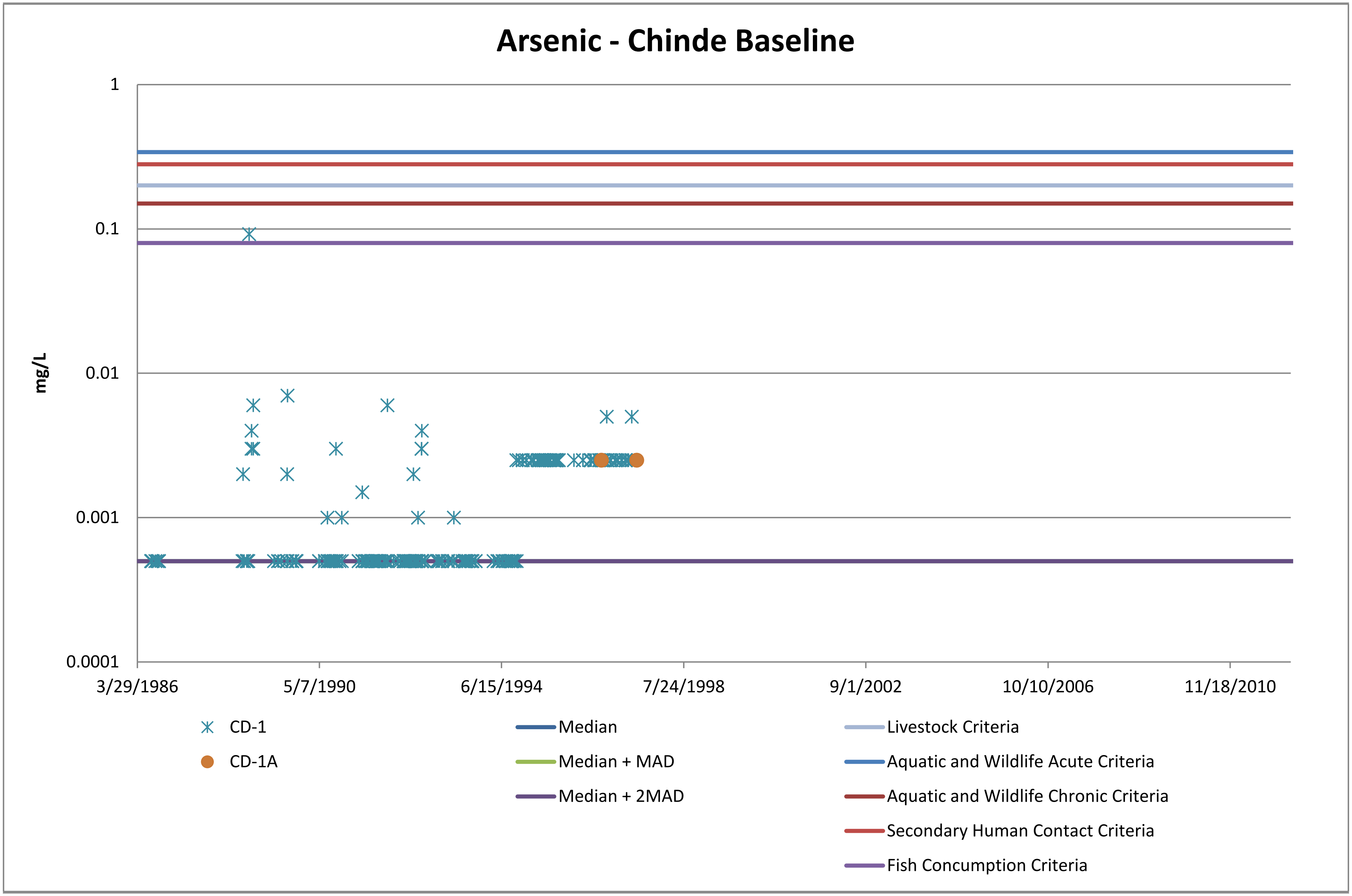

Conductivity - Chaco Downstream
mg/L
14000
12000
10000
8000
6000
4000
2000
0
6/11/1968
7/20/1972
8/28/1976
10/6/1980
11/14/1984
12/23/1988
1/31/1993
USGS # 09367950
Baseline Median + 2MAD

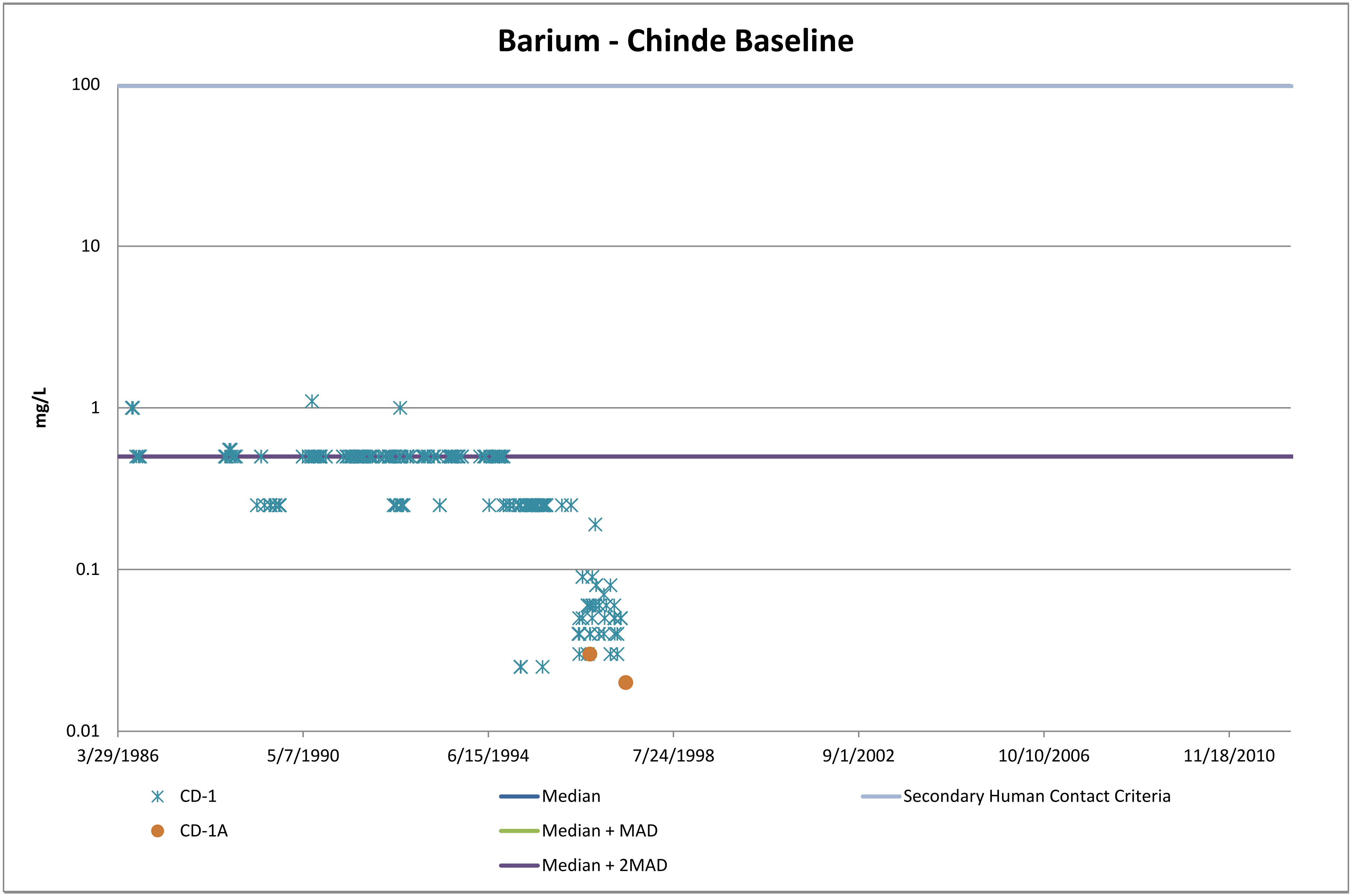

Total Iron - Chaco Downstream
mg/L
1000
100
10
1
0.1
6/11/1968
7/20/1972
8/28/1976
10/6/1980
11/14/1984
12/23/1988
1/31/1993
USGS # 09367950
Baseline Median + 2MAD

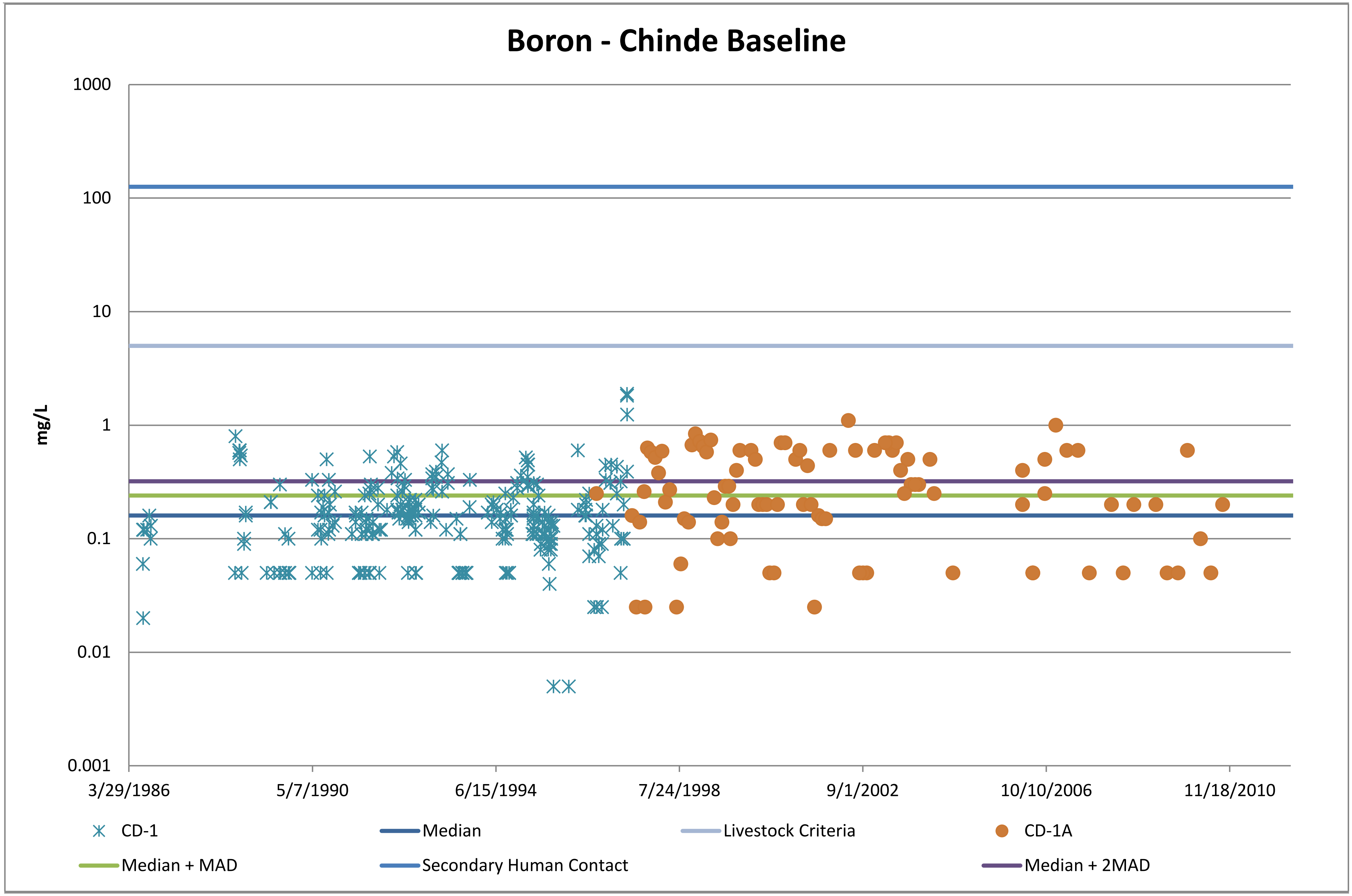

Manganese - Chaco Downstream
1
0.1
0.01
0.001
0.0001
mg/L
6/11/1968
7/20/1972
8/28/1976
10/6/1980
11/14/1984
12/23/1988
1/31/1993
USGS # 09367950
Baseline Median + 2MAD

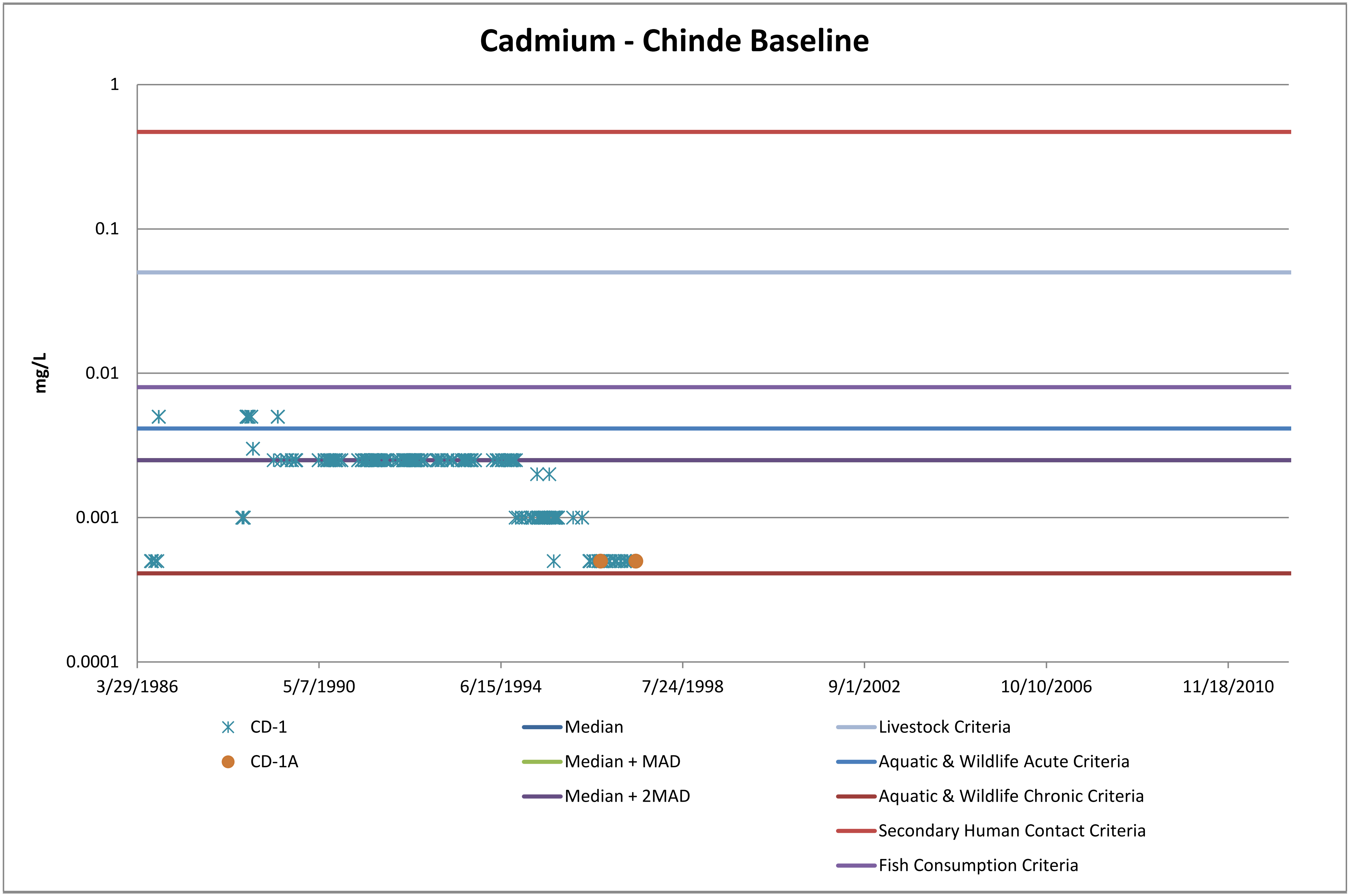

Mercury - Chaco Downstream
mg/L
1
0.1
0.01
0.001
0.0001
0.00001
0.000001
6/11/1968
7/20/1972
8/28/1976
10/6/1980
11/14/1984
12/23/1988
1/31/1993
USGS # 09367950
Fish Consumption
Aquatic & Wildlife Acute Criteria
Aquatic & Wildlife Chronic Criteria
Secondary Human Contact Criteria
Baseline Median + 2MAD

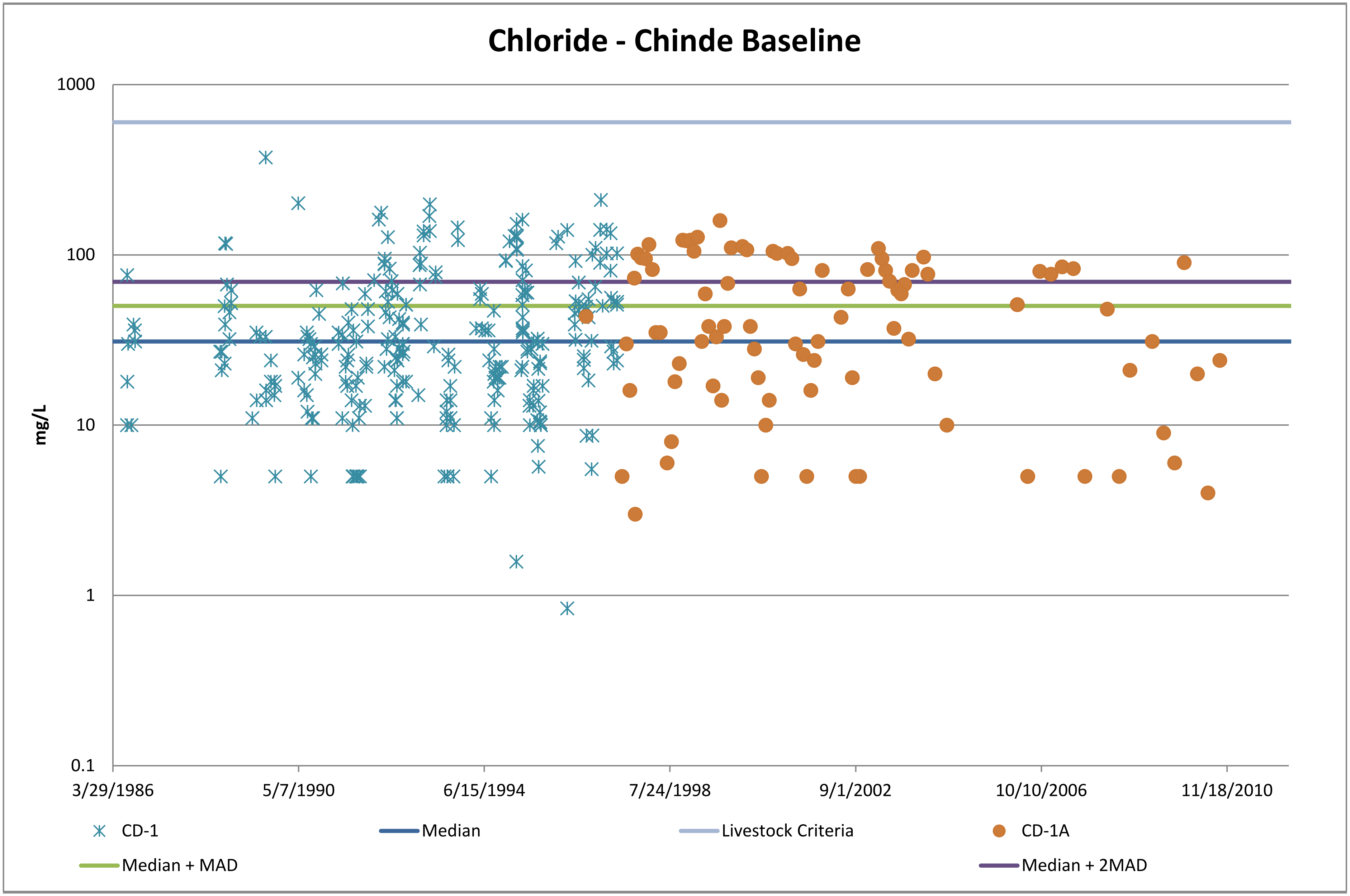

Aluminum - Chinde Baseline
mg/L
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
3/29/1986
5/7/1990
6/15/1994
7/24/1998
9/1/2002
10/10/2006
11/18/2010
CD-1
CD-1A
Median
Median + MAD
Median + 2MAD
Aquatic & Wildlife Acute Criteria
Aquatic & Wildlife Chronic Criteria

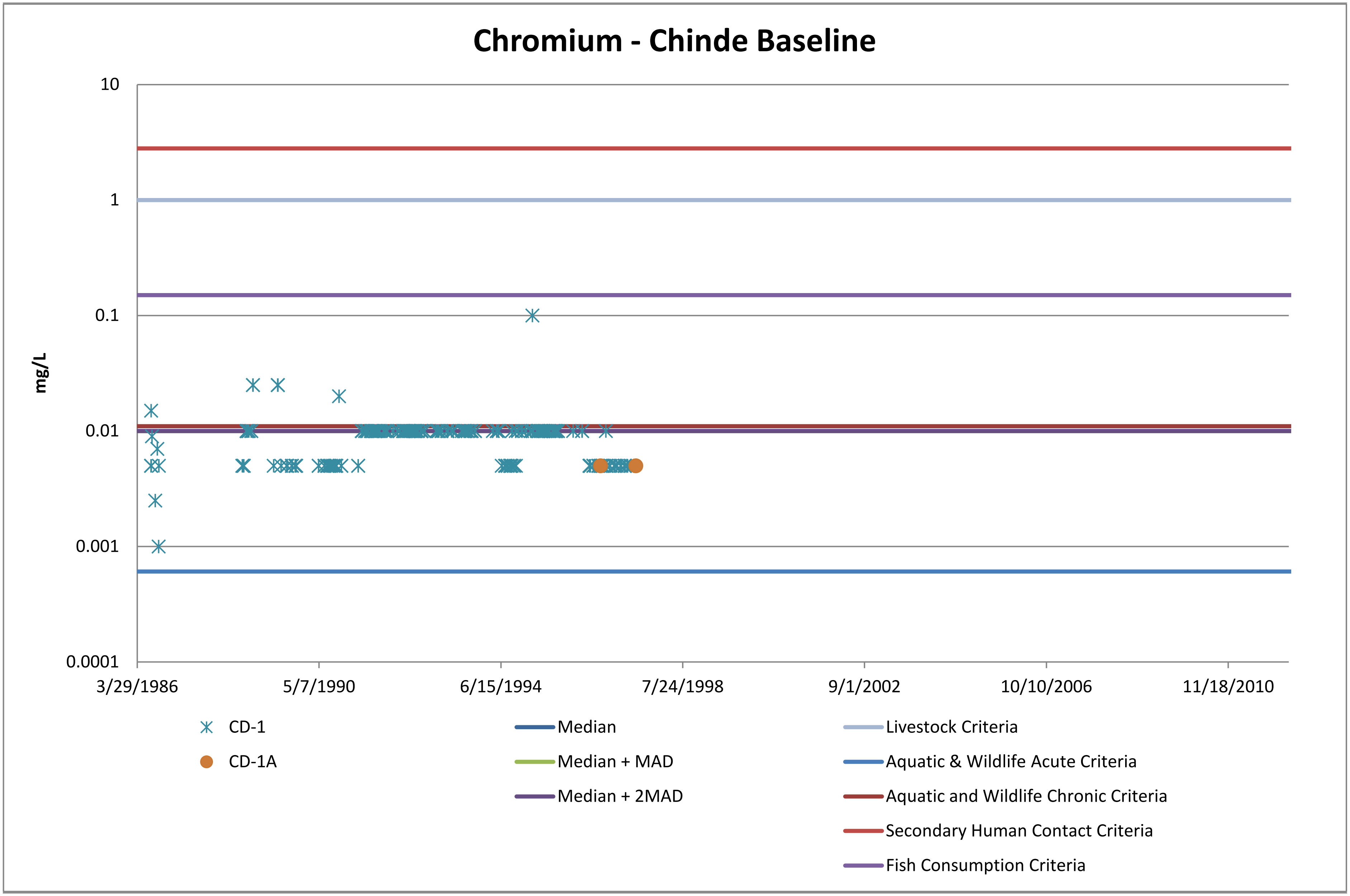

Arsenic - Chinde Baseline
1
0.1
0.01
0.001
0.0001
mg/L
3/29/1986
5/7/1990
6/15/1994
7/24/1998
9/1/2002
10/10/2006
11/18/2010
CD-1
CD-1A
Median
Median + MAD
Median + 2MAD
Livestock Criteria
Aquatic and Wildlife Acute Criteria
Aquatic and Wildlife Chronic Criteria
Secondary Human Contact Criteria
Fish Concumption Criteria

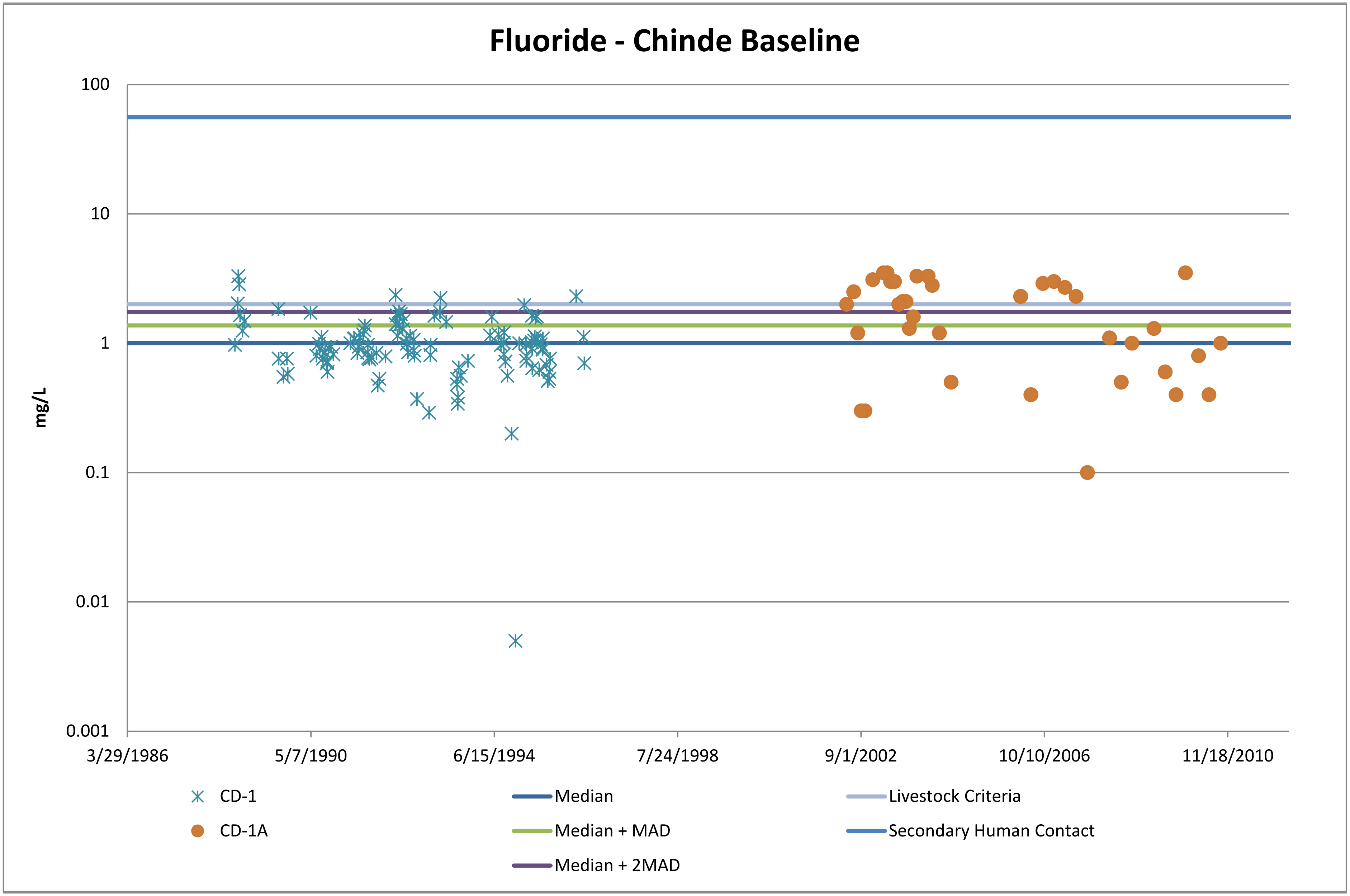

Barium - Chinde Baseline
mg/L
100
10
1
0.1
0.01
3/29/1986
5/7/1990
6/15/1994
7/24/1998
9/1/2002
10/10/2006
11/18/2010
CD-1
CD-1A
Median
Median + MAD
Median + 2MAD
Secondary Human Contact Criteria

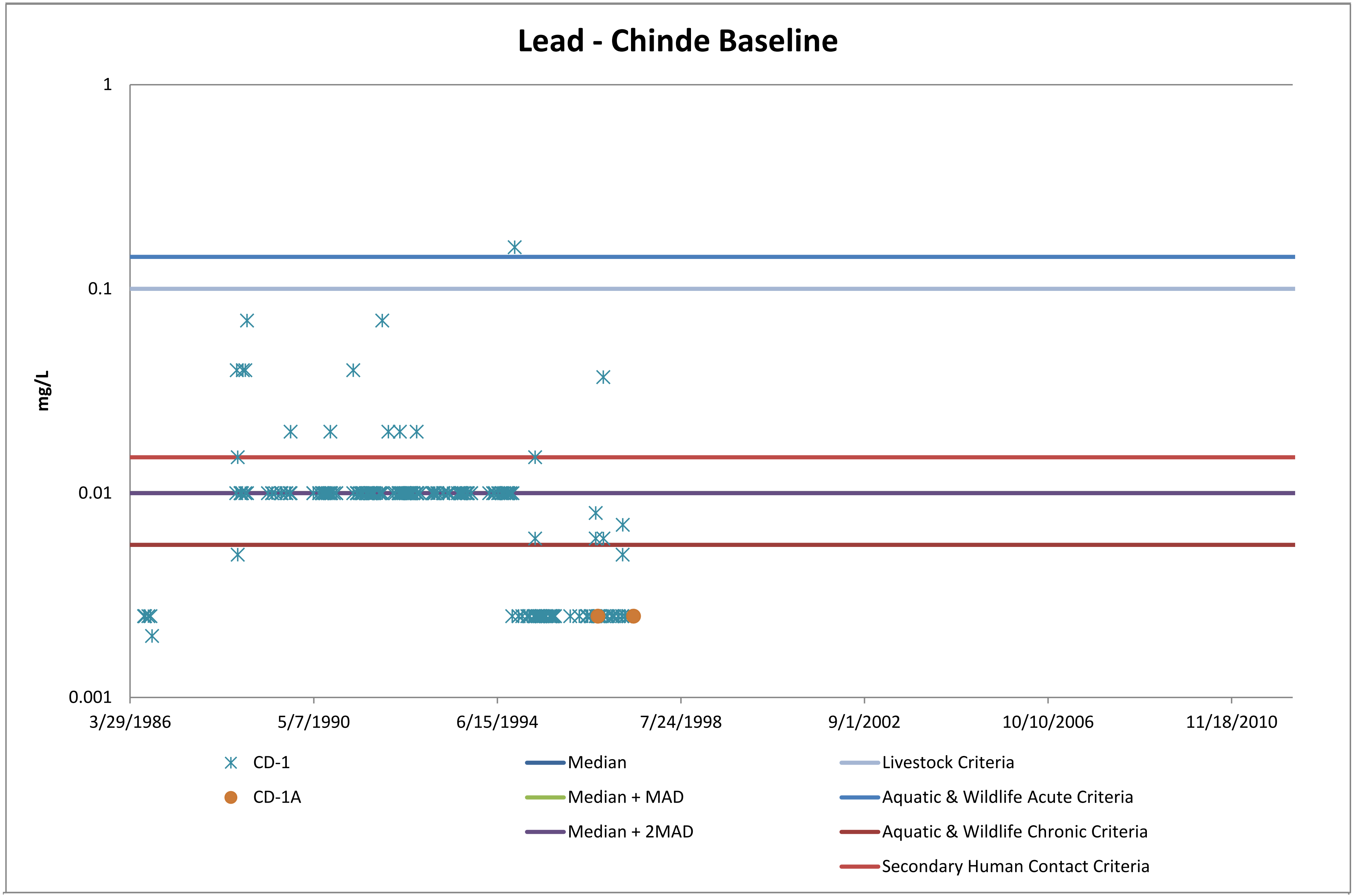

Boron - Chinde Baseline
mg/L
1000
100
10
1
0.1
0.01
0.001
3/29/1986
5/7/1990
6/15/1994
7/24/1998
9/1/2002
10/10/2006
11/18/2010
CD-1
Median
Livestock Criteria
CD-1A
Median + MAD
Secondary Human Contact
Median + 2MAD

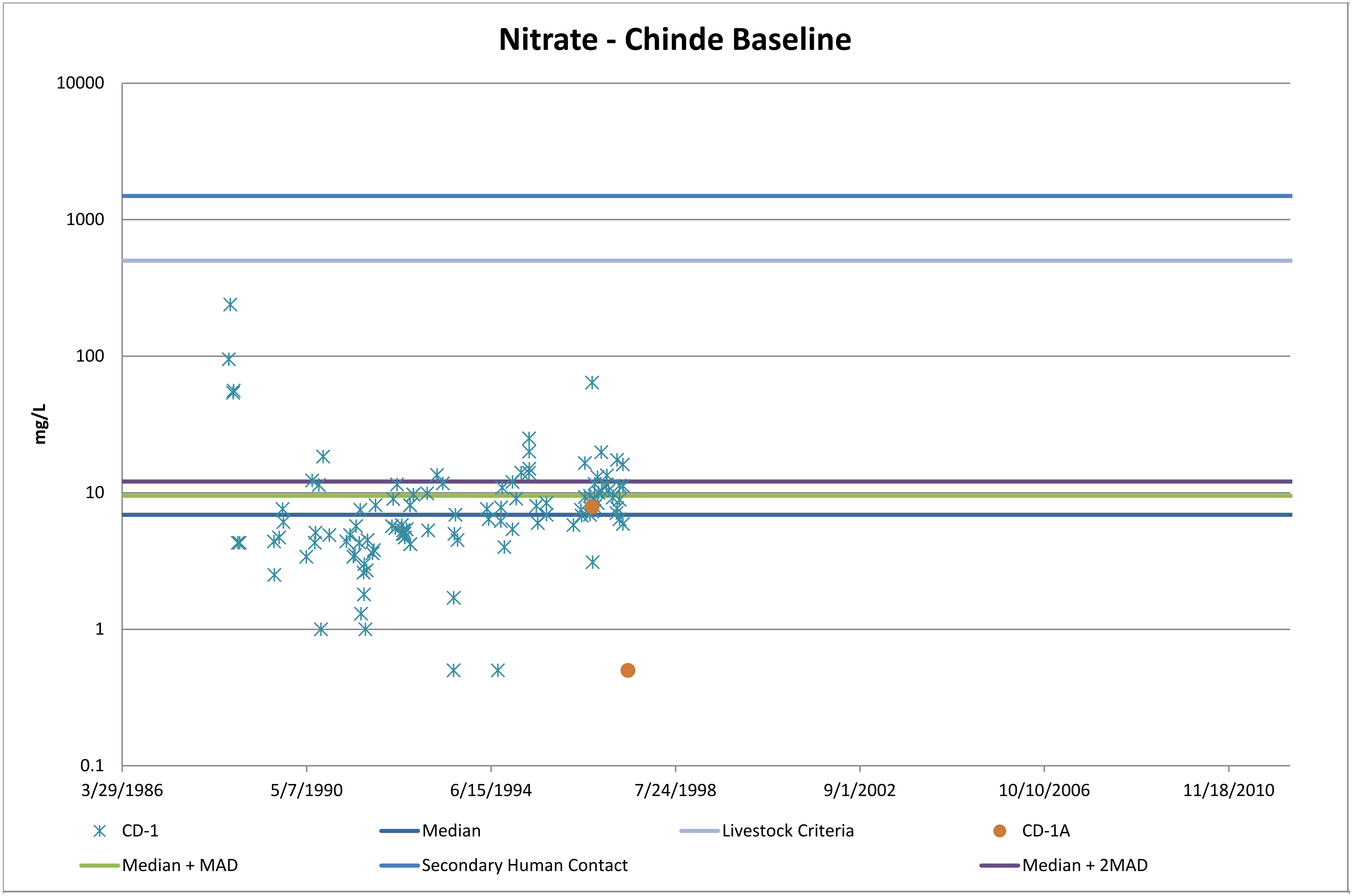

Cadmium - Chinde Baseline
mg/L
1
0.1
0.01
0.001
0.0001
3/29/1986
5/7/1990
6/15/1994
7/24/1998
9/1/2002
10/10/2006
11/18/2010
CD-1
CD-1A
Median
Median + MAD
Median + 2MAD
Livestock Criteria
Aquatic & Wildlife Acute Criteria
Aquatic & Wildlife Chronic Criteria
Secondary Human Contact Criteria
Fish Consumption Criteria

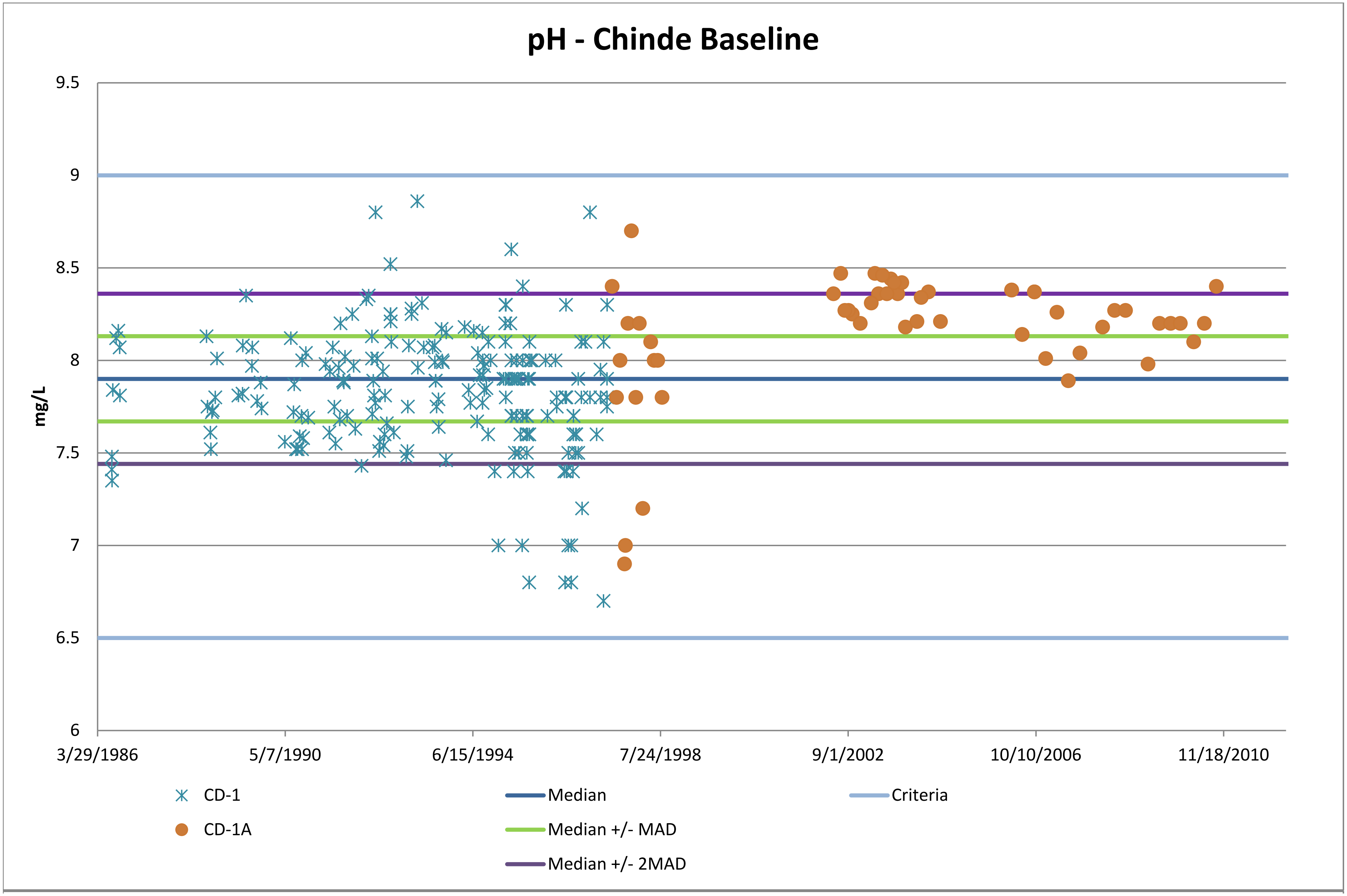

Chloride - Chinde Baseline
1000
100
10
1
0.1
mg/L
3/29/1986
5/7/1990
6/15/1994
7/24/1998
9/1/2002
10/10/2006
11/18/2010
CD-1
Median
Livestock Criteria
CD-1A
Median + MAD
Median + 2MAD

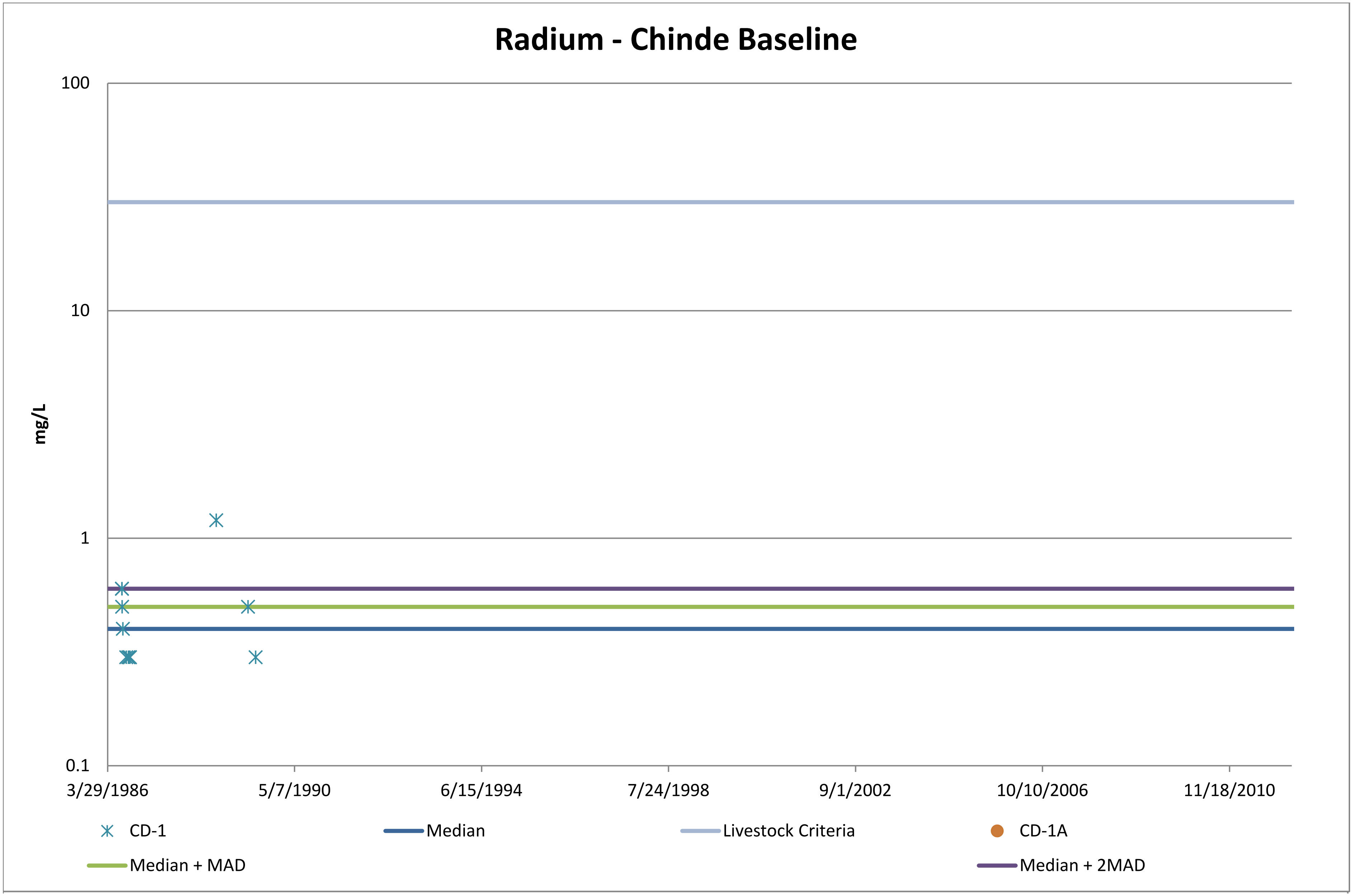

Chromium - Chinde Baseline
mg/L
10
1
0.1
0.01
0.001
0.0001
3/29/1986
5/7/1990
6/15/1994
7/24/1998
9/1/2002
10/10/2006
11/18/2010
CD-1
CD-1A
Median
Median + MAD
Median + 2MAD
Livestock Criteria
Aquatic & Wildlife Acute Criteria
Aquatic and Wildlife Chronic Criteria
Secondary Human Contact Criteria
Fish Consumption Criteria

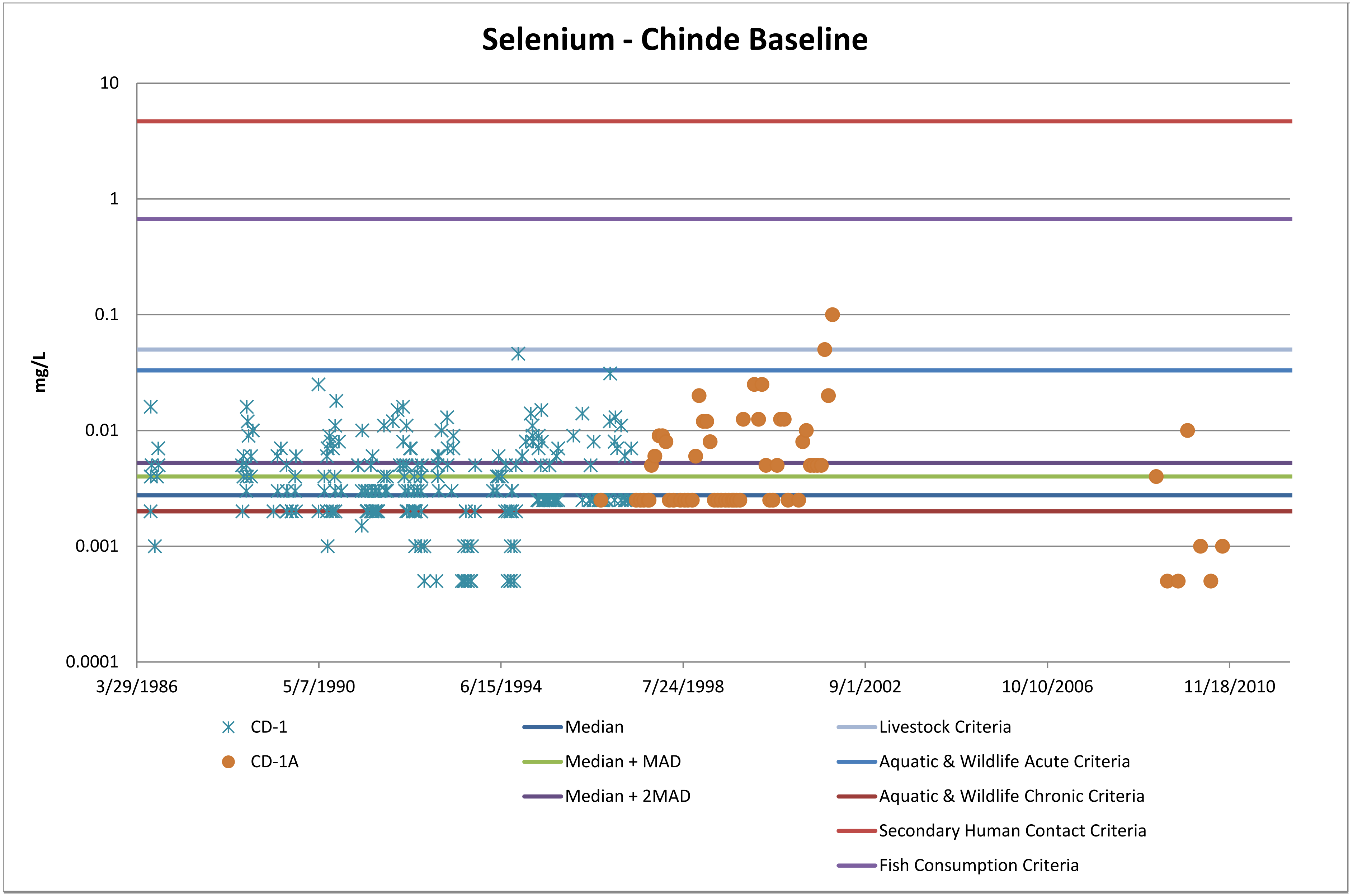

Fluoride - Chinde Baseline
100
10
1
0.1
0.01
0.001
mg/L
3/29/1986
5/7/1990
6/15/1994
7/24/1998
9/1/2002
10/10/2006
11/18/2010
CD-1
CD-1A
Median
Median + MAD
Median + 2MAD
Livestock Criteria
Secondary Human Contact

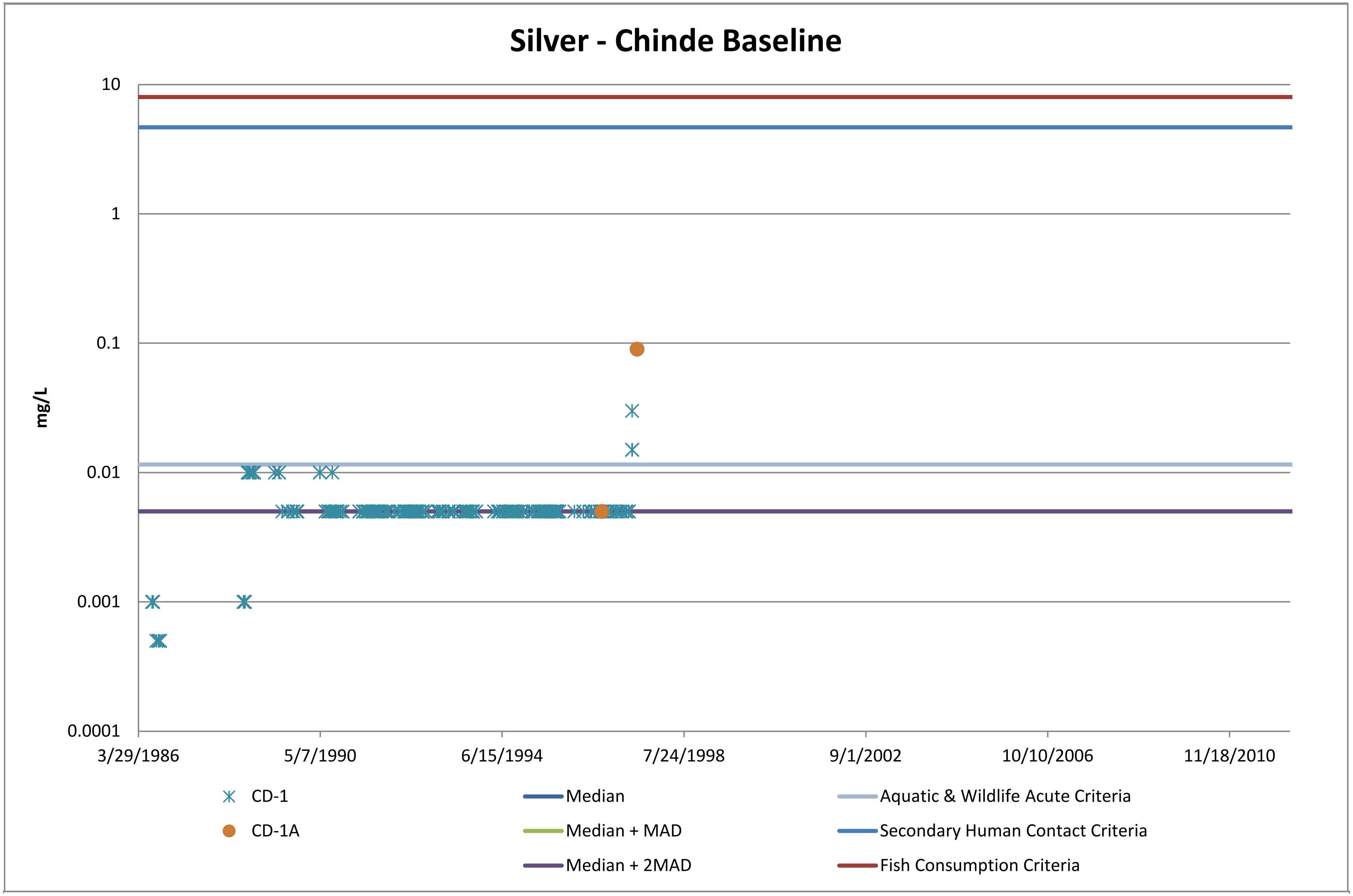

Lead - Chinde Baseline
mg/L
1
0.1
0.01
0.001
3/29/1986
5/7/1990
6/15/1994
7/24/1998
9/1/2002
10/10/2006
11/18/2010
CD-1
CD-1A
Median
Median + MAD
Median + 2MAD
Livestock Criteria
Aquatic & Wildlife Acute Criteria
Aquatic & Wildlife Chronic Criteria
Secondary Human Contact Criteria

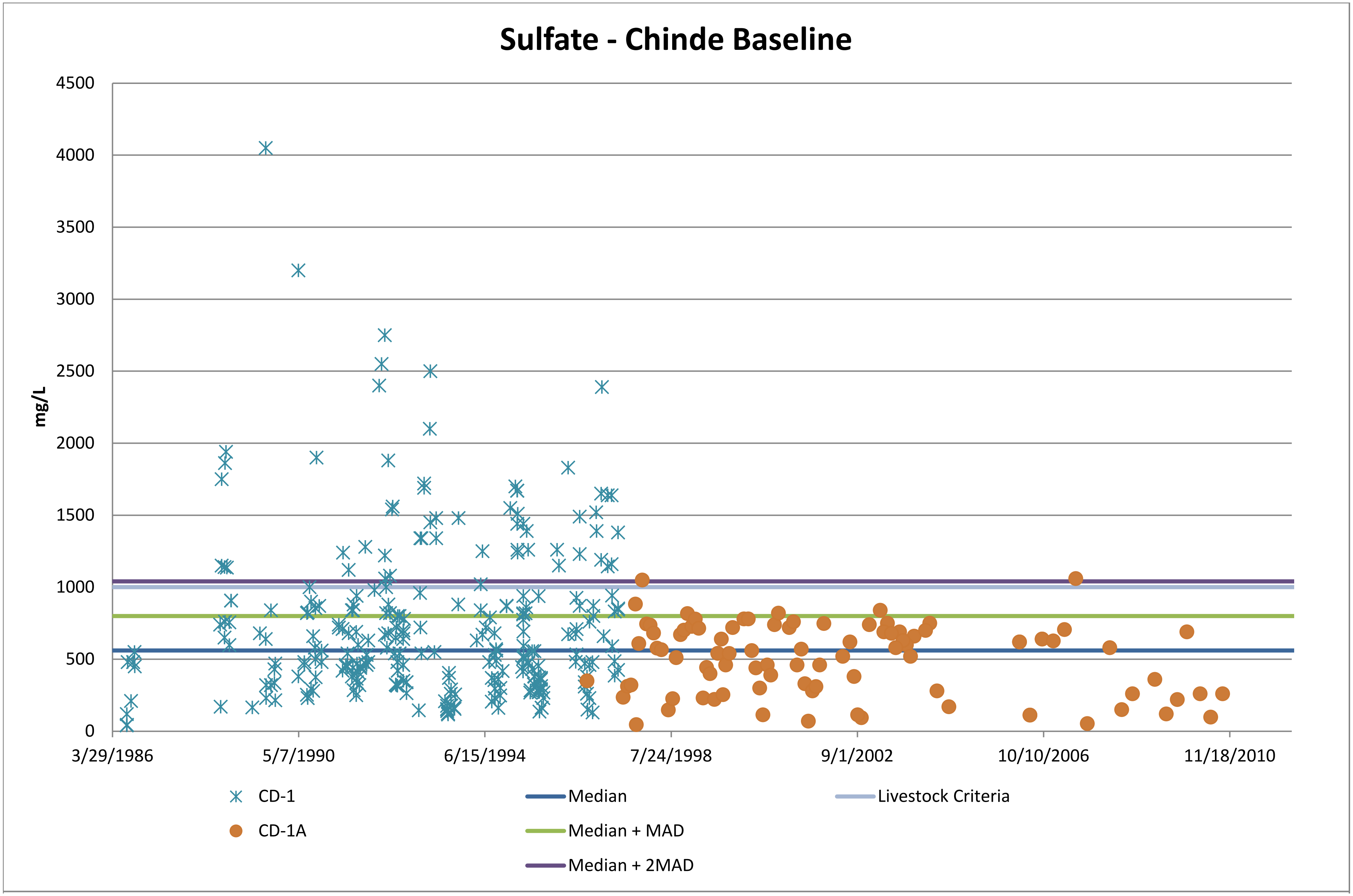

Nitrate - Chinde Baseline
mg/L
10000
1000
100
10
1
0.1
3/29/1986
5/7/1990
6/15/1994
7/24/1998
9/1/2002
10/10/2006
11/18/2010
CD-1
Median
Livestock Criteria
CD-1A
Median + MAD
Secondary Human Contact
Median + 2MAD

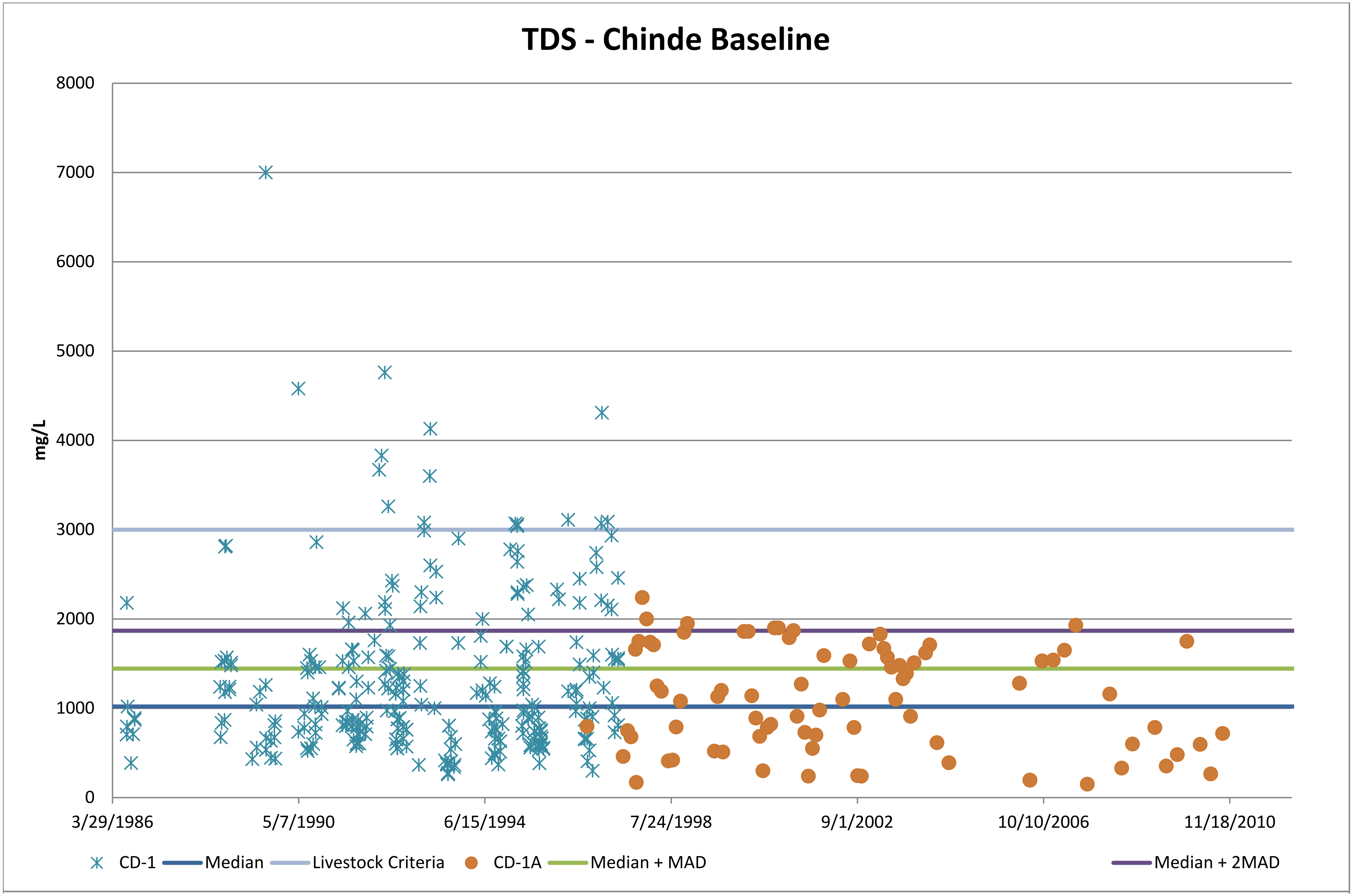

pH - Chinde Baseline
9.5
9
8.5
8
7.5
7
6.5
6
mg/L
3/29/1986
5/7/1990
6/15/1994
7/24/1998
9/1/2002
10/10/2006
11/18/2010
CD-1
CD-1A
Median
Median +/- MAD
Median +/- 2MAD
Criteria

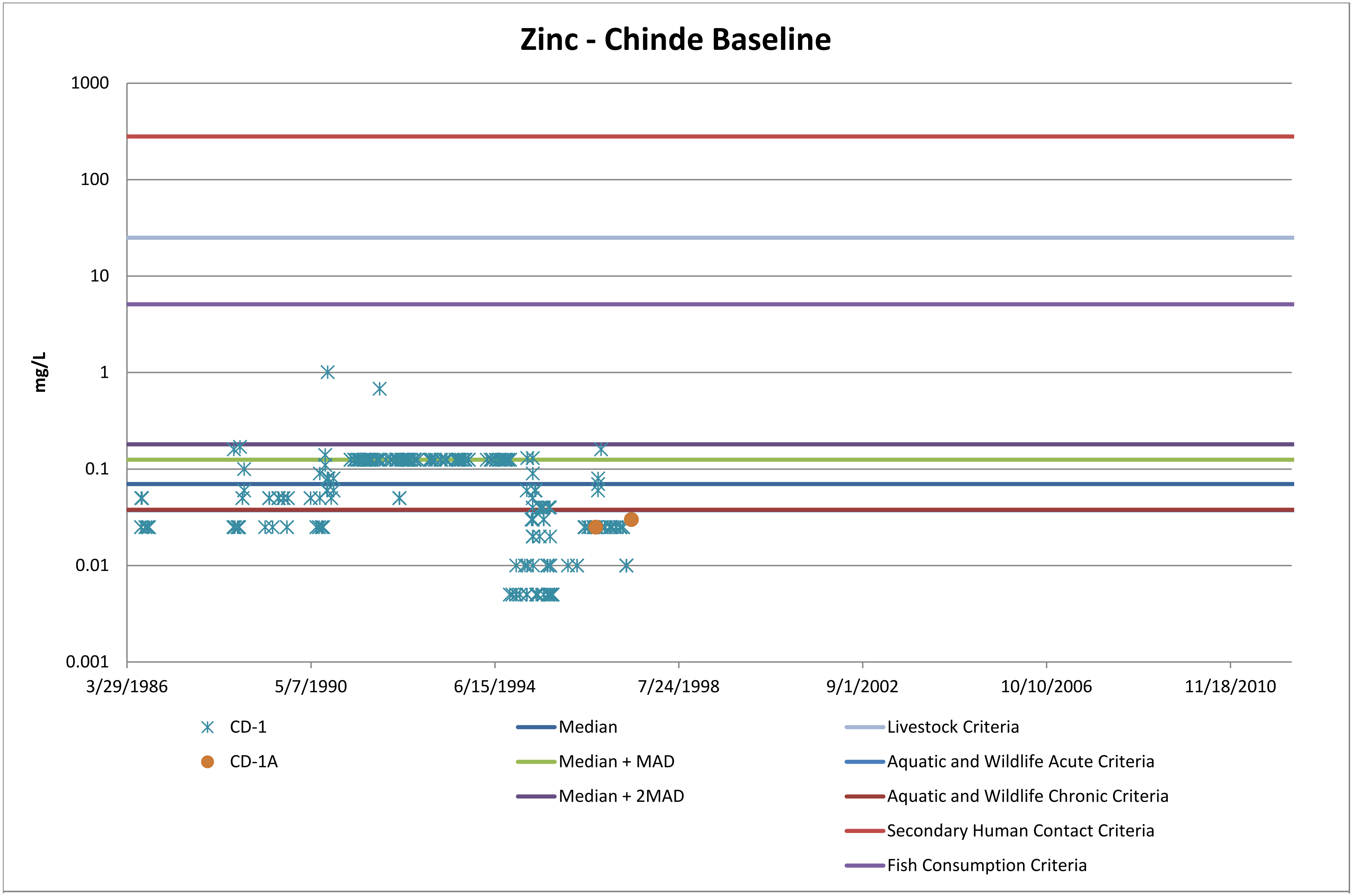

Radium - Chinde Baseline
100
10
1
0.1
mg/L
3/29/1986
5/7/1990
6/15/1994
7/24/1998
9/1/2002
10/10/2006
11/18/2010
CD-1
Median
Livestock Criteria
CD-1A
Median + MAD
Median + 2MAD

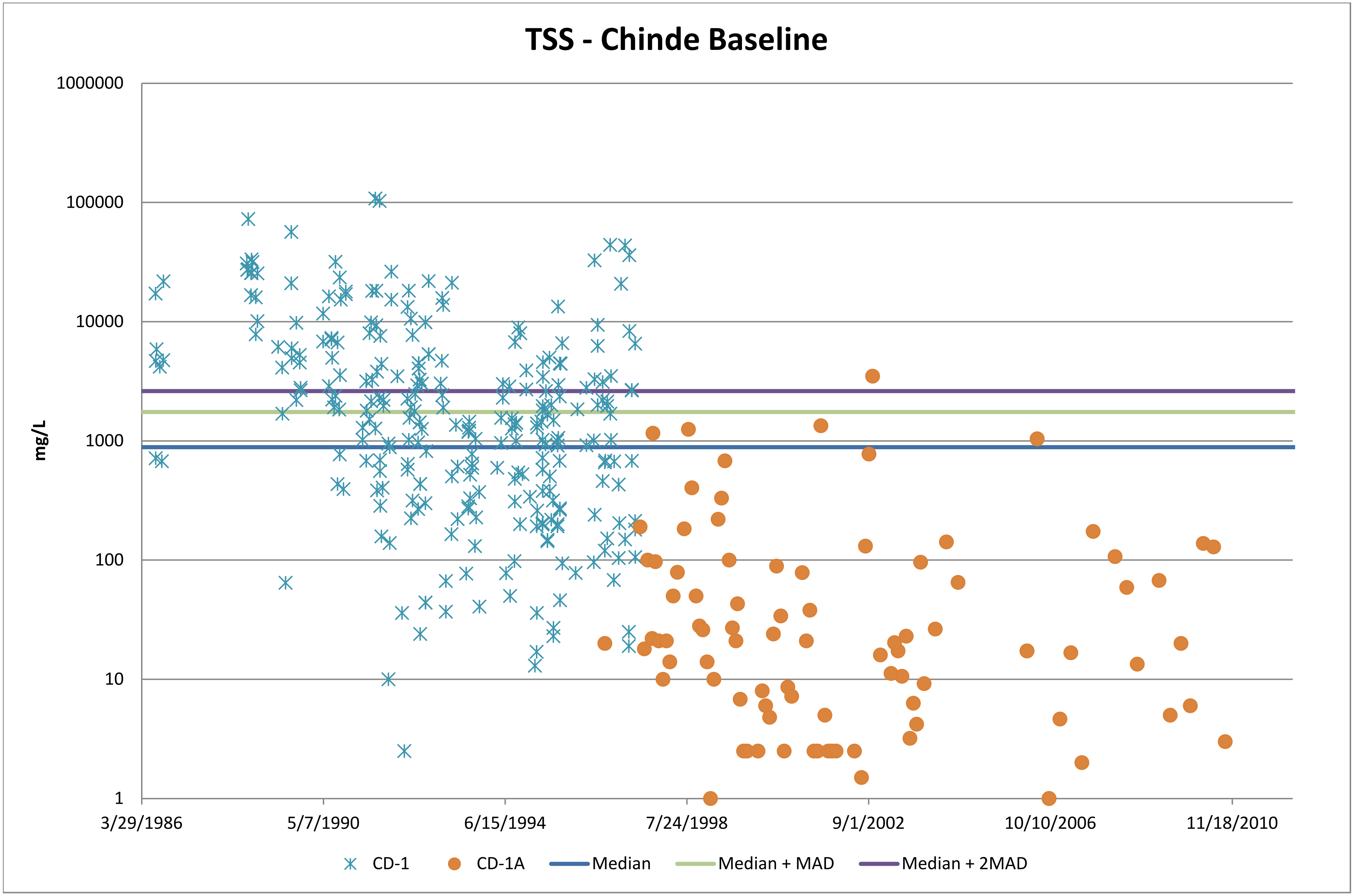

Selenium - Chinde Baseline
mg/L
10
1
0.1
0.01
0.001
0.0001
3/29/1986
5/7/1990
6/15/1994
7/24/1998
9/1/2002
10/10/2006
11/18/2010
CD-1
CD-1A
Median
Median + MAD
Median + 2MAD
Livestock Criteria
Aquatic & Wildlife Acute Criteria
Aquatic & Wildlife Chronic Criteria
Secondary Human Contact Criteria
Fish Consumption Criteria

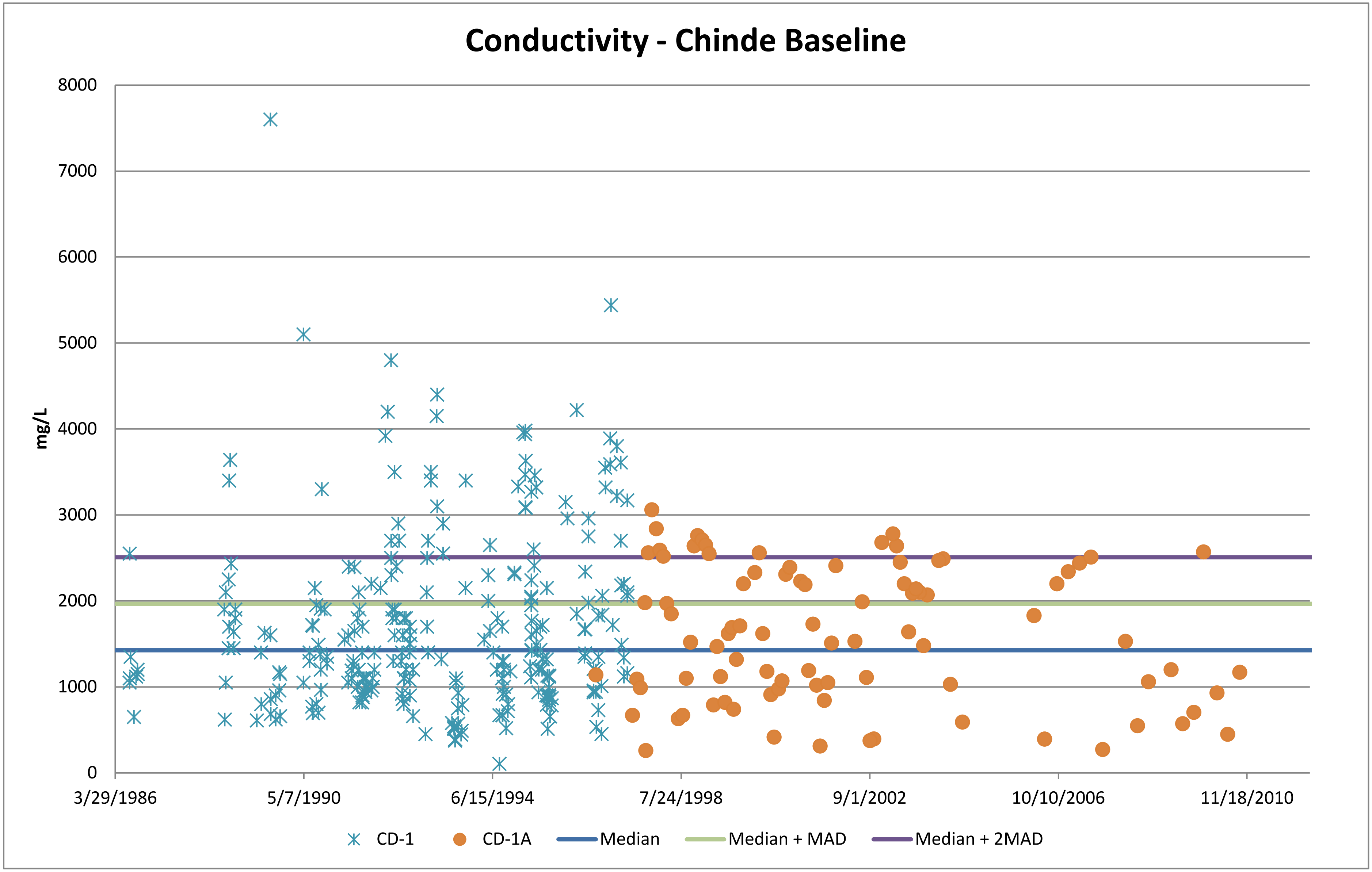

Silver - Chinde Baseline
mg/L
10
1
0.1
0.01
0.001
0.0001
3/29/1986
5/7/1990
6/15/1994
7/24/1998
9/1/2002
10/10/2006
11/18/2010
CD-1
CD-1A
Median
Median + MAD
Median + 2MAD
Aquatic & Wildlife Acute Criteria
Secondary Human Contact Criteria
Fish Consumption Criteria

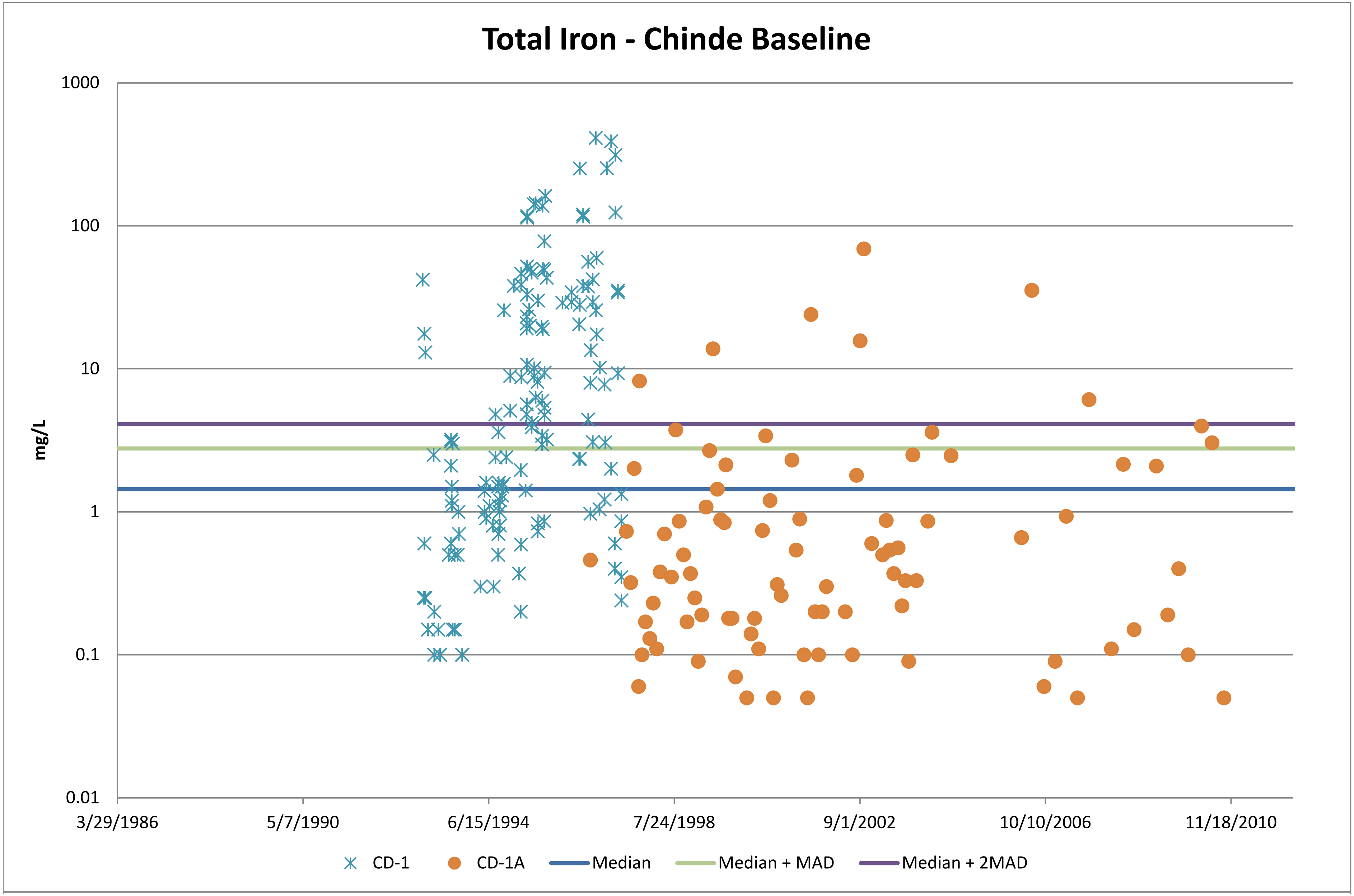

Sulfate - Chinde Baseline
mg/L
4500
4000
3500
3000
2500
2000
1500
1000
500
0
3/29/1986
5/7/1990
6/15/1994
7/24/1998
9/1/2002
10/10/2006
11/18/2010
CD-1
CD-1A
Median
Median + MAD
Median + 2MAD
Livestock Criteria

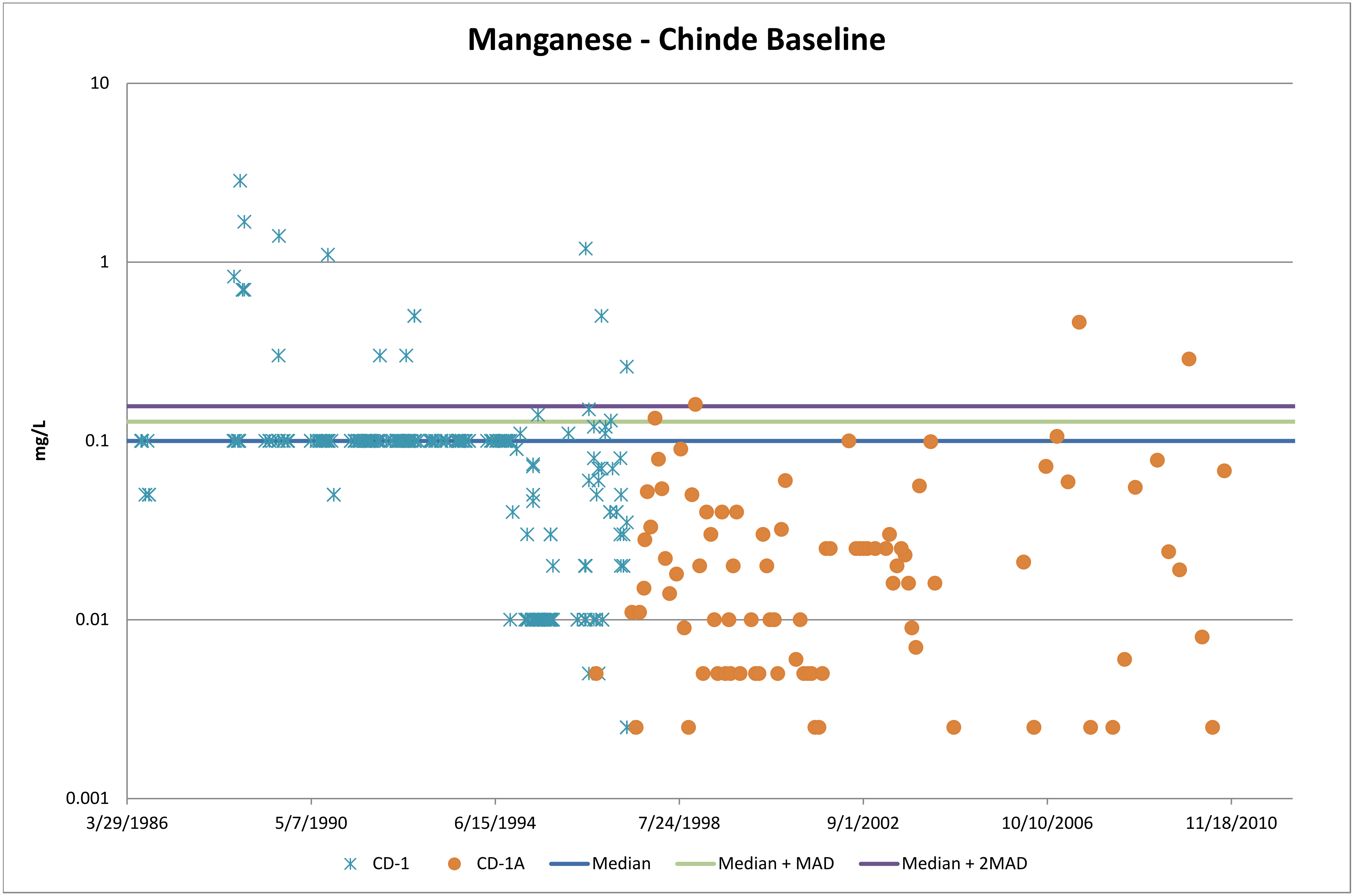

TDS - Chinde Baseline
mg/L
8000
7000
6000
5000
4000
3000
2000
1000
0
3/29/1986
5/7/1990
6/15/1994
7/24/1998
9/1/2002
10/10/2006
11/18/2010
CD-1
Median
Livestock Criteria
CD-1A
Median + MAD
Median + 2MAD

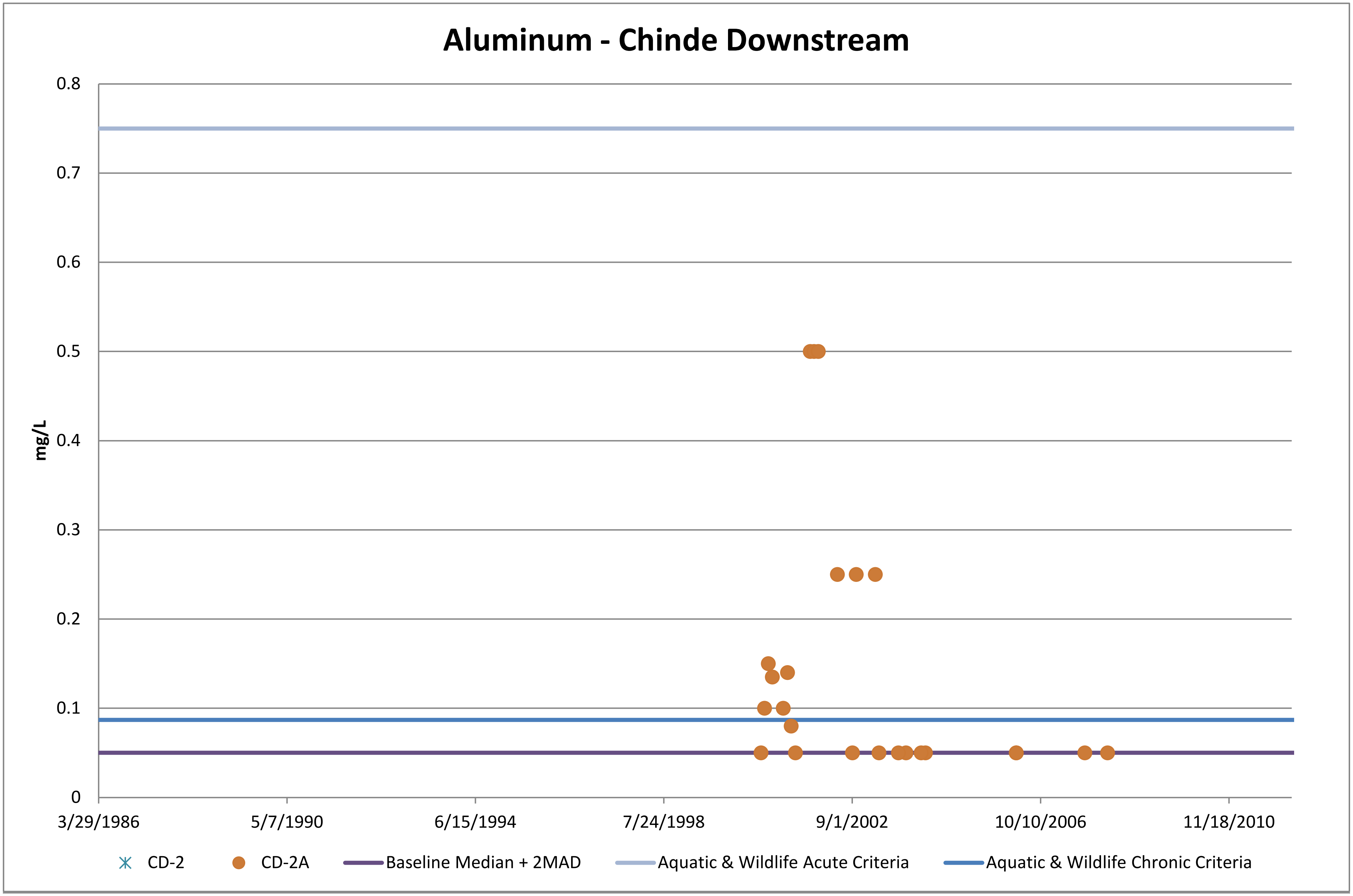

Zinc - Chinde Baseline
mg/L
1000
100
10
1
0.1
0.01
0.001
3/29/1986
5/7/1990
6/15/1994
7/24/1998
9/1/2002
10/10/2006
11/18/2010
CD-1
CD-1A
Median
Median + MAD
Median + 2MAD
Livestock Criteria
Aquatic and Wildlife Acute Criteria
Aquatic and Wildlife Chronic Criteria
Secondary Human Contact Criteria
Fish Consumption Criteria

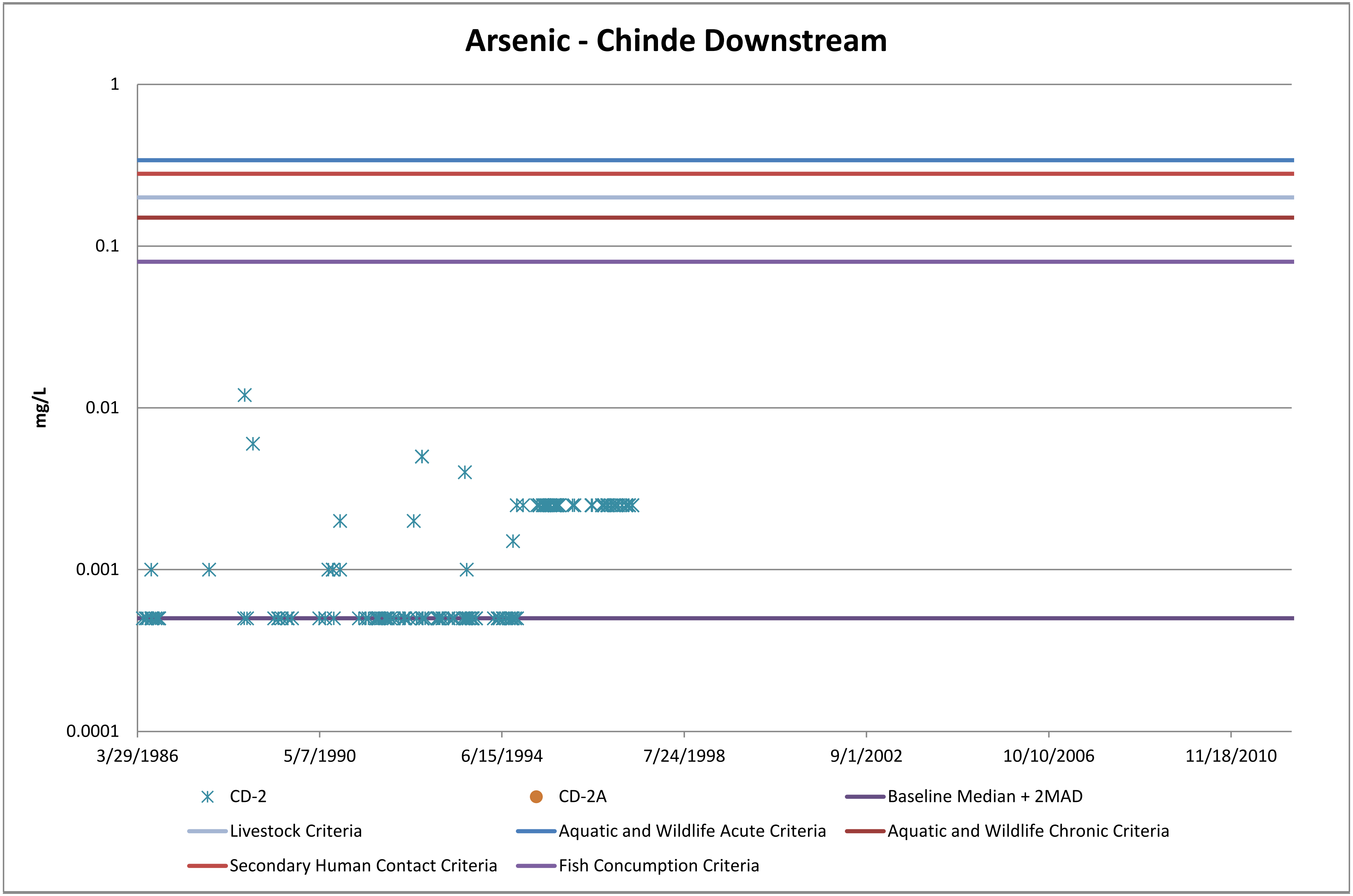

TSS - Chinde Baseline
mg/L
1000000
100000
10000
1000
100
10
1
3/29/1986
5/7/1990
6/15/1994
7/24/1998
9/1/2002
10/10/2006
11/18/2010
CD-1
CD-1A
Median
Median + MAD
Median + 2MAD

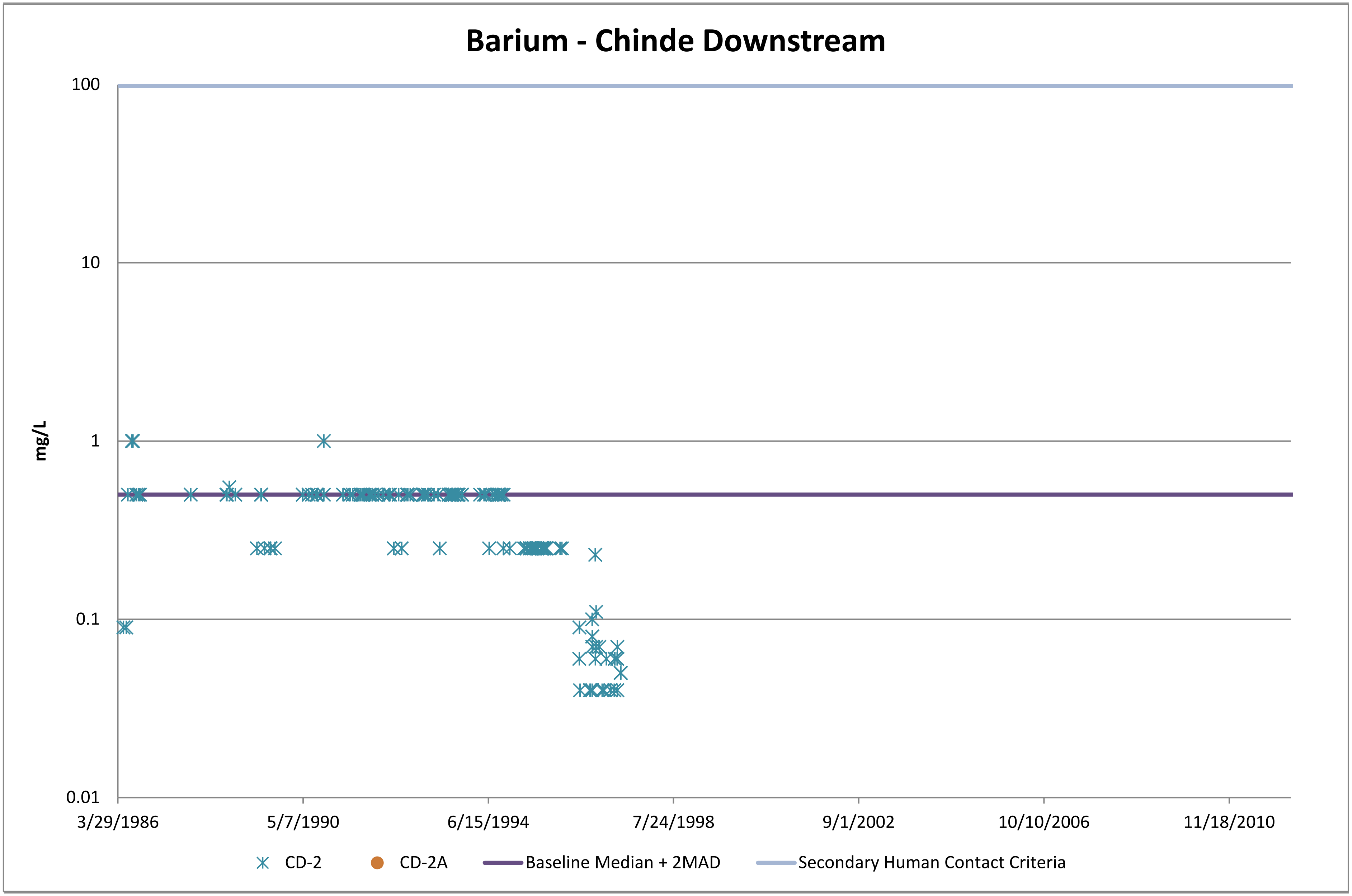

Conductivity - Chinde Baseline
8000
7000
6000
5000
4000
3000
2000
1000
0
mg/L
3/29/1986
5/7/1990
6/15/1994
7/24/1998
9/1/2002
10/10/2006
11/18/2010
CD-1
CD-1A
Median
Median + MAD
Median + 2MAD

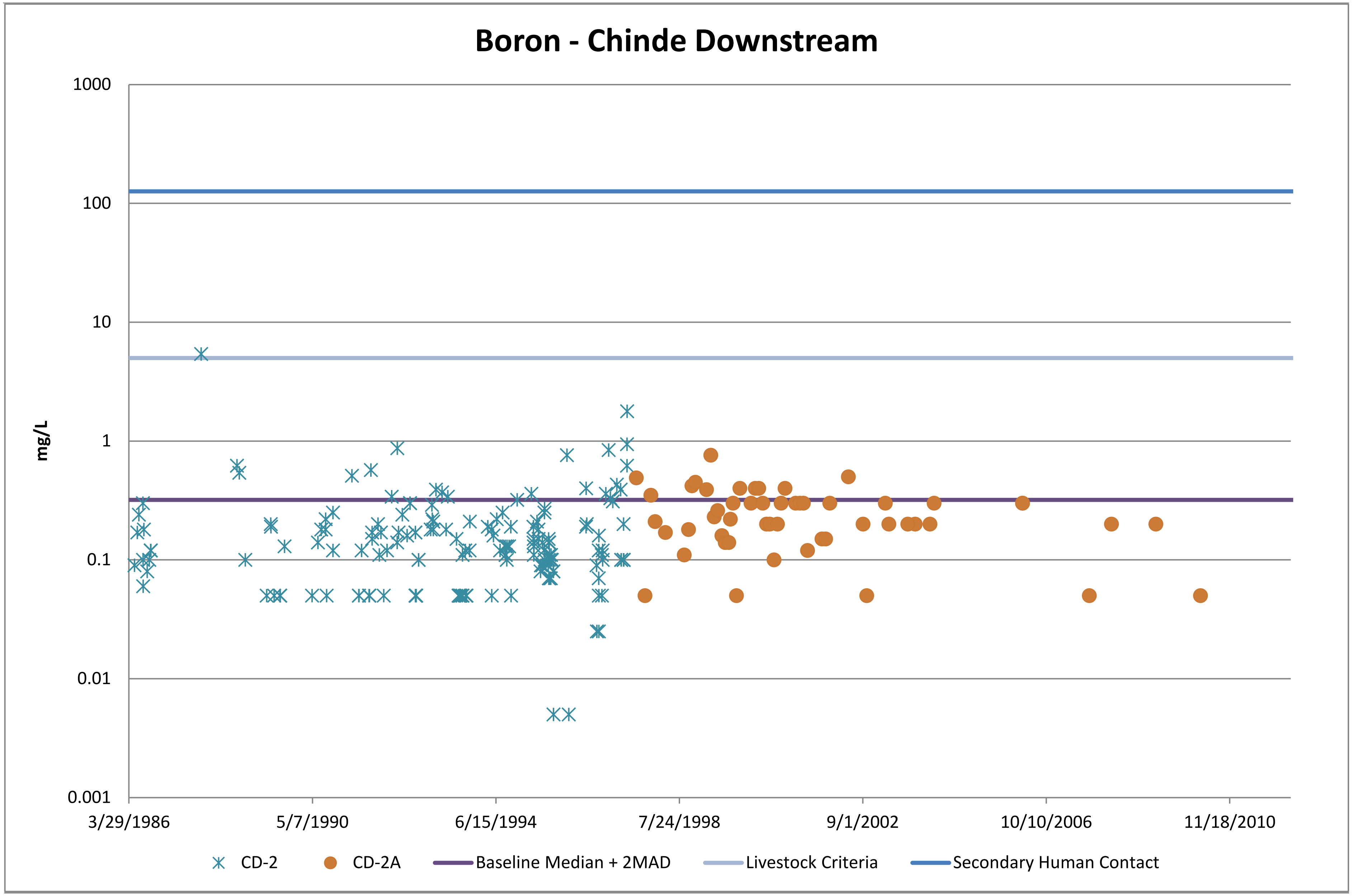

Total Iron - Chinde Baseline
1000
100
10
1
0.1
0.01
mg/L
3/29/1986
5/7/1990
6/15/1994
7/24/1998
9/1/2002
10/10/2006
11/18/2010
CD-1
CD-1A
Median
Median + MAD
Median + 2MAD

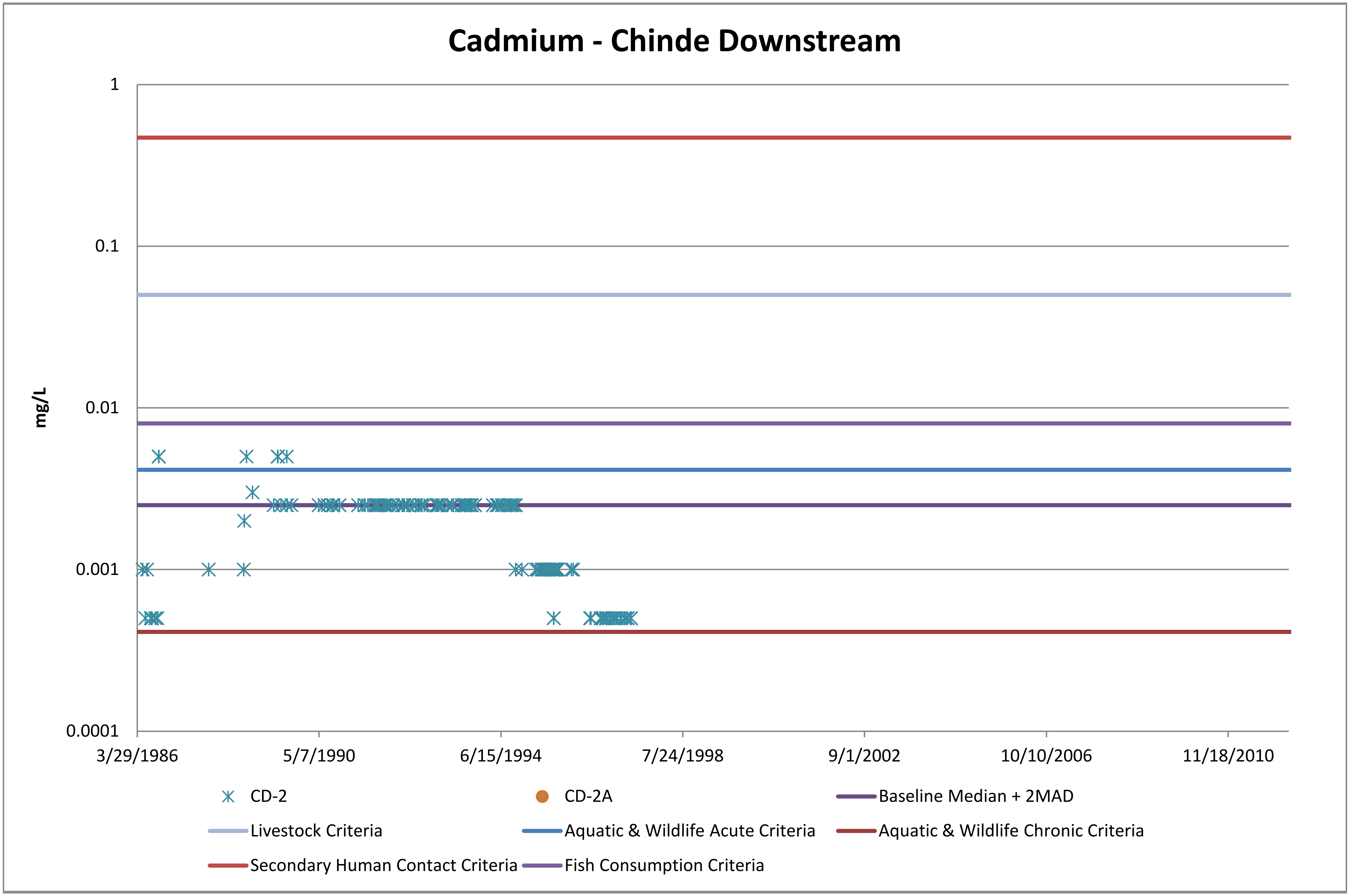

Manganese - Chinde Baseline
mg/L
10
1
0.1
0.01
0.001
3/29/1986
5/7/1990
6/15/1994
7/24/1998
9/1/2002
10/10/2006
11/18/2010
CD-1
CD-1A
Median
Median + MAD
Median + 2MAD

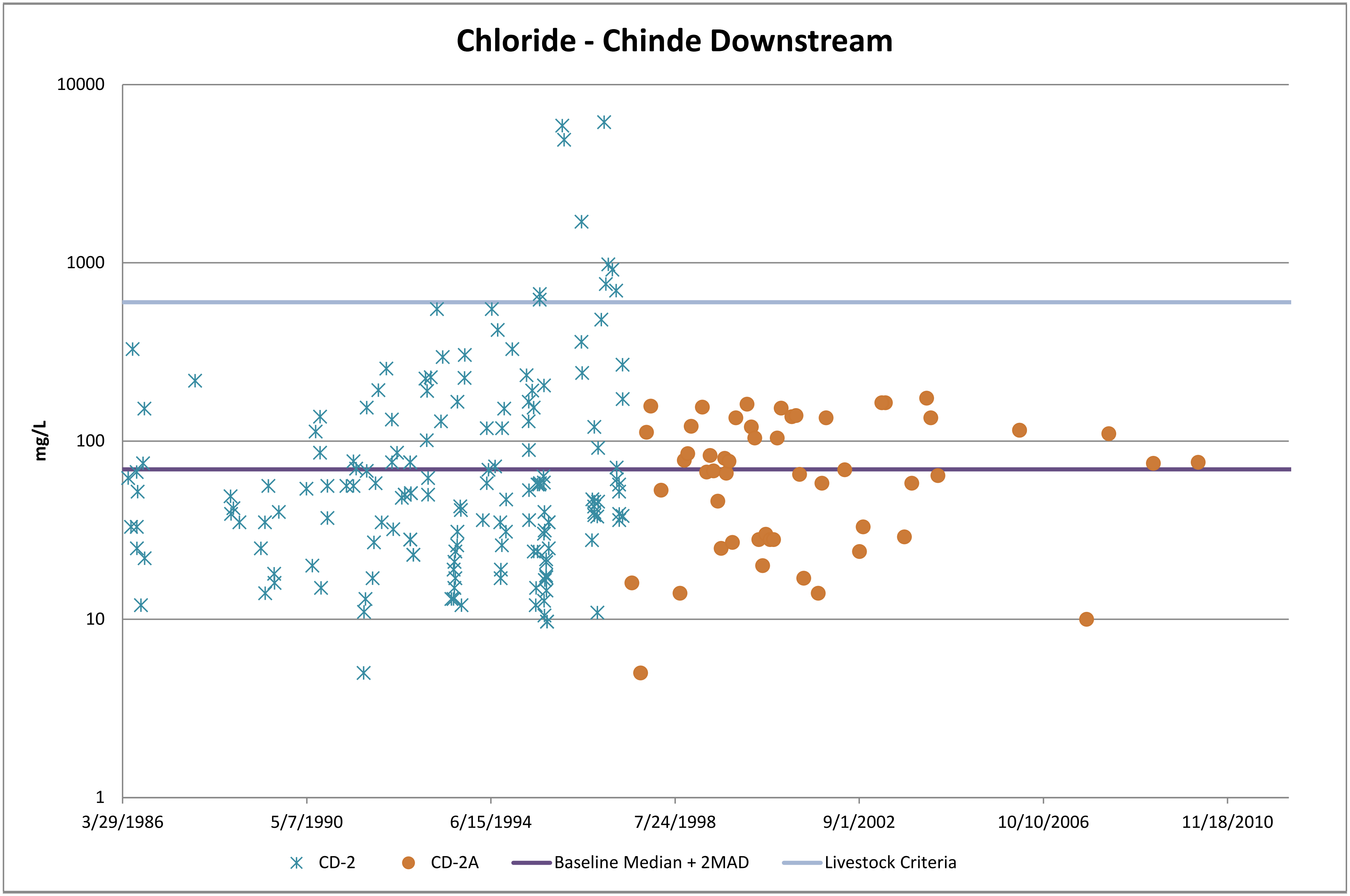

Aluminum - Chinde Downstream
mg/L
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
3/29/1986
5/7/1990
6/15/1994
7/24/1998
9/1/2002
10/10/2006
11/18/2010
CD-2
CD-2A
Baseline Median + 2MAD
Aquatic & Wildlife Acute Criteria
Aquatic & Wildlife Chronic Criteria

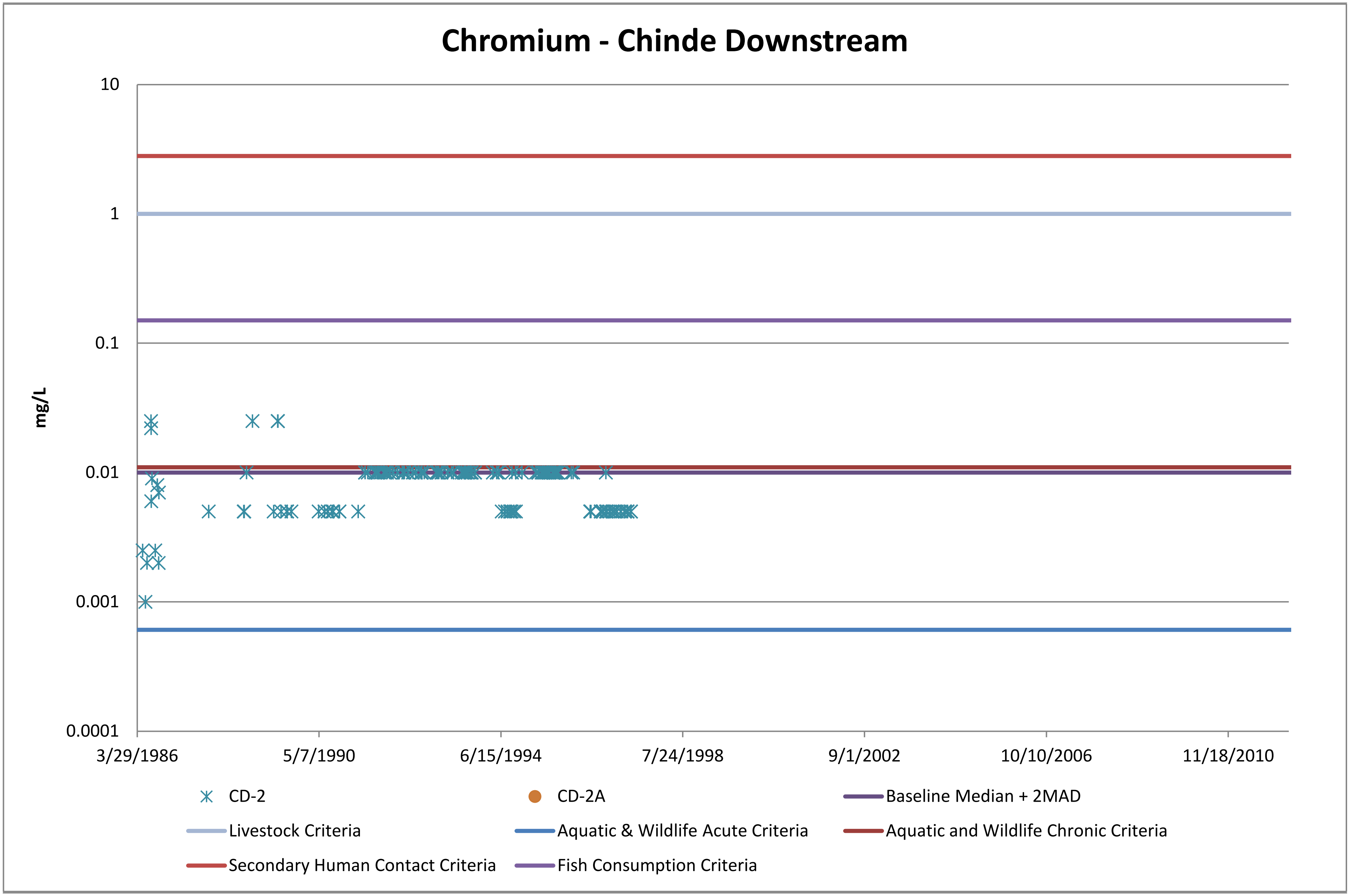

Arsenic - Chinde Downstream
mg/L
1
0.1
0.01
0.001
0.0001
3/29/1986
5/7/1990
6/15/1994
7/24/1998
9/1/2002
10/10/2006
11/18/2010
CD-2
CD-2A
Baseline Median + 2MAD
Livestock Criteria
Aquatic and Wildlife Acute Criteria
Aquatic and Wildlife Chronic Criteria
Secondary Human Contact Criteria
Fish Concumption Criteria

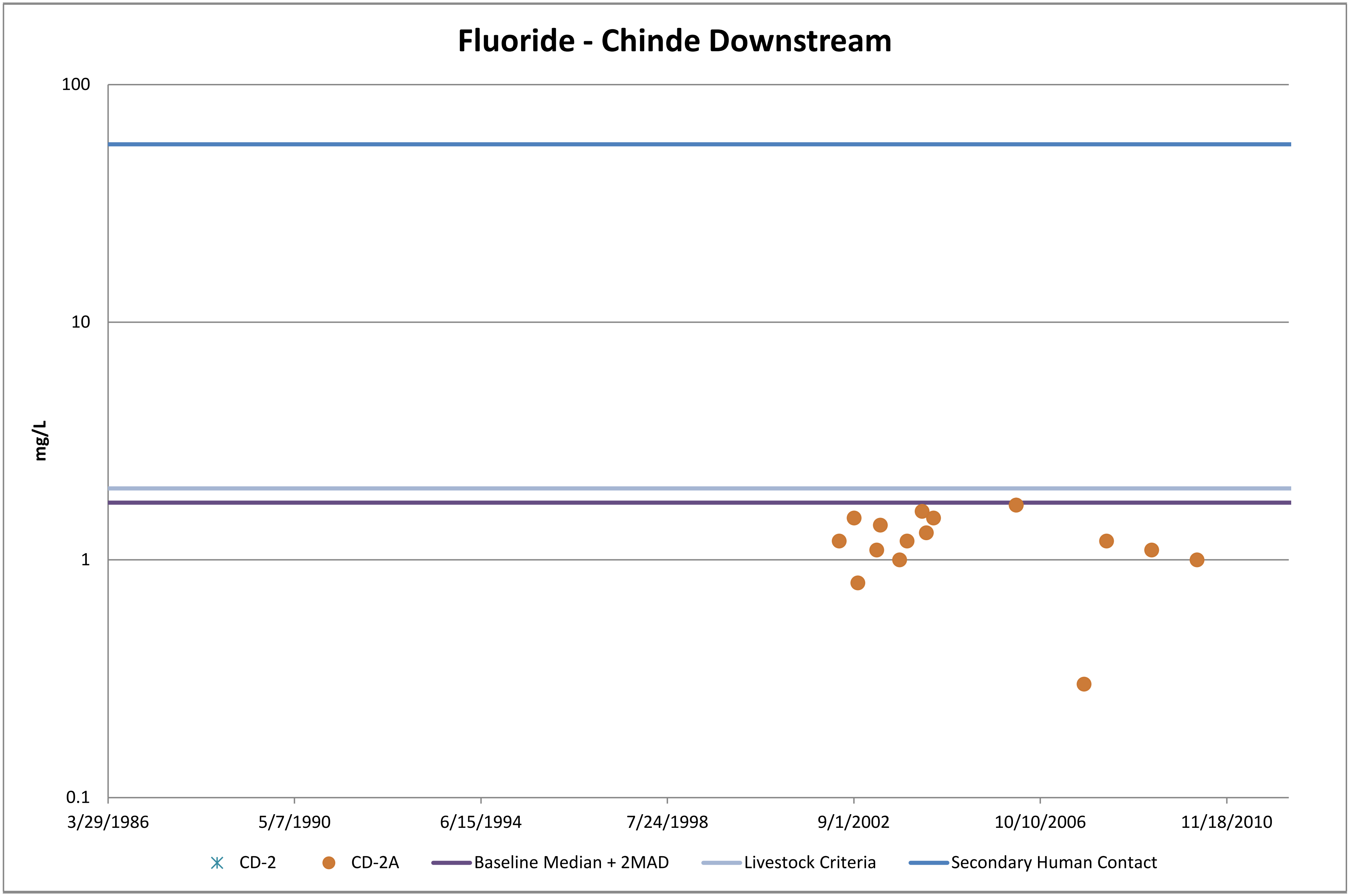

Barium - Chinde Downstream
100
10
1
0.1
0.01
mg/L
3/29/1986
5/7/1990
6/15/1994
7/24/1998
9/1/2002
10/10/2006
11/18/2010
CD-2
CD-2A
Baseline Median + 2MAD
Secondary Human Contact Criteria

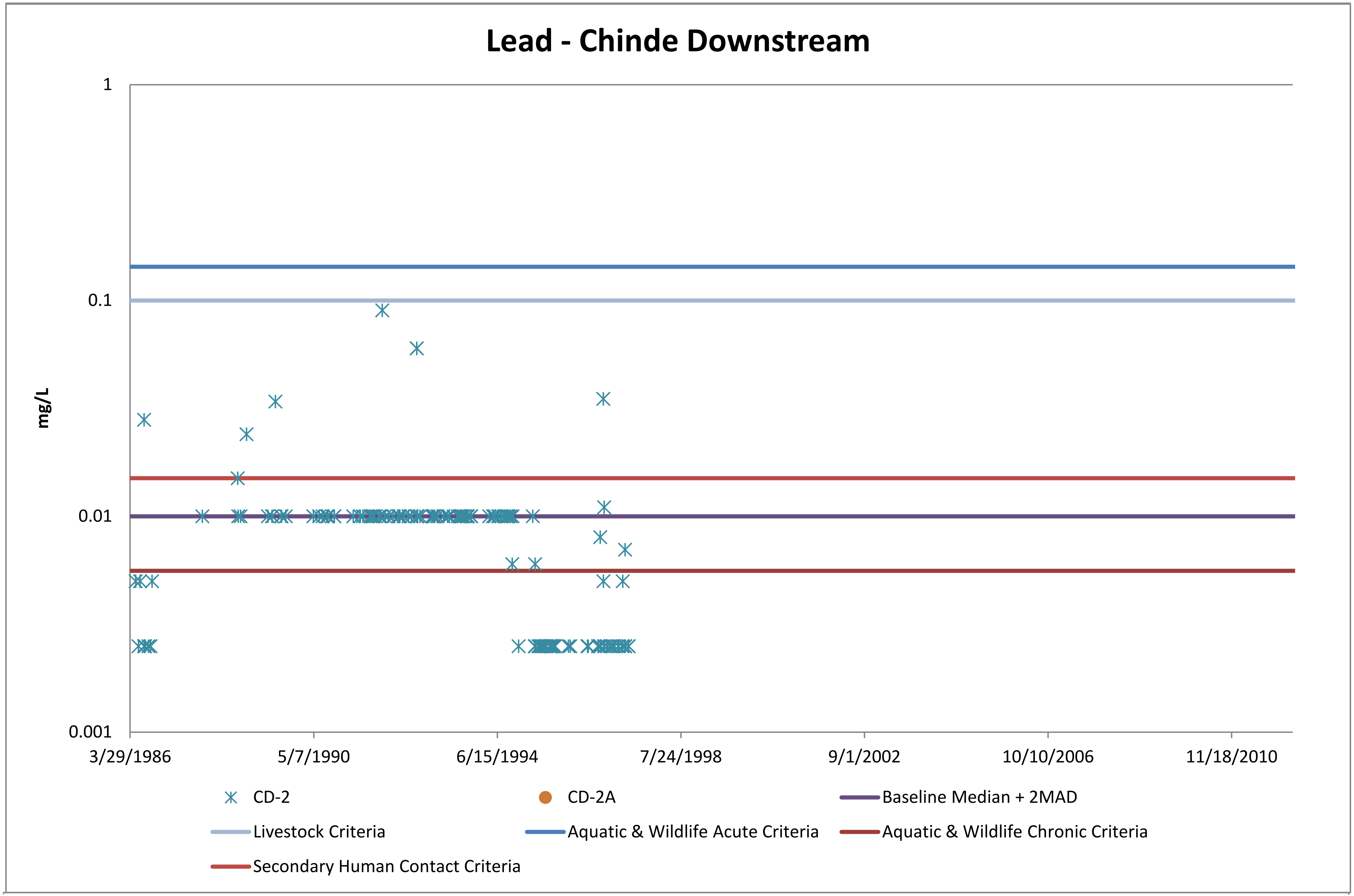

Boron - Chinde Downstream
mg/L
1000
100
10
1
0.1
0.01
0.001
3/29/1986
5/7/1990
6/15/1994
7/24/1998
9/1/2002
10/10/2006
11/18/2010
CD-2
CD-2A
Baseline Median + 2MAD
Livestock Criteria
Secondary Human Contact

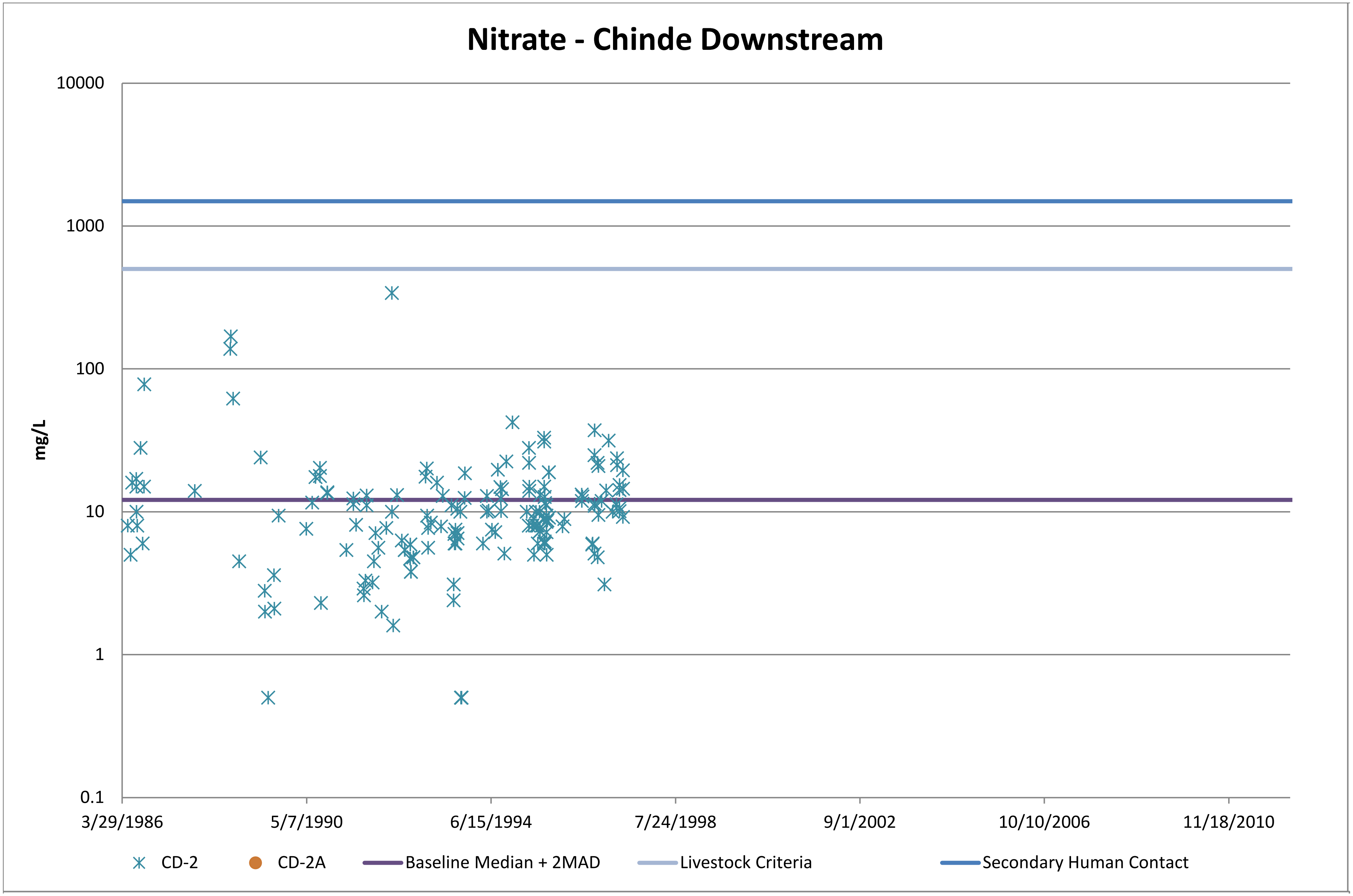

Cadmium - Chinde Downstream
mg/L
1
0.1
0.01
0.001
0.0001
3/29/1986
5/7/1990
6/15/1994
7/24/1998
9/1/2002
10/10/2006
11/18/2010
CD-2
CD-2A
Baseline Median + 2MAD
Livestock Criteria
Aquatic & Wildlife Acute Criteria
Aquatic & Wildlife Chronic Criteria
Secondary Human Contact Criteria
Fish Consumption Criteria

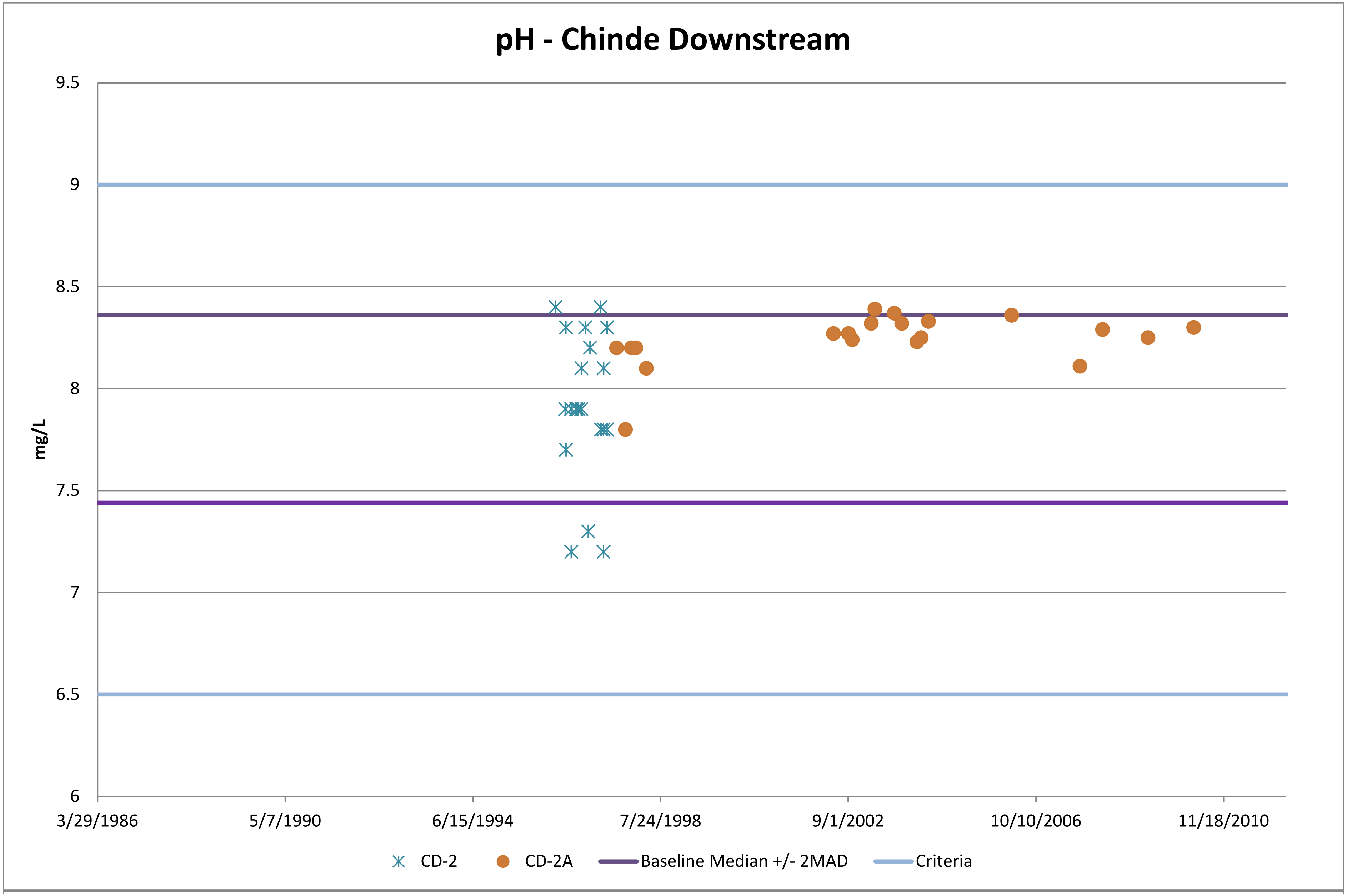

Chloride - Chinde Downstream
mg/L
10000
1000
100
10
1
3/29/1986
5/7/1990
6/15/1994
7/24/1998
9/1/2002
10/10/2006
11/18/2010
CD-2
CD-2A
Baseline Median + 2MAD
Livestock Criteria

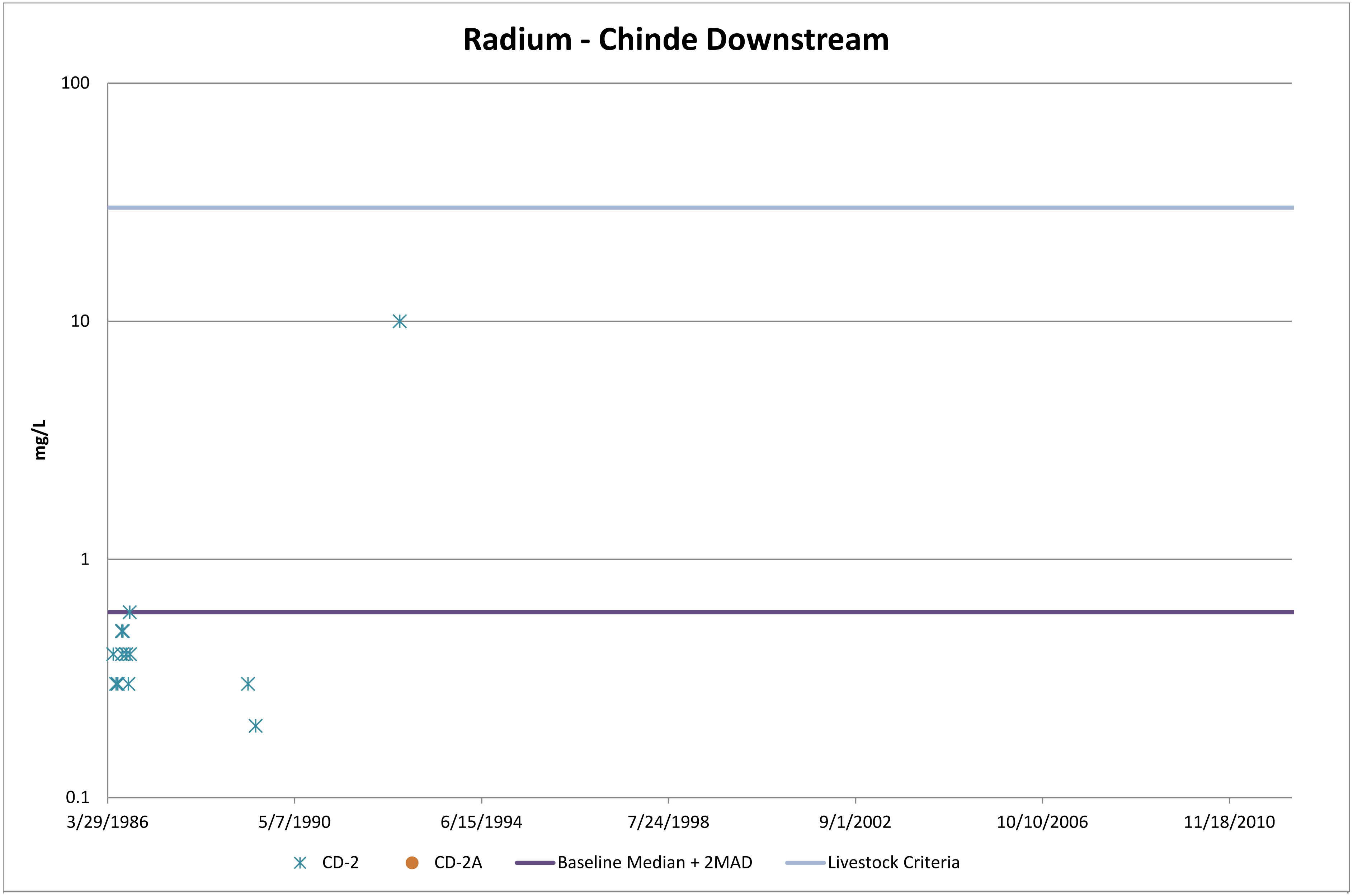

Chromium - Chinde Downstream
mg/L
10
1
0.1
0.01
0.001
0.0001
3/29/1986
5/7/1990
6/15/1994
7/24/1998
9/1/2002
10/10/2006
11/18/2010
CD-2
CD-2A
Baseline Median + 2MAD
Livestock Criteria
Aquatic & Wildlife Acute Criteria
Aquatic and Wildlife Chronic Criteria
Secondary Human Contact Criteria
Fish Consumption Criteria

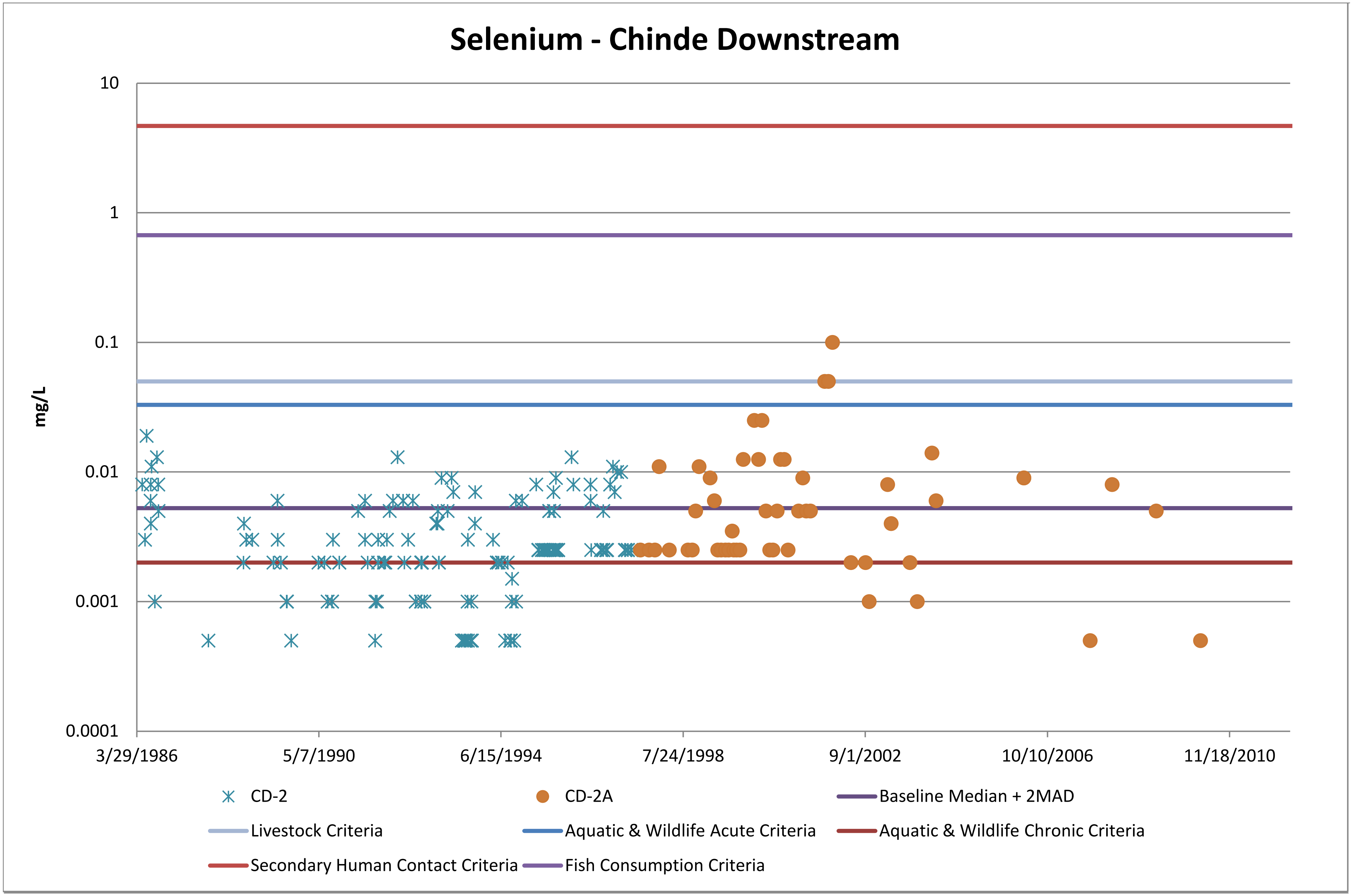

Fluoride - Chinde Downstream
100
10
1
0.1
mg/L
3/29/1986
5/7/1990
6/15/1994
7/24/1998
9/1/2002
10/10/2006
11/18/2010
CD-2
CD-2A
Baseline Median + 2MAD
Livestock Criteria
Secondary Human Contact

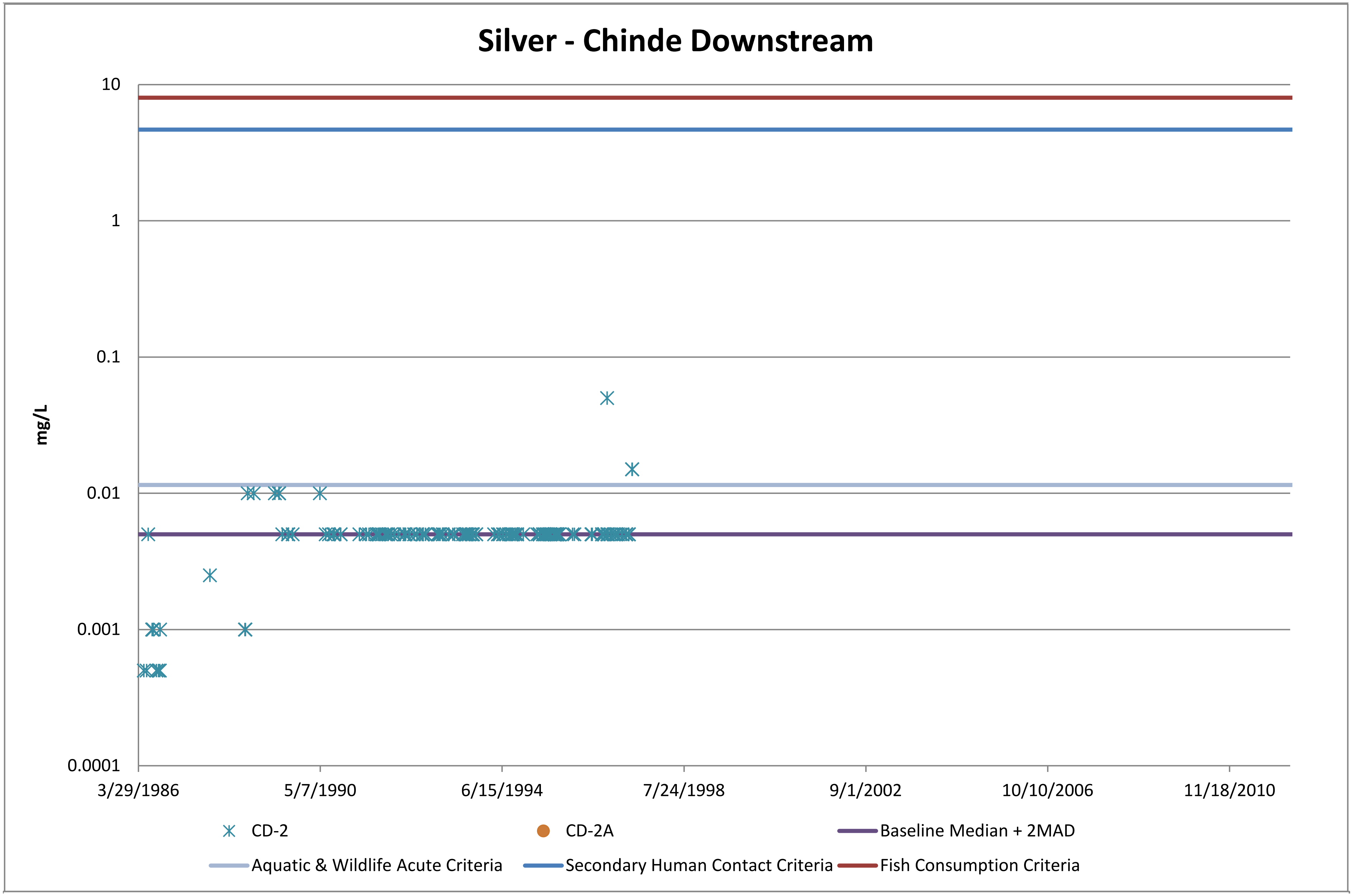

Lead - Chinde Downstream
mg/L
1
0.1
0.01
0.001
3/29/1986
5/7/1990
6/15/1994
7/24/1998
9/1/2002
10/10/2006
11/18/2010
CD-2
CD-2A
Baseline Median + 2MAD
Livestock Criteria
Aquatic & Wildlife Acute Criteria
Aquatic & Wildlife Chronic Criteria
Secondary Human Contact Criteria

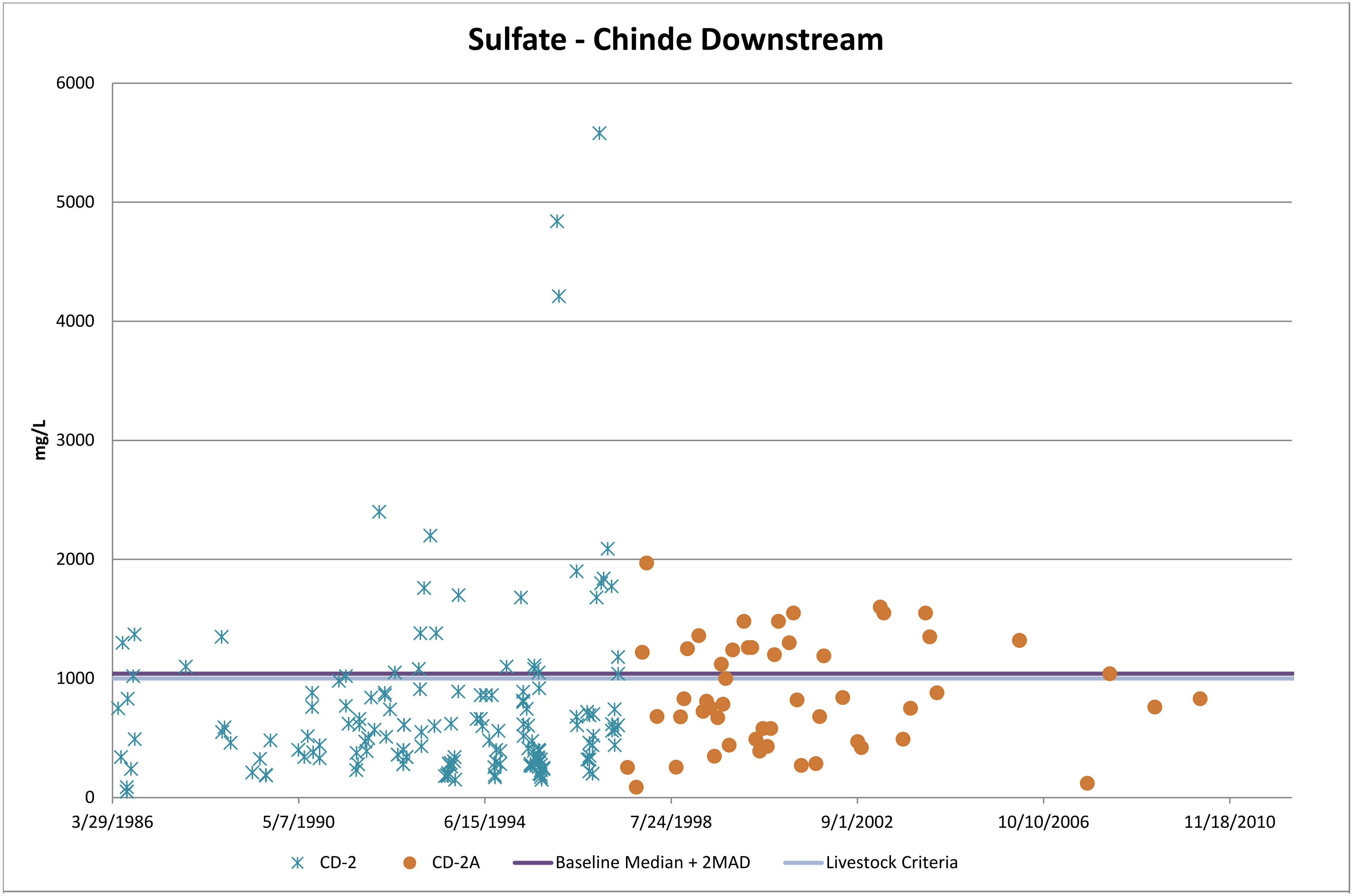

Nitrate - Chinde Downstream
mg/L
10000
1000
100
10
1
0.1
3/29/1986
5/7/1990
6/15/1994
7/24/1998
9/1/2002
10/10/2006
11/18/2010
CD-2
CD-2A
Baseline Median + 2MAD
Livestock Criteria
Secondary Human Contact

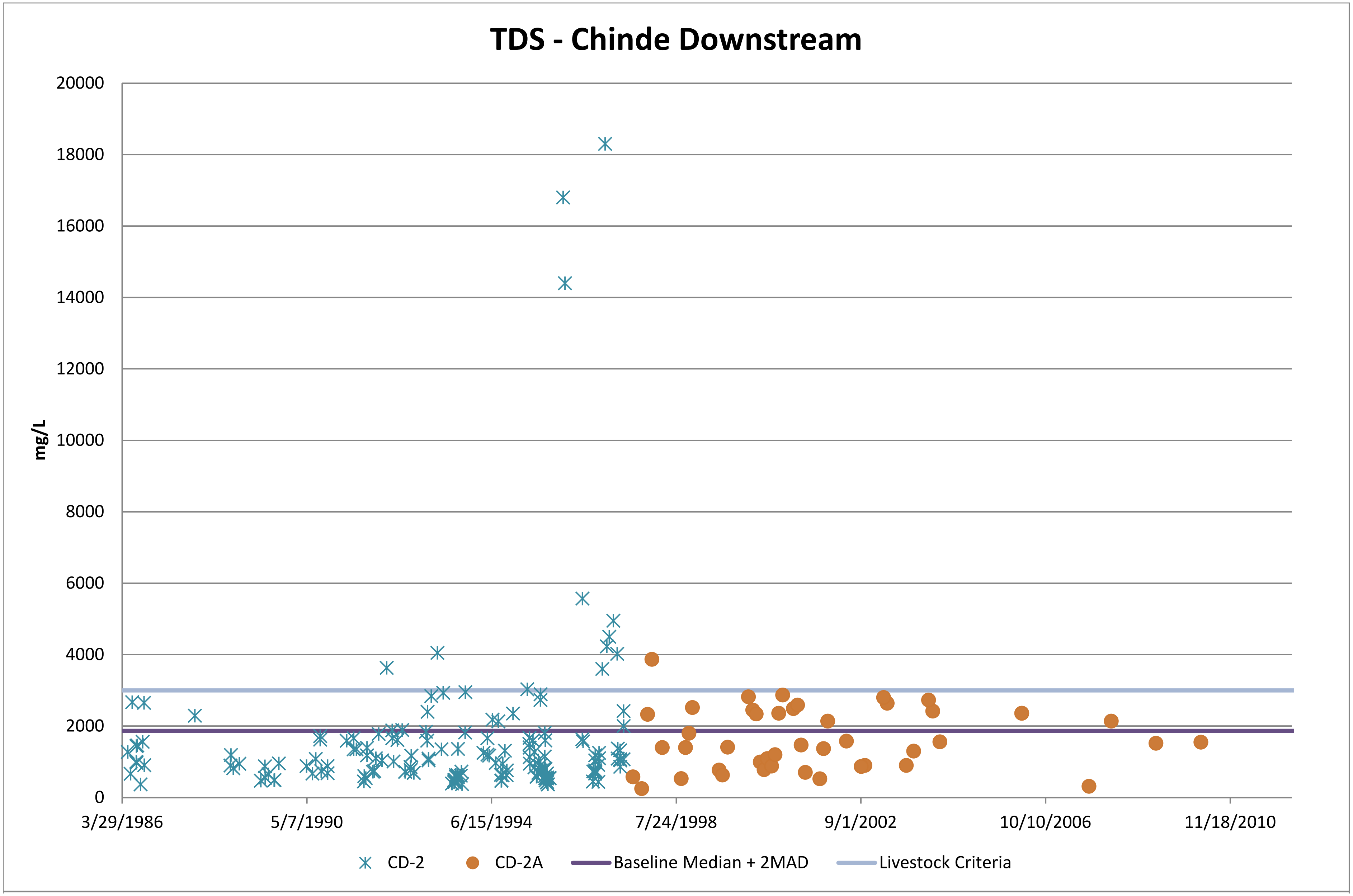

pH - Chinde Downstream
9.5
9
8.5
8
7.5
7
6.5
6
mg/L
3/29/1986
5/7/1990
6/15/1994
7/24/1998
9/1/2002
10/10/2006
11/18/2010
CD-2
CD-2A
Baseline Median +/- 2MAD
Criteria

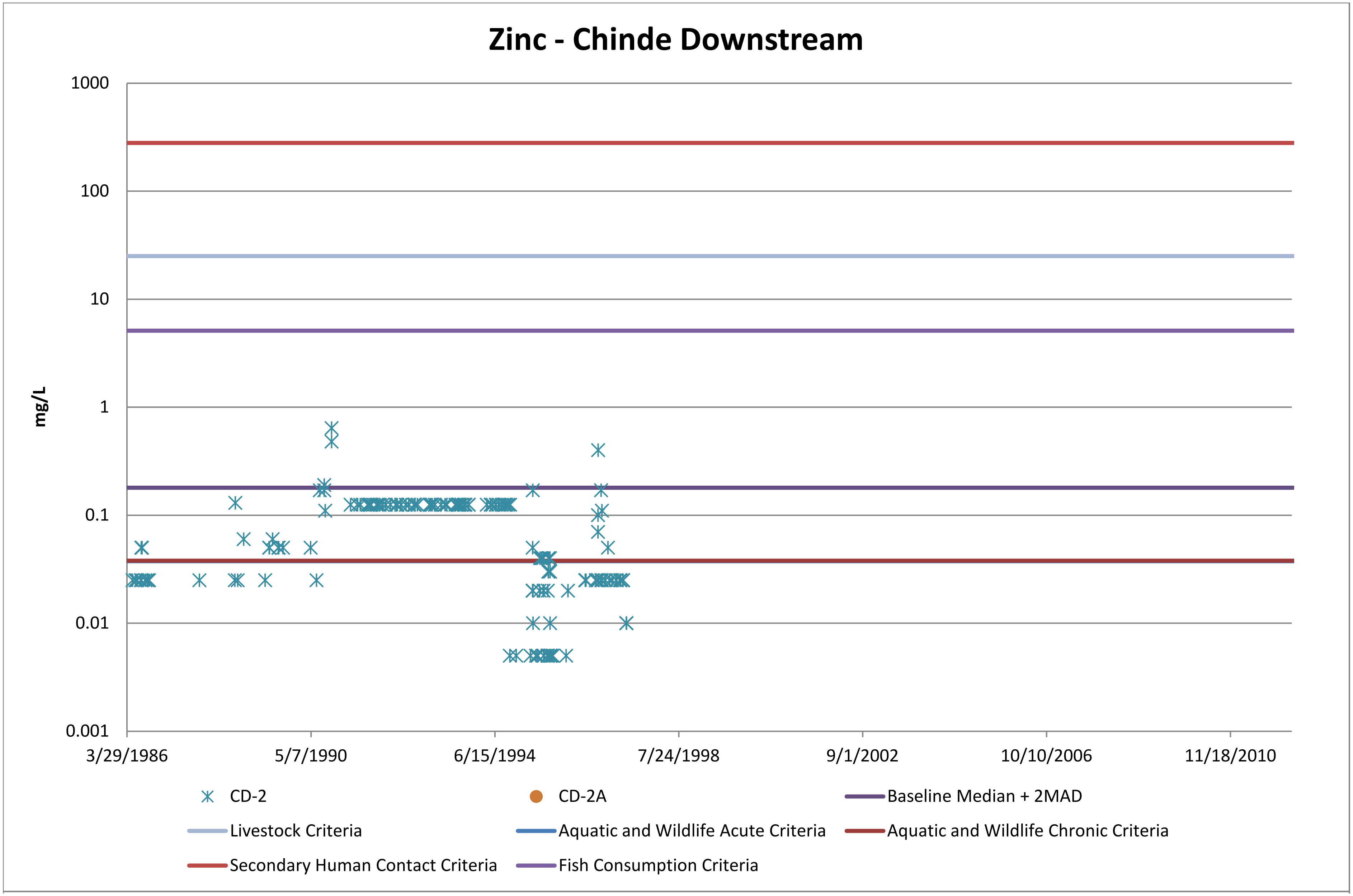

Radium - Chinde Downstream
100
10
1
0.1
mg/L
3/29/1986
5/7/1990
6/15/1994
7/24/1998
9/1/2002
10/10/2006
11/18/2010
CD-2
CD-2A
Baseline Median + 2MAD
Livestock Criteria

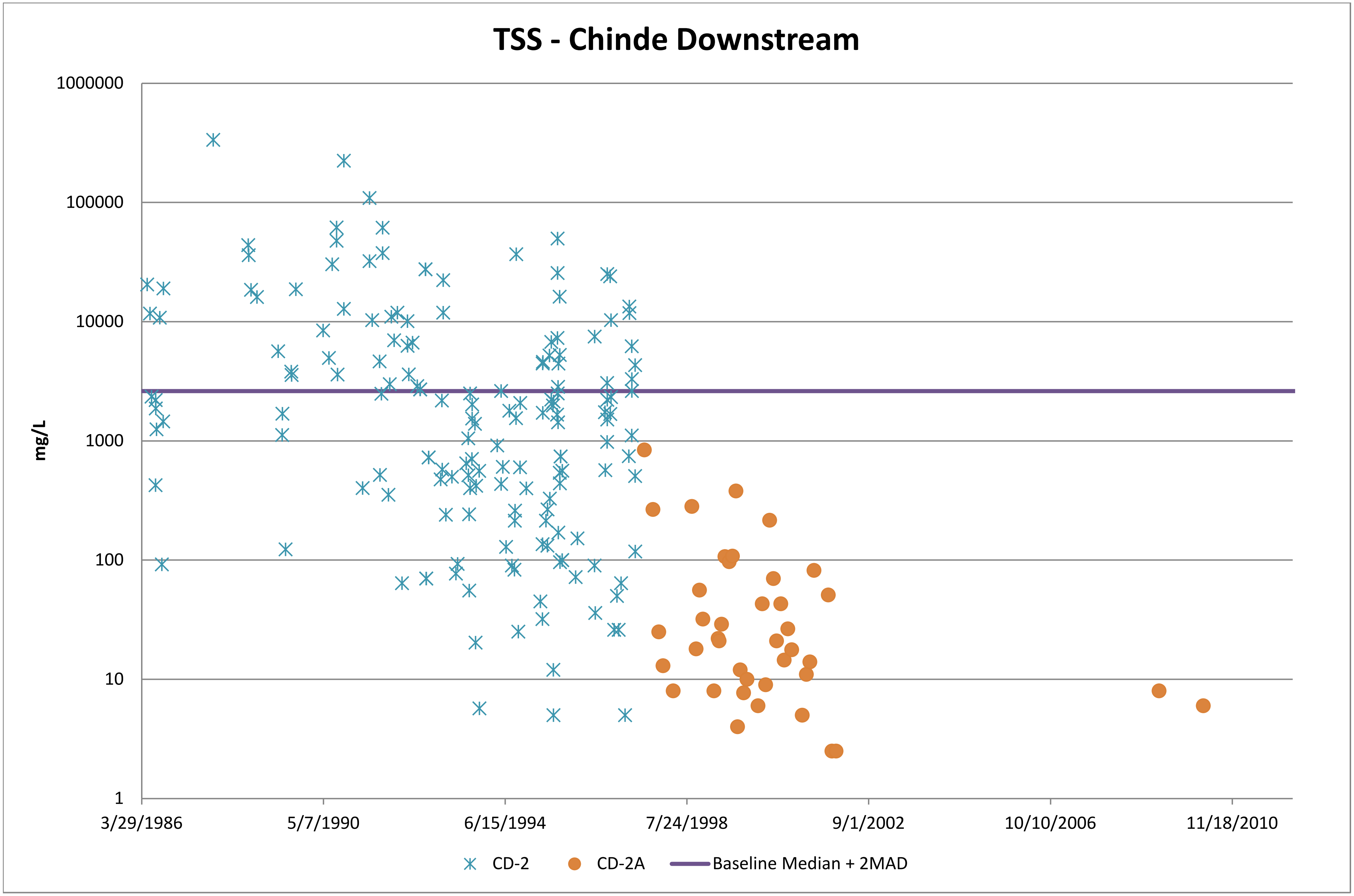

Selenium - Chinde Downstream
mg/L
10
1
0.1
0.01
0.001
0.0001
3/29/1986
5/7/1990
6/15/1994
7/24/1998
9/1/2002
10/10/2006
11/18/2010
CD-2
CD-2A
Baseline Median + 2MAD
Livestock Criteria
Aquatic & Wildlife Acute Criteria
Aquatic & Wildlife Chronic Criteria
Secondary Human Contact Criteria
Fish Consumption Criteria

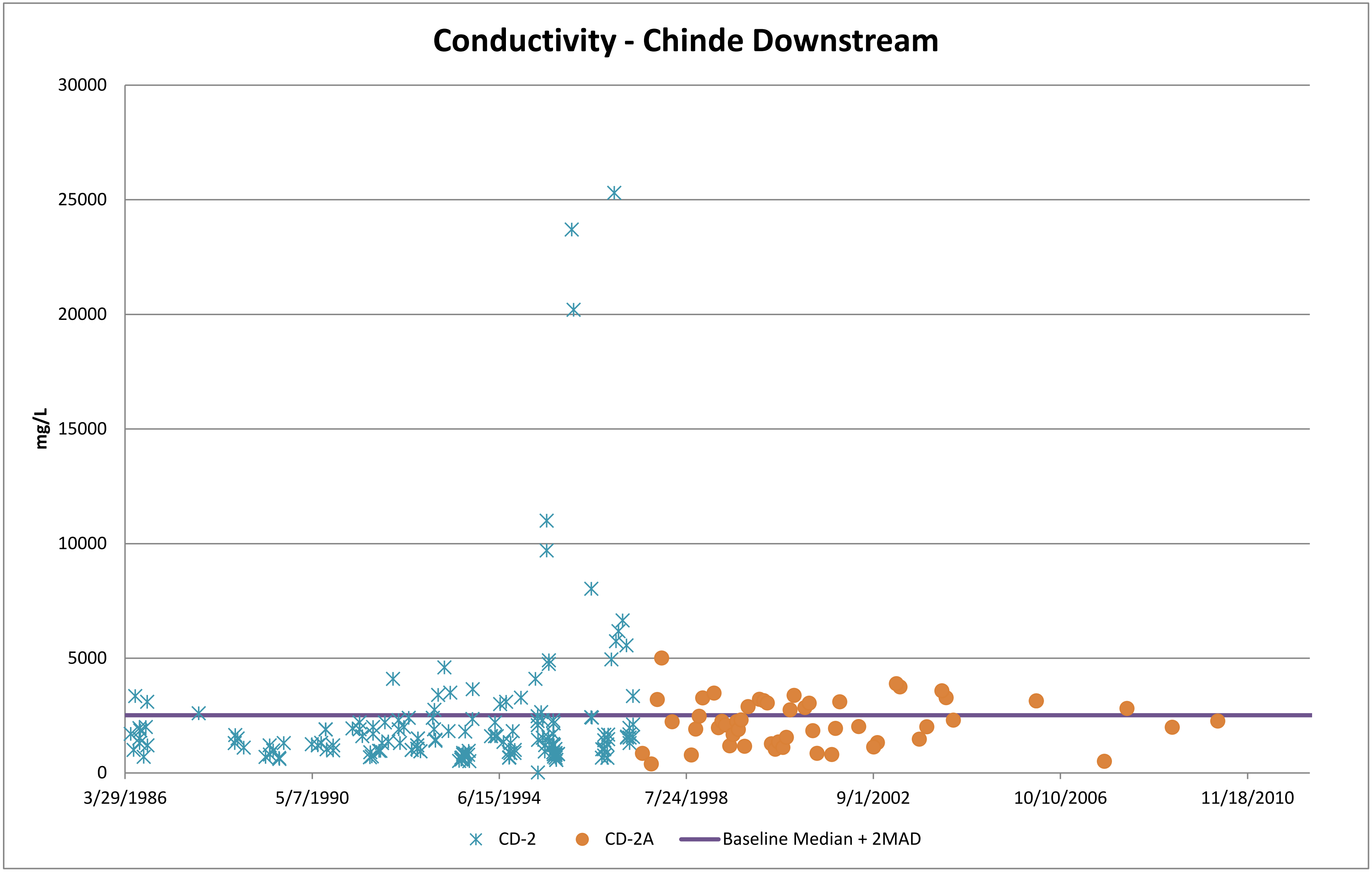

Silver - Chinde Downstream
10
1
0.1
0.01
0.001
0.0001
mg/L
3/29/1986
5/7/1990
6/15/1994
7/24/1998
9/1/2002
10/10/2006
11/18/2010
CD-2
CD-2A
Baseline Median + 2MAD
Aquatic & Wildlife Acute Criteria
Secondary Human Contact Criteria
Fish Consumption Criteria

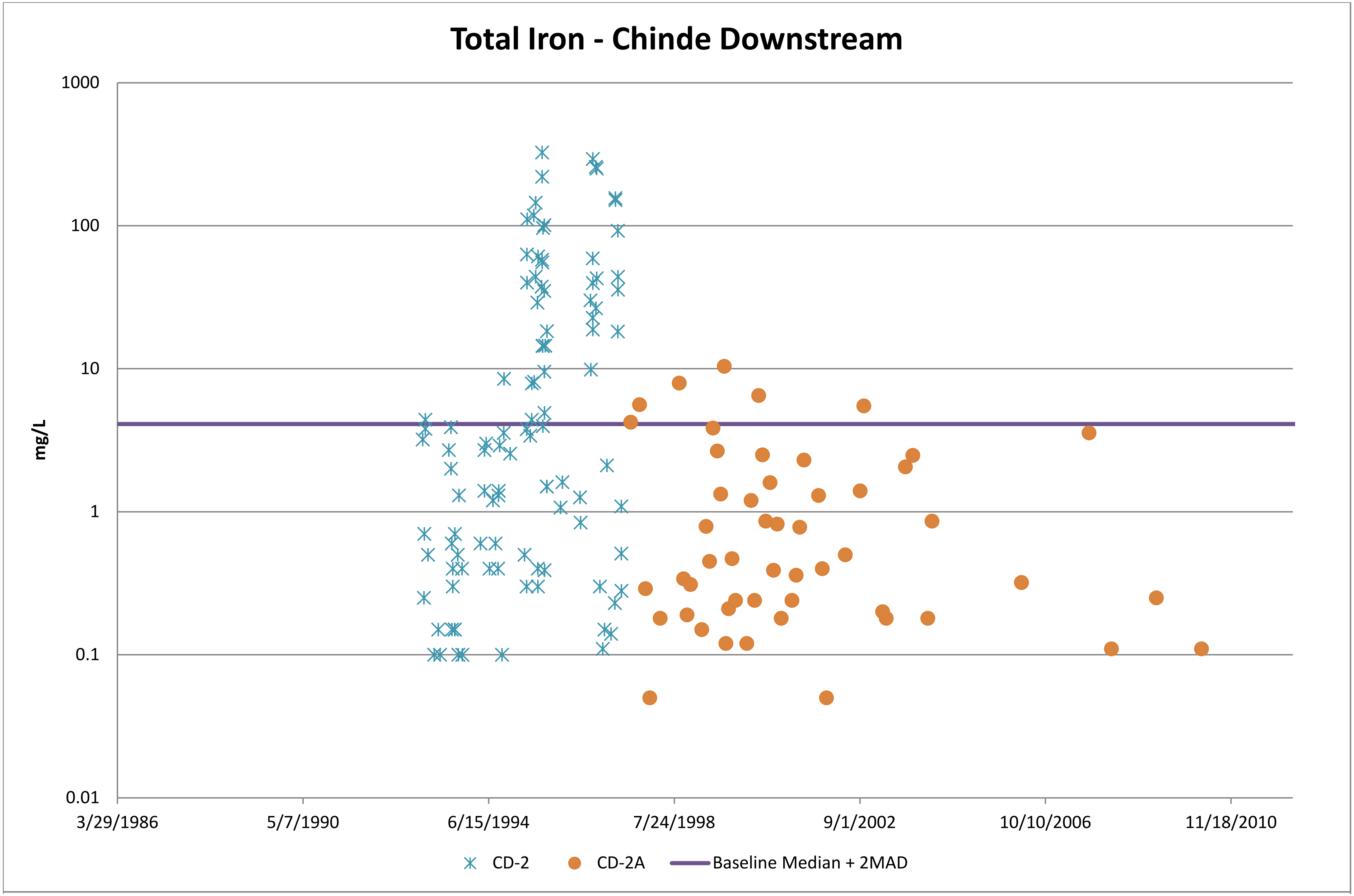

Sulfate - Chinde Downstream
mg/L
6000
5000
4000
3000
2000
1000
0
3/29/1986
5/7/1990
6/15/1994
7/24/1998
9/1/2002
10/10/2006
11/18/2010
CD-2
CD-2A
Baseline Median + 2MAD
Livestock Criteria

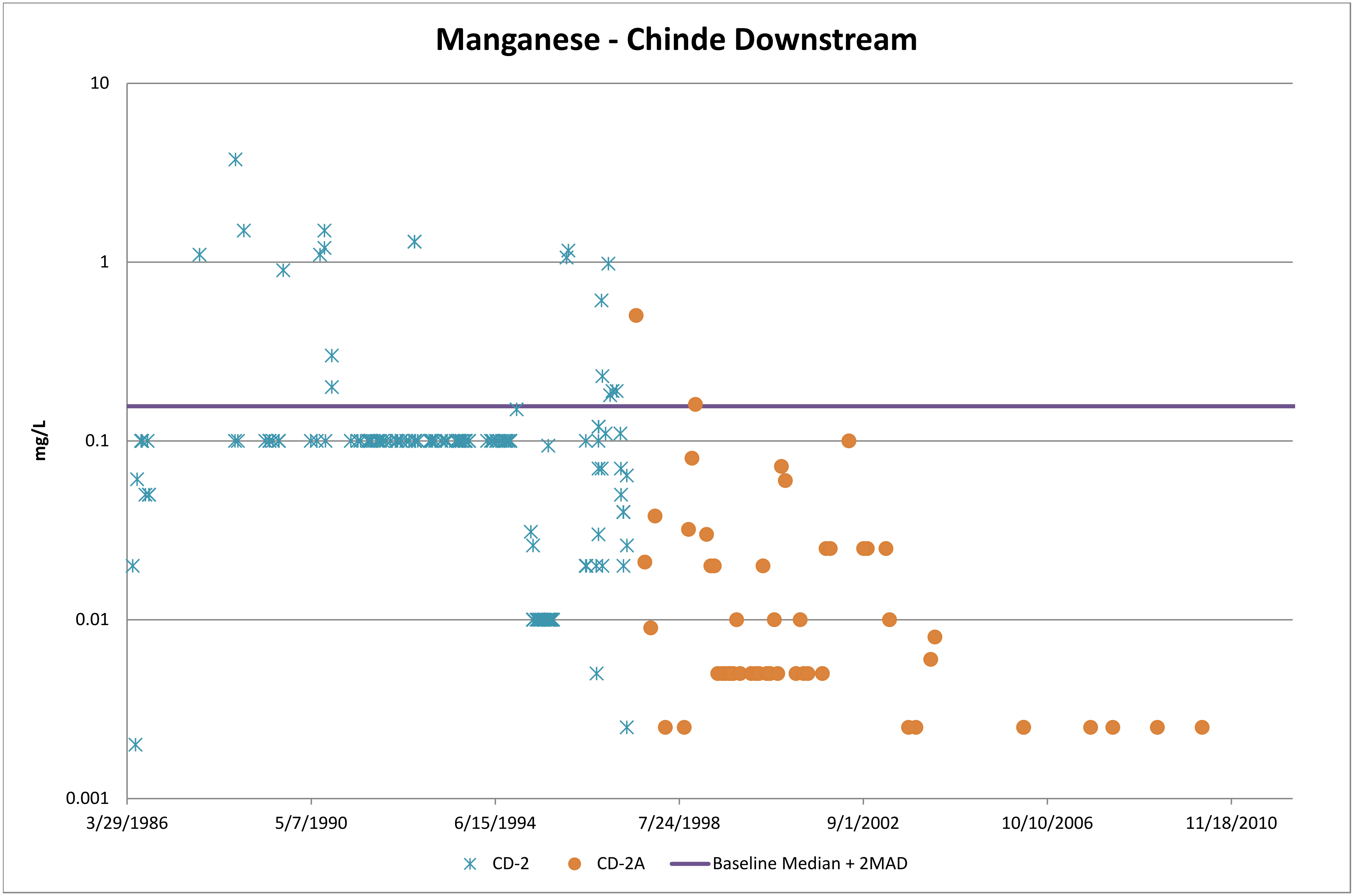

TDS - Chinde Downstream
mg/L
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
3/29/1986
5/7/1990
6/15/1994
7/24/1998
9/1/2002
10/10/2006
11/18/2010
CD-2
CD-2A
Baseline Median + 2MAD
Livestock Criteria

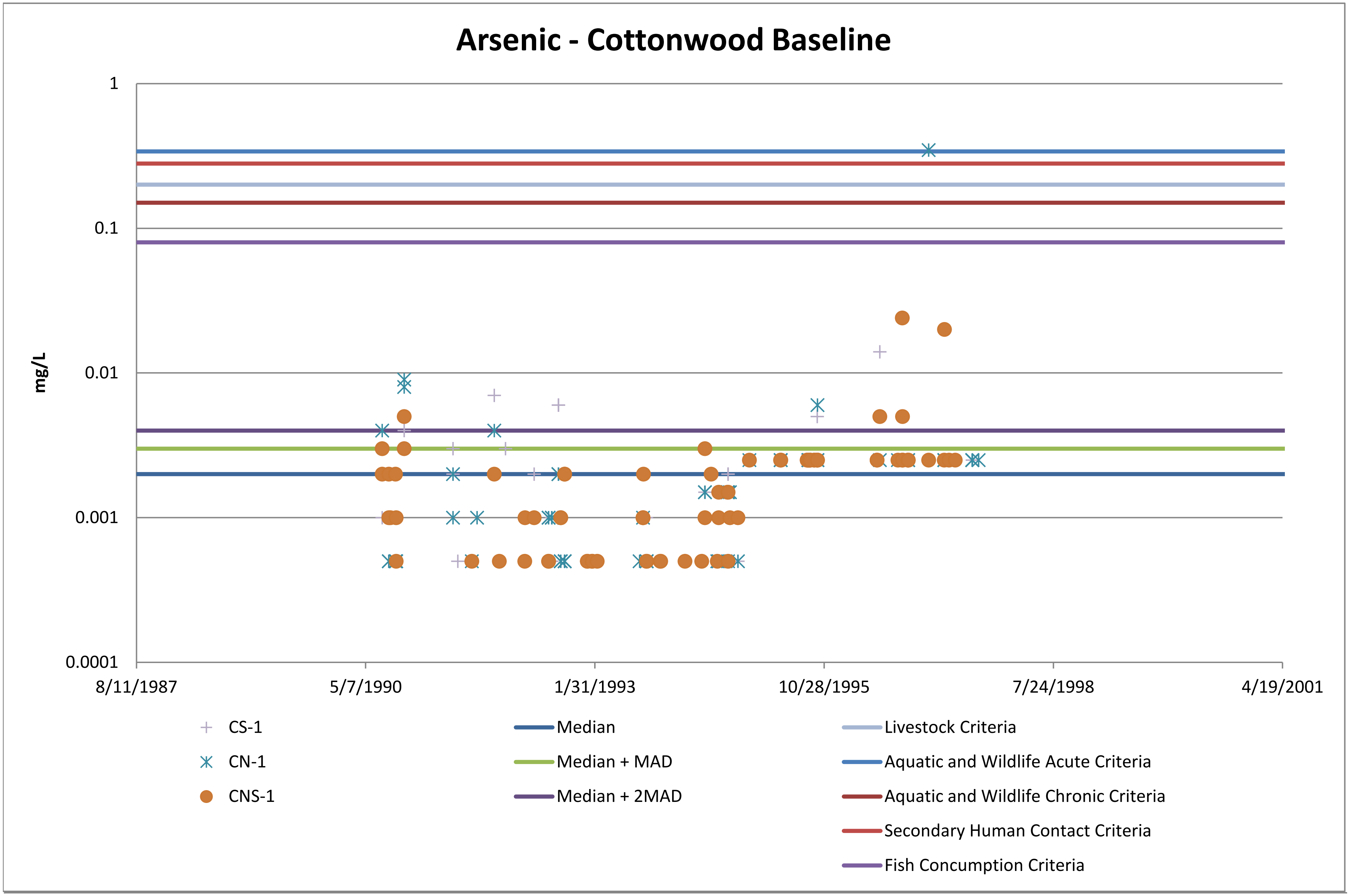

Zinc - Chinde Downstream
mg/L
1000
100
10
1
0.1
0.01
0.001
3/29/1986
5/7/1990
6/15/1994
7/24/1998
9/1/2002
10/10/2006
11/18/2010
CD-2
CD-2A
Baseline Median + 2MAD
Livestock Criteria
Aquatic and Wildlife Acute Criteria
Aquatic and Wildlife Chronic Criteria
Secondary Human Contact Criteria
Fish Consumption Criteria

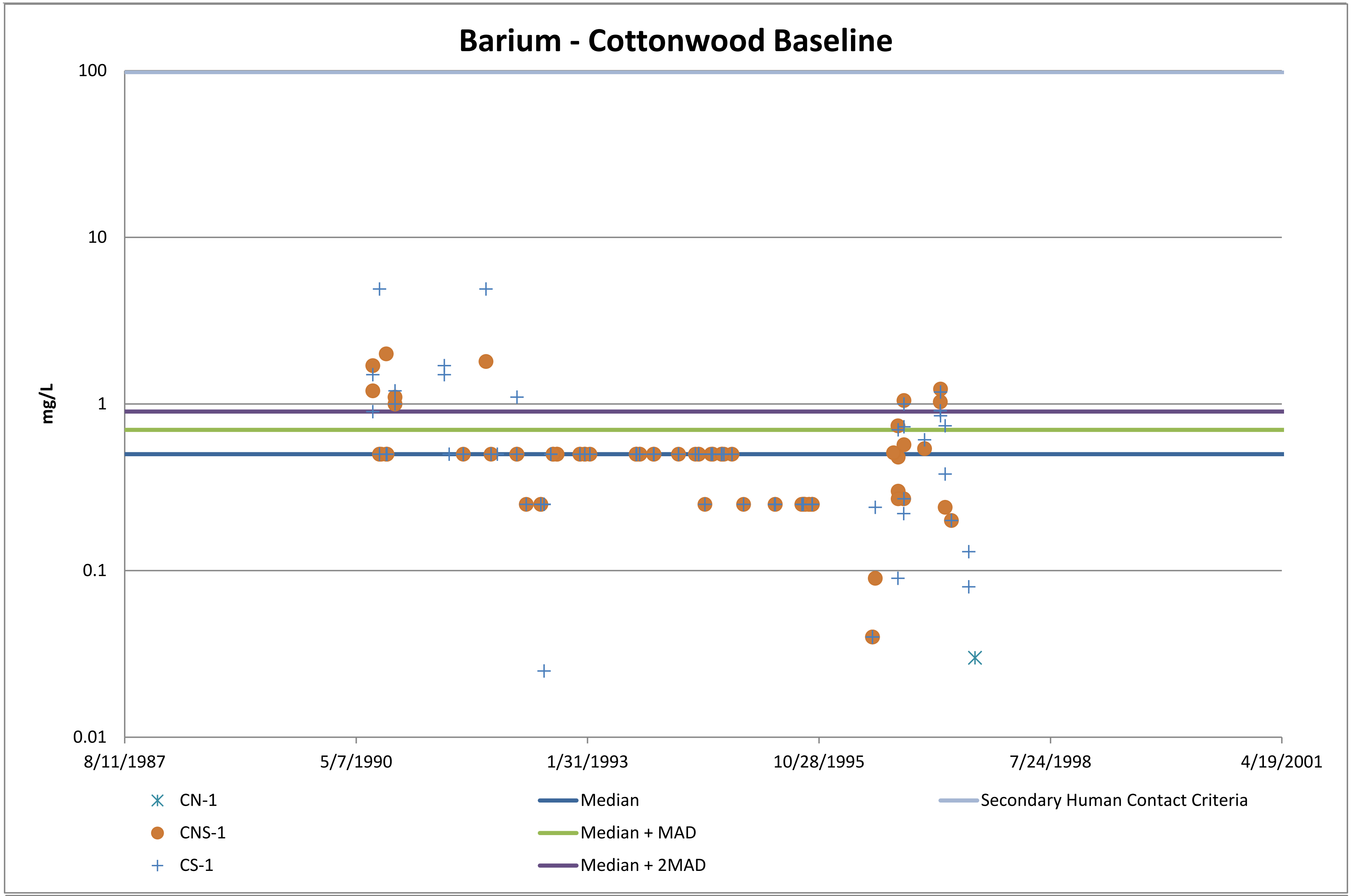

TSS - Chinde Downstream
mg/L
1000000
100000
10000
1000
100
10
1
3/29/1986
5/7/1990
6/15/1994
7/24/1998
9/1/2002
10/10/2006
11/18/2010
CD-2
CD-2A
Baseline Median + 2MAD

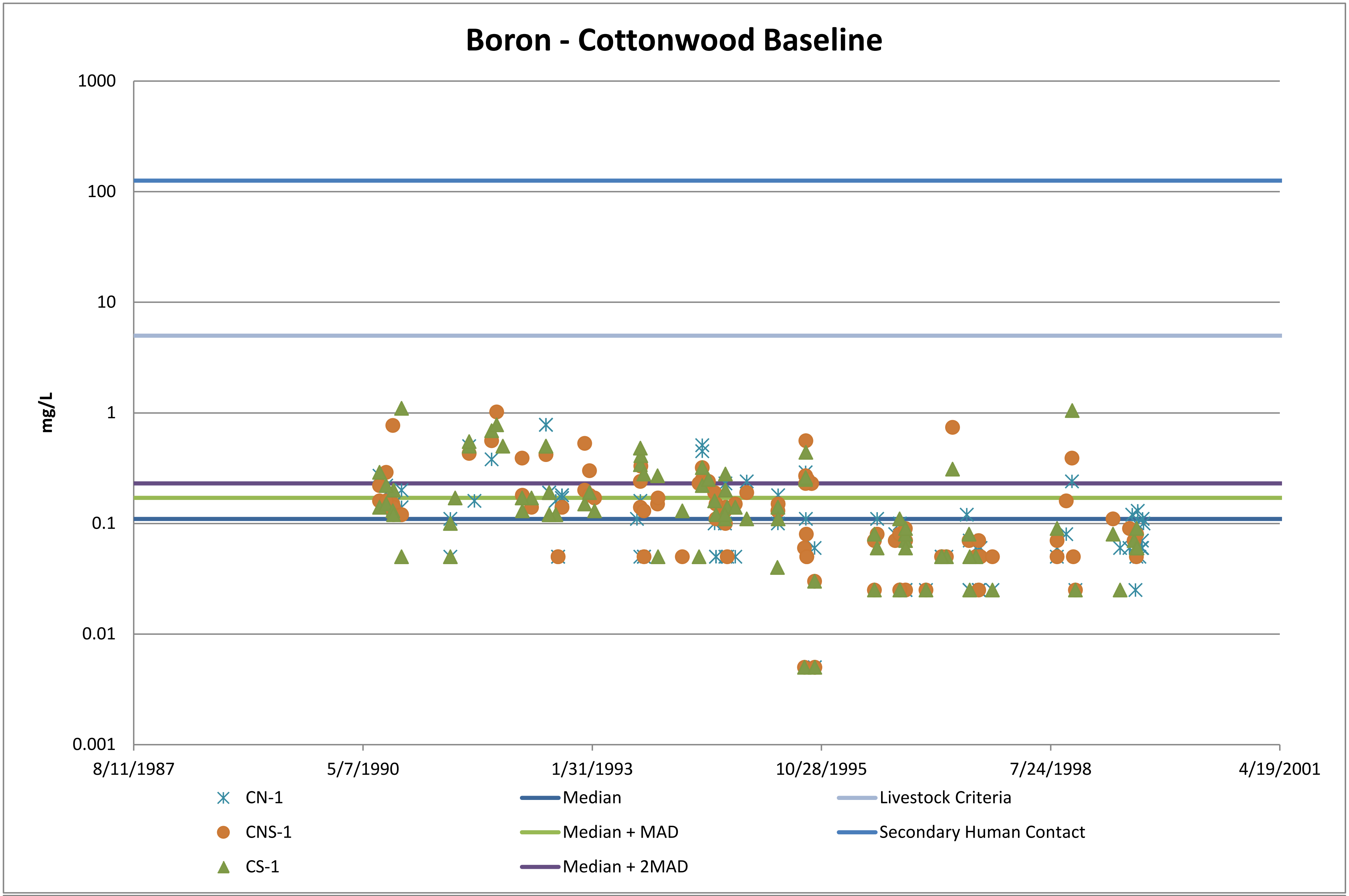

Conductivity - Chinde Downstream
mg/L
30000
25000
20000
15000
10000
5000
0
3/29/1986
5/7/1990
6/15/1994
7/24/1998
9/1/2002
10/10/2006
11/18/2010
CD-2
CD-2A
Baseline Median + 2MAD

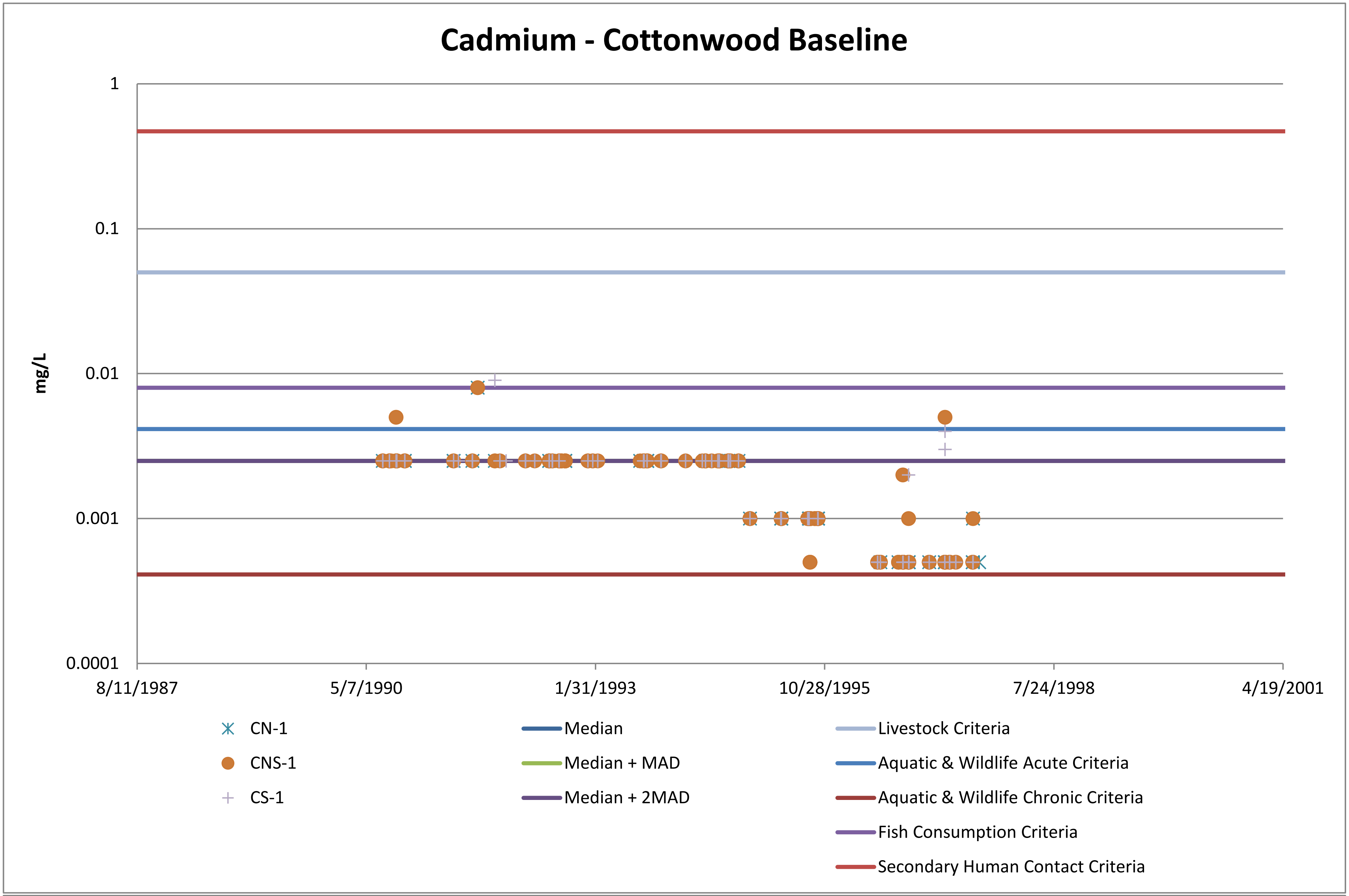

Total Iron - Chinde Downstream
1000
100
10
1
0.1
0.01
mg/L
3/29/1986
5/7/1990
6/15/1994
7/24/1998
9/1/2002
10/10/2006
11/18/2010
CD-2
CD-2A
Baseline Median + 2MAD

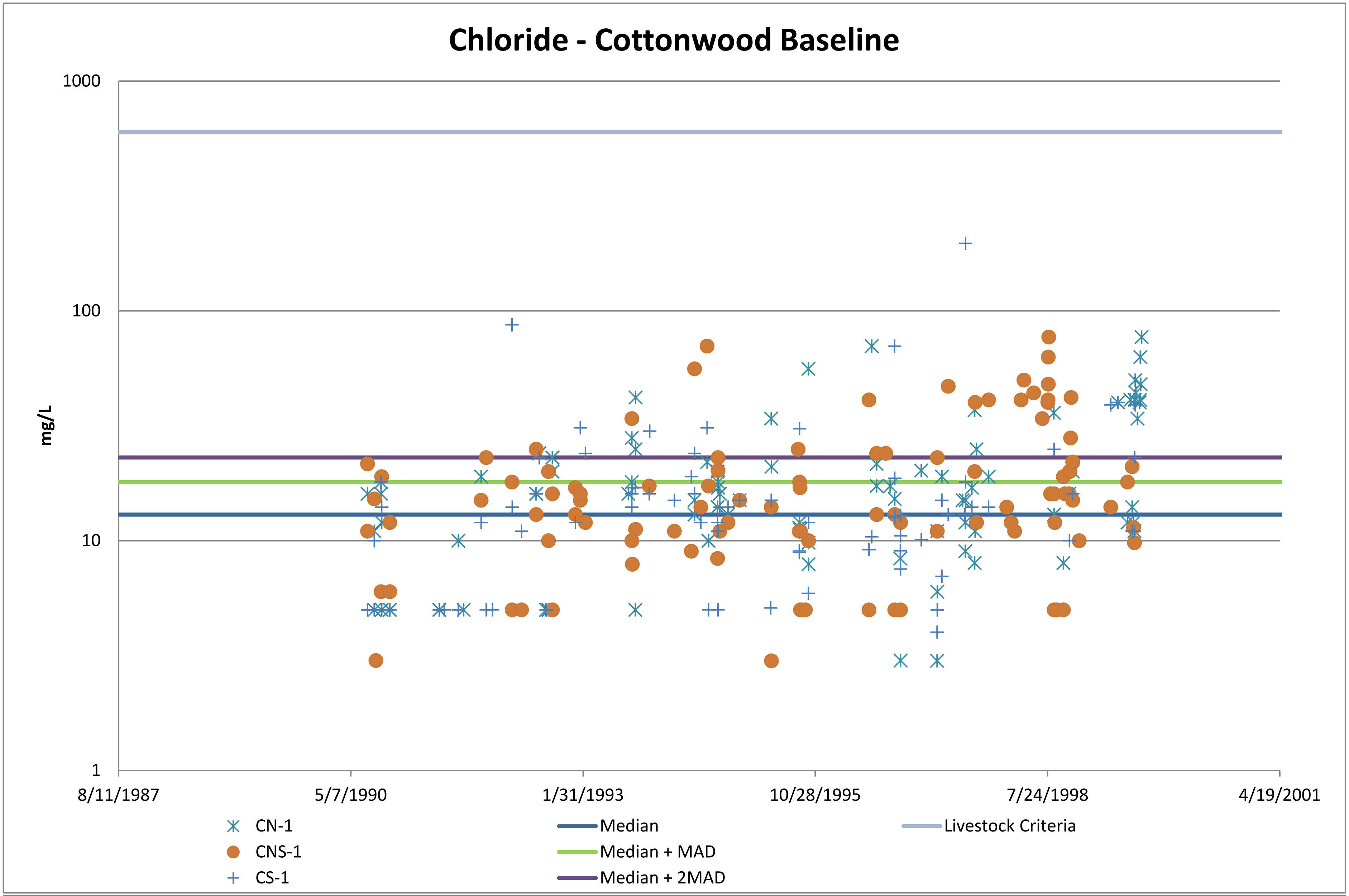

Manganese - Chinde Downstream
10
1
0.1
0.01
0.001
mg/L
3/29/1986
5/7/1990
6/15/1994
7/24/1998
9/1/2002
10/10/2006
11/18/2010
CD-2
CD-2A
Baseline Median + 2MAD

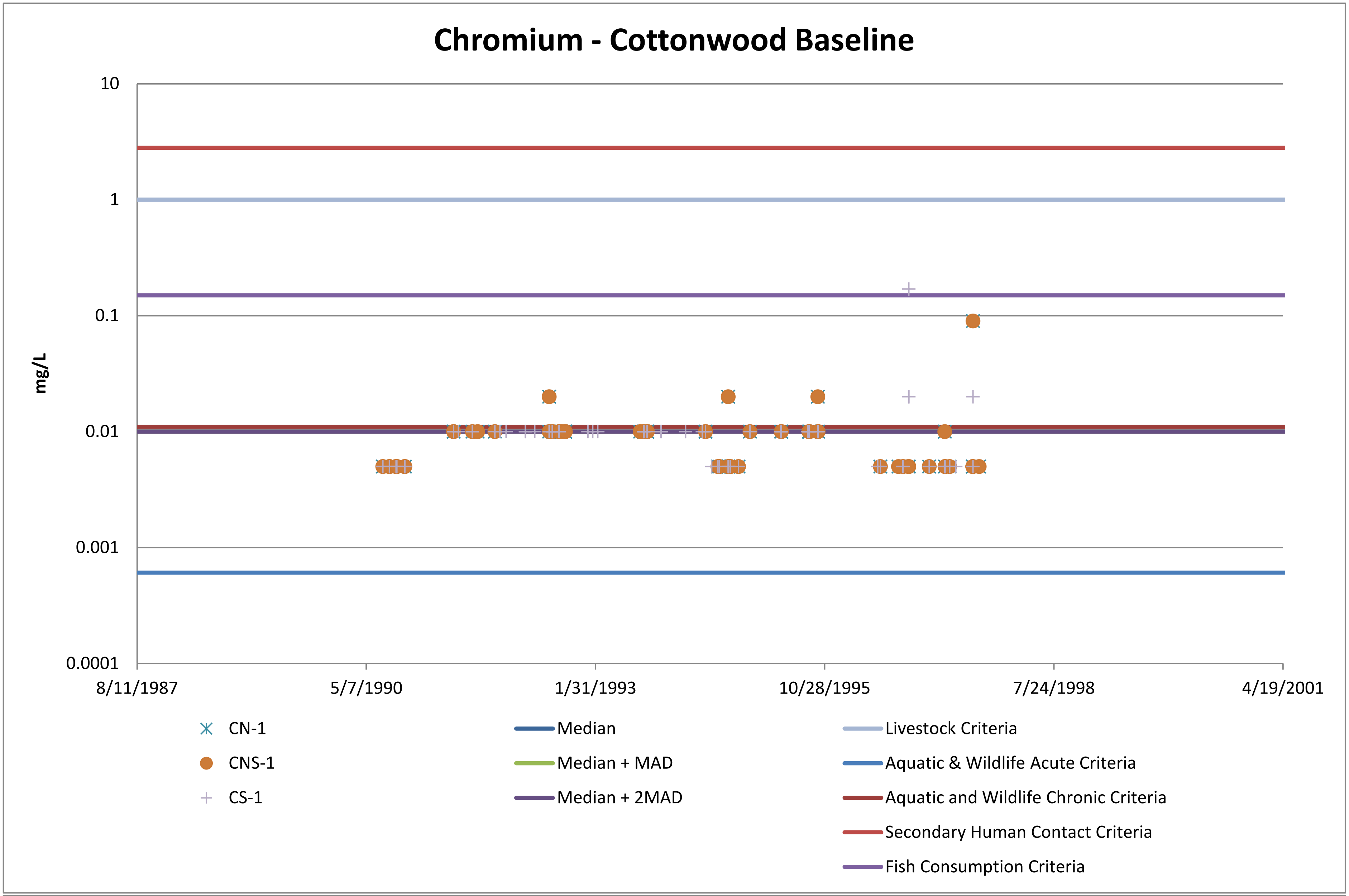

Arsenic - Cottonwood Baseline
mg/L
1
0.1
0.01
0.001
0.0001
8/11/1987
5/7/1990
1/31/1993
10/28/1995
7/24/1998
4/19/2001
CS-1
CN-1
CNS-1
Median
Median + MAD
Median + 2MAD
Livestock Criteria
Aquatic and Wildlife Acute Criteria
Aquatic and Wildlife Chronic Criteria
Secondary Human Contact Criteria
Fish Concumption Criteria

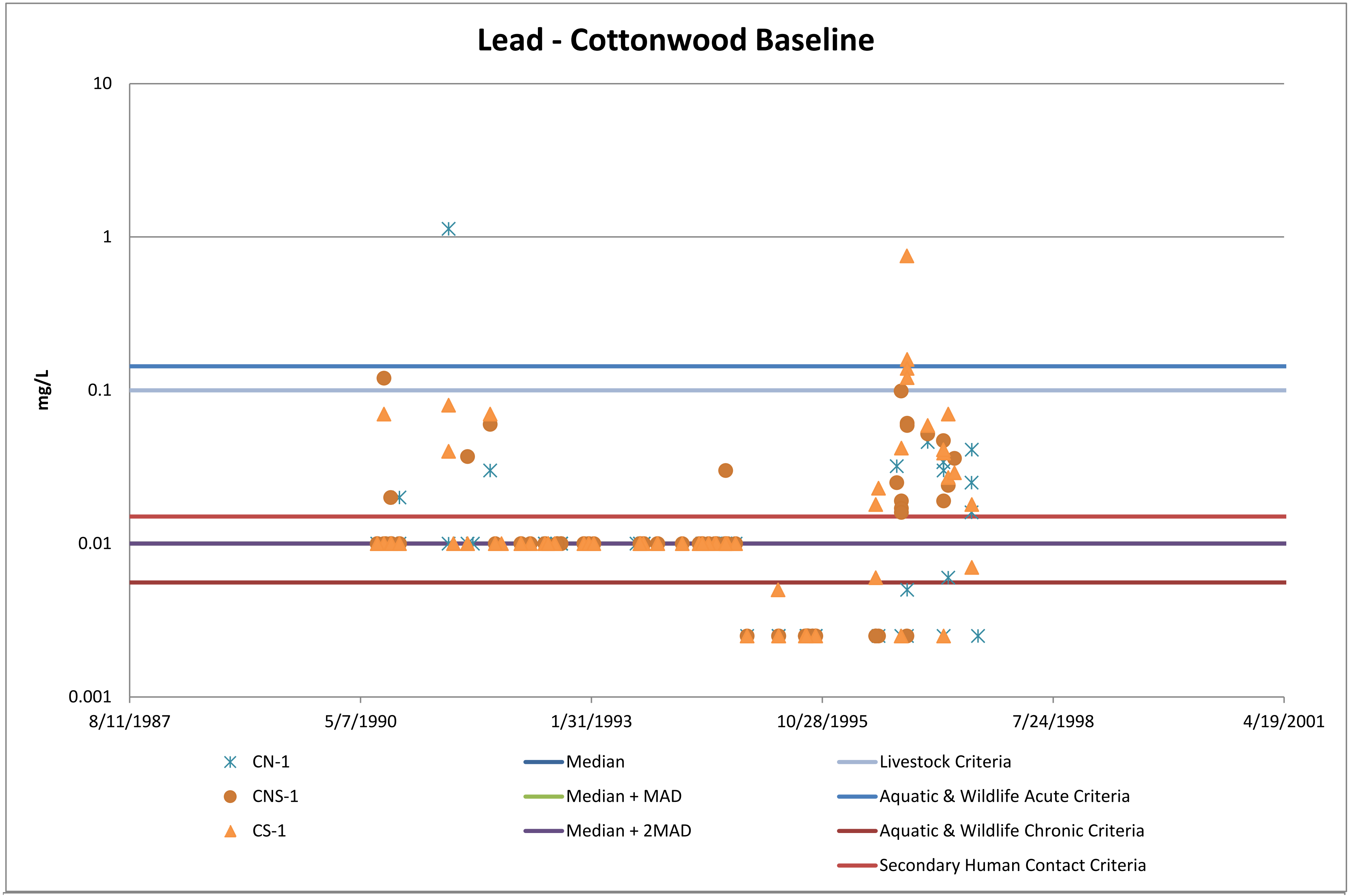

Barium - Cottonwood Baseline
100
10
1
0.1
0.01
mg/L
8/11/1987
5/7/1990
1/31/1993
10/28/1995
7/24/1998
4/19/2001
CN-1
CNS-1
CS-1
Median
Median + MAD
Median + 2MAD
Secondary Human Contact Criteria

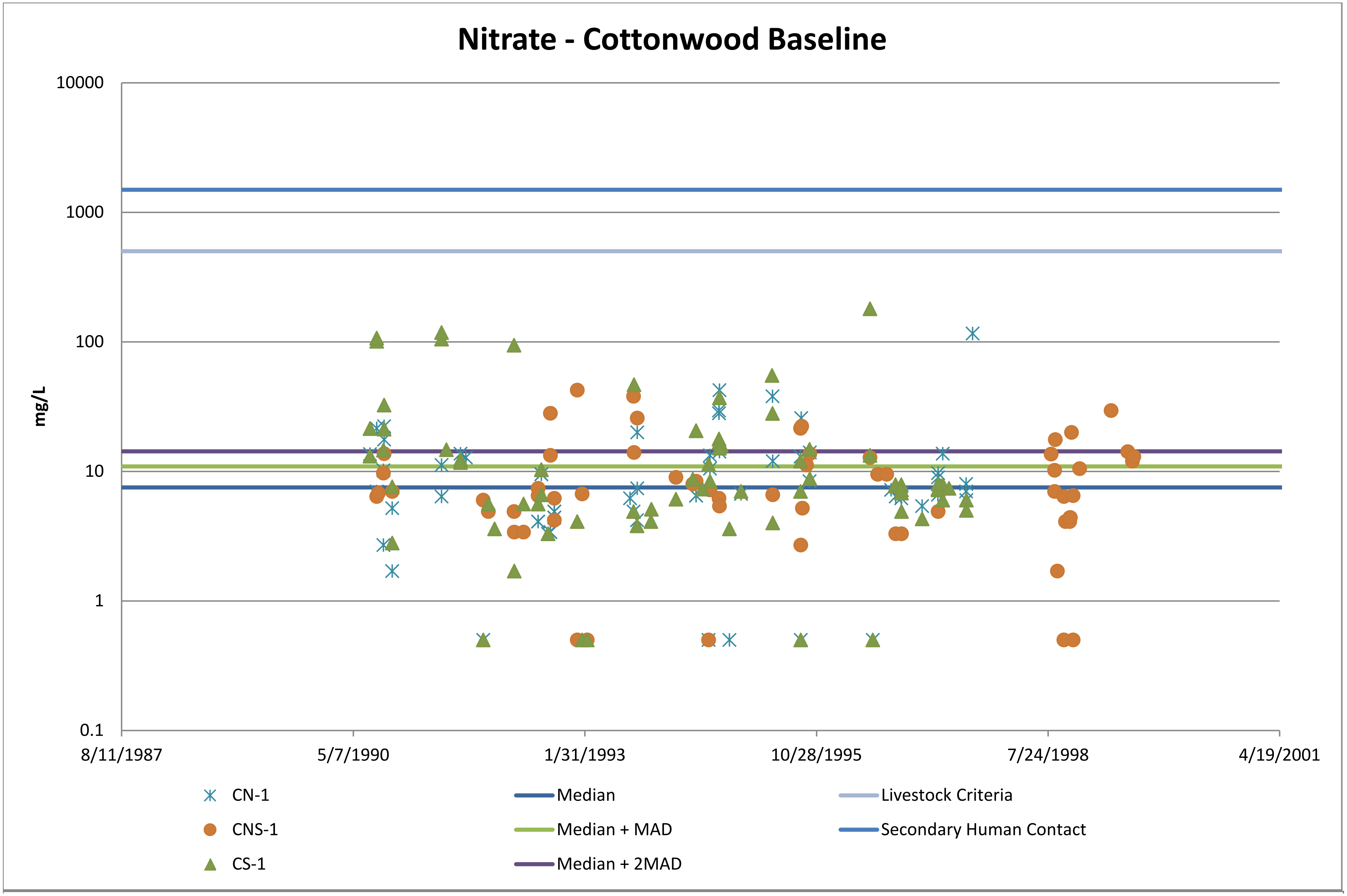

Boron - Cottonwood Baseline
mg/L
1000
100
10
1
0.1
0.01
0.001
8/11/1987
5/7/1990
1/31/1993
10/28/1995
7/24/1998
4/19/2001
CN-1
CNS-1
CS-1
Median
Median + MAD
Median + 2MAD
Livestock Criteria
Secondary Human Contact

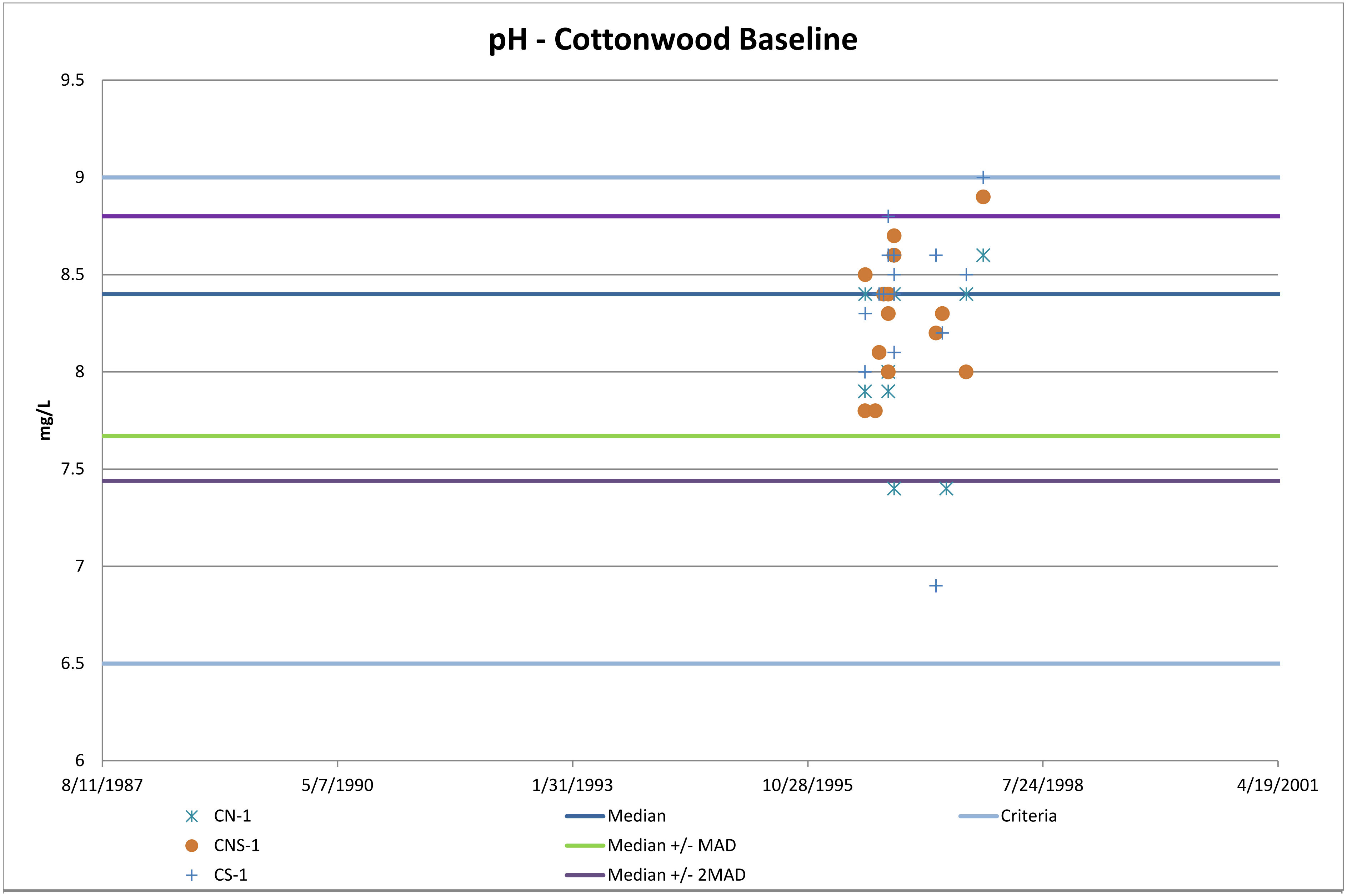

Cadmium - Cottonwood Baseline
mg/L
1
0.1
0.01
0.001
0.0001
8/11/1987
5/7/1990
1/31/1993
10/28/1995
7/24/1998
4/19/2001
CN-1
CNS-1
CS-1
Median
Median + MAD
Median + 2MAD
Livestock Criteria
Aquatic & Wildlife Acute Criteria
Aquatic & Wildlife Chronic Criteria
Fish Consumption Criteria
Secondary Human Contact Criteria

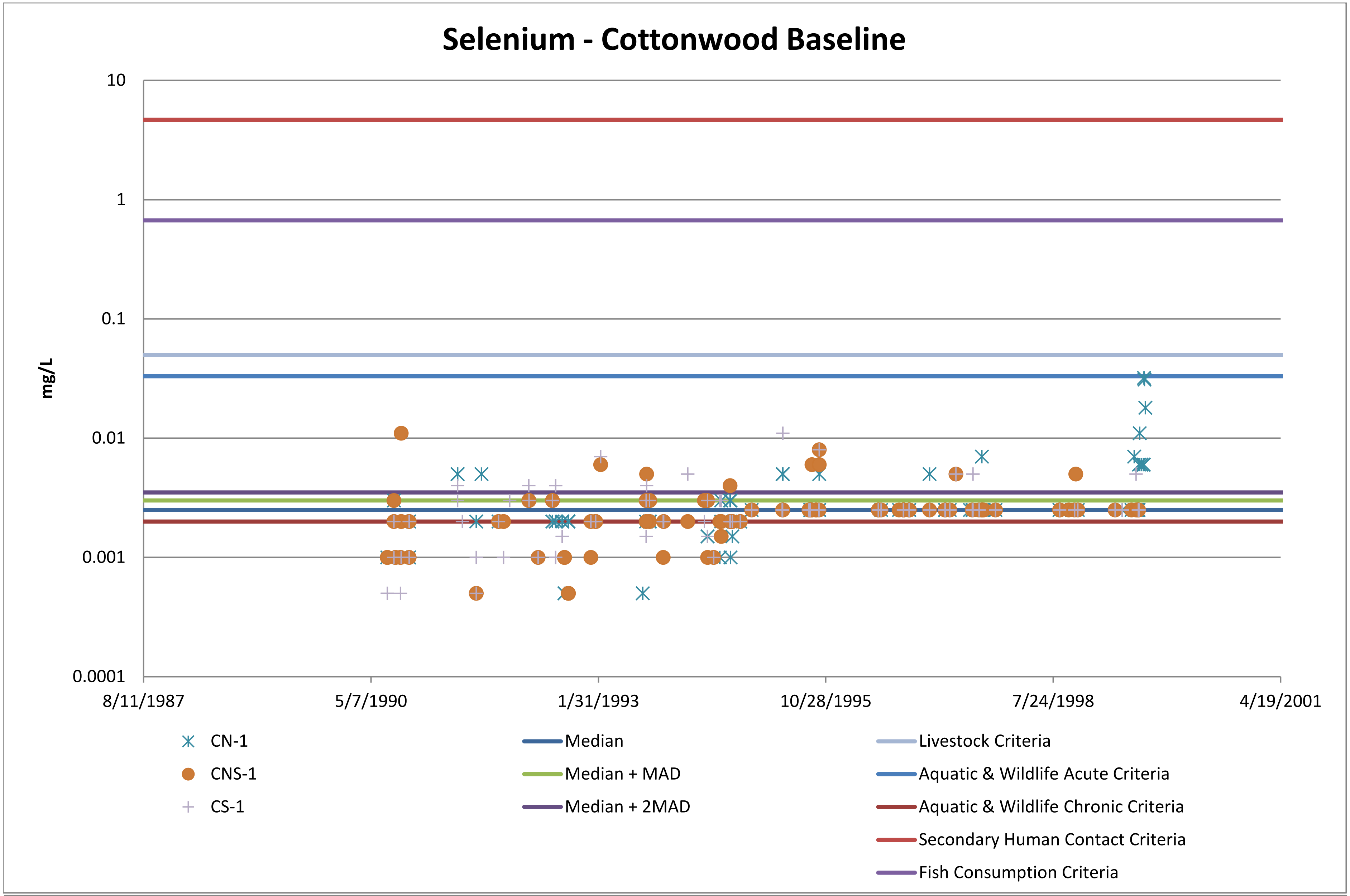

Chloride - Cottonwood Baseline
mg/L
1000
100
10
1
8/11/1987
5/7/1990
1/31/1993
10/28/1995
7/24/1998
4/19/2001
CN-1
CNS-1
CS-1
Median
Median + MAD
Median + 2MAD
Livestock Criteria

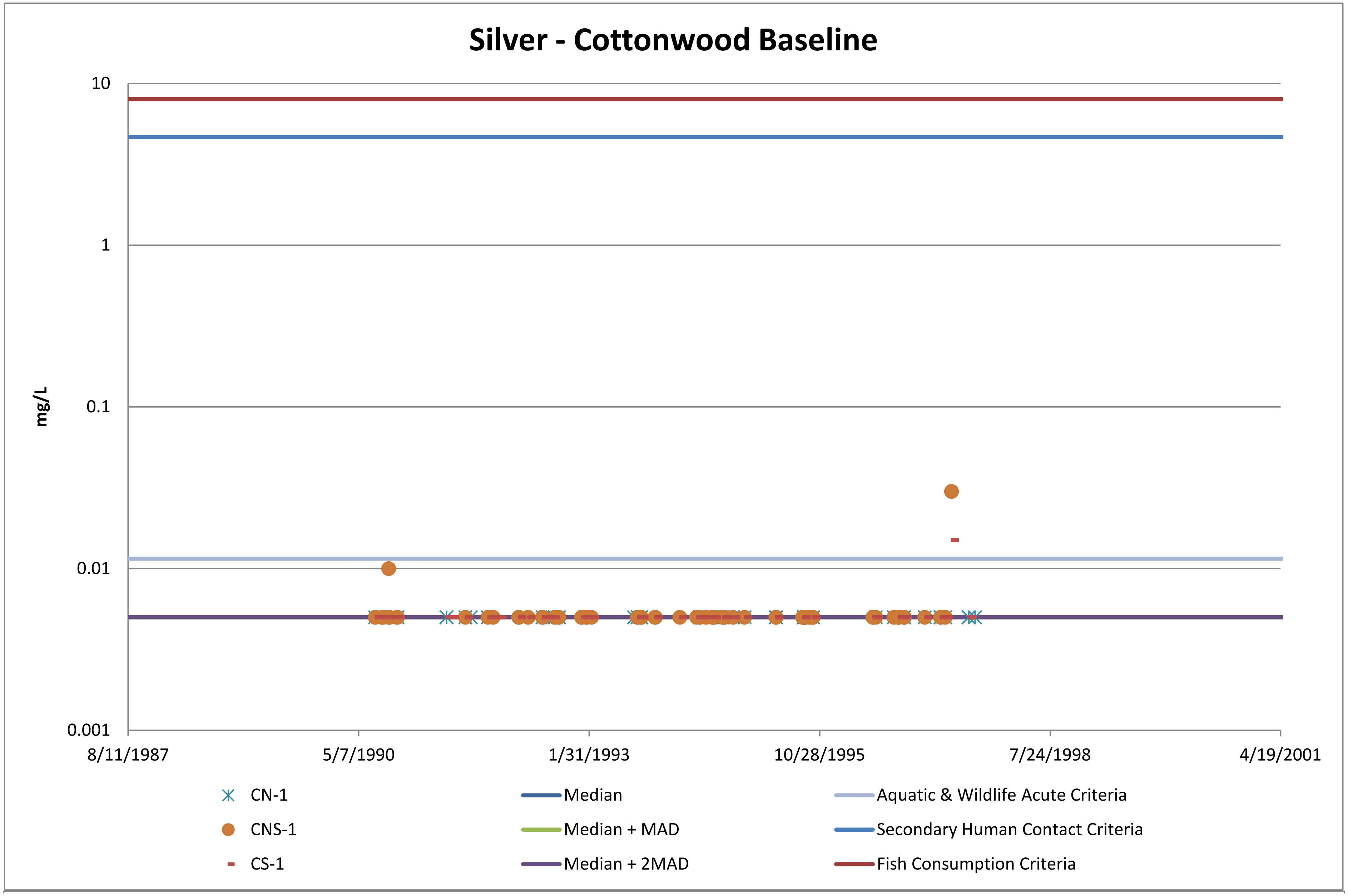

Chromium - Cottonwood Baseline
mg/L
10
1
0.1
0.01
0.001
0.0001
8/11/1987
5/7/1990
1/31/1993
10/28/1995
7/24/1998
4/19/2001
CN-1
CNS-1
CS-1
Median
Median + MAD
Median + 2MAD
Livestock Criteria
Aquatic & Wildlife Acute Criteria
Aquatic and Wildlife Chronic Criteria
Secondary Human Contact Criteria
Fish Consumption Criteria

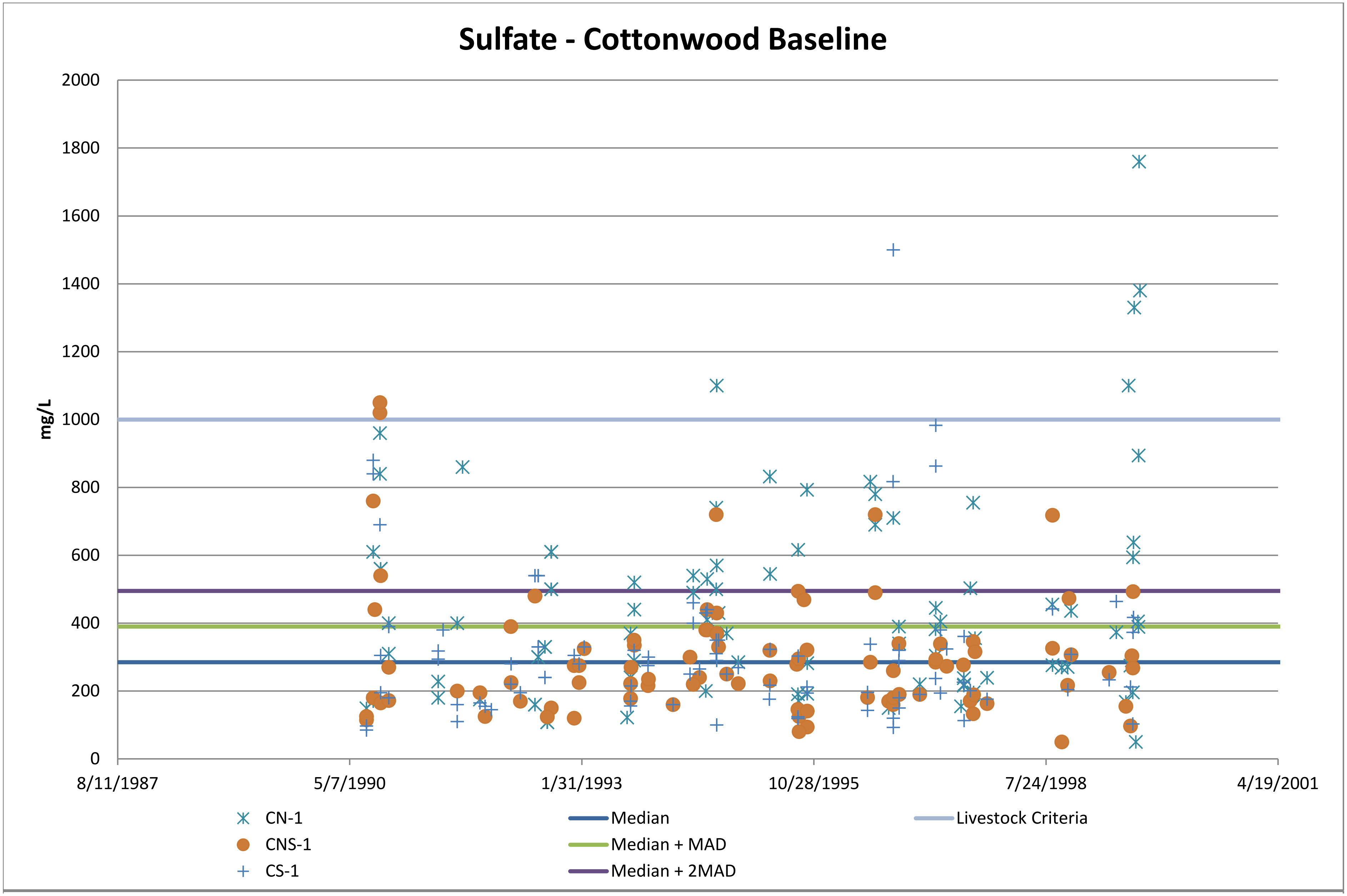

Lead - Cottonwood Baseline
mg/L
10
1
0.1
0.01
0.001
8/11/1987
5/7/1990
1/31/1993
10/28/1995
7/24/1998
4/19/2001
CN-1
CNS-1
CS-1
Median
Median + MAD
Median + 2MAD
Livestock Criteria
Aquatic & Wildlife Acute Criteria
Aquatic & Wildlife Chronic Criteria
Secondary Human Contact Criteria

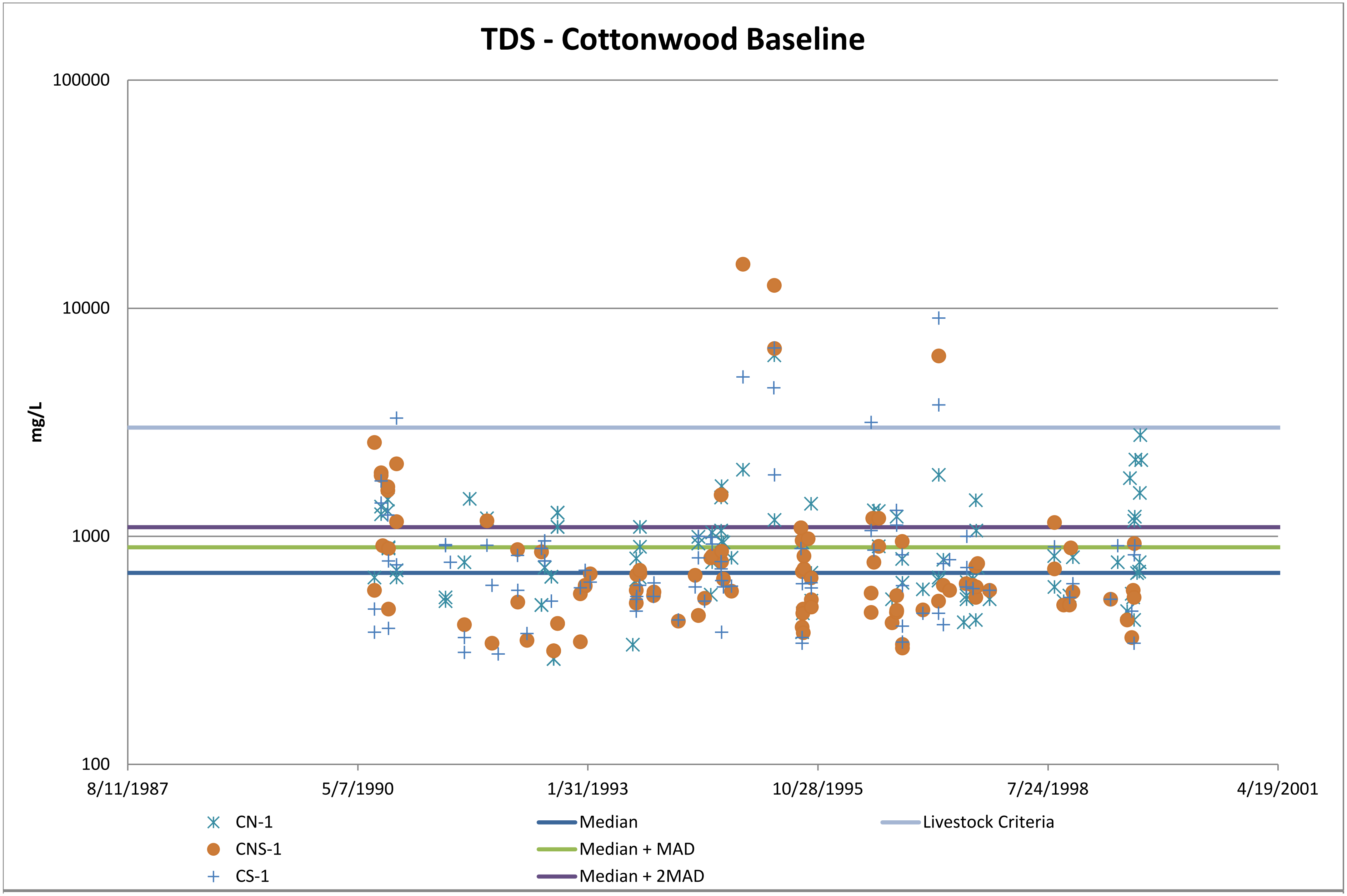

Nitrate - Cottonwood Baseline
10000
1000
100
10
1
0.1
mg/L
8/11/1987
5/7/1990
1/31/1993
10/28/1995
7/24/1998
4/19/2001
CN-1
CNS-1
CS-1
Median
Median + MAD
Median + 2MAD
Livestock Criteria
Secondary Human Contact

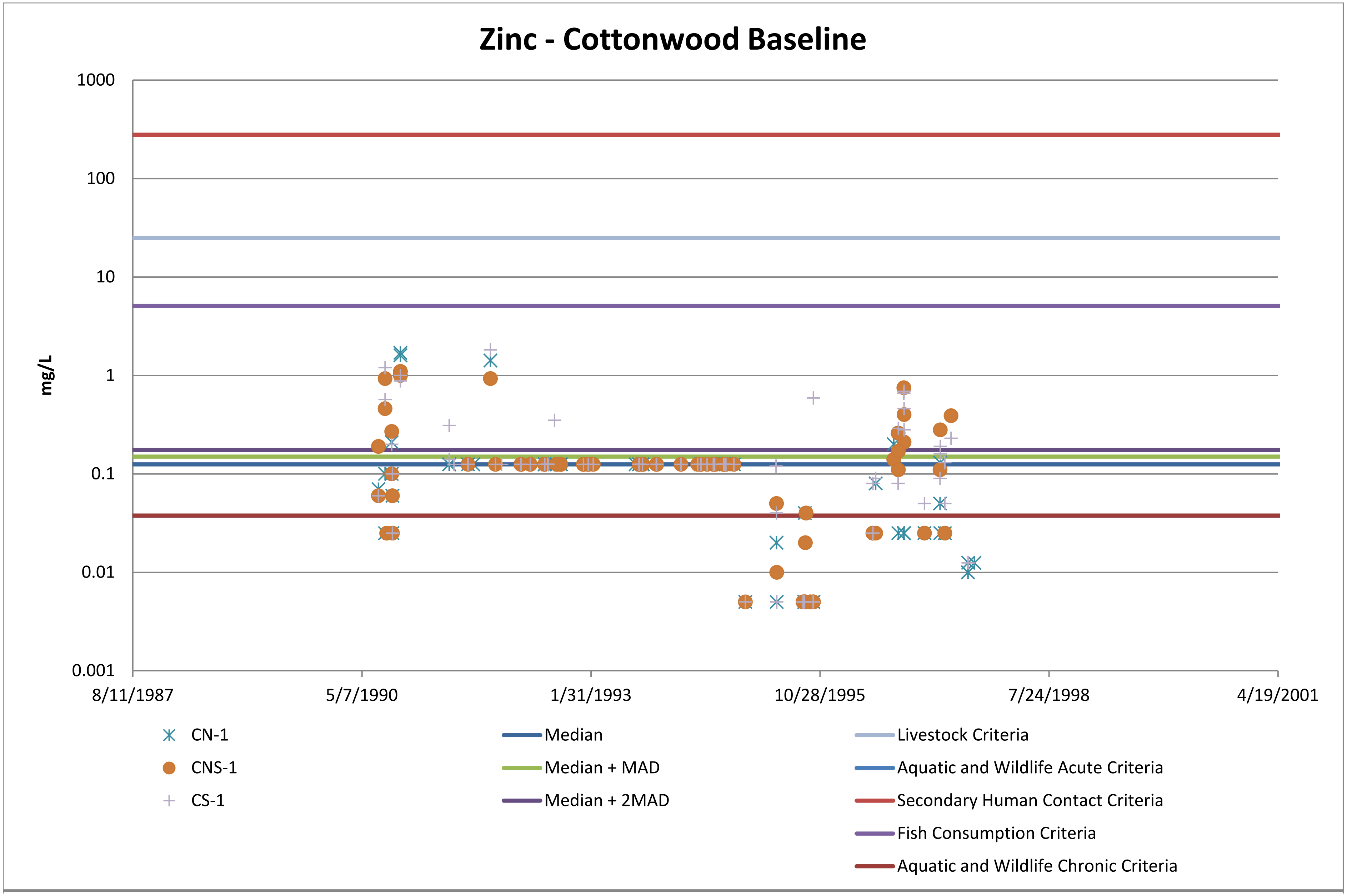

pH - Cottonwood Baseline
mg/L
9.5
9
8.5
8
7.5
7
6.5
6
8/11/1987
5/7/1990
1/31/1993
10/28/1995
7/24/1998
4/19/2001
CN-1
CNS-1
CS-1
Median
Median +/- MAD
Median +/- 2MAD
Criteria

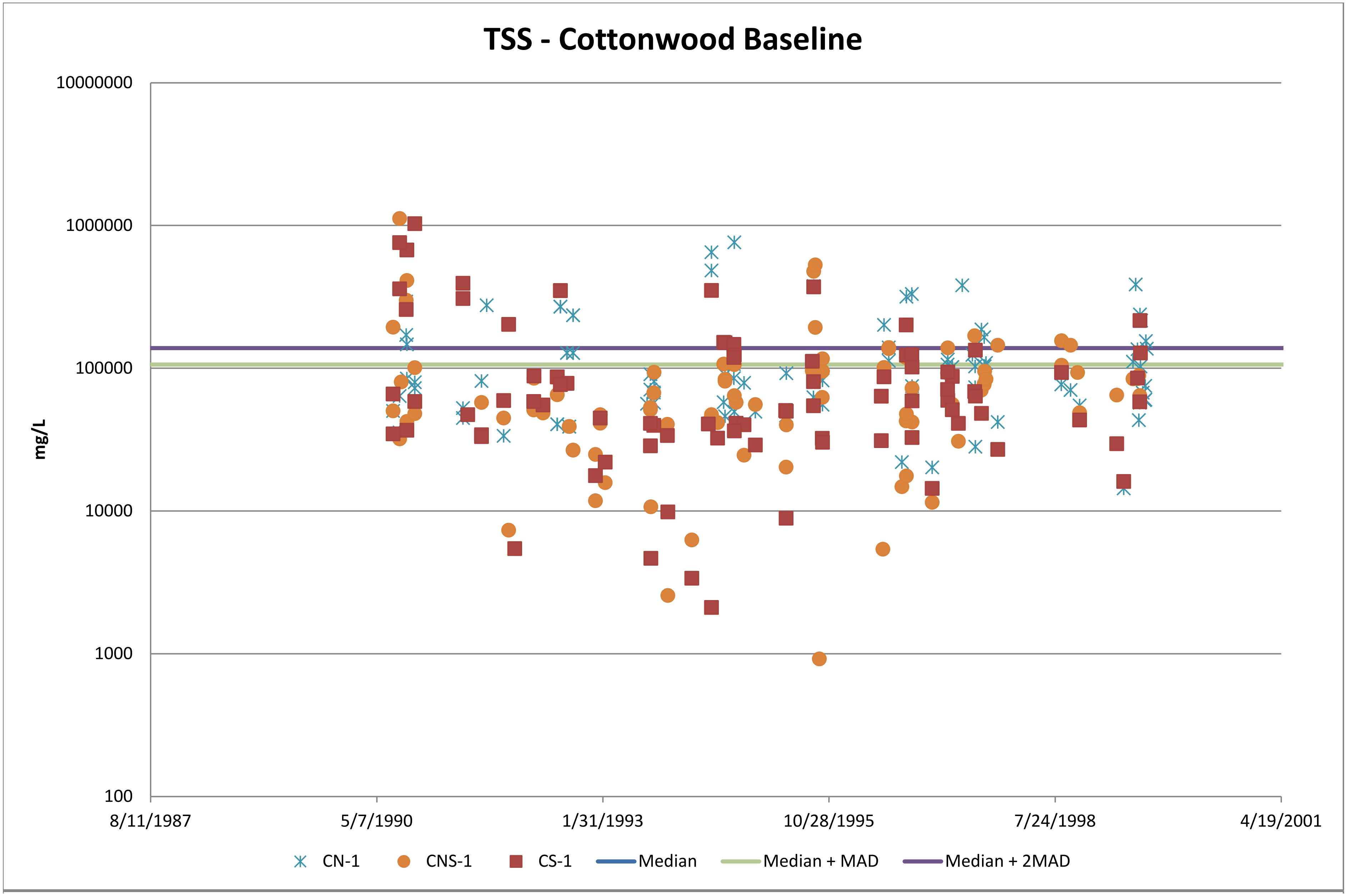

Selenium - Cottonwood Baseline
mg/L
10
1
0.1
0.01
0.001
0.0001
8/11/1987
5/7/1990
1/31/1993
10/28/1995
7/24/1998
4/19/2001
CN-1
CNS-1
CS-1
Median
Median + MAD
Median + 2MAD
Livestock Criteria
Aquatic & Wildlife Acute Criteria
Aquatic & Wildlife Chronic Criteria
Secondary Human Contact Criteria
Fish Consumption Criteria

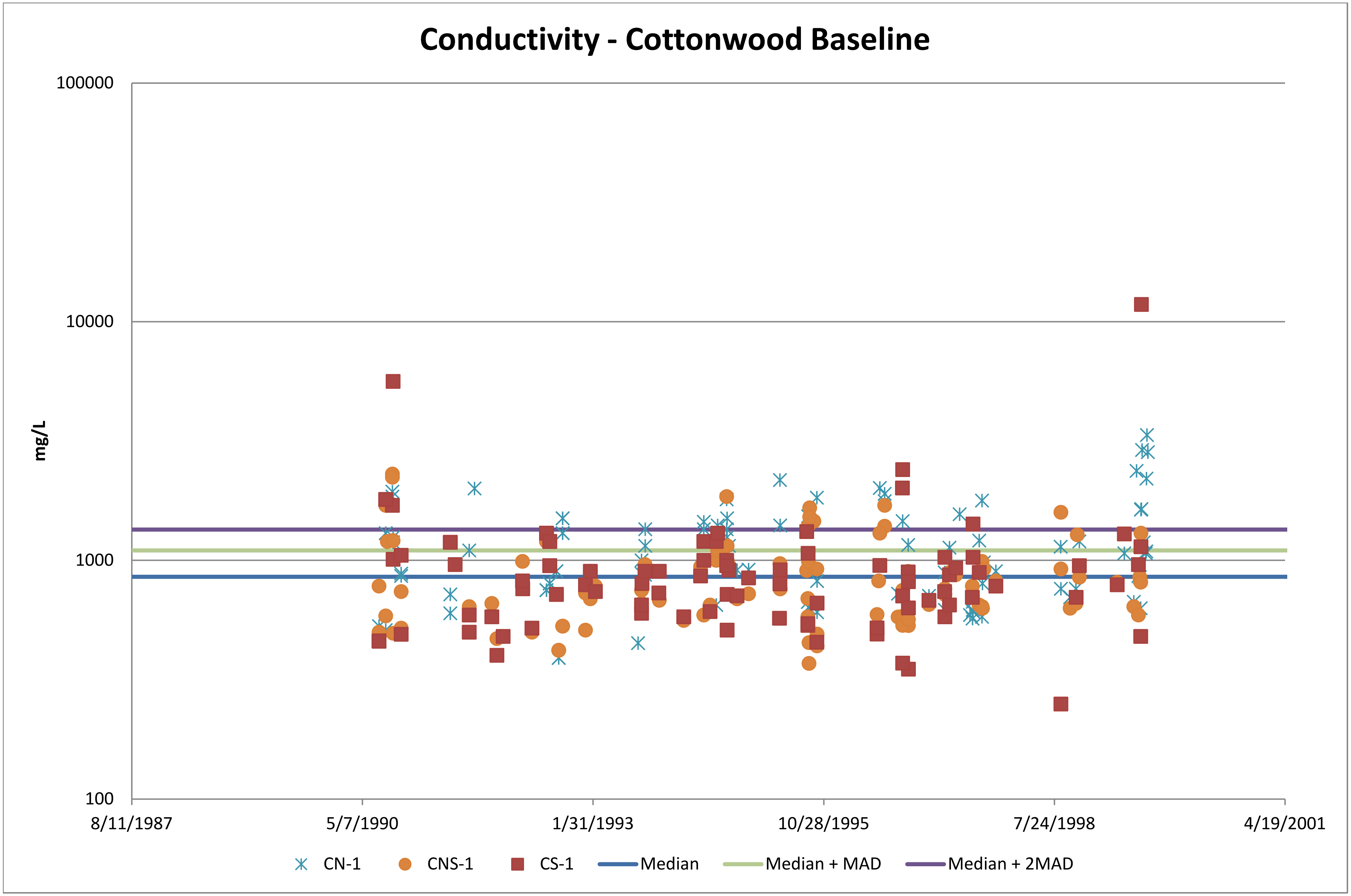

Silver - Cottonwood Baseline
mg/L
10
1
0.1
0.01
0.001
8/11/1987
5/7/1990
1/31/1993
10/28/1995
7/24/1998
4/19/2001
CN-1
CNS-1
CS-1
Median
Median + MAD
Median + 2MAD
Aquatic & Wildlife Acute Criteria
Secondary Human Contact Criteria
Fish Consumption Criteria

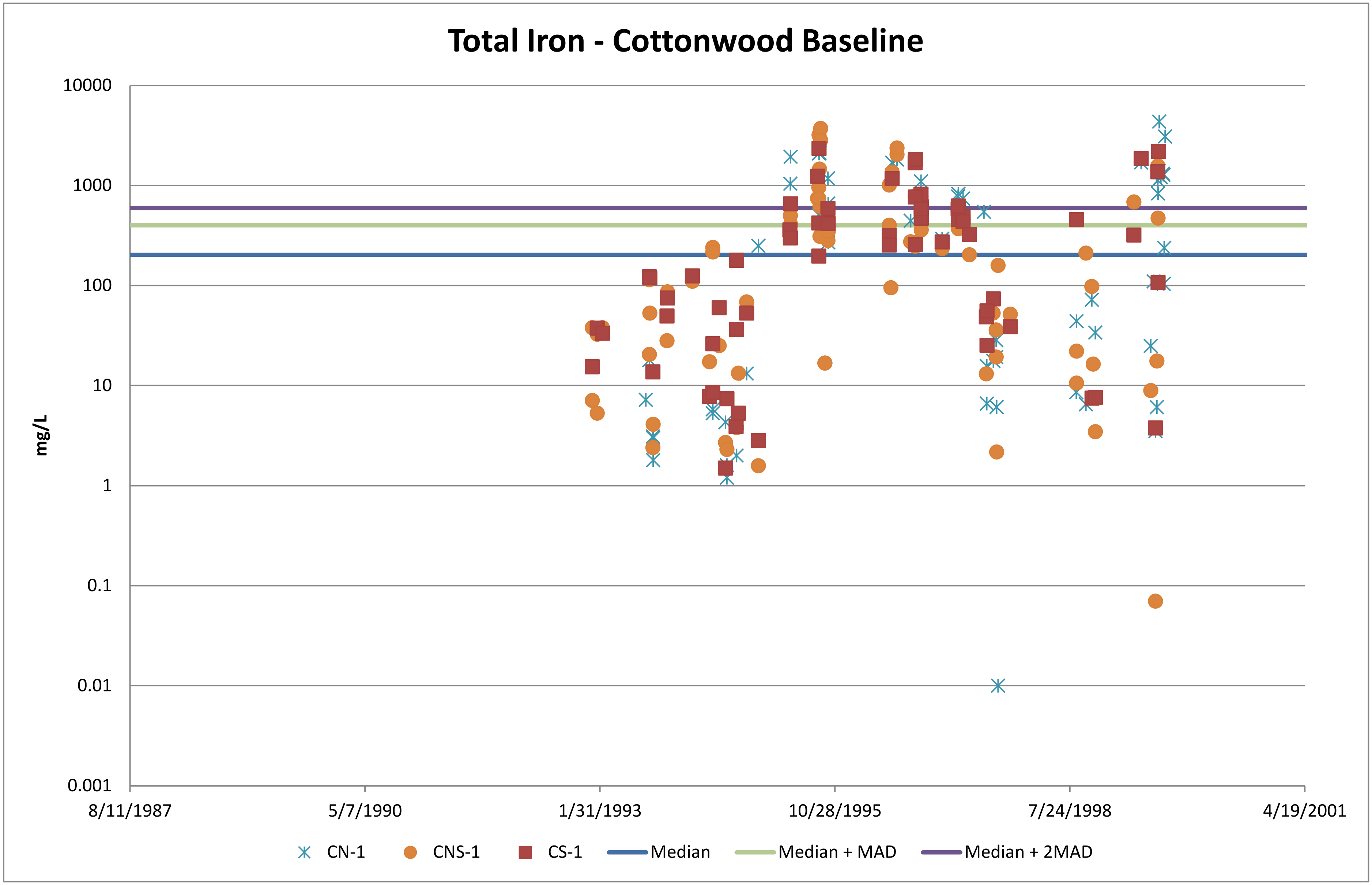

Sulfate - Cottonwood Baseline
mg/L
2000
1800
1600
1400
1200
1000
800
600
400
200
0
8/11/1987
5/7/1990
1/31/1993
10/28/1995
7/24/1998
4/19/2001
CN-1
CNS-1
CS-1
Median
Median + MAD
Median + 2MAD
Livestock Criteria

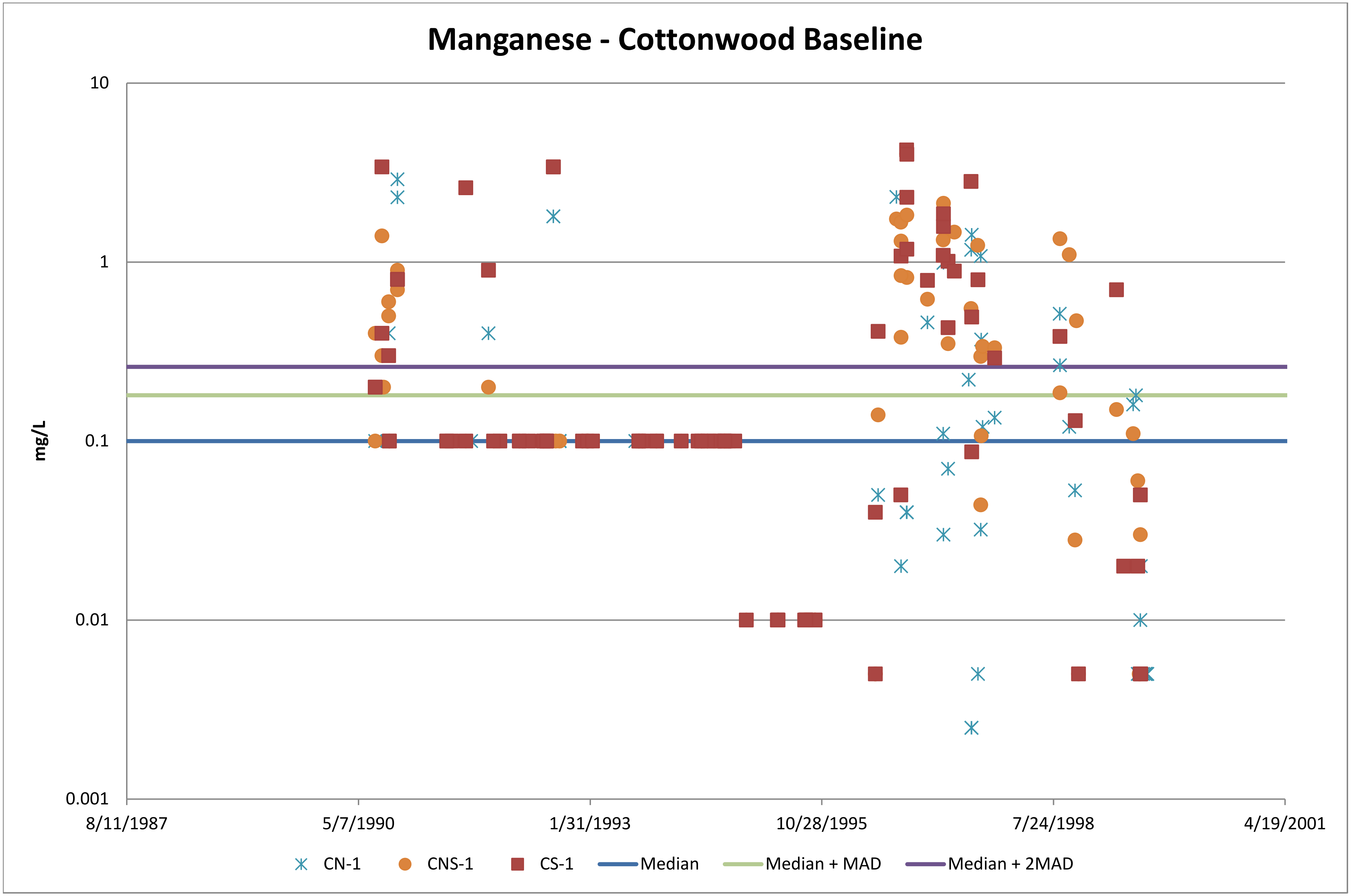

TDS - Cottonwood Baseline
mg/L
100000
10000
1000
100
8/11/1987
5/7/1990
1/31/1993
10/28/1995
7/24/1998
4/19/2001
CN-1
CNS-1
CS-1
Median
Median + MAD
Median + 2MAD
Livestock Criteria

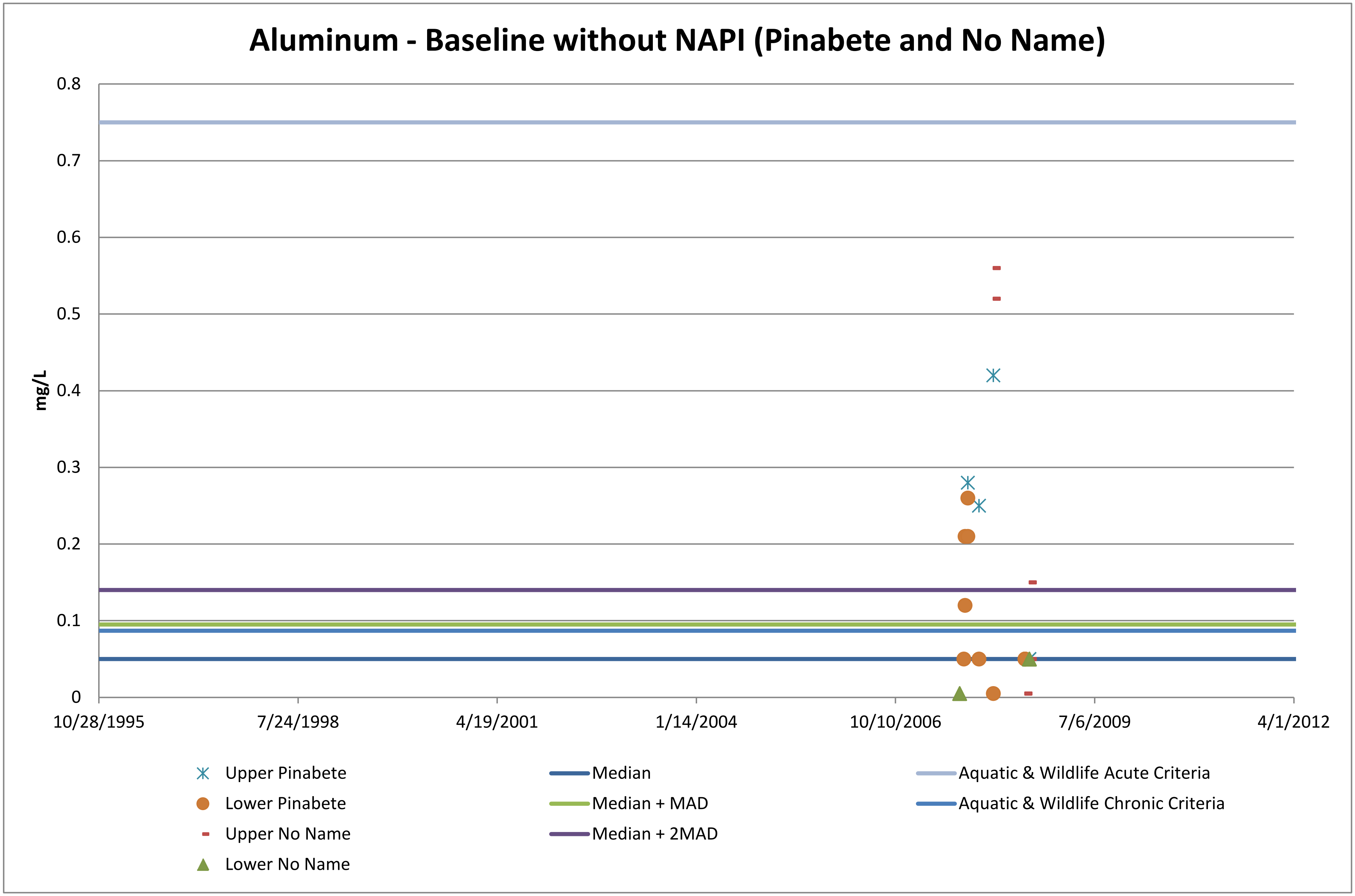

Zinc - Cottonwood Baseline
mg/L
1000
100
10
1
0.1
0.01
0.001
8/11/1987
5/7/1990
1/31/1993
10/28/1995
7/24/1998
4/19/2001
CN-1
CNS-1
CS-1
Median
Median + MAD
Median + 2MAD
Livestock Criteria
Aquatic and Wildlife Acute Criteria
Secondary Human Contact Criteria
Fish Consumption Criteria
Aquatic and Wildlife Chronic Criteria

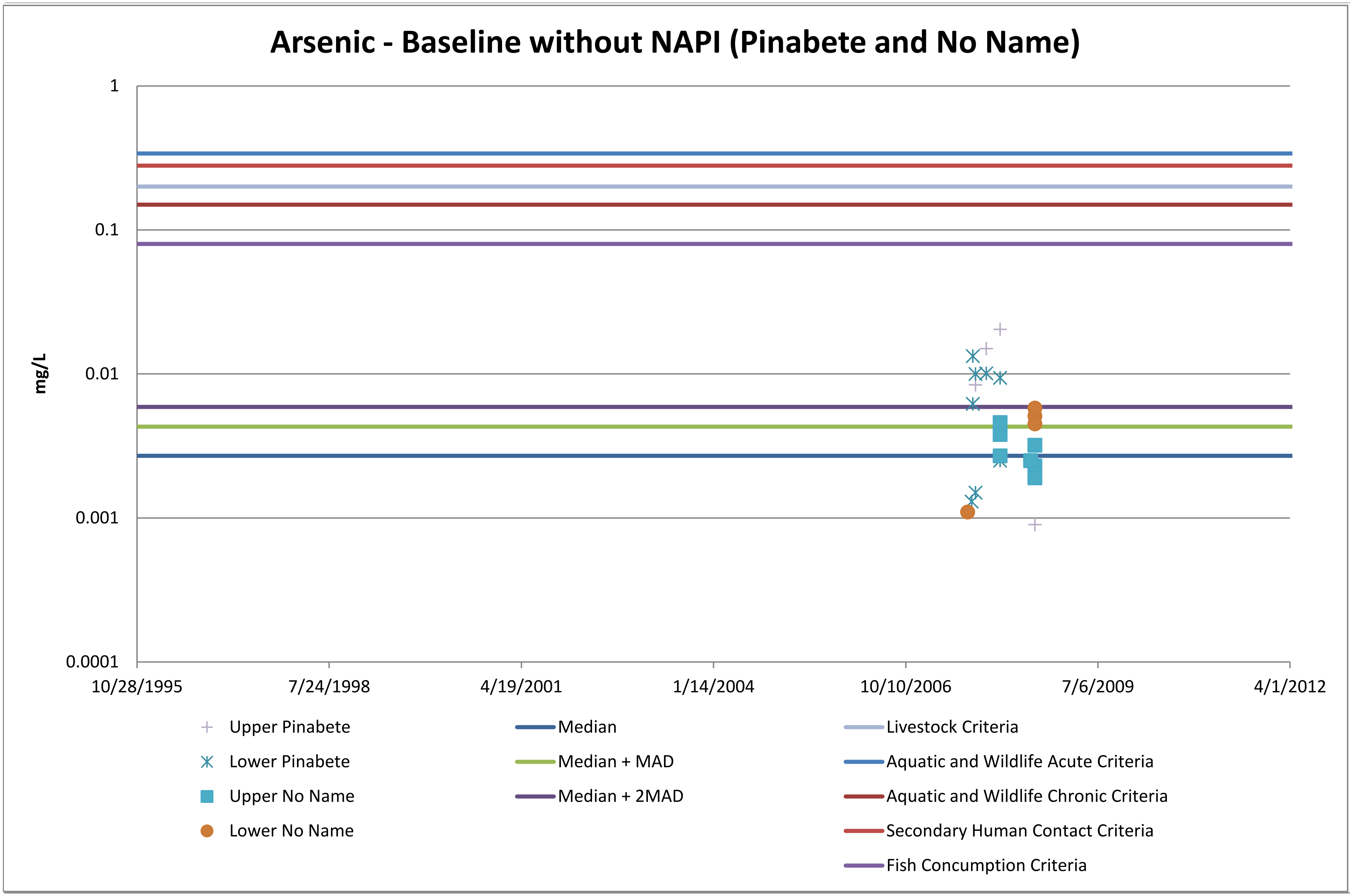

TSS - Cottonwood Baseline
10000000
1000000
100000
10000
1000
100
mg/L
8/11/1987
5/7/1990
1/31/1993
10/28/1995
7/24/1998
4/19/2001
CN-1
CNS-1
CS-1
Median
Median + MAD
Median + 2MAD

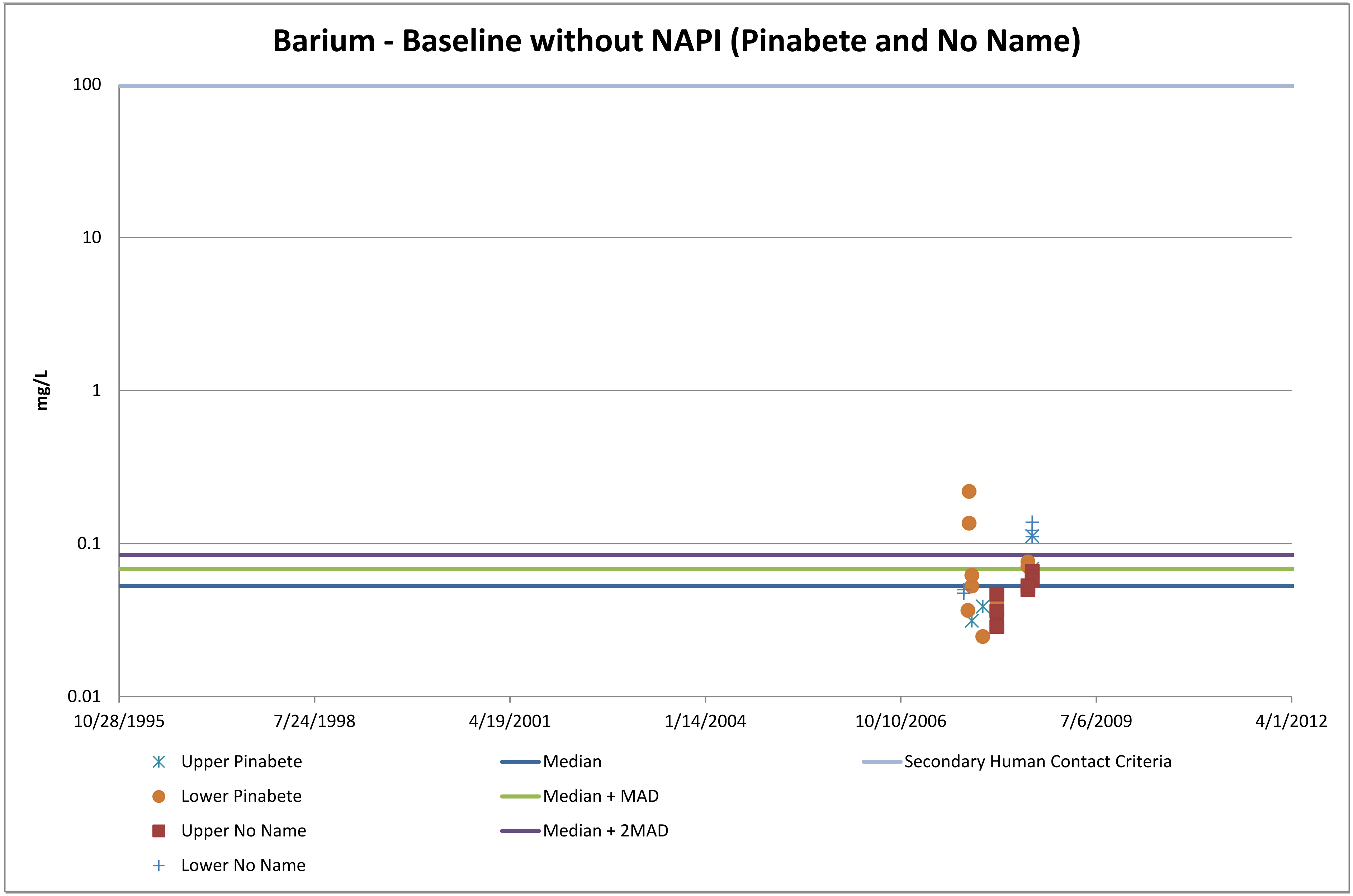

Conductivity - Cottonwood Baseline
mg/L
100000
10000
1000
100
8/11/1987
5/7/1990
1/31/1993
10/28/1995
7/24/1998
4/19/2001
CN-1
CNS-1
CS-1
Median
Median + MAD
Median + 2MAD

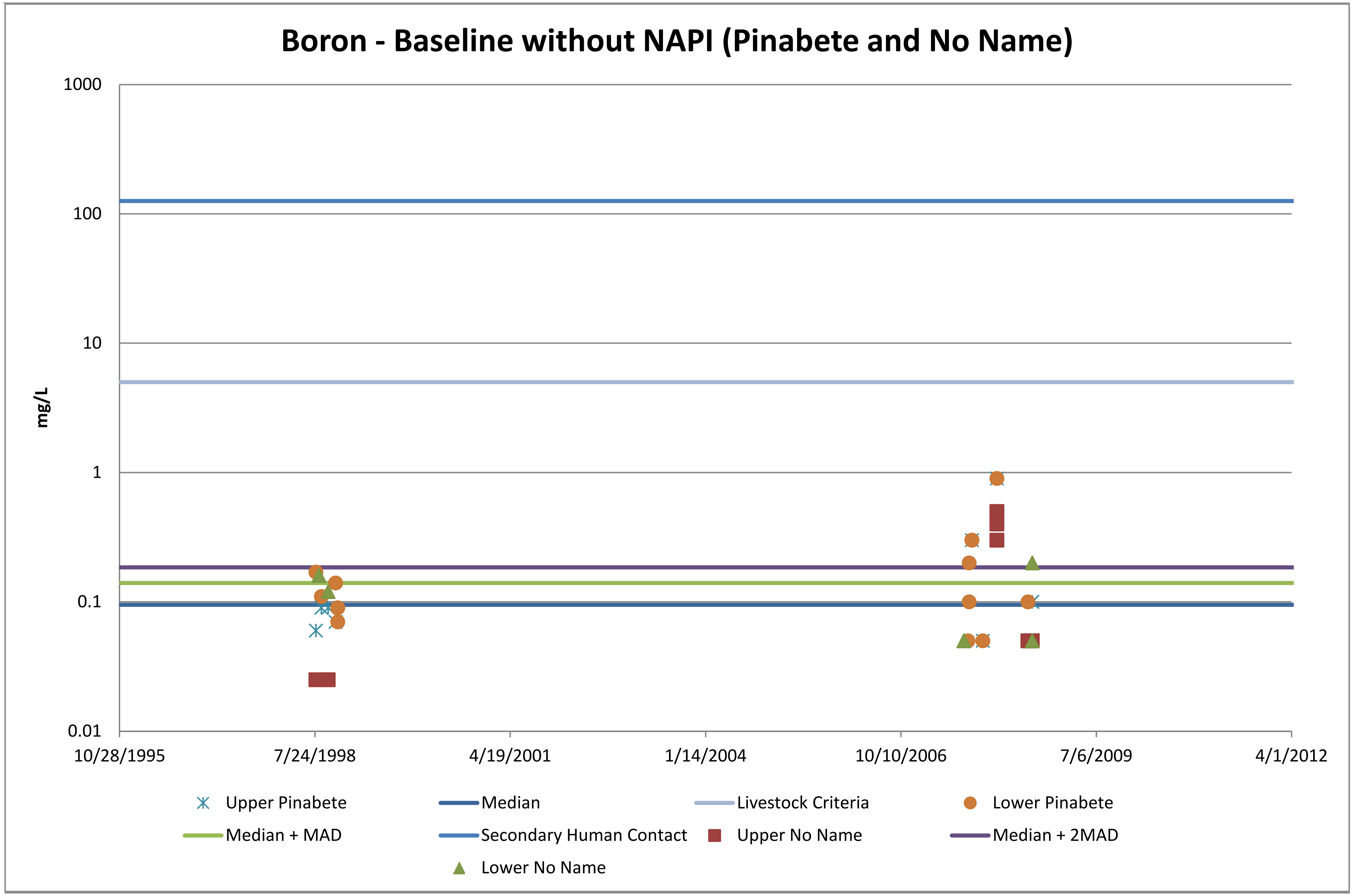

Total Iron - Cottonwood Baseline
10000
1000
100
10
1
0.1
0.01
0.001
mg/L
8/11/1987
5/7/1990
1/31/1993
10/28/1995
7/24/1998
4/19/2001
CN-1
CNS-1
CS-1
Median
Median + MAD
Median + 2MAD

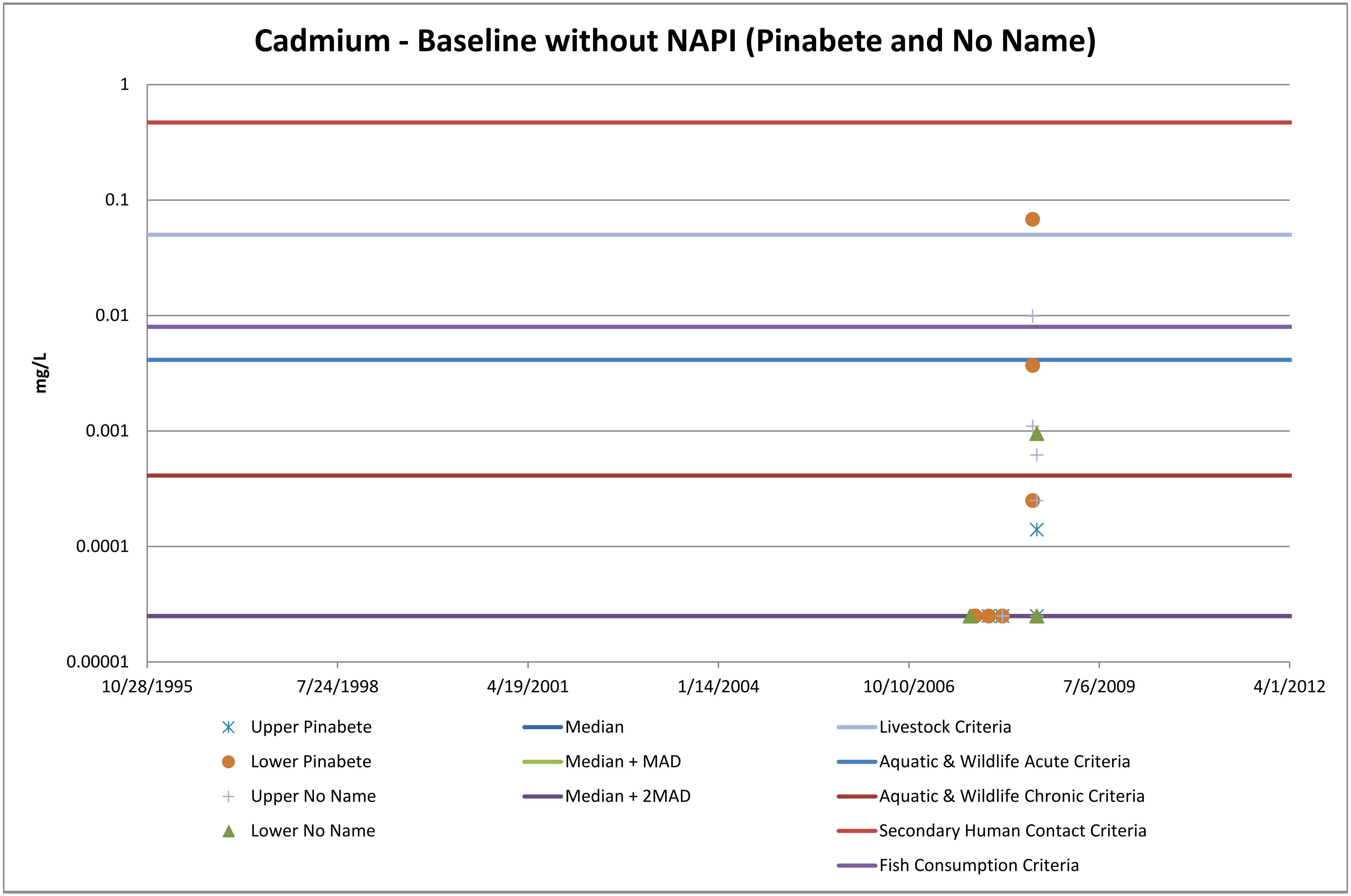

Manganese - Cottonwood Baseline
mg/L
10
1
0.1
0.01
0.001
8/11/1987
5/7/1990
1/31/1993
10/28/1995
7/24/1998
4/19/2001
CN-1
CNS-1
CS-1
Median
Median + MAD
Median + 2MAD

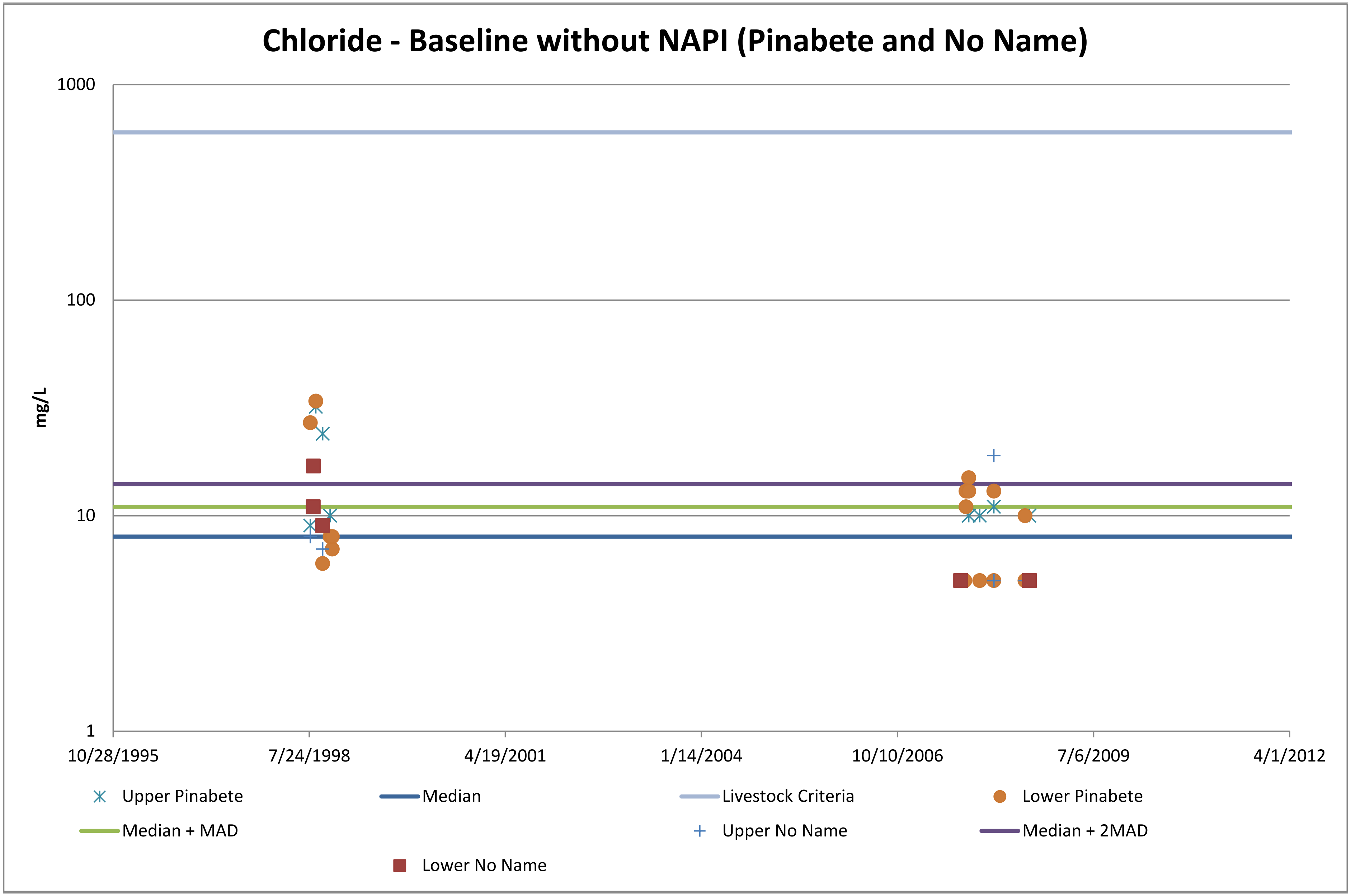

Aluminum - Baseline without NAPI (Pinabete and No Name)
mg/L
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
10/28/1995
7/24/1998
4/19/2001
1/14/2004
10/10/2006
7/6/2009
4/1/2012
Upper Pinabete
Lower Pinabete
Upper No Name
Lower No Name
Median
Median + MAD
Median + 2MAD
Aquatic & Wildlife Acute Criteria
Aquatic & Wildlife Chronic Criteria

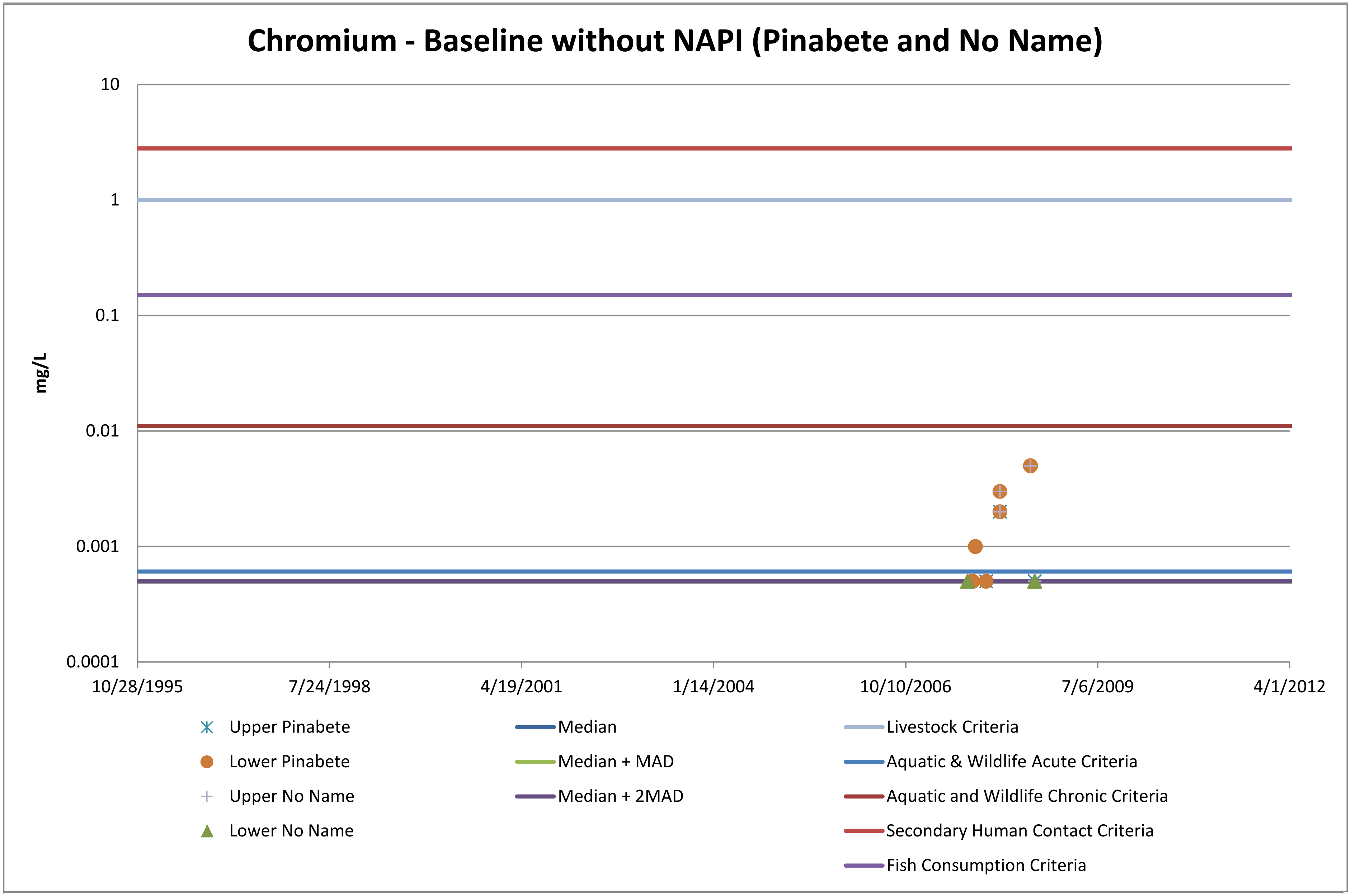

Arsenic - Baseline without NAPI (Pinabete and No Name)
mg/L
1
0.1
0.01
0.001
0.0001
10/28/1995
7/24/1998
4/19/2001
1/14/2004
10/10/2006
7/6/2009
4/1/2012
Upper Pinabete
Lower Pinabete
Upper No Name
Lower No Name
Median
Median + MAD
Median + 2MAD
Livestock Criteria
Aquatic and Wildlife Acute Criteria
Aquatic and Wildlife Chronic Criteria
Secondary Human Contact Criteria
Fish Concumption Criteria

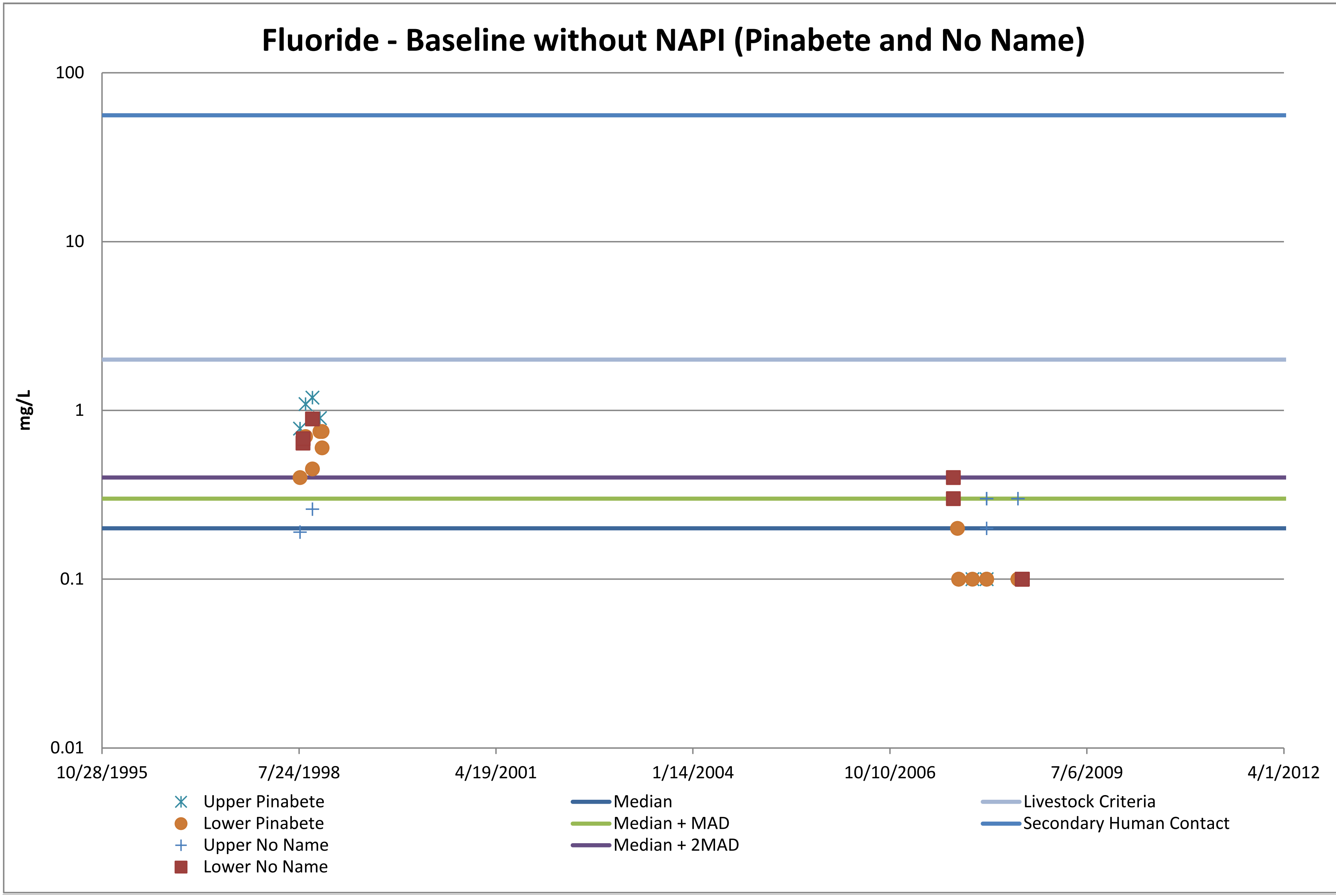

Barium - Baseline without NAPI (Pinabete and No Name)
mg/L
100
10
1
0.1
0.01
10/28/1995
7/24/1998
4/19/2001
1/14/2004
10/10/2006
7/6/2009
4/1/2012
Upper Pinabete
Lower Pinabete
Upper No Name
Lower No Name
Median
Median + MAD
Median + 2MAD
Secondary Human Contact Criteria

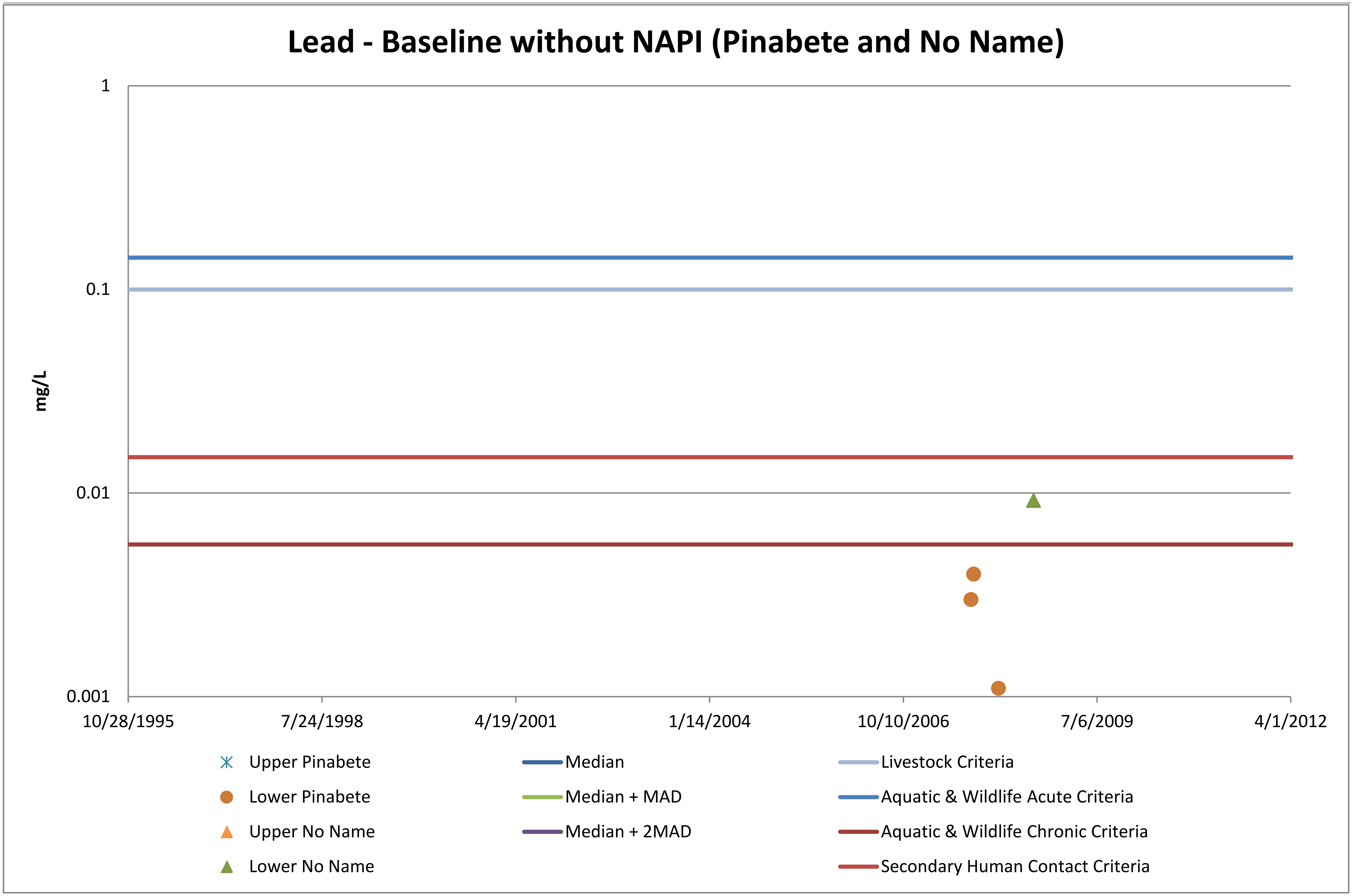

Boron - Baseline without NAPI (Pinabete and No Name)
mg/L
1000
100
10
1
0.1
0.01
10/28/1995
7/24/1998
4/19/2001
1/14/2004
10/10/2006
7/6/2009
4/1/2012
Upper Pinabete
Median
Livestock Criteria
Lower Pinabete
Median + MAD
Secondary Human Contact
Upper No Name
Median + 2MAD
Lower No Name

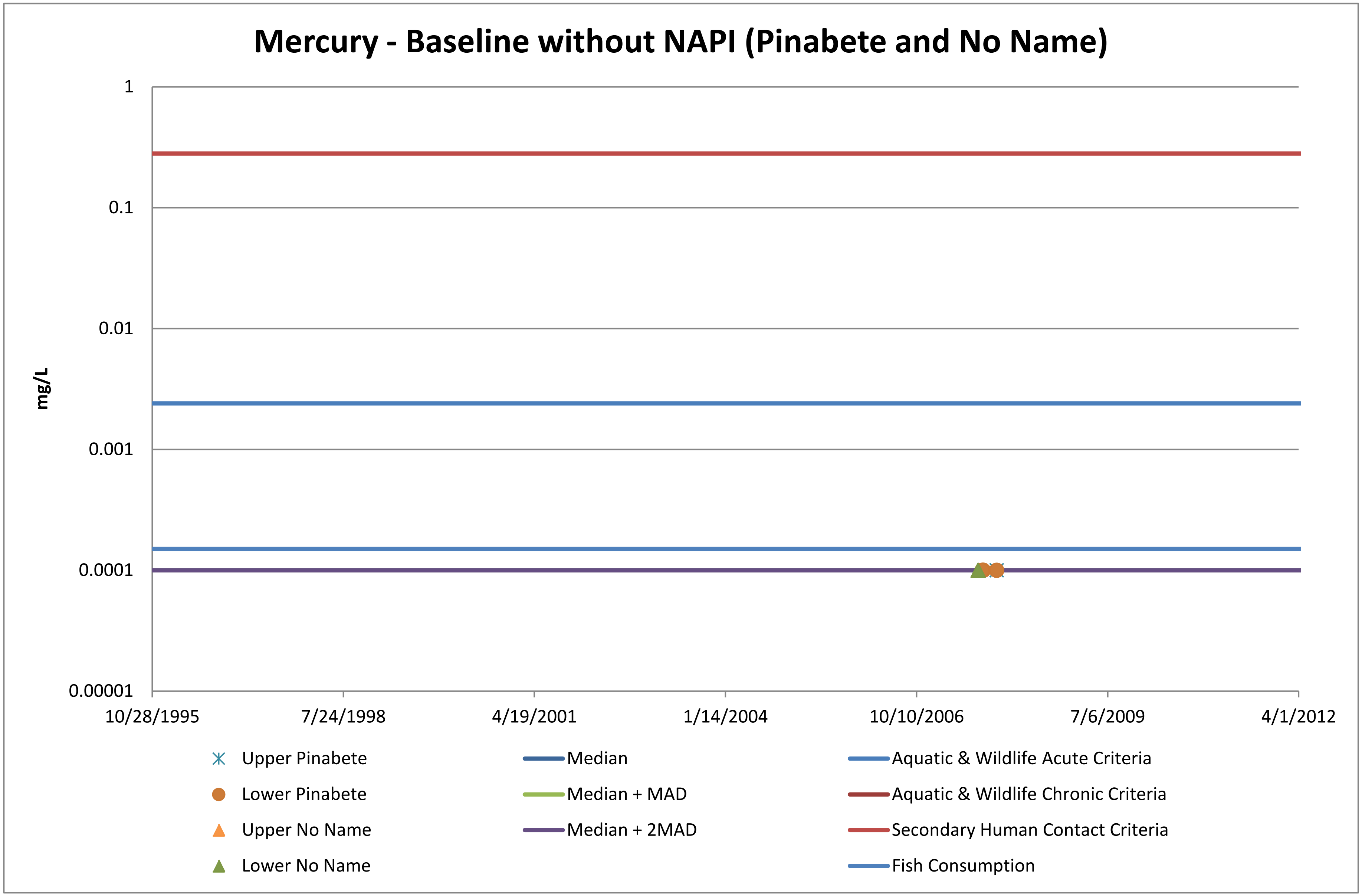

Cadmium - Baseline without NAPI (Pinabete and No Name)
mg/L
1
0.1
0.01
0.001
0.0001
0.00001
10/28/1995
7/24/1998
4/19/2001
1/14/2004
10/10/2006
7/6/2009
4/1/2012
Upper Pinabete
Lower Pinabete
Upper No Name
Lower No Name
Median
Median + MAD
Median + 2MAD
Livestock Criteria
Aquatic & Wildlife Acute Criteria
Aquatic & Wildlife Chronic Criteria
Secondary Human Contact Criteria
Fish Consumption Criteria

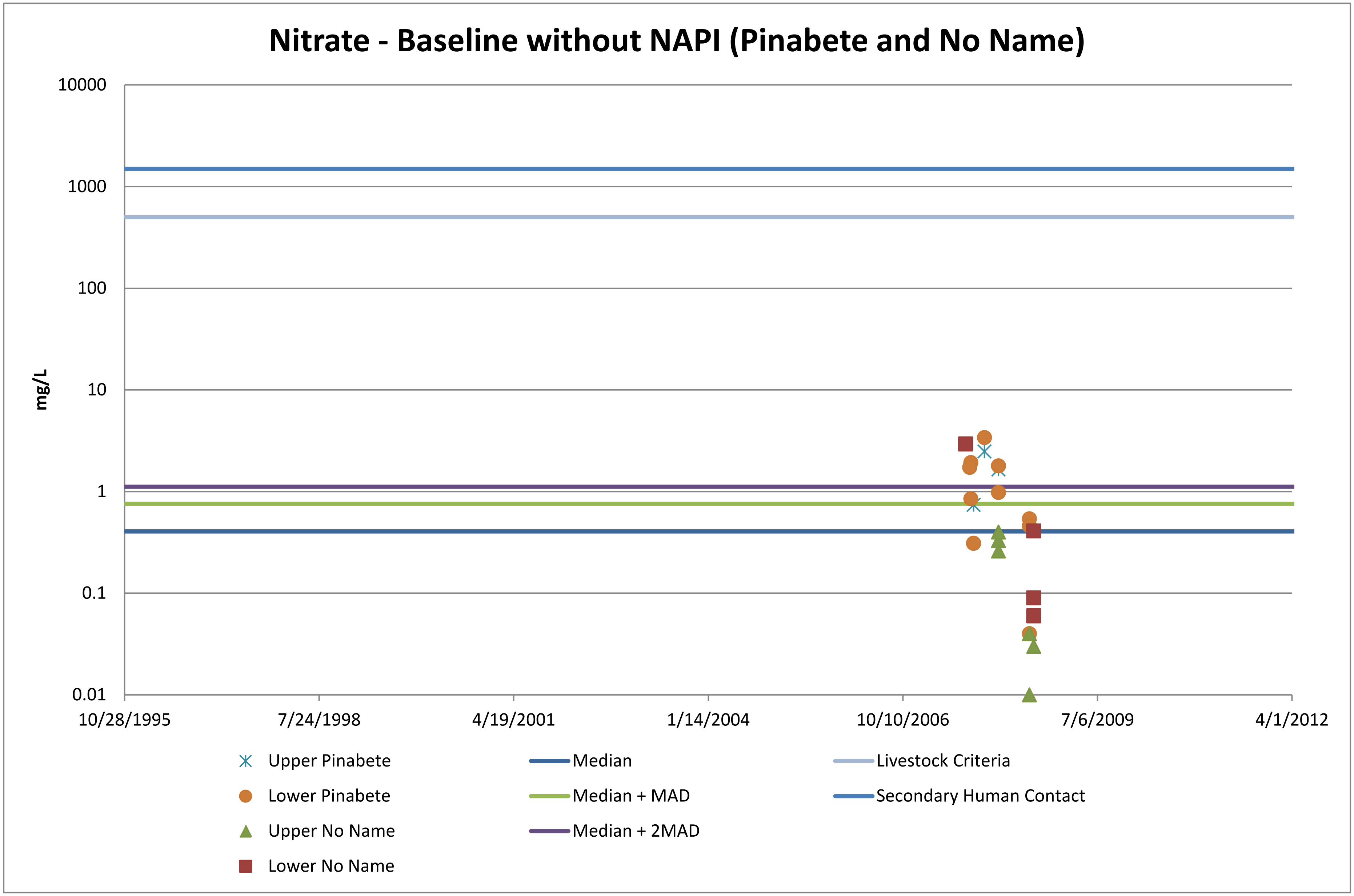

Chloride - Baseline without NAPI (Pinabete and No Name)
mg/L
1000
100
10
1
10/28/1995
7/24/1998
4/19/2001
1/14/2004
10/10/2006
7/6/2009
4/1/2012
Upper Pinabete
Median
Livestock Criteria
Lower Pinabete
Median + MAD
Upper No Name
Median + 2MAD
Lower No Name

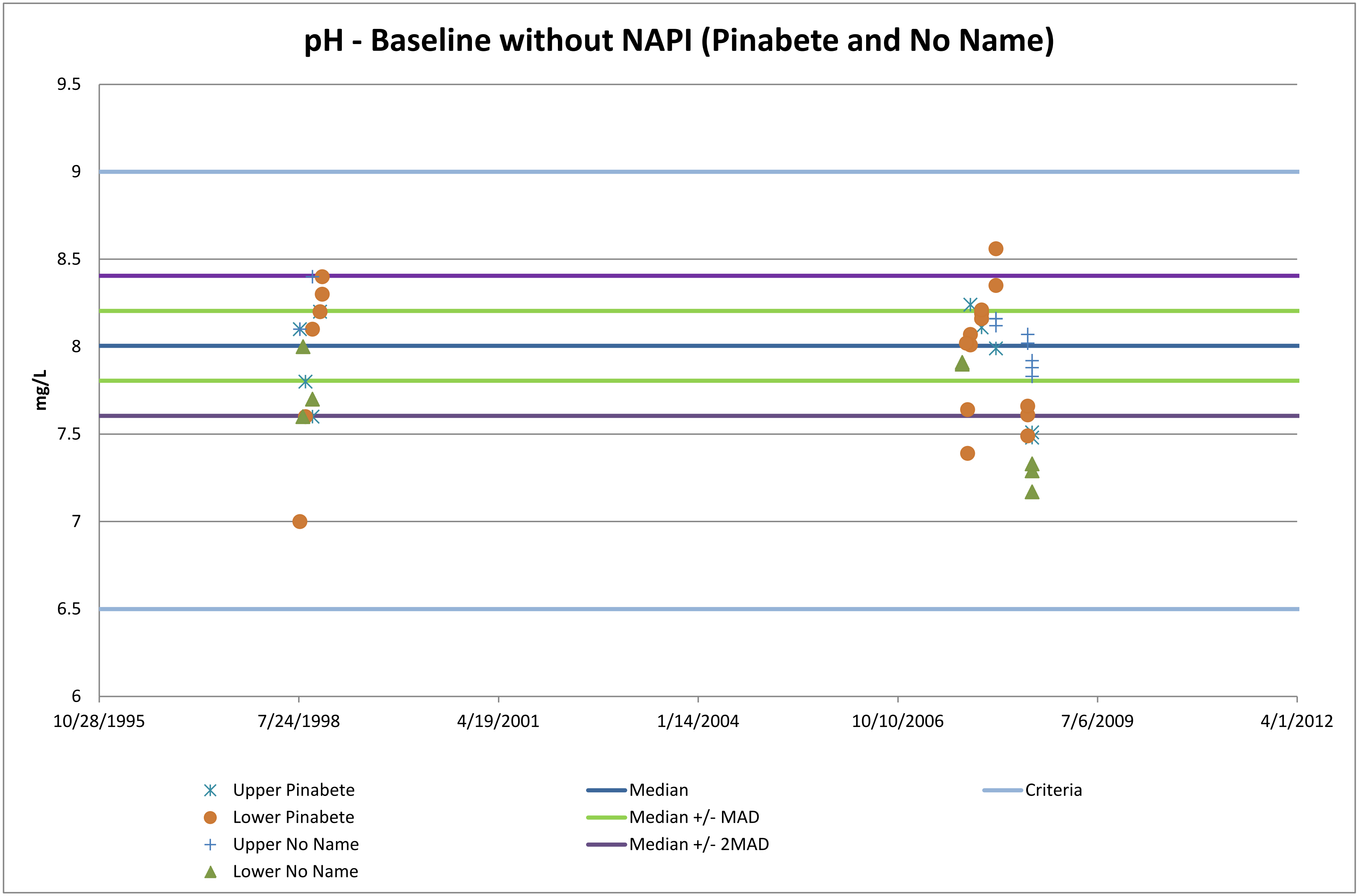

Chromium - Baseline without NAPI (Pinabete and No Name)
mg/L
10
1
0.1
0.01
0.001
0.0001
10/28/1995
7/24/1998
4/19/2001
1/14/2004
10/10/2006
7/6/2009
4/1/2012
Upper Pinabete
Lower Pinabete
Upper No Name
Lower No Name
Median
Median + MAD
Median + 2MAD
Livestock Criteria
Aquatic & Wildlife Acute Criteria
Aquatic and Wildlife Chronic Criteria
Secondary Human Contact Criteria
Fish Consumption Criteria

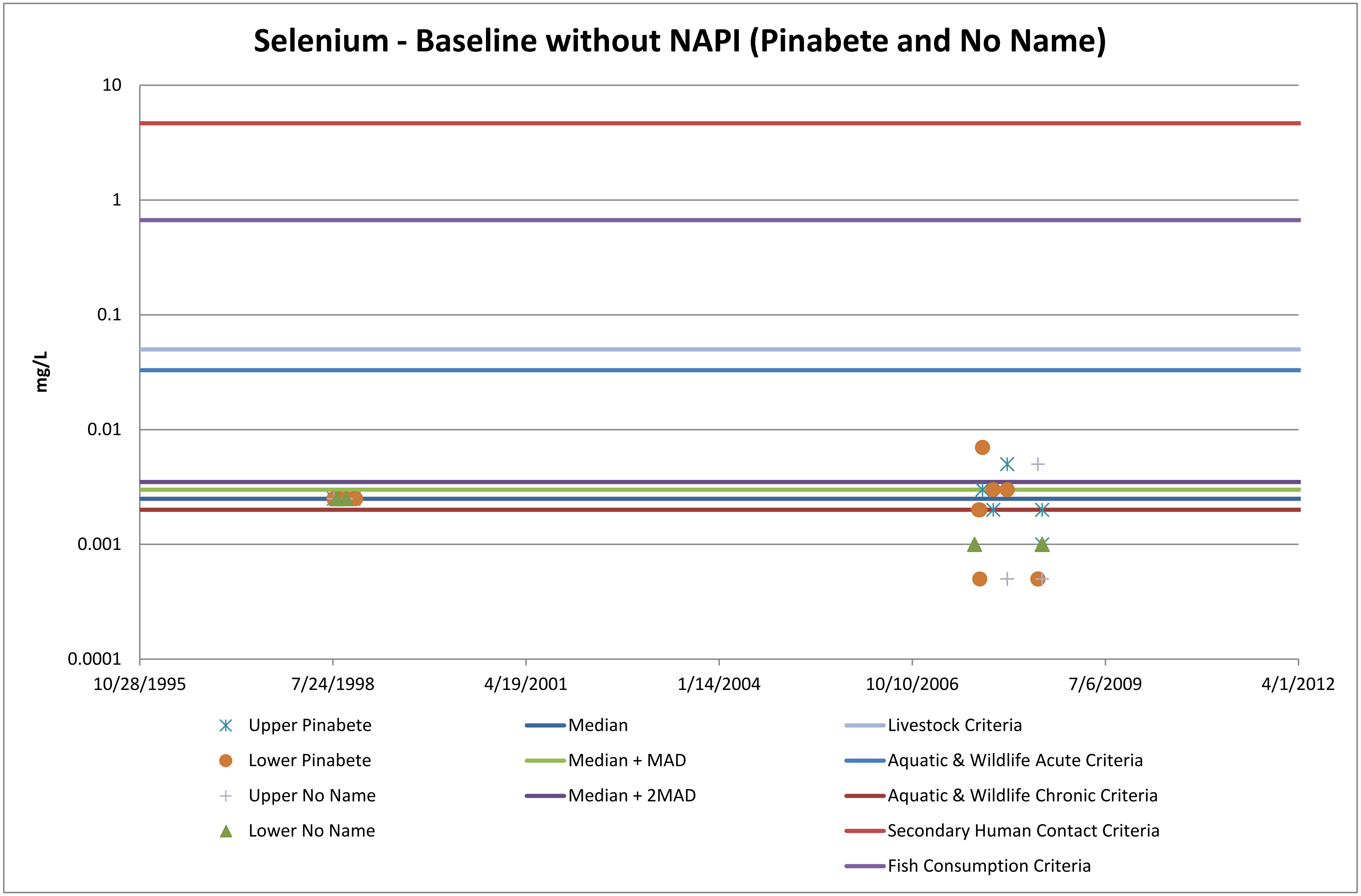

Fluoride - Baseline without NAPI (Pinabete and No Name)
mg/L
100
10
1
0.1
0.01
10/28/1995
7/24/1998
4/19/2001
1/14/2004
10/10/2006
7/6/2009
4/1/2012
Upper Pinabete
Lower Pinabete
Upper No Name
Lower No Name
Median
Median + MAD
Median + 2MAD
Livestock Criteria
Secondary Human Contact

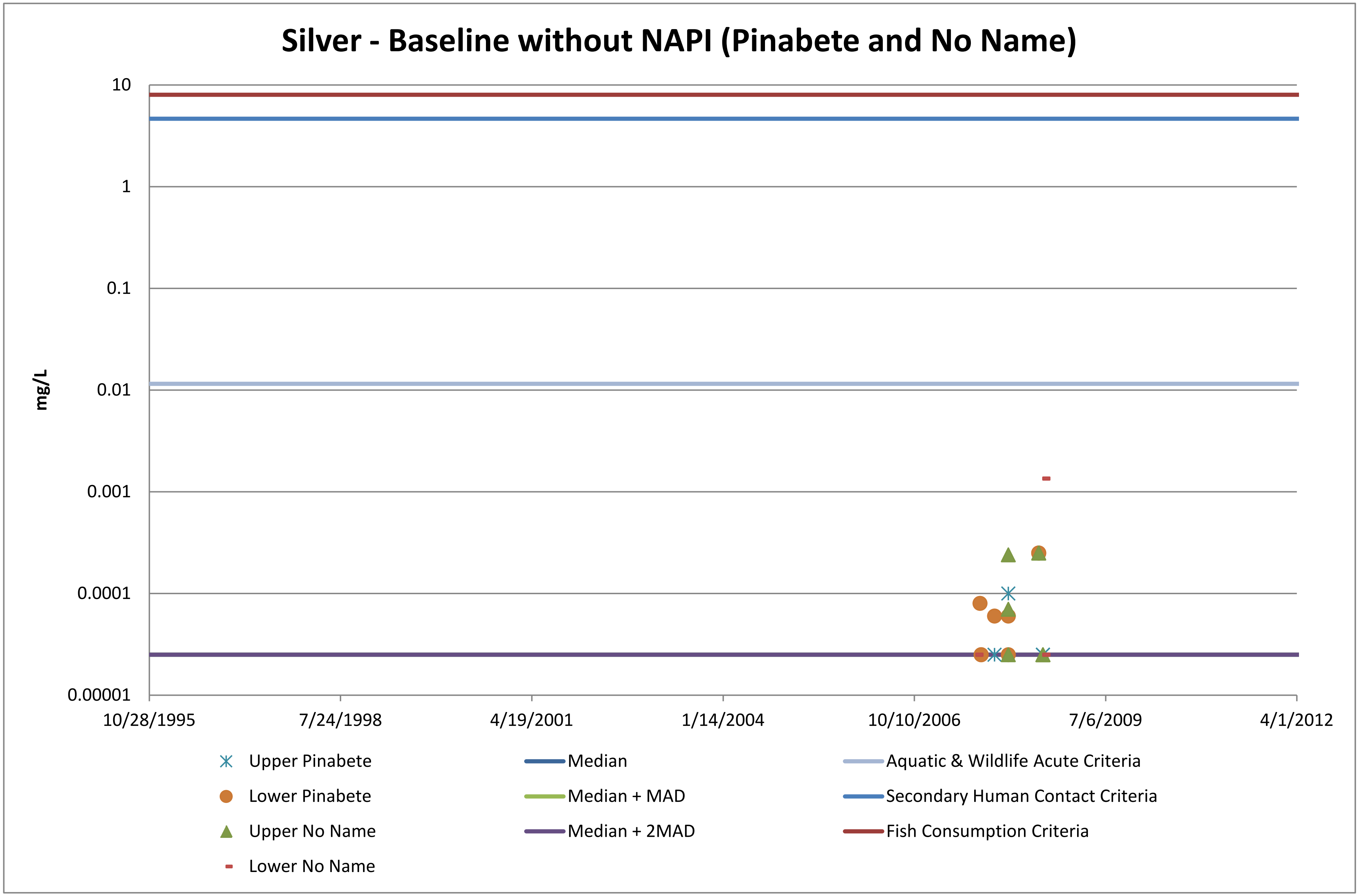

Lead - Baseline without NAPI (Pinabete and No Name)
mg/L
1
0.1
0.01
0.001
10/28/1995
7/24/1998
4/19/2001
1/14/2004
10/10/2006
7/6/2009
4/1/2012
Upper Pinabete
Lower Pinabete
Upper No Name
Lower No Name
Median
Median + MAD
Median + 2MAD
Livestock Criteria
Aquatic & Wildlife Acute Criteria
Aquatic & Wildlife Chronic Criteria
Secondary Human Contact Criteria

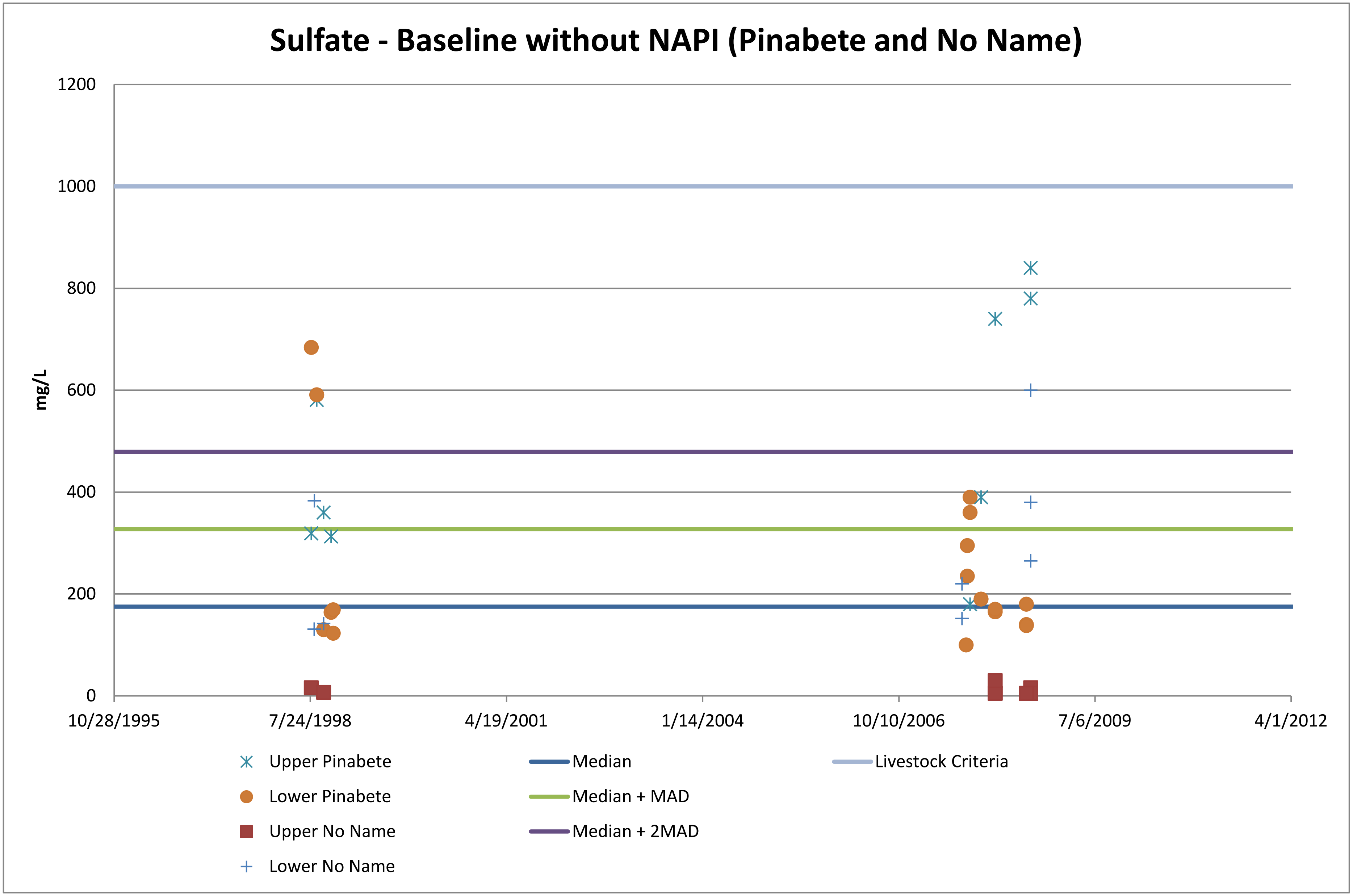

Mercury - Baseline without NAPI (Pinabete and No Name)
mg/L
1
0.1
0.01
0.001
0.0001
0.00001
10/28/1995
7/24/1998
4/19/2001
1/14/2004
10/10/2006
7/6/2009
4/1/2012
Upper Pinabete
Lower Pinabete
Upper No Name
Lower No Name
Median
Median + MAD
Median + 2MAD
Aquatic & Wildlife Acute Criteria
Aquatic & Wildlife Chronic Criteria
Secondary Human Contact Criteria
Fish Consumption

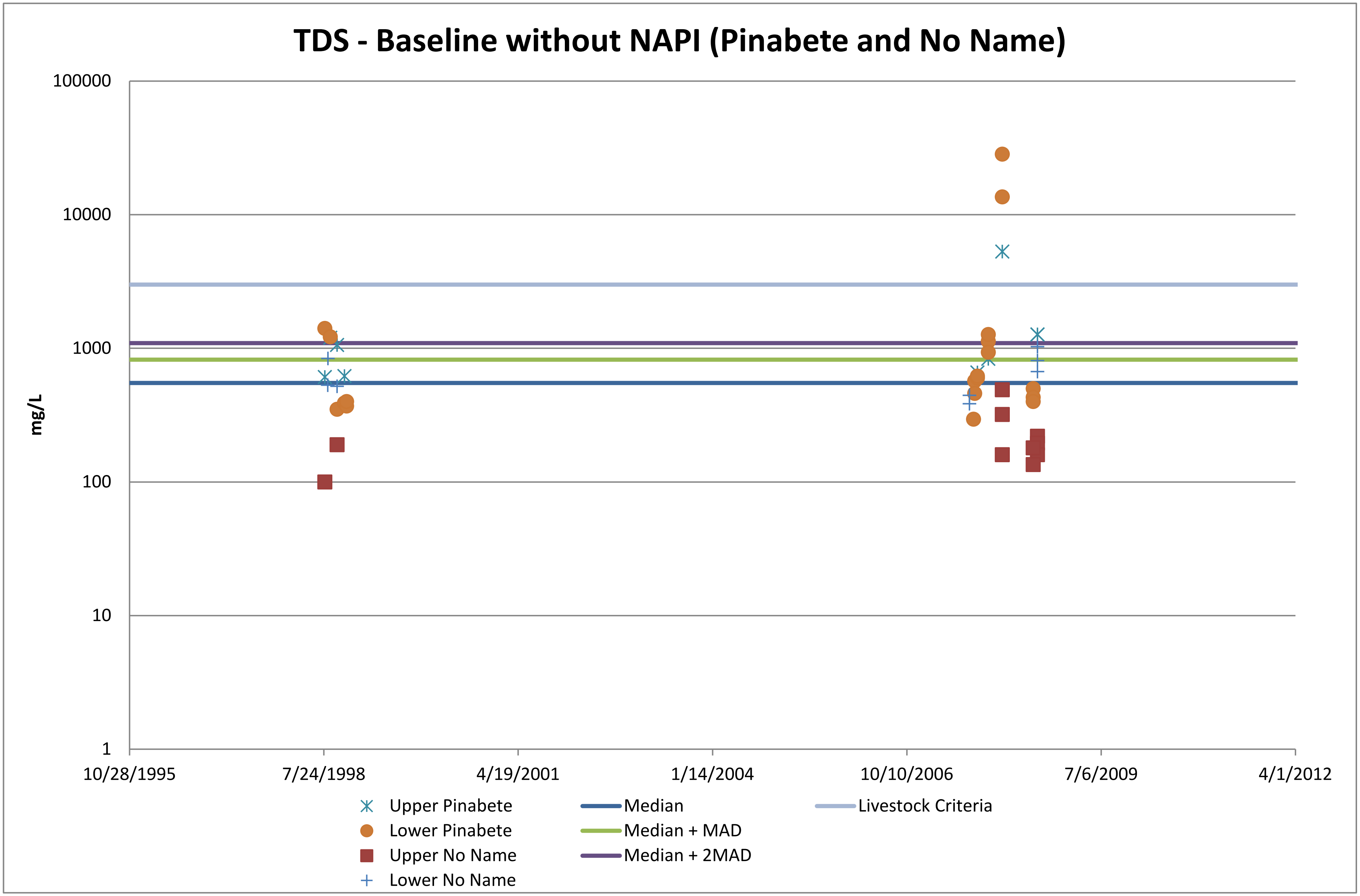

Nitrate - Baseline without NAPI (Pinabete and No Name)
mg/L
10000
1000
100
10
1
0.1
0.01
10/28/1995
7/24/1998
4/19/2001
1/14/2004
10/10/2006
7/6/2009
4/1/2012
Upper Pinabete
Lower Pinabete
Upper No Name
Lower No Name
Median
Median + MAD
Median + 2MAD
Livestock Criteria
Secondary Human Contact

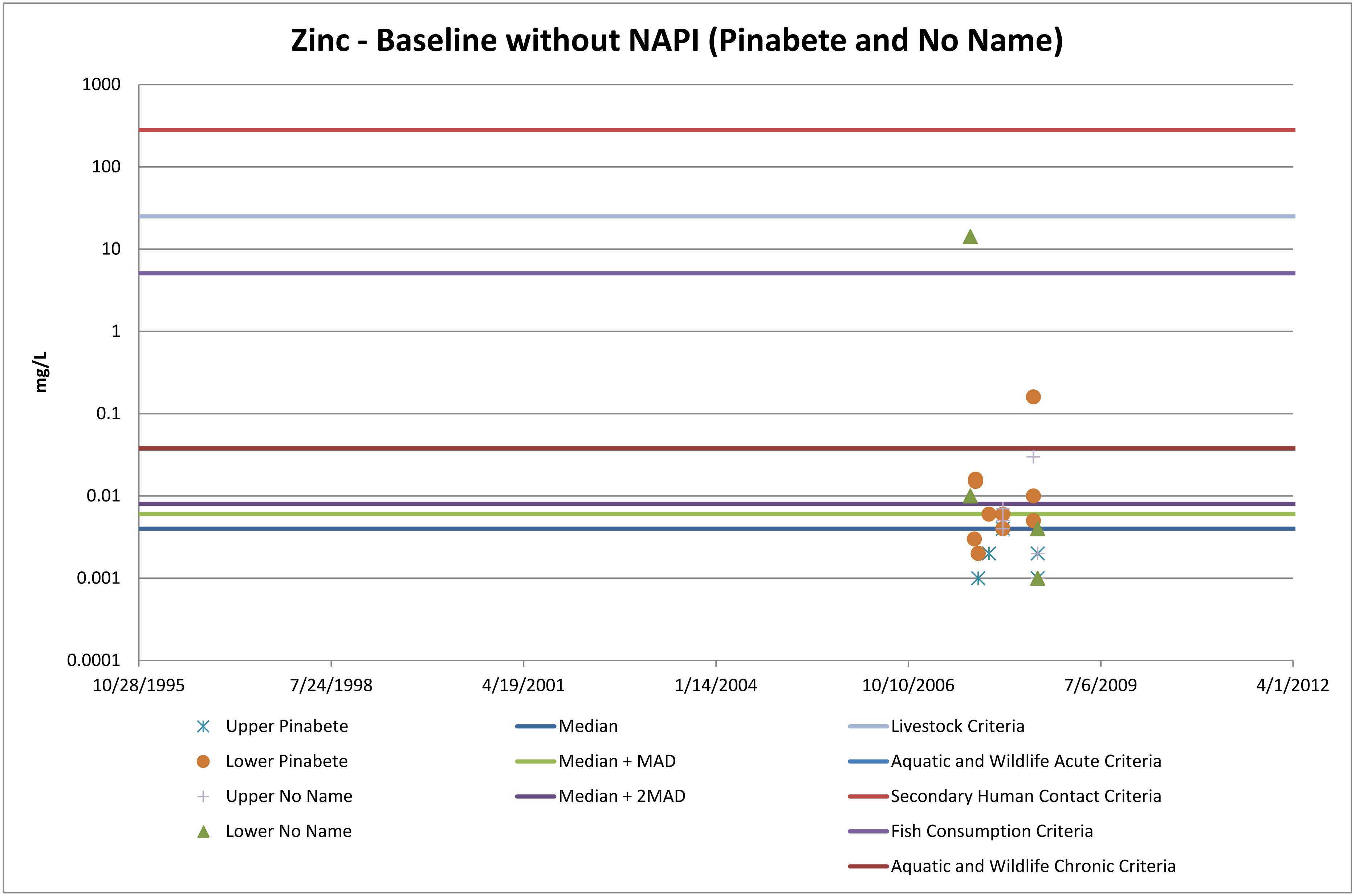

pH - Baseline without NAPI (Pinabete and No Name)
mg/L
9.5
9
8.5
8
7.5
7
6.5
6
10/28/1995
7/24/1998
4/19/2001
1/14/2004
10/10/2006
7/6/2009
4/1/2012
Upper Pinabete
Lower Pinabete
Upper No Name
Lower No Name
Median
Median +/- MAD
Median +/- 2MAD
Criteria

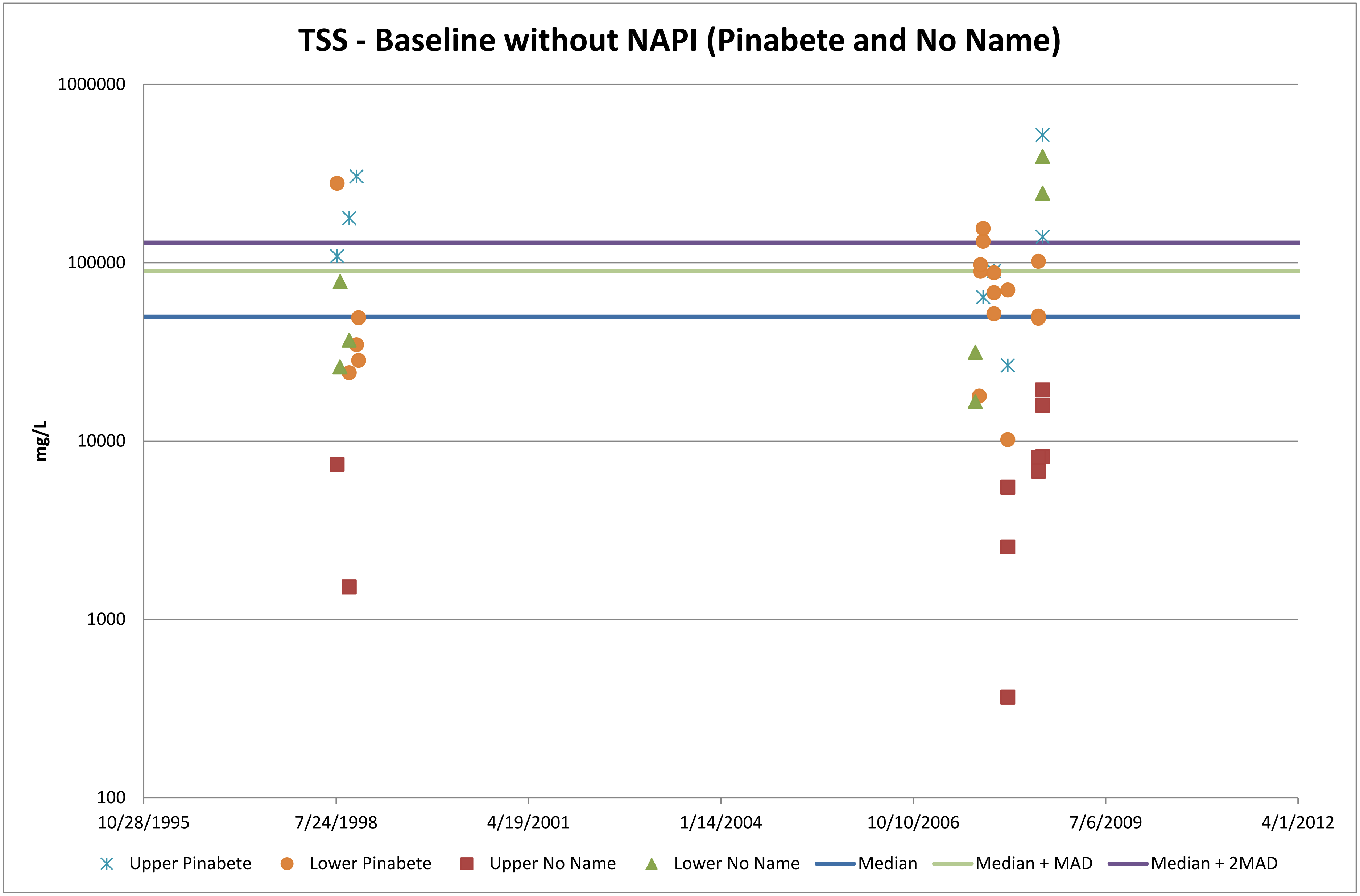

Selenium - Baseline without NAPI (Pinabete and No Name)
mg/L
10
1
0.1
0.01
0.001
0.0001
10/28/1995
7/24/1998
4/19/2001
1/14/2004
10/10/2006
7/6/2009
4/1/2012
Upper Pinabete
Lower Pinabete
Upper No Name
Lower No Name
Median
Median + MAD
Median + 2MAD
Livestock Criteria
Aquatic & Wildlife Acute Criteria
Aquatic & Wildlife Chronic Criteria
Secondary Human Contact Criteria
Fish Consumption Criteria

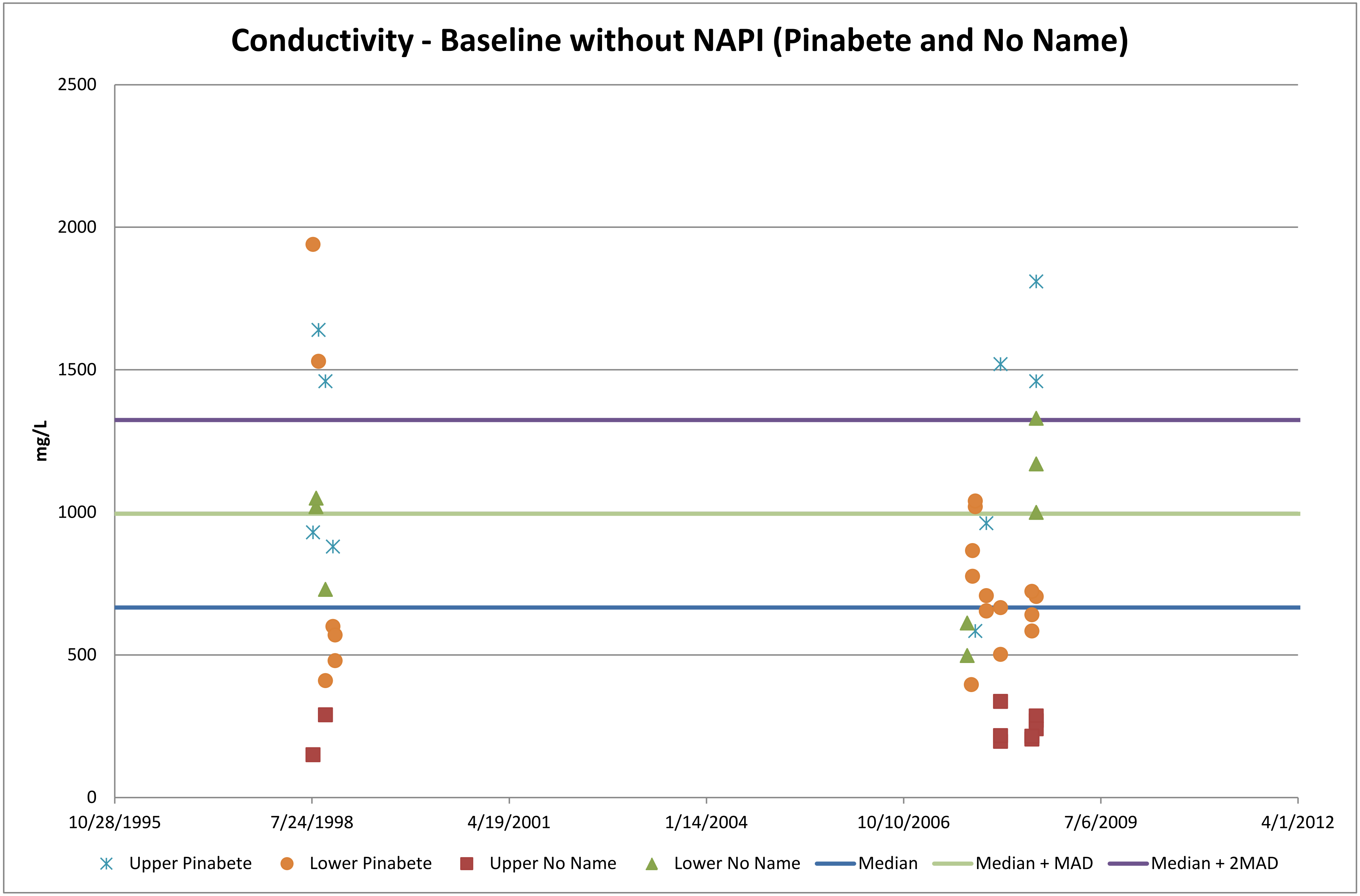

Silver - Baseline without NAPI (Pinabete and No Name)
mg/L
10
1
0.1
0.01
0.001
0.0001
0.00001
10/28/1995
7/24/1998
4/19/2001
1/14/2004
10/10/2006
7/6/2009
4/1/2012
Upper Pinabete
Lower Pinabete
Upper No Name
Lower No Name
Median
Median + MAD
Median + 2MAD
Aquatic & Wildlife Acute Criteria
Secondary Human Contact Criteria
Fish Consumption Criteria

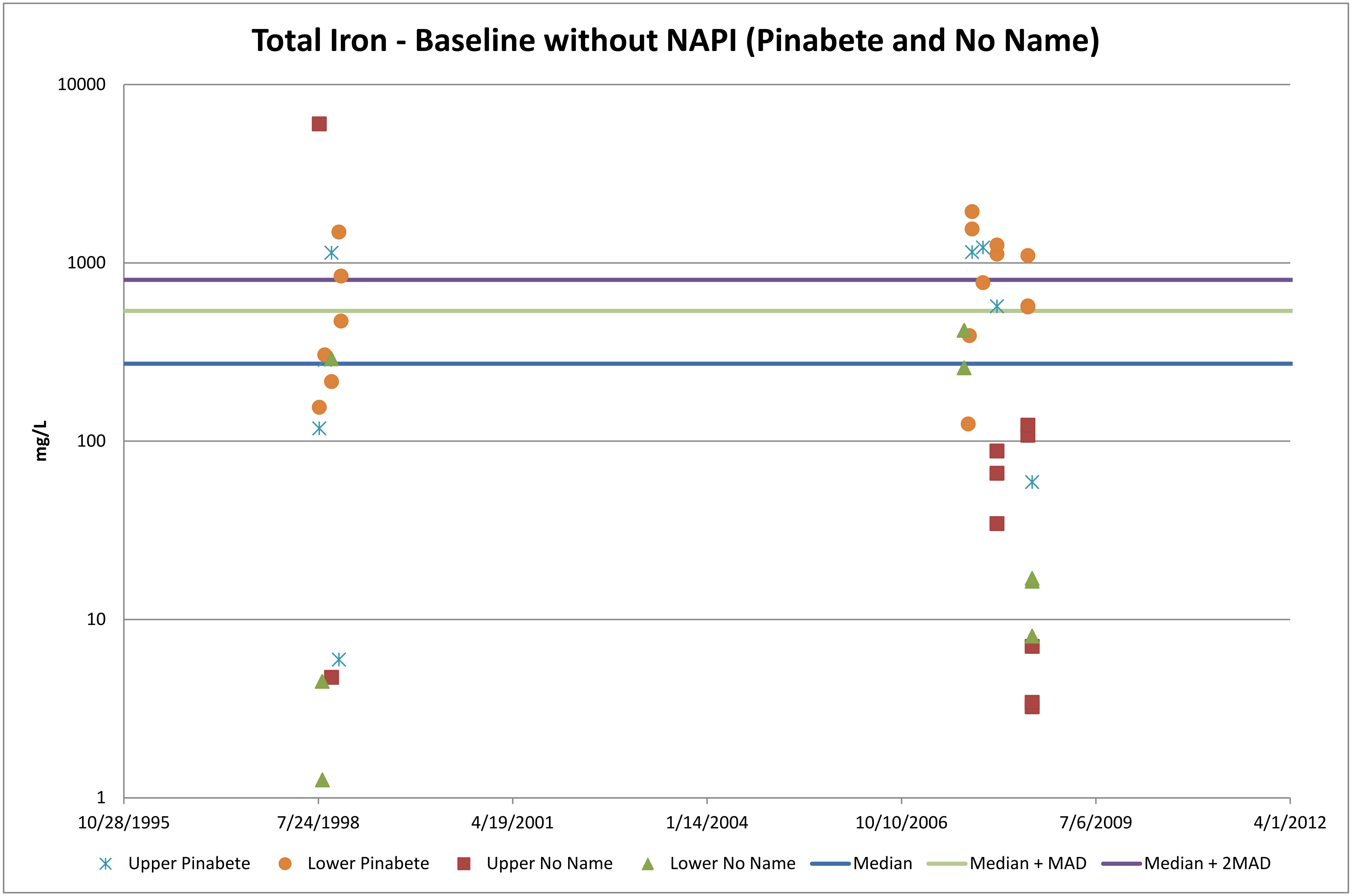

Sulfate - Baseline without NAPI (Pinabete and No Name)
mg/L
1200
1000
800
600
400
200
0
10/28/1995
7/24/1998
4/19/2001
1/14/2004
10/10/2006
7/6/2009
4/1/2012
Upper Pinabete
Lower Pinabete
Upper No Name
Lower No Name
Median
Median + MAD
Median + 2MAD
Livestock Criteria

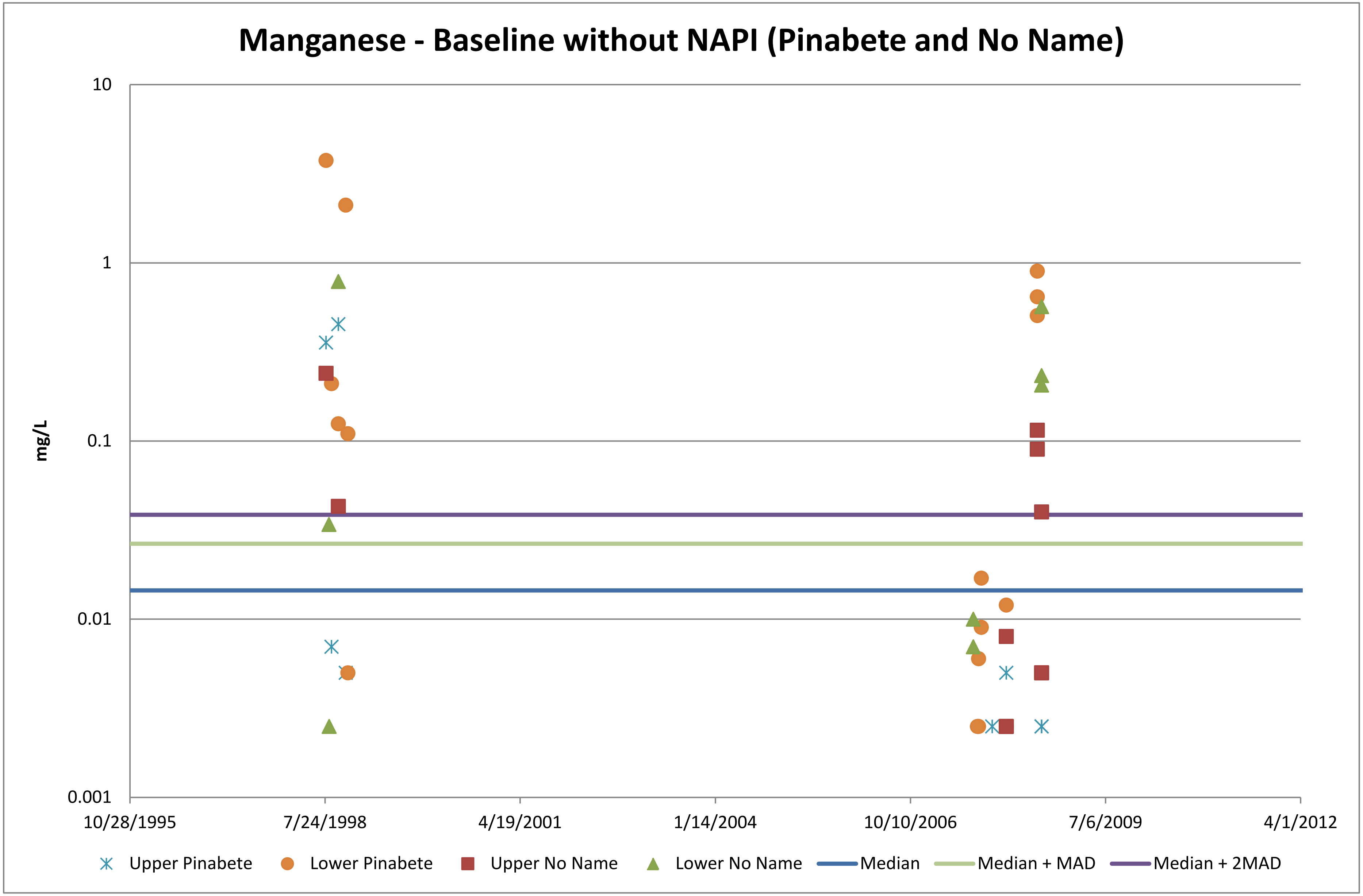

TDS - Baseline without NAPI (Pinabete and No Name)
100000
10000
1000
100
10
1
mg/L
10/28/1995
7/24/1998
4/19/2001
1/14/2004
10/10/2006
7/6/2009
4/1/2012
Upper Pinabete
Lower Pinabete
Upper No Name
Lower No Name
Median
Median + MAD
Median + 2MAD
Livestock Criteria


Zinc - Baseline without NAPI (Pinabete and No Name)
mg/L
1000
100
10
1
0.1
0.01
0.001
0.0001
10/28/1995
7/24/1998
4/19/2001
1/14/2004
10/10/2006
7/6/2009
4/1/2012
Upper Pinabete
Lower Pinabete
Upper No Name
Lower No Name
Median
Median + MAD
Median + 2MAD
Livestock Criteria
Aquatic and Wildlife Acute Criteria
Secondary Human Contact Criteria
Fish Consumption Criteria
Aquatic and Wildlife Chronic Criteria


TSS - Baseline without NAPI (Pinabete and No Name)
mg/L
1000000
100000
10000
1000
100
10/28/1995
7/24/1998
4/19/2001
1/14/2004
10/10/2006
7/6/2009
4/1/2012
Upper Pinabete
Lower Pinabete
Upper No Name
Lower No Name
Median
Median + MAD
Median + 2MAD


Conductivity - Baseline without NAPI (Pinabete and No Name)
mg/L
2500
2000
1500
1000
500
0
10/28/1995
7/24/1998
4/19/2001
1/14/2004
10/10/2006
7/6/2009
4/1/2012
Upper Pinabete
Lower Pinabete
Upper No Name
Lower No Name
Median
Median + MAD
Median + 2MAD


Total Iron - Baseline without NAPI (Pinabete and No Name)
mg/L
10000
1000
100
10
1
10/28/1995
7/24/1998
4/19/2001
1/14/2004
10/10/2006
7/6/2009
4/1/2012
Upper Pinabete
Lower Pinabete
Upper No Name
Lower No Name
Median
Median + MAD
Median + 2MAD


Manganese - Baseline without NAPI (Pinabete and No Name)
mg/L
10
1
0.1
0.01
0.001
10/28/1995
7/24/1998
4/19/2001
1/14/2004
10/10/2006
7/6/2009
4/1/2012
Upper Pinabete
Lower Pinabete
Upper No Name
Lower No Name
Median
Median + MAD
Median + 2MAD

Appendix E:
SEDCAD Modeling Reports

Coal Creek Watershed Pre-Mining

OSM

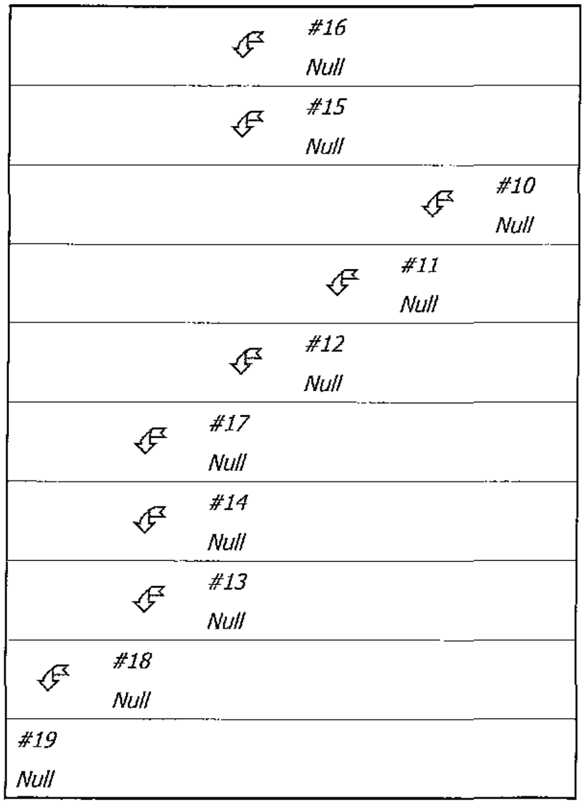
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#10	==>	#11	0.000	0.000	
Null	#11	==>	#12	0.541	0.326	
Null	#12	==>	#17	0.990	0.322	
Null	#13	==>	#18	0.000	0.000	
Null	#14	==>	#18	0.000	0.000	
Null	#15	==>	#17	0.000	0.000	
Null	#16	==>	#17	0.000	0.000	
Null	#17	==>	#18	3.667	0.234	
Null	#18	==>	#19	2.962	0.234	
Null	#19	==>	End	0.000	0.000	



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#11	8. Large gullies, diversions, and low flowing streams	1.13	70.00	6,200.72	3.18	0.541

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#11	**Muskingum K:**					**0.541**
#12	8. Large gullies, diversions, and low flowing streams	1.05	115.00	10,950.29	3.07	0.990
#12	**Muskingum K:**					**0.990**
#17	8. Large gullies, diversions, and low flowing streams	0.25	50.00	19,801.98	1.50	3.667
#17	**Muskingum K:**					**3.667**
#18	8. Large gullies, diversions, and low flowing streams	0.25	40.00	16,000.00	1.50	2.962
#18	**Muskingum K:**					**2.962**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#16	7,300.000	7,300.000	467.26	213.70
#15	3,530.000	3,530.000	388.14	103.33
#10	2,860.000	2,860.000	370.09	85.50
#11	3,930.000	6,790.000	898.95	202.93
#12	940.000	7,730.000	933.82	223.67
#17	5,060.000	23,620.000	1,827.86	689.00
#14	1,280.000	1,280.000	261.33	39.01
#13	1,762.000	1,762.000	250.23	53.97
#18	1,590.000	28,252.000	1,757.70	829.50
#19	0.000	28,252.000	1,719.96	829.50

Structure Detail:

Structure #16 (Null)

Structure #15 (Null)

Structure #10 (Null)

Structure #11 (Null)

Structure #12 (Null)

Structure #17 (Null)

Structure #14 (Null)

Structure #13 (Null)

Structure #18 (Null)

Structure #19 (Null)

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#16	1	3,500.000	1.666	1.666	0.319	88.000	M	482.75	102.471
	2	3,800.000	3.588	3.588	0.293	88.000	M	301.20	111.230
	Σ	**7,300.000**						**467.26**	**213.701**
#15	1	3,530.000	2.208	2.208	0.308	88.000	M	397.56	103.325
	Σ	**3,530.000**						**388.14**	**103.325**
#10	1	1,660.000	1.043	1.043	0.355	87.000	M	282.80	44.218
	2	800.000	0.442	0.442	0.360	89.000	M	280.42	25.735
	3	400.000	0.221	0.221	0.360	91.000	M	220.98	15.547
	Σ	**2,860.000**						**370.09**	**85.500**
#11	1	2,230.000	1.084	0.885	0.360	87.000	M	370.48	59.441
	2	1,200.000	0.442	0.442	0.360	89.000	M	420.64	38.603
	3	500.000	0.271	0.271	0.353	91.000	M	260.01	19.385
	Σ	**6,790.000**						**898.95**	**202.930**
#12	1	940.000	0.268	0.000	0.000	85.000	M	269.99	20.743
	Σ	**7,730.000**						**933.82**	**223.673**
#17	1	5,060.000	0.559	0.559	0.362	88.000	M	1,412.31	148.302
	Σ	**23,620.000**						**1,827.86**	**689.002**
#14	1	780.000	0.667	0.667	0.372	88.000	M	196.46	22.870
	2	500.000	0.308	0.308	0.372	89.000	M	205.13	16.137
	Σ	**1,280.000**						**261.33**	**39.007**
#13	1	940.000	1.151	1.151	0.360	88.000	M	167.40	27.528
	2	822.000	0.533	0.533	0.367	89.000	M	261.43	26.444
	Σ	**1,762.000**						**250.23**	**53.972**
#18	1	1,590.000	0.141	0.141	0.388	88.000	M	732.90	47.524
	Σ	**28,252.000**						**1,757.70**	**829.505**
#19	Σ	**28,252.000**						**1,719.96**	**829.505**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#10	1	8. Large gullies, diversions, and low flowing streams	1.94	305.00	15,700.60	4.180	1.043

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#10	**1**	**Time of Concentration:**					**1.043**
#10	2	8. Large gullies, diversions, and low flowing streams	2.14	150.00	7,000.18	4.390	0.442
#10	**2**	**Time of Concentration:**					**0.442**
#10	3	8. Large gullies, diversions, and low flowing streams	2.14	75.00	3,500.09	4.390	0.221
#10	**3**	**Time of Concentration:**					**0.221**
#11	1	8. Large gullies, diversions, and low flowing streams	1.88	300.00	15,999.99	4.100	1.084
#11	**1**	**Time of Concentration:**					**1.084**
#11	2	8. Large gullies, diversions, and low flowing streams	2.14	150.00	7,000.18	4.390	0.442
#11	**2**	**Time of Concentration:**					**0.442**
#11	3	8. Large gullies, diversions, and low flowing streams	1.88	75.00	3,999.99	4.100	0.271
#11	**3**	**Time of Concentration:**					**0.271**
#12	1	5. Nearly bare and untilled, and alluvial valley fans	5.23	115.00	2,200.03	2.280	0.268
#12	**1**	**Time of Concentration:**					**0.268**
#13	1	8. Large gullies, diversions, and low flowing streams	2.14	390.00	18,200.48	4.390	1.151
#13	**1**	**Time of Concentration:**					**1.151**
#13	2	8. Large gullies, diversions, and low flowing streams	2.44	220.00	9,000.00	4.690	0.533
#13	**2**	**Time of Concentration:**					**0.533**
#14	1	8. Large gullies, diversions, and low flowing streams	2.73	325.00	11,900.40	4.950	0.667
#14	**1**	**Time of Concentration:**					**0.667**
#14	2	8. Large gullies, diversions, and low flowing streams	2.73	150.00	5,500.14	4.950	0.308
#14	**2**	**Time of Concentration:**					**0.308**
#15	1	8. Large gullies, diversions, and low flowing streams	0.83	180.00	21,702.43	2.730	2.208
#15	**1**	**Time of Concentration:**					**2.208**
#16	1	8. Large gullies, diversions, and low flowing streams	1.00	180.00	18,000.00	3.000	1.666
#16	**1**	**Time of Concentration:**					**1.666**
#16	2	8. Large gullies, diversions, and low flowing streams	0.65	200.00	31,002.94	2.400	3.588
#16	**2**	**Time of Concentration:**					**3.588**
#17	1	8. Large gullies, diversions, and low flowing streams	2.22	200.00	9,000.09	4.470	0.559
#17	**1**	**Time of Concentration:**					**0.559**
#18	1	8. Large gullies, diversions, and low flowing streams	3.83	115.00	3,000.02	5.870	0.141
#18	**1**	**Time of Concentration:**					**0.141**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#10	1	8. Large gullies, diversions, and low flowing streams	1.94	305.00	15,700.60	4.180	1.043
#10	**1**	**Muskingum K:**					**1.043**
#10	2	8. Large gullies, diversions, and low flowing streams	2.14	150.00	7,000.18	4.390	0.442
#10	**2**	**Muskingum K:**					**0.442**
#10	3	8. Large gullies, diversions, and low flowing streams	2.14	75.00	3,500.09	4.390	0.221
#10	**3**	**Muskingum K:**					**0.221**
#11	1	8. Large gullies, diversions, and low flowing streams	2.14	300.00	14,000.37	4.390	0.885
#11	**1**	**Muskingum K:**					**0.885**
#11	2	8. Large gullies, diversions, and low flowing streams	2.14	150.00	7,000.00	4.390	0.442
#11	**2**	**Muskingum K:**					**0.442**
#11	3	8. Large gullies, diversions, and low flowing streams	1.88	75.00	3,999.99	4.100	0.271
#11	**3**	**Muskingum K:**					**0.271**
#13	1	8. Large gullies, diversions, and low flowing streams	2.14	390.00	18,200.48	4.390	1.151
#13	**1**	**Muskingum K:**					**1.151**
#13	2	8. Large gullies, diversions, and low flowing streams	2.44	220.00	9,000.16	4.690	0.533
#13	**2**	**Muskingum K:**					**0.533**
#14	1	8. Large gullies, diversions, and low flowing streams	2.73	325.00	11,900.40	4.950	0.667
#14	**1**	**Muskingum K:**					**0.667**
#14	2	8. Large gullies, diversions, and low flowing streams	2.73	150.00	5,500.14	4.950	0.308
#14	**2**	**Muskingum K:**					**0.308**
#15	1	8. Large gullies, diversions, and low flowing streams	0.83	180.00	21,702.43	2.730	2.208
#15	**1**	**Muskingum K:**					**2.208**
#16	1	8. Large gullies, diversions, and low flowing streams	1.00	180.00	18,000.00	3.000	1.666
#16	**1**	**Muskingum K:**					**1.666**
#16	2	8. Large gullies, diversions, and low flowing streams	0.65	200.00	31,002.94	2.400	3.588
#16	**2**	**Muskingum K:**					**3.588**
#17	1	8. Large gullies, diversions, and low flowing streams	2.22	200.00	9,000.09	4.470	0.559
#17	**1**	**Muskingum K:**					**0.559**
#18	1	8. Large gullies, diversions, and low flowing streams	3.83	115.00	3,000.02	5.870	0.141
#18	**1**	**Muskingum K:**					**0.141**

Chaco-Chinde Watershed Post Mining

OSM

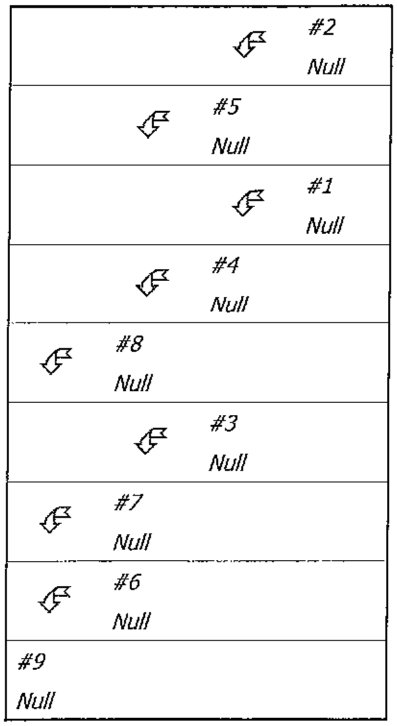
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	#4	0.000	0.000	
Null	#2	==>	#5	0.000	0.000	
Null	#3	==>	#7	0.000	0.000	
Null	#4	==>	#8	0.770	0.355	
Null	#5	==>	#8	0.658	0.358	
Null	#6	==>	#9	0.000	0.000	
Null	#7	==>	#9	0.967	0.340	
Null	#8	==>	#9	0.385	0.320	
Null	#9	==>	End	0.000	0.000	



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#4	8. Large gullies, diversions, and low flowing streams	1.95	226.00	11,600.00	4.18	0.770
#4	**Muskingum K:**					**0.770**
#5	8. Large gullies, diversions, and low flowing streams	2.06	210.00	10,200.11	4.30	0.658

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#5	**Muskingum K:**					**0.658**
#7	8. Large gullies, diversions, and low flowing streams	1.46	184.00	12,610.00	3.62	0.967
#7	**Muskingum K:**					**0.967**
#8	8. Large gullies, diversions, and low flowing streams	1.02	43.00	4,200.00	3.03	0.385
#8	**Muskingum K:**					**0.385**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2	1,650.000	1,650.000	81.38	11.14
#5	750.000	2,400.000	262.42	33.13
#1	850.000	850.000	32.21	5.70
#4	1,250.000	2,100.000	307.04	42.33
#8	980.000	5,480.000	575.42	104.18
#3	1,140.000	1,140.000	161.25	25.03
#7	1,225.000	2,365.000	326.80	51.91
#6	1,985.000	1,985.000	406.98	58.12
#9	2,930.000	12,760.000	1,331.61	292.27

Structure Detail:

Structure #2 (Null)

Structure #5 (Null)

Structure #1 (Null)

Structure #4 (Null)

Structure #8 (Null)

Structure #3 (Null)

Structure #7 (Null)

Structure #6 (Null)

Structure #9 (Null)

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#2	1	1,650.000	0.272	0.818	0.364	75.000	M	99.12	11.135
	Σ	**1,650.000**						**81.38**	**11.135**
#5	1	750.000	0.658	0.658	0.358	88.000	M	190.45	21.992
	Σ	**2,400.000**						**262.42**	**33.127**
#1	1	850.000	0.632	0.632	0.363	75.000	M	32.81	5.704
	Σ	**850.000**						**32.21**	**5.704**
#4	1	1,250.000	0.770	0.770	0.355	88.000	M	288.29	36.631
	Σ	**2,100.000**						**307.04**	**42.334**
#8	1	980.000	0.385	0.385	0.320	88.000	M	329.99	28.722
	Σ	**5,480.000**						**575.42**	**104.182**
#3	1	1,140.000	0.900	1.106	0.353	85.000	M	169.76	25.026
	Σ	**1,140.000**						**161.25**	**25.026**
#7	1	1,225.000	0.967	0.967	0.340	85.000	M	174.30	26.882
	Σ	**2,365.000**						**326.80**	**51.908**
#6	1	1,985.000	0.867	0.867	0.358	88.000	M	424.81	58.115
	Σ	**1,985.000**						**406.98**	**58.115**
#9	1	2,930.000	1.129	1.129	0.372	87.000	M	473.76	78.066
	Σ	**12,760.000**						**1,331.61**	**292.272**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	2.25	230.00	10,225.40	4.490	0.632
#1	**1**	**Time of Concentration:**					**0.632**
#2	1	9. Small streams flowing bankfull	2.29	305.00	13,340.00	13.600	0.272
#2	**1**	**Time of Concentration:**					**0.272**
#4	1	8. Large gullies, diversions, and low flowing streams	1.95	226.00	11,600.45	4.180	0.770
#4	**1**	**Time of Concentration:**					**0.770**
#5	1	8. Large gullies, diversions, and low flowing streams	2.06	210.00	10,200.11	4.300	0.658
#5	**1**	**Time of Concentration:**					**0.658**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#6	1	8. Large gullies, diversions, and low flowing streams	2.04	272.00	13,360.00	4.280	0.867
#6	**1**	**Time of Concentration:**					**0.867**
#7	1	8. Large gullies, diversions, and low flowing streams	1.46	184.00	12,610.00	3.620	0.967
#7	**1**	**Time of Concentration:**					**0.967**
#8	1	8. Large gullies, diversions, and low flowing streams	1.02	43.00	4,200.00	3.030	0.385
#8	**1**	**Time of Concentration:**					**0.385**
#9	1	8. Large gullies, diversions, and low flowing streams	2.70	540.00	20,000.00	4.920	1.129
#9	**1**	**Time of Concentration:**					**1.129**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	2.25	230.00	10,225.40	4.490	0.632
#1	**1**	**Muskingum K:**					**0.632**
#2	1	8. Large gullies, diversions, and low flowing streams	2.29	305.00	13,340.33	4.530	0.818
#2	**1**	**Muskingum K:**					**0.818**
#3	1	8. Large gullies, diversions, and low flowing streams	1.86	302.00	16,250.53	4.080	1.106
#3	**1**	**Muskingum K:**					**1.106**
#4	1	8. Large gullies, diversions, and low flowing streams	1.95	226.00	11,600.45	4.180	0.770
#4	**1**	**Muskingum K:**					**0.770**
#5	1	8. Large gullies, diversions, and low flowing streams	2.06	210.00	10,200.11	4.300	0.658
#5	**1**	**Muskingum K:**					**0.658**
#6	1	8. Large gullies, diversions, and low flowing streams	2.04	272.00	13,360.18	4.280	0.867
#6	**1**	**Muskingum K:**					**0.867**
#7	1	8. Large gullies, diversions, and low flowing streams	1.46	184.00	12,610.51	3.620	0.967
#7	**1**	**Muskingum K:**					**0.967**
#8	1	8. Large gullies, diversions, and low flowing streams	1.02	43.00	4,200.03	3.030	0.385
#8	**1**	**Muskingum K:**					**0.385**
#9	1	8. Large gullies, diversions, and low flowing streams	2.70	540.00	20,000.00	4.920	1.129
#9	**1**	**Muskingum K:**					**1.129**

Chaco-Chinde Watershed Pre-Mining

OSM

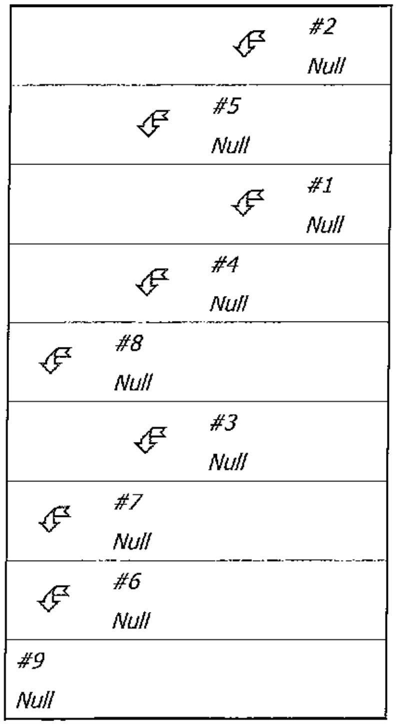
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	#4	0.000	0.000	
Null	#2	==>	#5	0.000	0.000	
Null	#3	==>	#7	0.000	0.000	
Null	#4	==>	#8	0.770	0.355	
Null	#5	==>	#8	0.658	0.358	
Null	#6	==>	#9	0.000	0.000	
Null	#7	==>	#9	0.967	0.340	
Null	#8	==>	#9	0.385	0.320	
Null	#9	==>	End	0.000	0.000	



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#4	8. Large gullies, diversions, and low flowing streams	1.95	226.00	11,600.00	4.18	0.770
#4	**Muskingum K:**					**0.770**
#5	8. Large gullies, diversions, and low flowing streams	2.06	210.00	10,200.11	4.30	0.658

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#5	**Muskingum K:**					**0.658**
#7	8. Large gullies, diversions, and low flowing streams	1.46	184.00	12,610.00	3.62	0.967
#7	**Muskingum K:**					**0.967**
#8	8. Large gullies, diversions, and low flowing streams	1.02	43.00	4,200.00	3.03	0.385
#8	**Muskingum K:**					**0.385**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2	2,010.000	2,010.000	680.13	59.21
#5	1,100.000	3,110.000	929.94	91.46
#1	1,210.000	1,210.000	298.30	35.44
#4	1,540.000	2,750.000	609.87	80.57
#8	980.000	6,840.000	1,408.08	200.75
#3	1,565.000	1,565.000	221.37	34.36
#7	1,650.000	3,215.000	444.33	70.56
#6	1,235.000	1,235.000	253.21	36.16
#9	2,930.000	14,220.000	2,096.39	385.54

Structure Detail:

Structure #2 (Null)

Structure #5 (Null)

Structure #1 (Null)

Structure #4 (Null)

Structure #8 (Null)

Structure #3 (Null)

Structure #7 (Null)

Structure #6 (Null)

Structure #9 (Null)

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#2	1	2,010.000	0.272	0.818	0.364	88.000	M	779.56	59.208
	Σ	**2,010.000**						**680.13**	**59.208**
#5	1	1,100.000	0.658	0.658	0.358	88.000	M	279.32	32.254
	Σ	**3,110.000**						**929.94**	**91.462**
#1	1	1,210.000	0.632	0.632	0.363	88.000	M	314.58	35.439
	Σ	**1,210.000**						**298.30**	**35.439**
#4	1	1,540.000	0.770	0.770	0.355	88.000	M	355.18	45.129
	Σ	**2,750.000**						**609.87**	**80.568**
#8	1	980.000	0.385	0.385	0.320	88.000	M	329.99	28.722
	Σ	**6,840.000**						**1,408.08**	**200.752**
#3	1	1,565.000	0.900	1.106	0.353	85.000	M	233.04	34.356
	Σ	**1,565.000**						**221.37**	**34.356**
#7	1	1,650.000	0.967	0.967	0.340	85.000	M	234.78	36.208
	Σ	**3,215.000**						**444.33**	**70.564**
#6	1	1,235.000	0.867	0.867	0.358	88.000	M	264.30	36.157
	Σ	**1,235.000**						**253.21**	**36.157**
#9	1	2,930.000	1.129	1.129	0.372	87.000	M	473.76	78.066
	Σ	**14,220.000**						**2,096.39**	**385.539**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	2.25	230.00	10,225.40	4.490	0.632
#1	**1**	**Time of Concentration:**					**0.632**
#2	1	9. Small streams flowing bankfull	2.29	305.00	13,340.00	13.600	0.272
#2	**1**	**Time of Concentration:**					**0.272**
#4	1	8. Large gullies, diversions, and low flowing streams	1.95	226.00	11,600.45	4.180	0.770
#4	**1**	**Time of Concentration:**					**0.770**
#5	1	8. Large gullies, diversions, and low flowing streams	2.06	210.00	10,200.11	4.300	0.658
#5	**1**	**Time of Concentration:**					**0.658**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#6	1	8. Large gullies, diversions, and low flowing streams	2.04	272.00	13,360.00	4.280	0.867
#6	**1**	**Time of Concentration:**					**0.867**
#7	1	8. Large gullies, diversions, and low flowing streams	1.46	184.00	12,610.00	3.620	0.967
#7	**1**	**Time of Concentration:**					**0.967**
#8	1	8. Large gullies, diversions, and low flowing streams	1.02	43.00	4,200.00	3.030	0.385
#8	**1**	**Time of Concentration:**					**0.385**
#9	1	8. Large gullies, diversions, and low flowing streams	2.70	540.00	20,000.00	4.920	1.129
#9	**1**	**Time of Concentration:**					**1.129**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	2.25	230.00	10,225.40	4.490	0.632
#1	**1**	**Muskingum K:**					**0.632**
#2	1	8. Large gullies, diversions, and low flowing streams	2.29	305.00	13,340.33	4.530	0.818
#2	**1**	**Muskingum K:**					**0.818**
#3	1	8. Large gullies, diversions, and low flowing streams	1.86	302.00	16,250.53	4.080	1.106
#3	**1**	**Muskingum K:**					**1.106**
#4	1	8. Large gullies, diversions, and low flowing streams	1.95	226.00	11,600.45	4.180	0.770
#4	**1**	**Muskingum K:**					**0.770**
#5	1	8. Large gullies, diversions, and low flowing streams	2.06	210.00	10,200.11	4.300	0.658
#5	**1**	**Muskingum K:**					**0.658**
#6	1	8. Large gullies, diversions, and low flowing streams	2.04	272.00	13,360.18	4.280	0.867
#6	**1**	**Muskingum K:**					**0.867**
#7	1	8. Large gullies, diversions, and low flowing streams	1.46	184.00	12,610.51	3.620	0.967
#7	**1**	**Muskingum K:**					**0.967**
#8	1	8. Large gullies, diversions, and low flowing streams	1.02	43.00	4,200.03	3.030	0.385
#8	**1**	**Muskingum K:**					**0.385**
#9	1	8. Large gullies, diversions, and low flowing streams	2.70	540.00	20,000.00	4.920	1.129
#9	**1**	**Muskingum K:**					**1.129**

Coal Creek Watershed Post-Mining

OSM

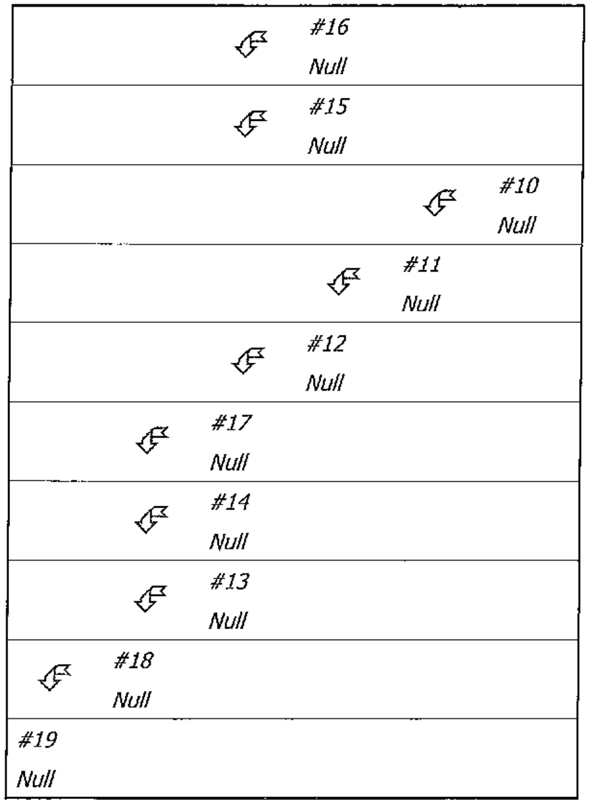
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#10	==>	#11	0.000	0.000	
Null	#11	==>	#12	0.541	0.326	
Null	#12	==>	#17	0.990	0.322	
Null	#13	==>	#18	0.000	0.000	
Null	#14	==>	#18	0.000	0.000	
Null	#15	==>	#17	0.000	0.000	
Null	#16	==>	#17	0.000	0.000	
Null	#17	==>	#18	3.667	0.234	
Null	#18	==>	#19	2.962	0.234	
Null	#19	==>	End	0.000	0.000	



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#11	8. Large gullies, diversions, and low flowing streams	1.13	70.00	6,200.72	3.18	0.541

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#11	**Muskingum K:**					**0.541**
#12	8. Large gullies, diversions, and low flowing streams	1.05	115.00	10,950.29	3.07	0.990
#12	**Muskingum K:**					**0.990**
#17	8. Large gullies, diversions, and low flowing streams	0.25	50.00	19,801.98	1.50	3.667
#17	**Muskingum K:**					**3.667**
#18	8. Large gullies, diversions, and low flowing streams	0.25	40.00	16,000.00	1.50	2.962
#18	**Muskingum K:**					**2.962**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#16	7,300.000	7,300.000	467.26	213.70
#15	3,530.000	3,530.000	388.14	103.33
#10	2,860.000	2,860.000	240.25	46.02
#11	3,930.000	6,790.000	500.47	96.60
#12	940.000	7,730.000	523.35	117.35
#17	5,060.000	23,620.000	1,471.57	582.68
#14	1,280.000	1,280.000	261.33	39.01
#13	1,762.000	1,762.000	250.23	53.97
#18	1,590.000	28,252.000	1,383.23	723.18
#19	0.000	28,252.000	1,335.69	723.18

Structure Detail:

Structure #16 (Null)

Structure #15 (Null)

Structure #10 (Null)

Structure #11 (Null)

Structure #12 (Null)

Structure #17 (Null)

Structure #14 (Null)

Structure #13 (Null)

Structure #18 (Null)

Structure #19 (Null)

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#16	1	3,500.000	1.666	1.666	0.319	88.000	M	482.75	102.471
	2	3,800.000	3.588	3.588	0.293	88.000	M	301.20	111.230
	Σ	**7,300.000**						**467.26**	**213.701**
#15	1	3,530.000	2.208	2.208	0.308	88.000	M	397.56	103.325
	Σ	**3,530.000**						**388.14**	**103.325**
#10	1	2,860.000	1.177	1.043	0.355	82.000	M	245.19	46.024
	Σ	**2,860.000**						**240.25**	**46.024**
#11	1	3,930.000	1.084	0.885	0.360	80.000	M	269.11	50.580
	Σ	**6,790.000**						**500.47**	**96.605**
#12	1	940.000	0.268	0.000	0.000	85.000	M	269.99	20.743
	Σ	**7,730.000**						**523.35**	**117.348**
#17	1	5,060.000	0.559	0.559	0.362	88.000	M	1,412.31	148.302
	Σ	**23,620.000**						**1,471.57**	**582.676**
#14	1	780.000	0.667	0.667	0.372	88.000	M	196.46	22.870
	2	500.000	0.308	0.308	0.372	89.000	M	205.13	16.137
	Σ	**1,280.000**						**261.33**	**39.007**
#13	1	940.000	1.151	1.151	0.360	88.000	M	167.40	27.528
	2	822.000	0.533	0.533	0.367	89.000	M	261.43	26.444
	Σ	**1,762.000**						**250.23**	**53.972**
#18	1	1,590.000	0.141	0.141	0.388	88.000	M	732.90	47.524
	Σ	**28,252.000**						**1,383.23**	**723.179**
#19	Σ	**28,252.000**						**1,335.69**	**723.179**

Subwatershed Time of Concentration Details:

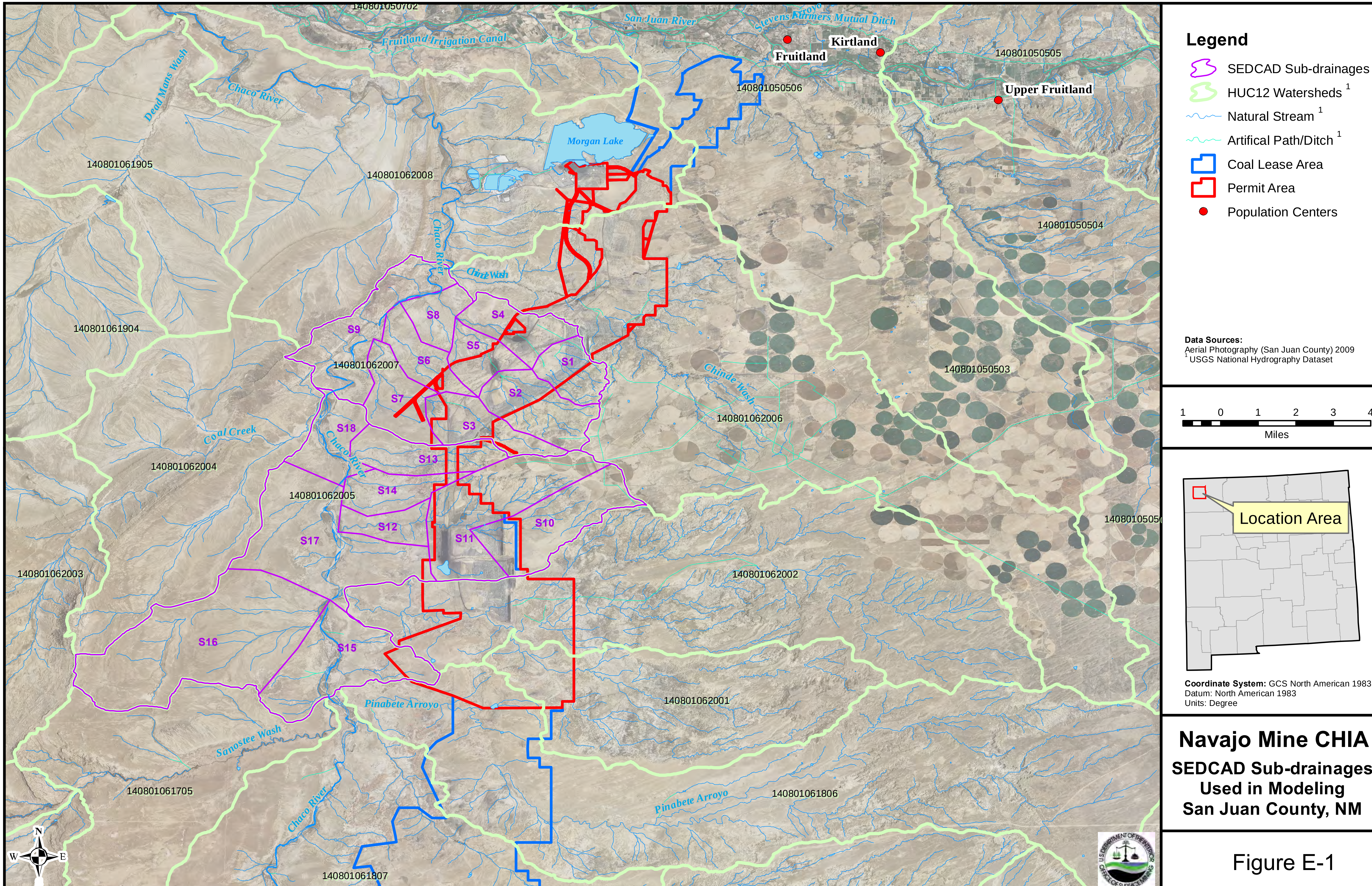
Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#10	1	8. Large gullies, diversions, and low flowing streams	1.79	305.00	17,000.16	4.010	1.177
#10	**1**	**Time of Concentration:**					**1.177**
#11	1	8. Large gullies, diversions, and low flowing streams	1.88	300.00	15,999.99	4.100	1.084
#11	**1**	**Time of Concentration:**					**1.084**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#12	1	5. Nearly bare and untilled, and alluvial valley fans	5.23	115.00	2,200.03	2.280	0.268
#12	**1**	**Time of Concentration:**					**0.268**
#13	1	8. Large gullies, diversions, and low flowing streams	2.14	390.00	18,200.48	4.390	1.151
#13	**1**	**Time of Concentration:**					**1.151**
#13	2	8. Large gullies, diversions, and low flowing streams	2.44	220.00	9,000.00	4.690	0.533
#13	**2**	**Time of Concentration:**					**0.533**
#14	1	8. Large gullies, diversions, and low flowing streams	2.73	325.00	11,900.40	4.950	0.667
#14	**1**	**Time of Concentration:**					**0.667**
#14	2	8. Large gullies, diversions, and low flowing streams	2.73	150.00	5,500.14	4.950	0.308
#14	**2**	**Time of Concentration:**					**0.308**
#15	1	8. Large gullies, diversions, and low flowing streams	0.83	180.00	21,702.43	2.730	2.208
#15	**1**	**Time of Concentration:**					**2.208**
#16	1	8. Large gullies, diversions, and low flowing streams	1.00	180.00	18,000.00	3.000	1.666
#16	**1**	**Time of Concentration:**					**1.666**
#16	2	8. Large gullies, diversions, and low flowing streams	0.65	200.00	31,002.94	2.400	3.588
#16	**2**	**Time of Concentration:**					**3.588**
#17	1	8. Large gullies, diversions, and low flowing streams	2.22	200.00	9,000.09	4.470	0.559
#17	**1**	**Time of Concentration:**					**0.559**
#18	1	8. Large gullies, diversions, and low flowing streams	3.83	115.00	3,000.02	5.870	0.141
#18	**1**	**Time of Concentration:**					**0.141**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#10	1	8. Large gullies, diversions, and low flowing streams	1.94	305.00	15,700.60	4.180	1.043
#10	**1**	**Muskingum K:**					**1.043**
#11	1	8. Large gullies, diversions, and low flowing streams	2.14	300.00	14,000.37	4.390	0.885
#11	**1**	**Muskingum K:**					**0.885**
#13	1	8. Large gullies, diversions, and low flowing streams	2.14	390.00	18,200.48	4.390	1.151
#13	**1**	**Muskingum K:**					**1.151**
#13	2	8. Large gullies, diversions, and low flowing streams	2.44	220.00	9,000.16	4.690	0.533
#13	**2**	**Muskingum K:**					**0.533**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#14	1	8. Large gullies, diversions, and low flowing streams	2.73	325.00	11,900.40	4.950	0.667
#14	**1**	**Muskingum K:**					**0.667**
#14	2	8. Large gullies, diversions, and low flowing streams	2.73	150.00	5,500.14	4.950	0.308
#14	**2**	**Muskingum K:**					**0.308**
#15	1	8. Large gullies, diversions, and low flowing streams	0.83	180.00	21,702.43	2.730	2.208
#15	**1**	**Muskingum K:**					**2.208**
#16	1	8. Large gullies, diversions, and low flowing streams	1.00	180.00	18,000.00	3.000	1.666
#16	**1**	**Muskingum K:**					**1.666**
#16	2	8. Large gullies, diversions, and low flowing streams	0.65	200.00	31,002.94	2.400	3.588
#16	**2**	**Muskingum K:**					**3.588**
#17	1	8. Large gullies, diversions, and low flowing streams	2.22	200.00	9,000.09	4.470	0.559
#17	**1**	**Muskingum K:**					**0.559**
#18	1	8. Large gullies, diversions, and low flowing streams	3.83	115.00	3,000.02	5.870	0.141
#18	**1**	**Muskingum K:**					**0.141**



Navajo Mine CHIA

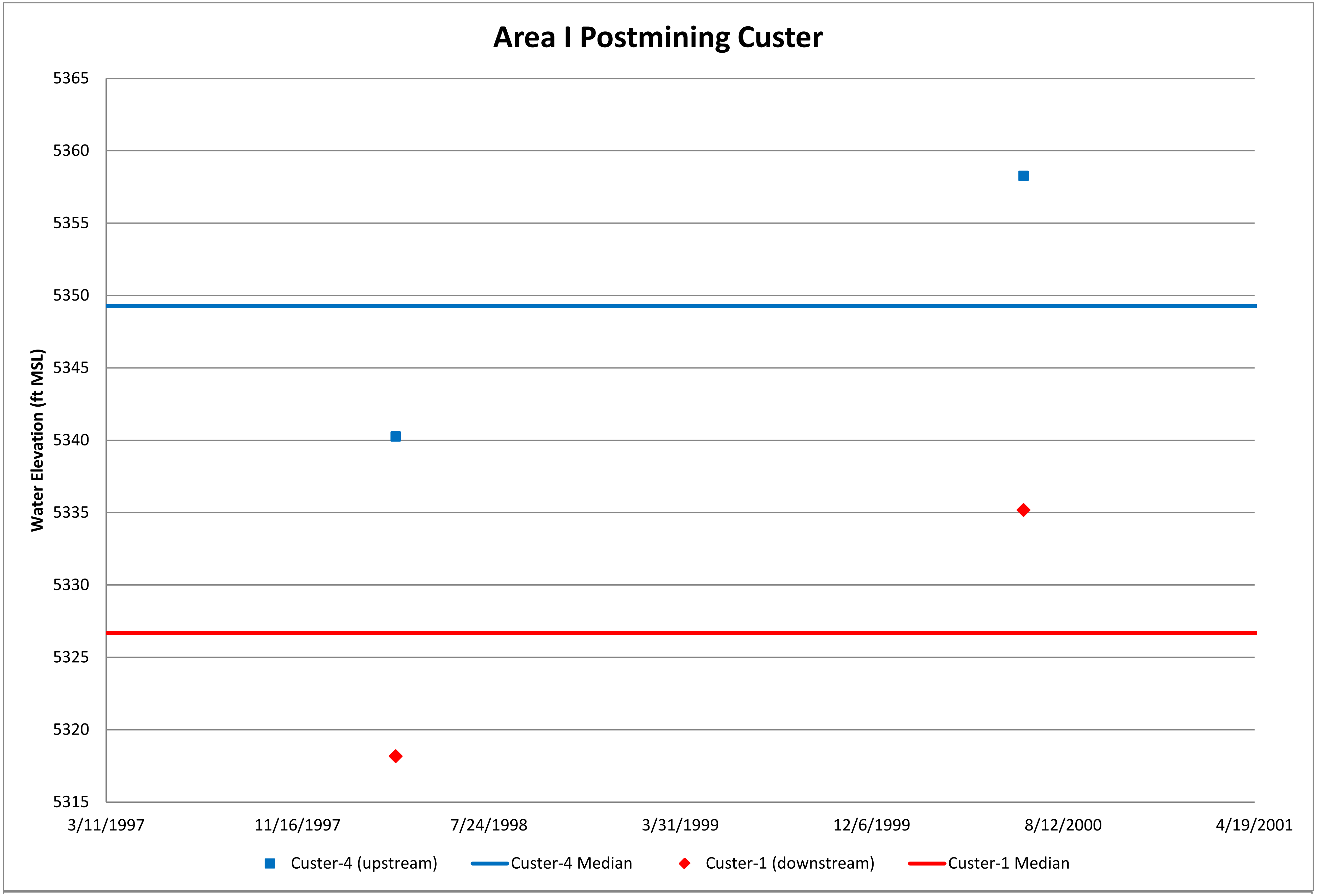
SEDCAD Sub-drainages Used in Modeling San Juan County, NM

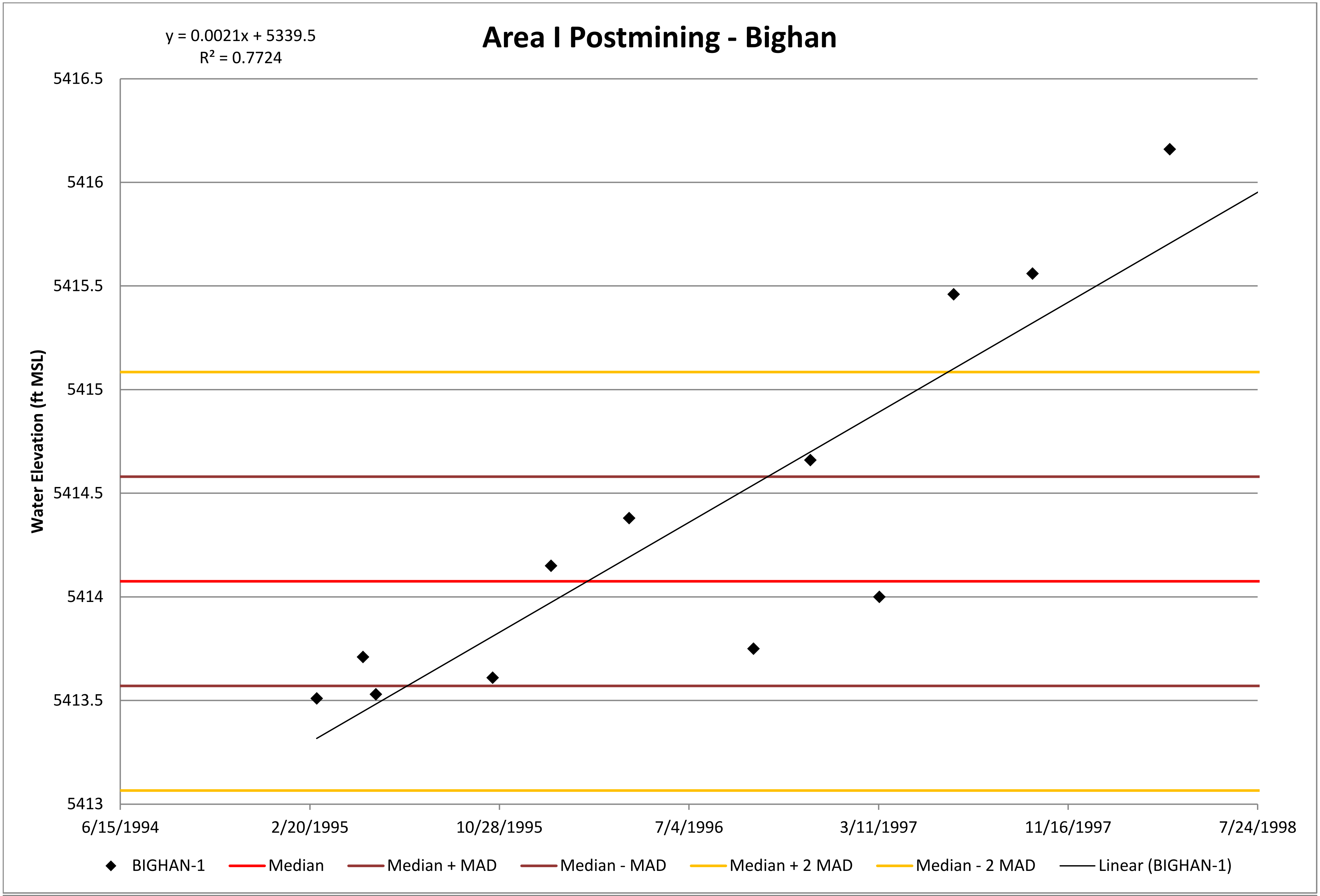
Figure E-1

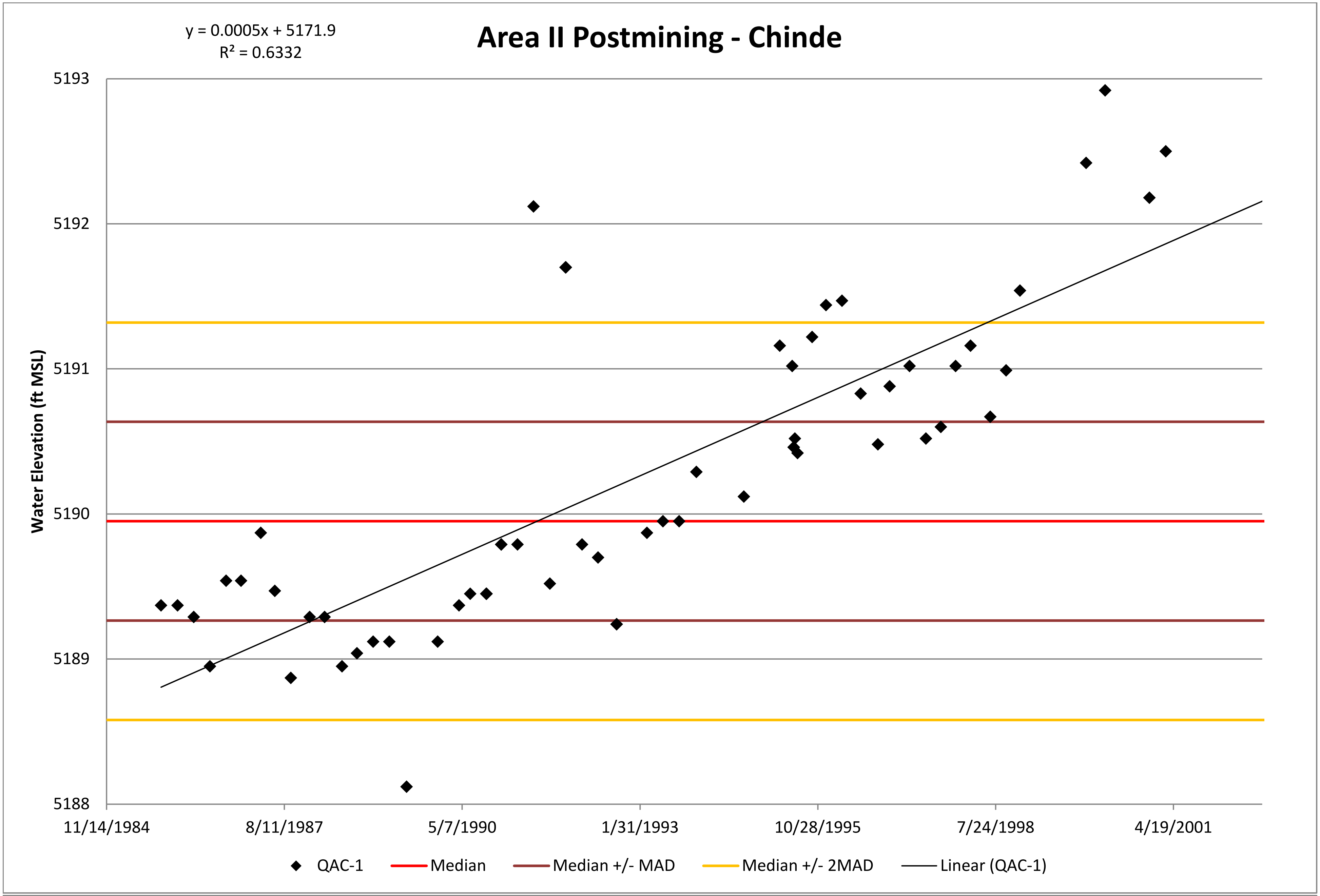
Appendix F: Groundwater Data Summary

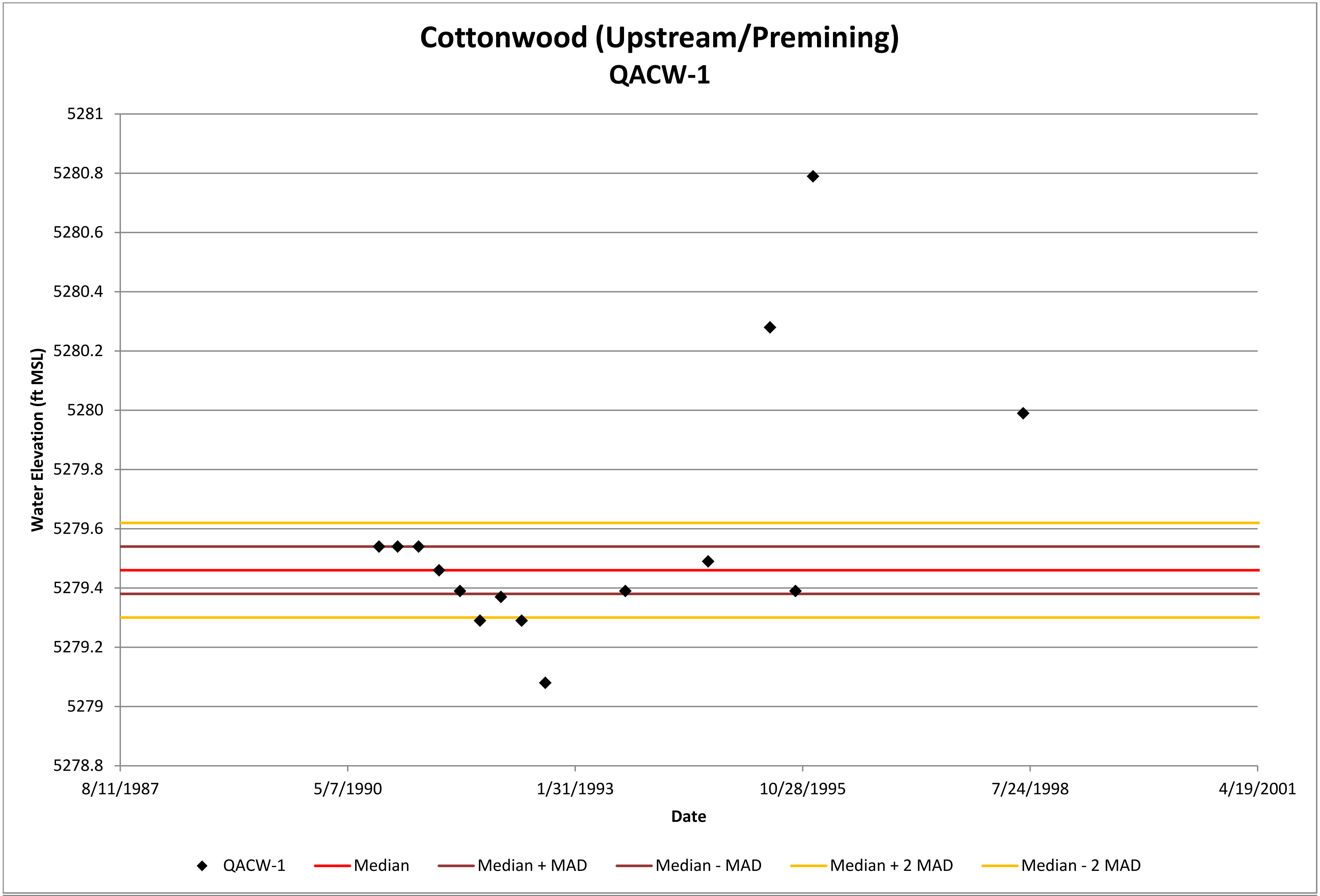
Alluvial Water Level Data

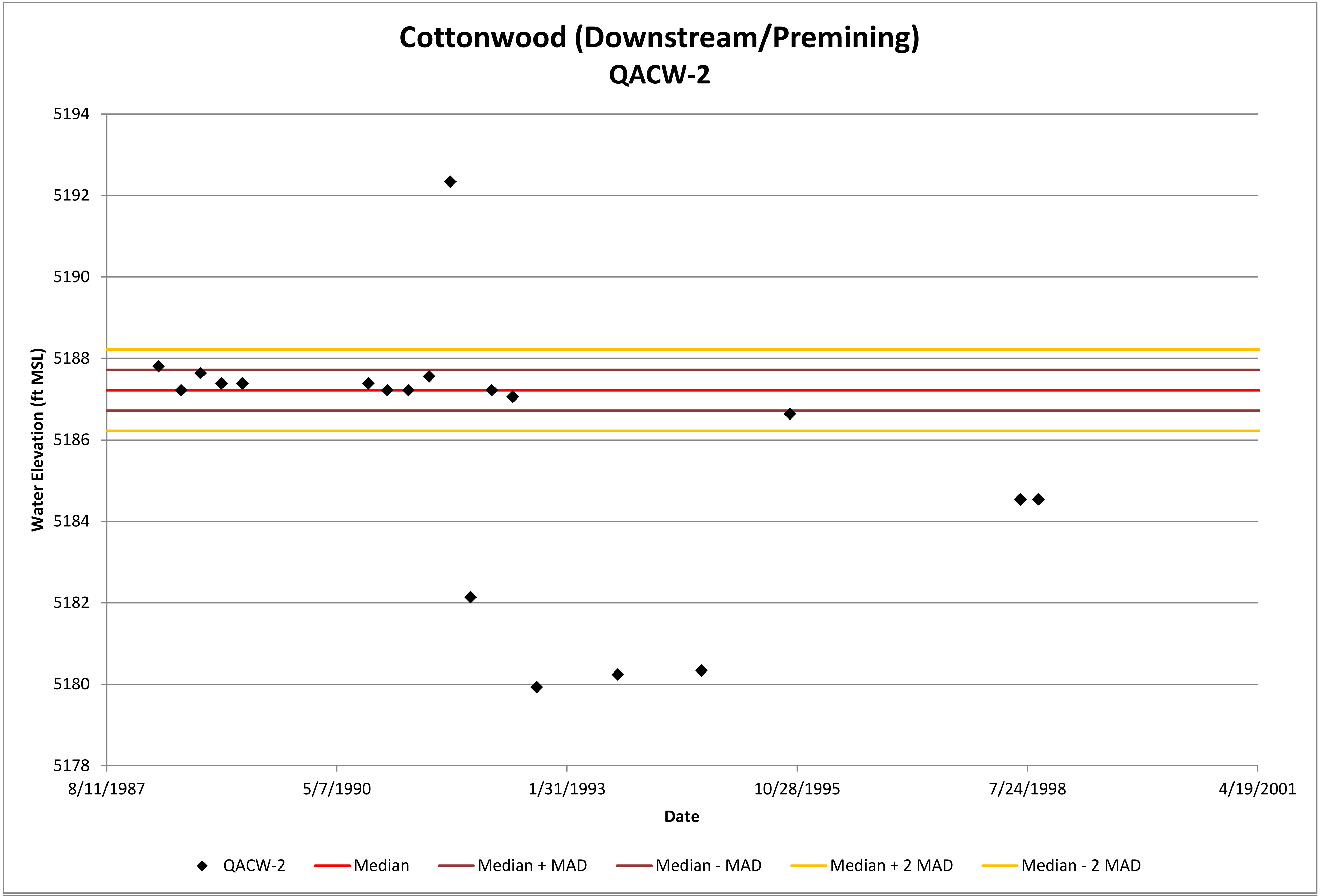
Well	n (% Not Dry)	% Not Dry	n (Water Level)	Water Level Range (ft MSL)	Median	MAD	Average	StDev	%RSD	Q3	Q1	95th%	5th%
CUSTER-4	8	25	2	(5358.27-5340.26)	5349.27	9.01	5349.27	12.73	0.24	5353.77	5344.76	5357.37	5341.16
CUSTER-4	8	25	2	(5358.27-5340.26)	5349.27	9.01	5349.27	12.73	0.24	5353.77	5344.76	5357.37	5341.16
BIGHAN-1	21	100	12	(5416.16-5413.51)	5414.08	0.51	5414.37	0.90	0.02	5414.86	5413.69	5415.83	5413.52
BIGHAN-1	21	100	12	(5416.16-5413.51)	5414.08	0.51	5414.37	0.90	0.02	5414.86	5413.69	5415.83	5413.52
CUSTER-1	8	25	2	(5335.18-5318.17)	5326.68	8.51	5326.68	12.03	0.23	5330.93	5322.42	5334.33	5319.02
CUSTER-1	8	25	2	(5335.18-5318.17)	5326.68	8.51	5326.68	12.03	0.23	5330.93	5322.42	5334.33	5319.02
QAC-1	110	100	61	(5192.92-5188.12)	5189.95	0.68	5190.24	1.06	0.02	5191.02	5189.37	5192.18	5188.95
QAC-1	110	100	61	(5192.92-5188.12)	5189.95	0.68	5190.24	1.06	0.02	5191.02	5189.37	5192.18	5188.95
QACW-1	48	54	15	(5280.79-5279.08)	5279.46	0.08	5279.59	0.44	0.01	5279.54	5279.38	5280.43	5279.23
QACW-1	48	54	15	(5280.79-5279.08)	5279.46	0.08	5279.59	0.44	0.01	5279.54	5279.38	5280.43	5279.23
QACW-2	59	66	20	(5192.34-5179.93)	5187.22	0.50	5185.82	3.12	0.06	5187.39	5184.54	5188.04	5180.22
QACW-2	59	66	20	(5192.34-5179.93)	5187.22	0.50	5185.82	3.12	0.06	5187.39	5184.54	5188.04	5180.22
QACW-2B	44	100	36	(5236.64-5230.)	5235.73	0.48	5235.33	1.66	0.03	5236.22	5235.27	5236.60	5230.41
QACW-2B	44	100	36	(5236.64-5230.)	5235.73	0.48	5235.33	1.66	0.03	5236.22	5235.27	5236.60	5230.41
PA-1	27	96	23	(5341.9-5340.7)	5341.20	0.30	5341.23	0.37	0.01	5341.49	5340.90	5341.88	5340.76
PA-1	27	96	23	(5341.9-5340.7)	5341.20	0.30	5341.23	0.37	0.01	5341.49	5340.90	5341.88	5340.76
PA-2	28	100	22	(5426.43-5422.23)	5423.19	0.48	5423.34	1.03	0.02	5423.54	5422.69	5425.82	5422.40
PA-2	28	100	22	(5426.43-5422.23)	5423.19	0.48	5423.34	1.03	0.02	5423.54	5422.69	5425.82	5422.40
NNA-1	26	27	6	(5418.76-5417.93)	5418.40	0.12	5418.38	0.27	0.01	5418.49	5418.32	5418.70	5418.02
NNA-1	26	27	6	(5418.76-5417.93)	5418.40	0.12	5418.38	0.27	0.01	5418.49	5418.32	5418.70	5418.02

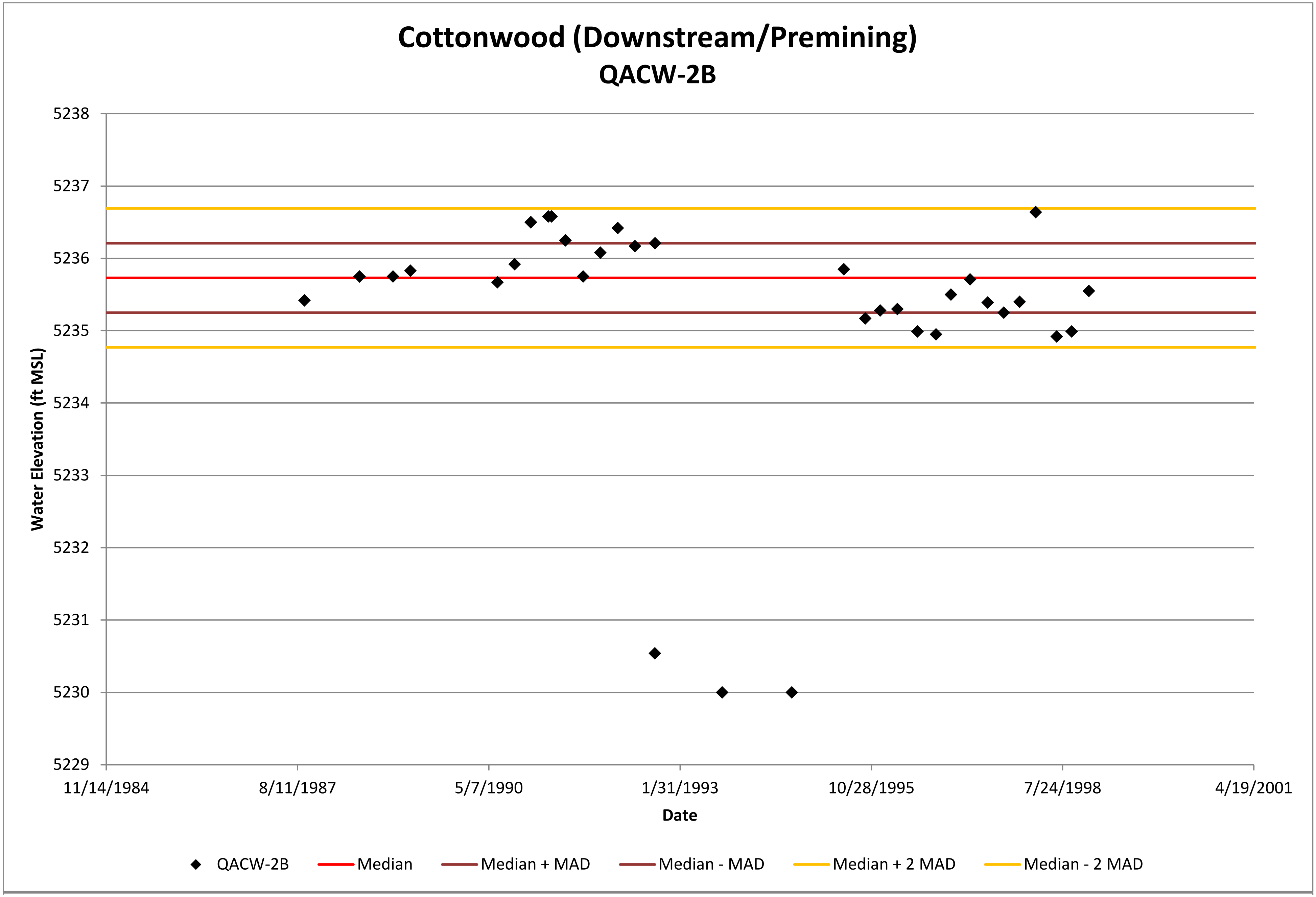

Area I Postmining Custer
Water Elevation (ft MSL)
5365
5360
5355
5350
5345
5340
5335
5330
5325
5320
5315
3/11/1997
11/16/1997
7/24/1998
3/31/1999
12/6/1999
8/12/2000
4/19/2001
Custer-4 (upstream)
Custer-4 Median
Custer-1 (downstream)
Custer-1 Median

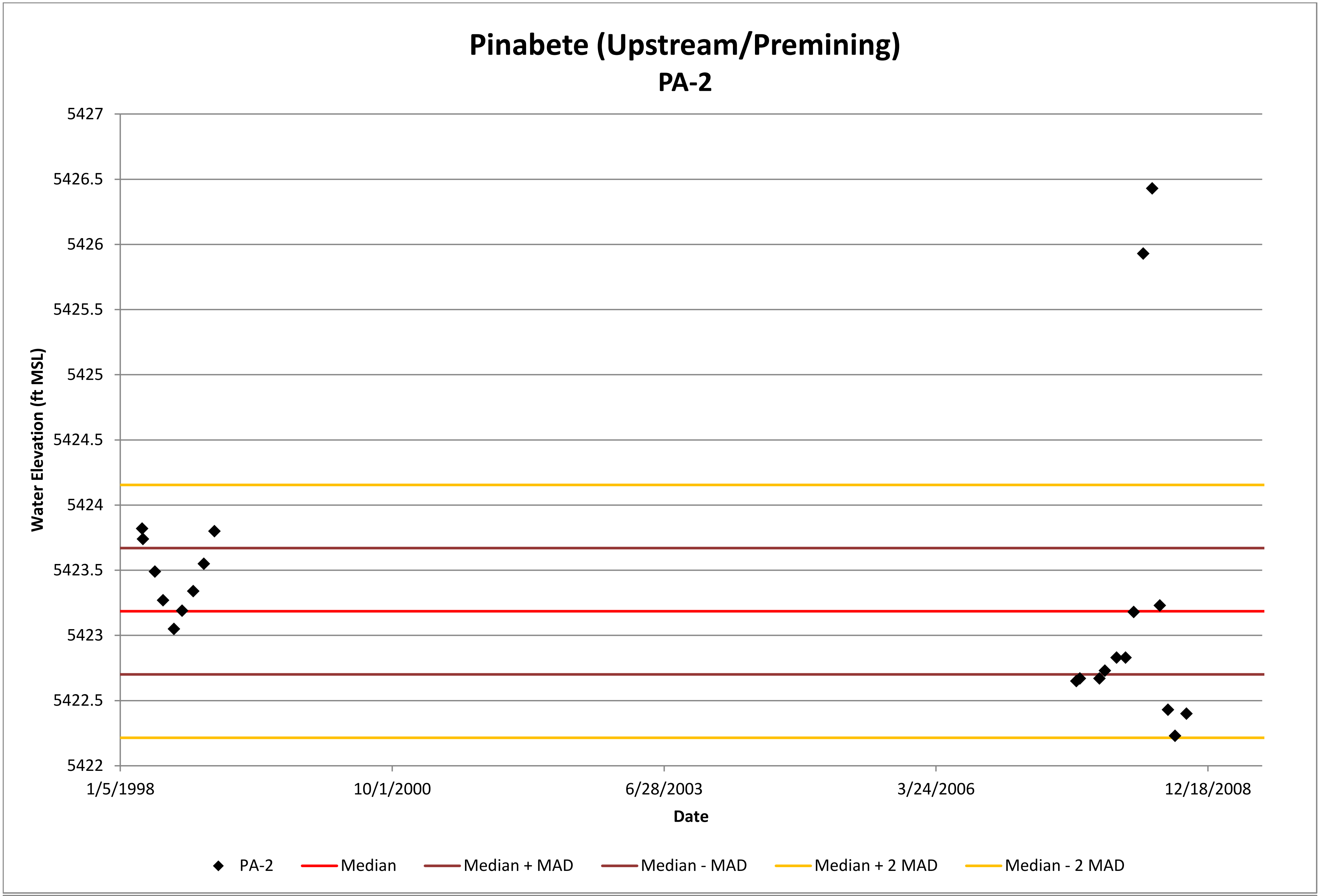

Area I Postmining - Bighan
y = 0.0021x + 5339.5
R² = 0.7724
Water Elevation (ft MSL)
5416.5
5416
5415.5
5415
5414.5
5414
5413.5
5413
6/15/1994
2/20/1995
10/28/1995
7/4/1996
3/11/1997
11/16/1997
7/24/1998
BIGHAN-1
Median
Median + MAD
Median - MAD
Median + 2 MAD
Median - 2 MAD
Linear (BIGHAN-1)

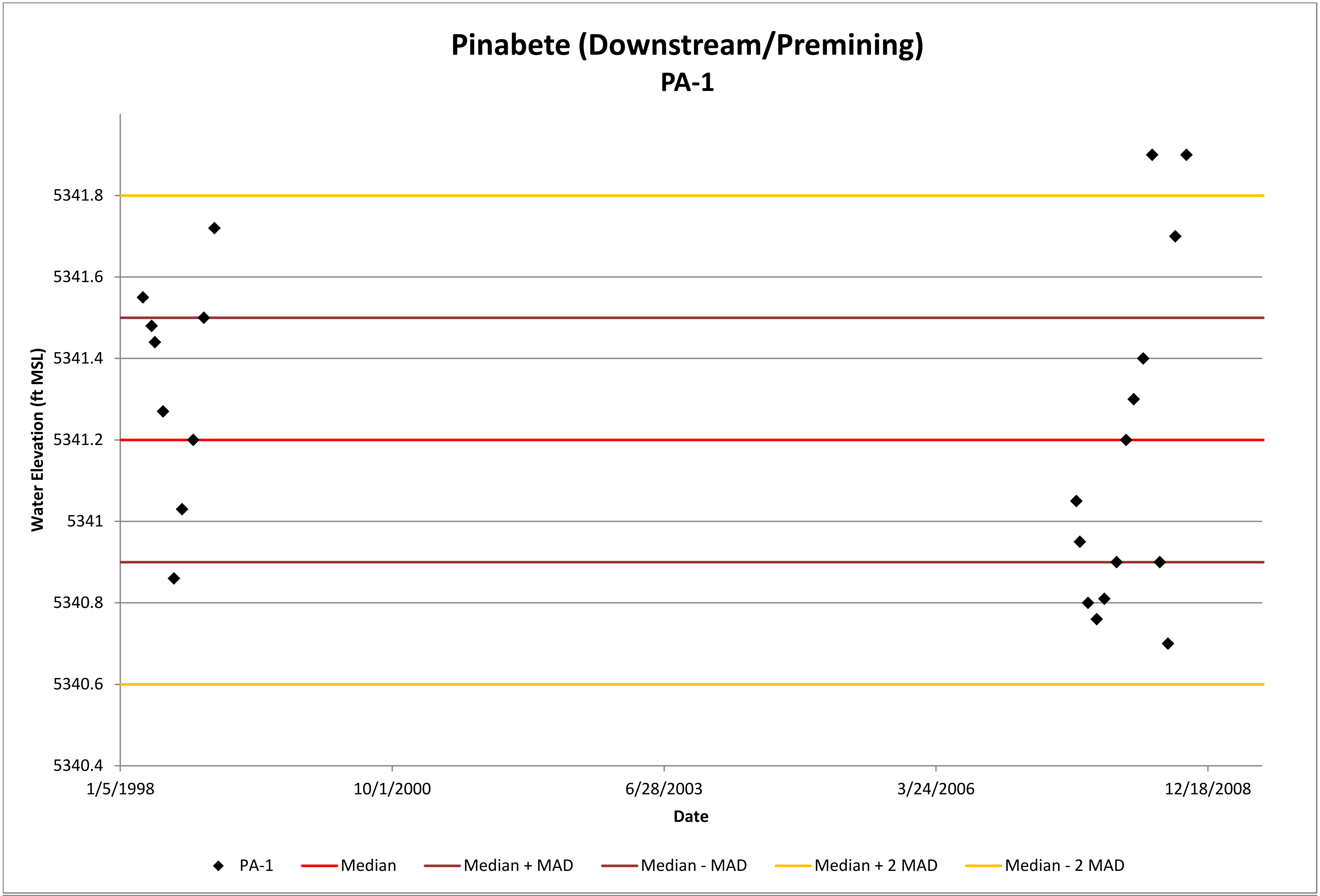

y = 0.0005x + 5171.9
R² = 0.6332
Area II Postmining - Chinde
5193
5192
5191
5190
5189
5188
Water Elevation (ft MSL)
11/14/1984
8/11/1987
5/7/1990
1/31/1993
10/28/1995
7/24/1998
4/19/2001
QAC-1
Median
Median +/- MAD
Median +/- 2MAD
Linear (QAC-1)

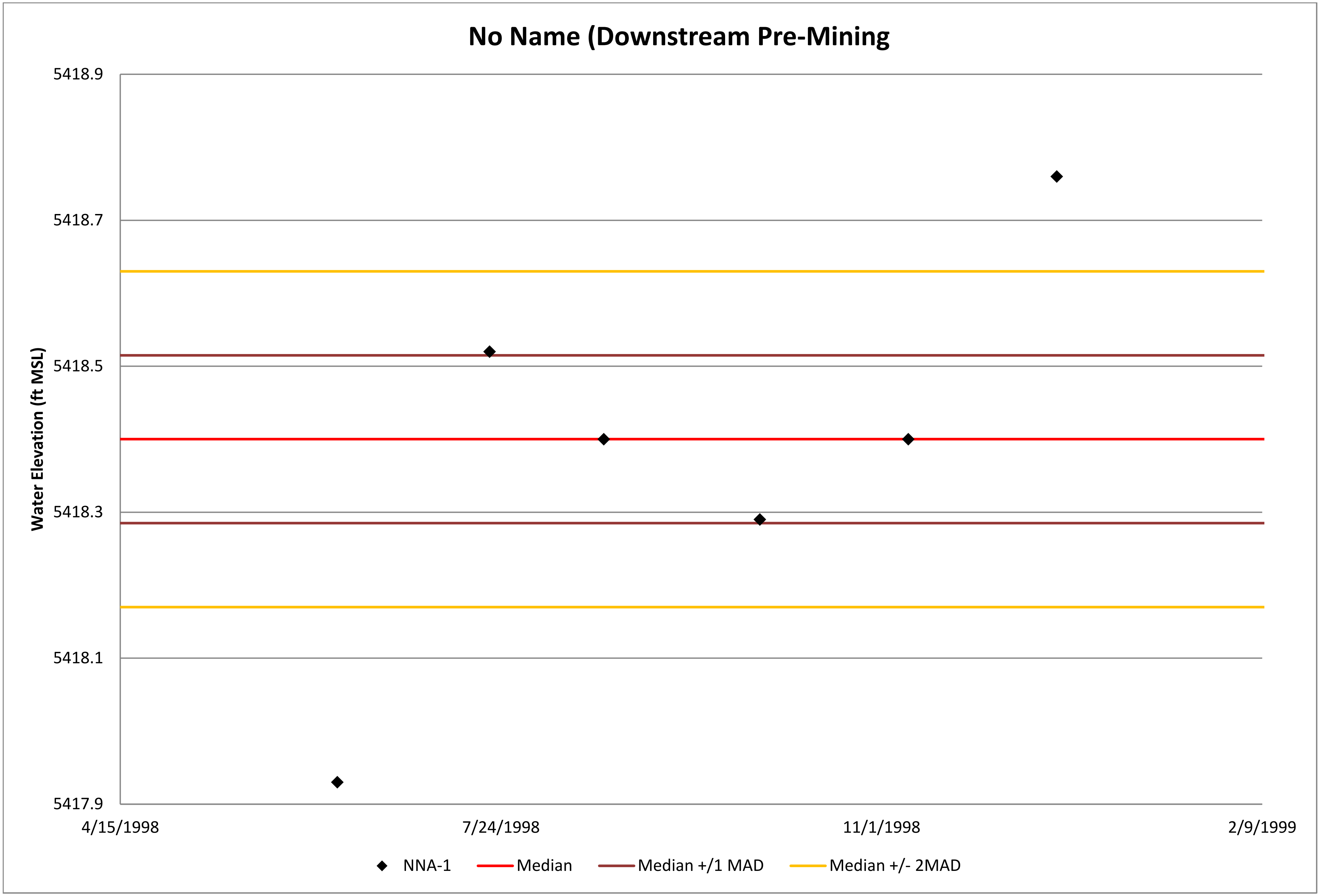

Cottonwood (Upstream/Premining)
QACW-1
Water Elevation (ft MSL)
5281
5280.8
5280.6
5280.4
5280.2
5280
5279.8
5279.6
5279.4
5279.2
5279
5278.8
8/11/1987
5/7/1990
1/31/1993
10/28/1995
7/24/1998
4/19/2001
Date
QACW-1
Median
Median + MAD
Median - MAD
Median + 2 MAD
Median - 2 MAD


Cottonwood (Downstream/Premining)
QACW-2
Water Elevation (ft MSL)
5194
5192
5190
5188
5186
5184
5182
5180
5178
8/11/1987
5/7/1990
1/31/1993
10/28/1995
7/24/1998
4/19/2001
Date
QACW-2
Median
Median + MAD
Median - MAD
Median + 2 MAD
Median - 2 MAD


Cottonwood (Downstream/Premining)
QACW-2B
5238
5237
5236
5235
5234
5233
5232
5231
5230
5229
Water Elevation (ft MSL)
11/14/1984
8/11/1987
5/7/1990
1/31/1993
10/28/1995
7/24/1998
4/19/2001
Date
QACW-2B
Median
Median + MAD
Median - MAD
Median + 2 MAD
Median - 2 MAD


Pinabete (Upstream/Premining)
PA-2
Water Elevation (ft MSL)
5427
5426.5
5426
5425.5
5425
5424.5
5424
5423.5
5423
5422.5
5422
1/5/1998
10/1/2000
6/28/2003
3/24/2006
12/18/2008
Date
PA-2
Median
Median + MAD
Median - MAD
Median + 2 MAD
Median - 2 MAD


Pinabete (Downstream/Premining)
PA-1
Water Elevation (ft MSL)
5341.8
5341.6
5341.4
5341.2
5341
5340.8
5340.6
5340.4
1/5/1998
10/1/2000
6/28/2003
3/24/2006
12/18/2008
Date
PA-1
Median
Median + MAD
Median - MAD
Median + 2 MAD
Median - 2 MAD


No Name (Downstream Pre-Mining
Water Elevation (ft MSL)
5418.9
5418.7
5418.5
5418.3
5418.1
5417.9
4/15/1998
7/24/1998
11/1/1998
2/9/1999
NNA-1
Median
Median +/1 MAD
Median +/- 2MAD

Appendix F: Groundwater Data Summary

Alluvial Quality Data (all Values are dissolved (mg/L) unless otherwise indicated)

Chaco Alluvial Wells (GM-24, GM-25 and GM-34)	Dates	**n**	Range	**Median**	MAD	**Average**	Standard Deviation	**Percent Relative Standard Deviation**	Q3	**95th Percentile**	**Livestock Criteria Exceedance**	
											n	%
pH	(11/16/1974-03/04/1977)	**18**	(6.5-8.1)	**7.67**	0.1	**7.61**	0.35	**4.59**	7.72	**8.10**	0	**0**
Conductivity (umho/cm)	(11/16/1974-03/04/1977)	**18**	(1350.-24300.)	**4500**	2590	**6687**	7207	**108**	6360	**23875**	0	**0**
Arsenic	(11/16/1974-03/04/1977)	**19**	(0.005-0.4)	**0.01**	0.005	**0.091**	0.136	**149.689**	0.150	**0.400**	4	**21**
Boron	(11/16/1974-03/04/1977)	**19**	(0.05-1.1)	**0.3**	0.1	**0.32**	0.23	**74.27**	0.39	**0.65**	0	**0**
Cadmium	(11/16/1974-03/04/1977)	**19**	(0.0005-0.005)	**0.0005**	0	**0.0026**	0.0023	**87.7211**	0.0050	**0.0050**	0	**0**
Chromium												
Copper	(11/16/1974-03/04/1977)	**19**	(0.002-0.496)	**0.008**	0.006	**0.037**	0.111	**298.734**	0.020	**0.081**	0	**0**
Iron (total)												
Lead	(11/16/1974-03/04/1977)	**19**	(0.0005-0.13)	**0.003**	0.0025	**0.0192**	0.0326	**169.9202**	0.0250	**0.0715**	1	**5**
Manganese	(11/16/1974-03/04/1977)	**19**	(0.055-4.6)	**1.98**	0.74	**1.863**	1.286692	**69.0656**	2.25	**4.06**	0	**0**
Mercury	(11/16/1974-03/04/1977)	**18**	(0.000014-0.013)	**0.000225**	0.000025	**0.00112**	0.00300	**267.85978**	0.00063	**0.00365**	1	**6**
Selenium	(11/16/1974-03/04/1977)	**19**	(0.0005-0.25)	**0.005**	0	**0.037**	0.068	**182.443**	0.025	**0.160**	3	**16**
Zinc	(11/16/1974-03/04/1977)	**19**	(0.012-0.864)	**0.076**	0.054	**0.187**	0.263	**141.028**	0.159	**0.838**	0	**0**
Chloride	(11/16/1974-03/04/1977)	**18**	(5.-920.)	**86.5**	81.05	**267**	305	**114**	503	**835**	2	**11**
Fluoride	(11/16/1974-03/04/1977)	**18**	(0.48-2.1)	**0.86**	0.335	**1.01**	0.43	**42.24**	1.29	**1.59**	1	**6**
Nitrate	(05/19/1976-03/04/1977)	**7**	(0.05-0.51)	**0.2**	0.15	**0.25**	0.20	**78.26**	0.41	**0.51**	0	**0**
Sulfate	(11/16/1974-03/04/1977)	**18**	(384.-24443.)	**1800**	1271	**3549**	5737	**162**	2900	**11274**	12	**67**
TDS - 180°C	(11/16/1974-03/04/1977)	**18**	(1216.-54730.)	**4101.5**	1802.5	**10079**	14692	**146**	6167	**37399**	13	**72**
Radium (pCi/l)												

Appendix F: Groundwater Data Summary

Alluvial Quality Data (all Values are dissolved (mg/L) unless otherwise indicated)

Chaco Alluvial Well GM-24	Dates	**n**	Range	**Median**	MAD	**Average**	Standard Deviation	**Percent Relative Standard Deviation**	Q3	**95th Percentile**	**Livestock Criteria Exceedance**	
											n	**%**
pH	(11/16/1974-03/04/1977)	**7**	(8.1-8.1)	**7.6**	0.2	**7.49**	0.51	**6.79**	7.75	**8.01**	0	**0**
Conductivity (umho/cm)	(11/16/1974-03/04/1977)	**7**	(2800.-2800.)	**1670**	110	**1904**	559	**29**	2150	**2740**	0	**0**
Arsenic	(11/16/1974-03/04/1977)	**7**	(0.4-0.4)	**0.01**	0.005	**0.118**	0.157	**133.234**	0.200	**0.355**	2	**29**
Boron	(11/16/1974-03/04/1977)	**7**	(1.1-1.1)	**0.3**	0.2	**0.39**	0.36	**91.51**	0.47	**0.95**	0	**0**
Cadmium	(11/16/1974-03/04/1977)	**7**	(0.005-0.005)	**0.005**	0	**0.0031**	0.0024	**78.3138**	0.0050	**0.0050**	0	**0**
Chromium												
Copper	(11/16/1974-03/04/1977)	**7**	(0.025-0.025)	**0.005**	0.002	**0.011**	0.009	**83.308**	0.018	**0.024**	0	**0**
Iron (total)												
Lead	(11/16/1974-03/04/1977)	**7**	(0.13-0.13)	**0.005**	0.0045	**0.0269**	0.0467	**173.5468**	0.0250	**0.0985**	1	**14**
Manganese	(11/16/1974-03/04/1977)	**7**	(2.4-2.4)	**1.42**	0.58	**1.286**	0.8303	**64.56457**	1.75	**2.28**	0	**0**
Mercury	(11/16/1974-08/06/1976)	**6**	(0.001-0.001)	**0.000225**	0.00003	**0.00038**	0.00032	**84.57580**	0.00037	**0.00085**	0	**0**
Selenium	(11/16/1974-03/04/1977)	**7**	(0.15-0.15)	**0.01**	0.005	**0.032**	0.053	**164.099**	0.025	**0.113**	1	**14**
Zinc	(11/16/1974-03/04/1977)	**7**	(0.864-0.864)	**0.05**	0.026	**0.154**	0.314	**203.615**	0.054	**0.622**	0	**0**
Chloride	(11/16/1974-08/06/1976)	**6**	(820.-820.)	**23**	15.05	**224**	342	**153**	353	**730**	1	**17**
Fluoride	(11/16/1974-08/06/1976)	**6**	(1.1-1.1)	**0.8**	0.03	**0.80**	0.18	**22.65**	0.82	**1.03**	0	**0**
Nitrate	(05/19/1976-08/06/1976)	**2**	(0.51-0.51)	**0.355**	0.155	**0.36**	0.22	**61.75**	0.43	**0.49**	0	**0**
Sulfate	(11/16/1974-08/06/1976)	**6**	(1400.-1400.)	**606**	191.5	**790**	452	**57**	1161	**1375**	2	**33**
TDS - 180°C	(11/16/1974-08/06/1976)	**6**	(3194.-3194.)	**1663.5**	446.5	**1944**	832	**43**	2505	**3073**	1	**17**
Radium (pCi/l)												

Appendix F: Groundwater Data Summary

Alluvial Quality Data (all Values are dissolved (mg/L) unless otherwise indicated)

Chaco Alluvial Well GM-25	Dates	n	Range	Median	MAD	Average	Standard Deviation	Percent Relative Standard Deviation	Q3	95th Percentile	Livestock Criteria Exceedance	
											n	%
pH	(11/16/1974-03/03/1977)	4	(7.9-7.9)	7.675	0.05	7.71	0.13	1.70	7.75	7.87	0	0
Conductivity (umho/cm)	(11/16/1974-03/03/1977)	4	(24300.-24300.)	18915	5135	18520	6445	35	23925	24225	0	0
Arsenic	(11/16/1974-03/03/1977)	4	(0.25-0.25)	0.015	0.0075	0.071	0.119	167.480	0.078	0.216	1	25
Boron	(11/16/1974-03/03/1977)	4	(0.4-0.4)	0.39	0.01	0.32	0.15	45.93	0.40	0.40	0	0
Cadmium	(11/16/1974-03/03/1977)	4	(0.005-0.005)	0.0005	0	0.0016	0.0023	138.4615	0.0016	0.0043	0	0
Chromium											0	0
Copper	(11/16/1974-03/03/1977)	4	(0.035-0.035)	0.01	0.0035	0.015	0.014	90.921	0.018	0.032	0	0
Iron (total)											0	0
Lead	(11/16/1974-03/03/1977)	4	(0.025-0.025)	0.002	0.00125	0.0074	0.0118	159.9938	0.0085	0.0217	0	0
Manganese	(11/16/1974-03/03/1977)	4	(4.-4.)	2.99	0.96	2.99	1.110015	37.12425	3.925	3.985	0	0
Mercury	(11/16/1974-03/03/1977)	4	(0.00025-0.00025)	0.0002	0	0.00021	0.00003	11.76471	0.00021	0.00024	0	0
Selenium	(11/16/1974-03/03/1977)	4	(0.025-0.025)	0.005	0.00225	0.009	0.011	123.463	0.010	0.022	0	0
Zinc	(11/16/1974-03/03/1977)	4	(0.177-0.177)	0.0835	0.0205	0.099	0.055	55.844	0.113	0.164	0	0
Chloride	(11/16/1974-03/03/1977)	4	(920.-920.)	596.5	41.35	658	179	27	680	872	1	25
Fluoride	(11/16/1974-03/03/1977)	4	(0.9-0.9)	0.68	0.14	0.69	0.18	26.80	0.80	0.88	0	0
Nitrate	(05/19/1976-03/03/1977)	3	(0.51-0.51)	0.3	0.21	0.29	0.23	80.33	0.41	0.49	0	0
Sulfate	(11/16/1974-03/03/1977)	4	(24443.-24443.)	8318.5	4259.5	10378	10100	97	12823	22119	3	75
TDS - 180°C	(11/16/1974-03/03/1977)	4	(54730.-54730.)	32142.5	9459.5	33609	16236	48	39438	51672	4	100
Radium (pCi/l)												

Appendix F: Groundwater Data Summary

Alluvial Quality Data (all Values are dissolved (mg/L) unless otherwise indicated)

Chaco Alluvial Well GM-34	Dates	**n**	Range	**Median**	MAD	**Average**	Standard Deviation	**Percent Relative Standard Deviation**	Q3	**95th Percentile**	**Livestock Criteria Exceedance**	
											n	%
pH	(11/16/1974-03/04/1977)	**7**	(8.1-8.1)	**7.69**	0.04	**7.68**	0.22	**2.86**	7.71	**7.99**	0	**0**
Conductivity (umho/cm)	(11/16/1974-03/04/1977)	**7**	(6880.-6880.)	**4790**	190	**4707**	1222	**26**	4800	**6256**	0	**0**
Arsenic	(11/16/1974-03/04/1977)	**8**	(0.4-0.4)	**0.015**	0.01	**0.078**	0.139	**179.622**	0.056	**0.313**	1	**13**
Boron	(11/16/1974-03/04/1977)	**8**	(0.4-0.4)	**0.28**	0.065	**0.25**	0.11	**44.69**	0.31	**0.38**	0	**0**
Cadmium	(11/16/1974-03/04/1977)	**8**	(0.005-0.005)	**0.00275**	0.00225	**0.0028**	0.0024	**87.4673**	0.0050	**0.0050**	0	**0**
Chromium												
Copper	(11/16/1974-03/04/1977)	**8**	(0.496-0.496)	**0.0115**	0.009	**0.072**	0.172	**239.695**	0.021	**0.331**	0	**0**
Iron (total)												
Lead	(11/16/1974-03/04/1977)	**8**	(0.065-0.065)	**0.00275**	0.00225	**0.0184**	0.0258	**140.6399**	0.0313	**0.0598**	0	**0**
Manganese	(11/16/1974-03/04/1977)	**8**	(4.6-4.6)	**1.67**	0.9	**1.804375**	1.440688	**79.84415**	2.275	**3.97**	0	**0**
Mercury	(11/16/1974-03/04/1977)	**8**	(0.013-0.013)	**0.000475**	0.000275	**0.00213**	0.00444	**207.95377**	0.00103	**0.00915**	1	**13**
Selenium	(11/16/1974-03/04/1977)	**8**	(0.25-0.25)	**0.005**	0	**0.056**	0.093	**165.189**	0.056	**0.215**	2	**25**
Zinc	(11/16/1974-03/04/1977)	**8**	(0.835-0.835)	**0.136**	0.075	**0.260**	0.285	**109.806**	0.290	**0.739**	0	**0**
Chloride	(11/16/1974-03/04/1977)	**8**	(306.-306.)	**67.4**	26.5	**105**	97	**92**	123	**265**	0	**0**
Fluoride	(11/16/1974-03/04/1977)	**8**	(2.1-2.1)	**1.3**	0.115	**1.32**	0.44	**33.10**	1.45	**1.89**	1	**13**
Nitrate	(10/06/1976-03/04/1977)	**2**	(0.14-0.14)	**0.095**	0.045	**0.10**	0.06	**66.99**	0.12	**0.14**	0	**0**
Sulfate	(11/16/1974-03/04/1977)	**8**	(3380.-3380.)	**2329**	529	**2204**	906	**41**	2676	**3251**	7	**88**
TDS - 180°C	(11/16/1974-03/04/1977)	**8**	(6728.-6728.)	**4209.5**	219	**4414**	984	**22**	4386	**5942**	8	**100**
Radium (pCi/l)												

Appendix F: Groundwater Data Summary

Alluvial Quality Data (all Values are dissolved (mg/L) unless otherwise indicated)

Area I Alluvial Well GM-7	Dates	n	Range	Median	MAD	Average	Standard Deviation	Percent Relative Standard Deviation	Q3	95th Percentile	Exceedance of Criteria: Live-stock		Exceedance of Criteria: Cotton-wood Baseline Median + 2MAD	
											n	%	n	%
pH	(03/24/1975-10/16/1976)	**4**	(7.1-7.9)	**7.525**	0.35	**7.51**	0.42	**5.60**	7.86	**7.89**	0	**0**	1	**25**
Conductivity (umho/cm)	(03/24/1975-10/16/1976)	**4**	(2630.-4500.)	**3530**	510	**3548**	770	**22**	3863	**4373**	0	**0**	1	**25**
Arsenic	(03/24/1975-10/16/1976)	**4**	(0.005-0.4)	**0.0125**	0.0075	**0.108**	0.195	**181.515**	0.115	**0.343**	1	**25**	4	**100**
Boron	(03/24/1975-10/16/1976)	**4**	(0.05-0.75)	**0.45**	0.175	**0.43**	0.29	**68.26**	0.56	**0.71**	0	**0**	3	**75**
Cadmium	(03/24/1975-10/16/1976)	**4**	(0.0005-0.005)	**0.00275**	0.00225	**0.0028**	0.0026	**94.4755**	0.0050	**0.0050**	0	**0**	0	**0**
Chromium											0	**0**	0	**0**
Copper	(03/24/1975-10/16/1976)	**4**	(0.008-0.025)	**0.014**	0.006	**0.015**	0.009	**56.504**	0.021	**0.024**	0	**0**	0	**0**
Iron (total)											0	**0**	0	**0**
Lead	(03/24/1975-10/16/1976)	**4**	(0.0005-0.025)	**0.00275**	0.00225	**0.0078**	0.0117	**150.8905**	0.0100	**0.0220**	0	**0**	1	**25**
Manganese	(03/24/1975-10/16/1976)	**4**	(0.012-0.047)	**0.0195**	0.0065	**0.0245**	0.016052	**65.51836**	0.0305	**0.0437**	0	**0**	0	**0**
Mercury	(03/24/1975-10/16/1976)	**4**	(0.0002-0.001)	**0.00022**	0.00002	**0.00041**	0.00039	**96.04513**	0.00043	**0.00089**	0	**0**	0	**0**
Selenium	(03/24/1975-10/16/1976)	**4**	(0.005-0.25)	**0.005**	0	**0.066**	0.123	**184.906**	0.066	**0.213**	1	**25**	1	**25**
Zinc	(03/24/1975-10/16/1976)	**4**	(0.075-0.12)	**0.0945**	0.017	**0.096**	0.022	**22.838**	0.112	**0.118**	0	**0**	0	**0**
Chloride	(03/24/1975-10/16/1976)	**4**	(180.-650.)	**204**	14	**310**	227	**73**	319	**584**	1	**25**	4	**100**
Fluoride	(03/24/1975-10/16/1976)	**4**	(4.62-6.)	**5.63**	0.37	**5.47**	0.67	**12.17**	6.00	**6.00**	4	**100**	4	**100**
Nitrate	(03/24/1975-10/16/1976)	**3**	(0.5-1.62)	**0.79**	0.29	**0.97**	0.58	**59.93**	1.21	**1.54**	0	**0**	1	**33**
Sulfate	(03/24/1975-10/16/1976)	**4**	(730.-1706.)	**1290**	253	**1254**	407	**32**	1462	**1657**	3	**75**	0	**0**
TDS - 180°C	(03/24/1975-10/16/1976)	**4**	(2583.-3027.)	**2700.5**	65	**2753**	191	**7**	2792	**2980**	1	**25**	0	**0**
Radium (pCi/l)														

Appendix F: Groundwater Data Summary

Alluvial Quality Data (all Values are dissolved (mg/L) unless otherwise indicated)

Area I Alluvial Well Bighan-1	Dates	**n**	Range	**Median**	MAD	**Average**	Standard Deviation	**Percent Relative Standard Deviation**	Q3	**95th Percentile**	**Exceedance of Criteria**			
											Live-stock		**Cotton-wood Baseline Median + 2MAD**	
											n	%	n	%
pH	(03/01/1995-08/07/2001)	**21**	(7.6-8.17)	**7.95**	0.05	**7.92**	0.15	**1.84**	8.00	**8.10**	0	**0**	0	**0**
Conductivity (umho/cm)	(03/01/1995-08/07/2001)	**20**	(1460.-2260.)	**1760**	65	**1810**	198	**11**	1905	**2232**	0	**0**	0	**0**
Arsenic	(03/01/1995-08/07/2001)	**19**	(0.0005-0.019)	**0.0025**	0	**0.004**	0.004	**109.574**	0.003	**0.006**	0	**0**	18	**95**
Boron	(03/01/1995-08/07/2001)	**20**	(0.99-1.67)	**1.4**	0.205	**1.39**	0.20	**14.42**	1.57	**1.63**	0	**0**	20	**100**
Cadmium	(03/01/1995-08/07/2001)	**20**	(0.0005-0.0025)	**0.001**	0.0005	**0.0010**	0.0006	**62.8281**	0.0010	**0.0025**	0	**0**	0	**0**
Chromium	(03/01/1995-08/07/2001)	**19**	(0.0025-0.03)	**0.005**	0.0025	**0.008289**	0.005896	**71.12221**	0.01	**0.012**	0	**0**	1	**5**
Copper	(03/01/1995-08/07/2001)	**19**	(0.0025-0.005)	**0.005**	0	**0.005**	0.001	**16.641**	0.005	**0.005**	0	**0**	0	**0**
Iron (total)	(03/01/1995-08/07/2001)	**20**	(0.05-58.)	**1.7**	0.975	**6.4595**	13.30538	**205.9816**	4.77	**25.51**	0	**0**	10	**50**
Lead	(03/01/1995-08/07/2001)	**20**	(0.002-0.005)	**0.0025**	0	**0.0026**	0.0006	**22.1473**	0.0025	**0.0026**	0	**0**	0	**0**
Manganese	(03/01/1995-08/07/2001)	**20**	(0.0025-0.15)	**0.01**	0.00625	**0.02515**	0.032966	**131.0765**	0.0265	**0.0645**	0	**0**	0	**0**
Mercury	(03/01/1995-08/07/2001)	**19**	(0.00005-0.0005)	**0.0005**	0	**0.00045**	0.00014	**31.34686**	0.00050	**0.00050**	0	**0**	0	**0**
Selenium	(03/01/1995-08/07/2001)	**20**	(0.01-0.026)	**0.016**	0.003	**0.017**	0.004	**26.237**	0.020	**0.026**	0	**0**	20	**100**
Zinc	(03/01/1995-08/07/2001)	**19**	(0.0025-0.05)	**0.01**	0.005	**0.014**	0.011	**74.977**	0.020	**0.027**	0	**0**	0	**0**
Chloride	(03/01/1995-08/07/2001)	**20**	(12.-59.)	**29**	9	**30**	12	**42**	36	**50**	0	**0**	0	**0**
Fluoride	(03/01/1995-08/07/2001)	**20**	(4.81-21.)	**9.045**	0.785	**10.06**	3.71	**36.86**	10.13	**19.10**	20	**100**	20	**100**
Nitrate	(03/01/1995-03/12/1997)	**11**	(23.3-30.2)	**28.5**	0.7	**28.45**	1.90	**6.69**	29.70	**30.10**	11	**100**	11	**100**
Sulfate	(03/01/1995-08/07/2001)	**20**	(260.-428.)	**328**	26.5	**334**	50	**15**	347	**424**	0	**0**	0	**0**
TDS - 180°C	(03/01/1995-08/07/2001)	**13**	(1020.-1360.)	**1250**	70	**1232**	100	**8**	1310	**1360**	0	**0**	0	**0**
Radium (pCi/l)	(01/04/1996-03/30/1998)	**9**	(0.7-3.6)	**1.8**	0.2	**1.81**	0.83	**46**	1.9	**3.04**	0	**0**	1	**11**

Appendix F: Groundwater Data Summary

Alluvial Quality Data (all Values are dissolved (mg/L) unless otherwise indicated)

Chinde Alluvial Wells (GM-9, GM-10, QAC-1)	Dates	**n**	Range	**Median**	MAD	**Average**	Standard Deviation	**Percent Relative Standard Deviation**	Q3	**95th Percentile**	**Exceedance of Criteria: Live-stock**		**Exceedance of Criteria: Cotton-wood Baseline Median + 2MAD**	
											n	%	n	%
pH	(03/23/1975-09/24/2008)	**106**	(6.45-8.19)	**7.295**	0.195	**7.37**	0.30	**4.08**	7.58	**7.88**	1	**1**	25	**24**
Conductivity (umho/cm)	(03/23/1975-09/24/2008)	**106**	(1280.-26700.)	**18050**	4050	**16998**	6010	**35**	21500	**25075**	0	**0**	100	**94**
Arsenic	(03/23/1975-09/09/2002)	**69**	(0.00005-0.4)	**0.0005**	0.0003	**0.009**	0.048	**553.434**	0.003	**0.013**	1	**1**	30	**43**
Boron	(03/23/1975-09/09/2002)	**89**	(0.05-2.92)	**1.42**	0.12	**1.30**	0.41	**31.49**	1.50	**1.60**	0	**0**	87	**98**
Cadmium	(03/23/1975-09/09/2002)	**90**	(0.00005-0.12)	**0.0025**	0.002	**0.0059**	0.0141	**238.4930**	0.0045	**0.0250**	1	**1**	14	**16**
Chromium	(09/10/1979-09/09/2002)	**41**	(0.002-0.13)	**0.02**	0.01	**0.022634**	0.024737	**109.2912**	0.03	**0.06**	0	**0**	21	**51**
Copper	(03/23/1975-09/09/2002)	**37**	(0.002-0.28)	**0.02**	0.015	**0.038**	0.062	**163.496**	0.025	**0.190**	0	**0**	7	**19**
Iron (total)	(09/10/1979-09/09/2002)	**54**	(0.01-70.)	**2.855**	1.62	**6.416111**	12.28497	**191.4706**	6.275	**24.065**	0	**0**	40	**74**
Lead	(03/23/1975-09/09/2002)	**66**	(0.0005-0.43)	**0.009**	0.0065	**0.0325**	0.0784	**241.6349**	0.0195	**0.2325**	5	**8**	34	**52**
Manganese	(03/23/1975-09/09/2002)	**90**	(0.019-11.9)	**4.695**	0.675	**4.2198**	2.359095	**55.90539**	5.33	**6.8**	0	**0**	79	**88**
Mercury	(03/23/1975-03/06/2002)	**35**	(0.0000005-0.001)	**0.0001**	0.00007	**0.00020**	0.00023	**114.31215**	0.00021	**0.00050**	0	**0**	0	**0**
Selenium	(03/23/1975-09/24/2008)	**114**	(0.000005-0.5)	**0.002**	0.0015	**0.022**	0.065	**291.804**	0.005	**0.100**	8	**7**	28	**25**
Zinc	(03/23/1975-03/06/2002)	**67**	(0.0025-5.3)	**0.05**	0.0475	**0.394**	0.935	**237.204**	0.246	**2.294**	0	**0**	6	**9**
Chloride	(03/23/1975-09/24/2008)	**113**	(200.-5400.)	**3730**	820	**3467**	1418	**41**	4640	**5100**	104	**92**	113	**100**
Fluoride	(03/23/1975-09/09/2002)	**90**	(0.005-7.5)	**0.84**	0.135	**1.33**	1.35	**101.85**	1.02	**4.60**	10	**11**	10	**11**
Nitrate	(03/23/1975-12/05/1996)	**33**	(0.06-36.4)	**0.37**	0.27	**1.70**	6.26	**367.51**	0.73	**2.10**	1	**3**	6	**18**
Sulfate	(03/23/1975-03/23/2006)	**103**	(440.-6565.)	**4300**	500	**4169**	1018	**24**	4825	**5390**	101	**98**	98	**95**
TDS - 180°C	(03/23/1975-09/24/2008)	**112**	(830.-17200.)	**12700**	1250	**12281**	3129	**25**	14300	**15700**	110	**98**	109	**97**
Radium (pCi/l)	(09/16/1985-12/15/1999)	**28**	(0.2-22.3)	**1.8**	1.85	**4.87**	5.77	**118**	4.375	**19.145**	0	**0**	14	**50**

Appendix F: Groundwater Data Summary

Alluvial Quality Data (all Values are dissolved (mg/L) unless otherwise indicated)

Chinde Alluvial Wells GM-9	Dates	n	Range	Median	MAD	Average	Standard Deviation	Percent Relative Standard Deviation	Q3	95th Percentile	Exceedance of Criteria			
											Live-stock		Cotton-wood Baseline Median + 2MAD	
											n	%	n	%
pH														
Conductivity (umho/cm)														
Arsenic	(09/10/1979-09/23/1980)	**3**	(0.0005-0.0008)	**0.0008**	0	**0.001**	0.000	**24.744**	0.001	**0.001**	0	**0**	2	**67**
Boron	(09/10/1979-09/23/1980)	**3**	(0.11-0.51)	**0.3**	0.19	**0.31**	0.20	**65.24**	0.41	**0.49**	0	**0**	2	**67**
Cadmium	(09/10/1979-09/23/1980)	**3**	(0.0005-0.005)	**0.005**	0	**0.0035**	0.0026	**74.2307**	0.0050	**0.0050**	0	**0**	0	**0**
Chromium	(09/10/1979-09/23/1980)	**3**	(0.004-0.04)	**0.03**	0.01	**0.024667**	0.018583	**75.33708**	0.035	**0.039**	0	**0**	2	**67**
Copper	(09/10/1979-09/23/1980)	**3**	(0.005-0.12)	**0.02**	0.015	**0.048**	0.063	**129.345**	0.070	**0.110**	0	**0**	1	**33**
Iron (total)	(09/10/1979-09/23/1980)	**3**	(0.01-0.06)	**0.06**	0	**0.043333**	0.028868	**66.61734**	0.06	**0.06**	0	**0**	0	**0**
Lead	(09/10/1979-09/23/1980)	**3**	(0.014-0.43)	**0.03**	0.016	**0.1580**	0.2357	**149.1739**	0.2300	**0.3900**	1	**33**	3	**100**
Manganese	(09/10/1979-09/23/1980)	**3**	(0.06-1.02)	**0.19**	0.13	**0.423333**	0.520801	**123.0238**	0.605	**0.937**	0	**0**	1	**33**
Mercury	(09/10/1979-09/23/1980)	**3**	(0.00004-0.00019)	**0.0001**	0.00006	**0.00011**	0.00008	**68.63486**	0.00015	**0.00018**	0	**0**	0	**0**
Selenium	(09/10/1979-09/23/1980)	**3**	(0.0006-0.002)	**0.0016**	0.0004	**0.001**	0.001	**51.508**	0.002	**0.002**	0	**0**	0	**0**
Zinc	(09/10/1979-09/23/1980)	**3**	(0.03-3.)	**0.13**	0.1	**1.053**	1.687	**160.121**	1.565	**2.713**	0	**0**	1	**33**
Chloride	(09/10/1979-09/23/1980)	**3**	(211.-227.)	**218**	7	**219**	8	**4**	223	**226**	0	**0**	3	**100**
Fluoride	(09/10/1979-09/23/1980)	**3**	(1.38-1.8)	**1.6**	0.2	**1.59**	0.21	**13.18**	1.70	**1.78**	0	**0**	0	**0**
Nitrate	(09/10/1979-09/23/1980)	**3**	(0.59-1.9)	**1.5**	0.4	**1.33**	0.67	**50.48**	1.70	**1.86**	0	**0**	2	**67**
Sulfate	(09/10/1979-09/23/1980)	**3**	(440.-6565.)	**5440**	1125	**4148**	3260	**79**	6003	**6453**	2	**67**	2	**67**
TDS - 180°C	(09/10/1979-09/23/1980)	**3**	(830.-10060.)	**9235**	825	**6708**	5107	**76**	9648	**9978**	2	**67**	2	**67**
Radium (pCi/l)														

Appendix F: Groundwater Data Summary

Alluvial Quality Data (all Values are dissolved (mg/L) unless otherwise indicated)

Chinde Alluvial Wells GM-10	Dates	n	Range	Median	MAD	Average	Standard Deviation	Percent Relative Standard Deviation	Q3	95th Percentile	Exceedance of Criteria			
											Live-stock		Cotton-wood Baseline Median + 2MAD	
											n	%	n	%
pH	(03/23/1975-09/29/1982)	**10**	(6.45-7.5)	**6.95**	0.15	**6.98**	0.28	**4.02**	7.10	**7.37**	1	**10**	8	**80**
Conductivity (umho/cm)	(03/23/1975-09/29/1982)	**10**	(3600.-18600.)	**4650**	665	**6437**	4521	**70**	6850	**13830**	0	**0**	6	**60**
Arsenic	(03/23/1975-09/29/1982)	**15**	(0.00005-0.4)	**0.0002**	0.00015	**0.030**	0.103	**347.986**	0.003	**0.141**	1	**7**	5	**33**
Boron	(03/23/1975-09/29/1982)	**14**	(0.05-1.33)	**0.73**	0.145	**0.73**	0.33	**45.72**	0.84	**1.31**	0	**0**	13	**93**
Cadmium	(03/23/1975-09/29/1982)	**15**	(0.00005-0.01)	**0.001**	0.00095	**0.0028**	0.0034	**120.6141**	0.0050	**0.0100**	0	**0**	2	**13**
Chromium	(09/10/1979-09/29/1982)	**11**	(0.005-0.13)	**0.03**	0.01	**0.038182**	0.034516	**90.3994**	0.04	**0.095**	0	**0**	9	**82**
Copper	(03/23/1975-09/29/1982)	**15**	(0.002-0.187)	**0.01**	0.008	**0.031**	0.051	**165.875**	0.025	**0.133**	0	**0**	2	**13**
Iron (total)	(09/10/1979-09/29/1982)	**10**	(0.05-70.)	**7.87**	7.17	**15.398**	22.22039	**144.307**	15.575	**55.15**	0	**0**	6	**60**
Lead	(03/23/1975-09/29/1982)	**15**	(0.0005-0.27)	**0.005**	0.004	**0.0321**	0.0722	**225.1755**	0.0100	**0.1650**	2	**13**	7	**47**
Manganese	(03/23/1975-09/29/1982)	**15**	(0.08-0.92)	**0.47**	0.267	**0.4742**	0.282505	**59.575**	0.7	**0.885**	0	**0**	8	**53**
Mercury	(03/23/1975-09/29/1982)	**15**	(0.0000005-0.001)	**0.00011**	0.00009	**0.00016**	0.00025	**155.37990**	0.00018	**0.00045**	0	**0**	0	**0**
Selenium	(03/23/1975-09/29/1982)	**15**	(0.000005-0.25)	**0.0005**	0.00045	**0.031**	0.079	**253.382**	0.005	**0.215**	2	**13**	2	**13**
Zinc	(03/23/1975-09/29/1982)	**15**	(0.22-5.3)	**0.56**	0.21	**1.212**	1.529	**126.122**	1.005	**4.432**	0	**0**	4	**27**
Chloride	(03/23/1975-09/29/1982)	**15**	(200.-4190.)	**660**	280	**1076**	1069	**99**	1280	**2797**	9	**60**	15	**100**
Fluoride	(03/23/1975-09/29/1982)	**15**	(0.6-5.8)	**0.72**	0.08	**1.10**	1.31	**118.25**	0.87	**2.51**	1	**7**	1	**7**
Nitrate	(03/23/1975-09/29/1982)	**15**	(0.1-2.)	**0.45**	0.25	**0.66**	0.61	**92.55**	0.89	**1.82**	0	**0**	2	**13**
Sulfate	(03/23/1975-09/29/1982)	**15**	(1340.-4090.)	**2915**	285	**2819**	775	**27**	3190	**3845**	15	**100**	12	**80**
TDS - 180°C	(03/23/1975-09/29/1982)	**15**	(2903.-13200.)	**6075**	1065	**6401**	2572	**40**	7295	**10351**	14	**93**	13	**87**
Radium (pCi/l)														

Appendix F: Groundwater Data Summary

Alluvial Quality Data (all Values are dissolved (mg/L) unless otherwise indicated)

Chinde Alluvial Wells QAC-1	Dates	n	Range	Median	MAD	Average	Standard Deviation	Percent Relative Standard Deviation	Q3	95th Percentile	Exceedance of Criteria: Live-stock		Exceedance of Criteria: Cotton-wood Baseline Median + 2MAD	
											n	%	n	%
pH	(09/16/1985-09/24/2008)	**96**	(6.885-8.19)	**7.325**	0.175	**7.41**	0.27	**3.69**	7.59	**7.88**	0	**0**	17	**18**
Conductivity (umho/cm)	(09/16/1985-09/24/2008)	**96**	(1280.-26700.)	**18450**	4450	**18098**	5003	**28**	21825	**25100**	0	**0**	94	**98**
Arsenic	(09/16/1985-09/09/2002)	**51**	(0.0005-0.05)	**0.0005**	0	**0.003**	0.007	**236.973**	0.003	**0.011**	0	**0**	23	**45**
Boron	(09/16/1985-09/09/2002)	**72**	(0.74-2.92)	**1.455**	0.07	**1.45**	0.24	**16.38**	1.53	**1.62**	0	**0**	72	**100**
Cadmium	(09/16/1985-09/09/2002)	**72**	(0.0005-0.12)	**0.0025**	0.0015	**0.0067**	0.0156	**234.7339**	0.0030	**0.0250**	1	**1**	12	**17**
Chromium	(09/16/1985-09/09/2002)	**27**	(0.002-0.09)	**0.01**	0.005	**0.016074**	0.017584	**109.3951**	0.025	**0.0299**	0	**0**	10	**37**
Copper	(12/11/1997-09/09/2002)	**19**	(0.0025-0.28)	**0.025**	0.02	**0.042**	0.072	**170.750**	0.025	**0.208**	0	**0**	4	**21**
Iron (total)	(12/17/1992-09/09/2002)	**41**	(0.29-51.7)	**3.11**	1.29	**4.691707**	7.912922	**168.6576**	4.43	**8.9**	0	**0**	34	**83**
Lead	(09/16/1985-09/09/2002)	**48**	(0.0005-0.32)	**0.008**	0.0055	**0.0247**	0.0594	**239.9986**	0.0185	**0.0700**	2	**4**	24	**50**
Manganese	(09/16/1985-09/09/2002)	**72**	(0.019-11.9)	**5.05**	0.55	**5.158319**	1.576917	**30.57037**	5.5625	**6.935**	0	**0**	70	**97**
Mercury	(12/11/1997-03/06/2002)	**17**	(0.00005-0.0005)	**0.0001**	0.00005	**0.00025**	0.00022	**89.50370**	0.00050	**0.00050**	0	**0**	0	**0**
Selenium	(09/16/1985-09/24/2008)	**96**	(0.0005-0.5)	**0.0025**	0.002	**0.021**	0.064	**296.536**	0.014	**0.100**	6	**6**	26	**27**
Zinc	(09/16/1985-03/06/2002)	**49**	(0.0025-2.)	**0.025**	0.0125	**0.104**	0.284	**274.178**	0.125	**0.241**	0	**0**	1	**2**
Chloride	(09/16/1985-09/24/2008)	**95**	(1200.-5400.)	**3910**	750	**3947**	862	**22**	4725	**5100**	95	**100**	95	**100**
Fluoride	(09/16/1985-09/09/2002)	**72**	(0.005-7.5)	**0.85**	0.12	**1.36**	1.39	**102.16**	1.01	**4.60**	9	**13**	9	**13**
Nitrate	(12/13/1990-12/05/1996)	**15**	(0.06-36.4)	**0.23**	0.15	**2.82**	9.31	**329.67**	0.70	**12.49**	1	**7**	2	**13**
Sulfate	(09/16/1985-03/23/2006)	**85**	(500.-5700.)	**4380**	370	**4408**	723	**16**	4900	**5300**	84	**99**	84	**99**
TDS - 180°C	(09/16/1985-09/24/2008)	**94**	(7700.-17200.)	**13000**	1050	**13397**	1513	**11**	14575	**15770**	94	**100**	94	**100**
Radium (pCi/l)	(09/16/1985-12/15/1999)	**28**	(0.2-22.3)	**1.8**	1.85	**4.87**	5.77	**118**	4.375	**19.145**	0	**0**	14	**50**

Appendix F: Groundwater Data Summary

Alluvial Quality Data (all Values are dissolved (mg/L) unless otherwise indicated)

Cottonwood Alluvial Wells (GM-17, GM-16, QACW-2, and QACW-2B)	Dates	**n**	Range	**Median**	MAD	**Average**	Standard Deviation	**Percent Relative Standard Deviation**	Q3	**95th Percentile**	**Livestock Criteria Exceedance**	
											n	%
pH	(11/16/1974-03/10/1999)	**51**	(6.1-8.39)	**7.7**	0.25	**7.64**	0.45	**5.88**	7.95	**8.17**	1	**2**
Conductivity (umho/cm)	(11/16/1974-03/10/1999)	**44**	(1720.-13200.)	**3695**	360	**4003**	2155	**54**	4043	**4864**	0	**0**
Arsenic	(11/16/1974-03/10/1999)	**36**	(0.0005-0.4)	**0.0005**	0	**0.029**	0.085	**291.402**	0.003	**0.207**	2	**6**
Boron	(11/16/1974-03/10/1999)	**57**	(0.005-1.4)	**0.13**	0.05	**0.21**	0.25	**121.72**	0.20	**0.66**	0	**0**
Cadmium	(11/16/1974-03/10/1999)	**44**	(0.0005-0.02)	**0.0025**	0.0015	**0.0029**	0.0035	**118.7268**	0.0030	**0.0094**	0	**0**
Chromium	(09/19/1990-03/10/1999)	**12**	(0.005-0.12)	**0.0075**	0.0025	**0.016667**	0.032637	**195.82**	0.01	**0.0595**	0	**0**
Copper	(11/16/1974-03/10/1999)	**14**	(0.0005-0.15)	**0.02**	0.01	**0.026**	0.037	**143.773**	0.029	**0.072**	0	**0**
Iron (total)	(09/10/1979-03/10/1999)	**29**	(0.01-41.4)	**0.62**	0.56	**3.67931**	8.874139	**241.1903**	2.12	**19.6**	0	**0**
Lead	(11/16/1974-03/10/1999)	**28**	(0.0005-0.1)	**0.0025**	0.00175	**0.0120**	0.0217	**180.5377**	0.0100	**0.0510**	0	**0**
Manganese	(11/16/1974-03/10/1999)	**59**	(0.005-4.95)	**0.11**	0.105	**0.669542**	1.046685	**156.3285**	0.765	**2.731**	0	**0**
Mercury	(11/16/1974-03/10/1999)	**14**	(0.000043-0.0029)	**0.0005**	0.0003	**0.00080**	0.00078	**97.90787**	0.00100	**0.00232**	0	**0**
Selenium	(11/16/1974-03/10/1999)	**54**	(0.00005-0.25)	**0.0025**	0.0015	**0.010**	0.039	**397.595**	0.003	**0.012**	2	**4**
Zinc	(11/16/1974-03/10/1999)	**36**	(0.0125-21.9)	**0.2915**	0.2665	**1.221**	3.684	**301.785**	0.885	**3.200**	0	**0**
Chloride	(11/16/1974-03/10/1999)	**59**	(0.7-800.)	**124**	23	**137**	132	**96**	145	**268**	2	**3**
Fluoride	(11/16/1974-03/10/1999)	**58**	(0.1-6.2)	**1.38**	0.475	**1.69**	1.21	**71.48**	2.08	**4.12**	15	**26**
Nitrate	(03/27/1975-03/27/1997)	**26**	(0.005-4.56)	**0.505**	0.42	**0.73**	0.98	**133.58**	1.02	**2.28**	0	**0**
Sulfate	(11/16/1974-03/10/1999)	**58**	(740.-9810.)	**1730**	340	**2952**	2916	**99**	2290	**9572**	53	**91**
TDS - 180°C	(11/16/1974-12/08/1998)	**58**	(210.5-16000.)	**3035**	423.5	**5101**	4763	**93**	3920	**15615**	32	**55**
Radium (pCi/l)	(06/18/1987-06/09/1992)	**17**	(0.1-6.8)	**1.2**	1	**1.78**	1.70	**95**	2.6	**4.24**	0	**0**

Appendix F: Groundwater Data Summary

Alluvial Quality Data (all Values are dissolved (mg/L) unless otherwise indicated)

Cottonwood Alluvial Wells GM-17	Dates	**n**	Range	**Median**	MAD	**Average**	Standard Deviation	**Percent Relative Standard Deviation**	Q3	**95th Percentile**	**Livestock Criteria Exceedance**	
											n	%
pH	(10/14/1975-09/29/1982)	**7**	(6.1-7.4)	**6.9**	0.2	**6.84**	0.42	**6.19**	7.10	**7.31**	1	**14**
Conductivity (umho/cm)	(10/14/1975-05/18/1976)	**2**	(13200.-13200.)	**13200**	0	**13200**	0		13200	**13200**	0	**0**
Arsenic	(10/14/1975-05/18/1976)	**2**	(0.005-0.01)	**0.0075**	0.0025	**0.008**	0.004	**47.140**	0.009	**0.010**	0	**0**
Boron	(10/14/1975-09/29/1982)	**11**	(0.005-0.66)	**0.28**	0.12	**0.27**	0.19	**71.15**	0.31	**0.59**	0	**0**
Cadmium	(10/14/1975-05/18/1976)	**2**	(0.002-0.005)	**0.0035**	0.0015	**0.0035**	0.0021	**60.6092**	0.0043	**0.0049**	0	**0**
Chromium											0	**0**
Copper	(10/14/1975-05/18/1976)	**2**	(0.021-0.025)	**0.023**	0.002	**0.023**	0.003	**12.298**	0.024	**0.025**	0	**0**
Iron (total)	(09/10/1979-09/29/1982)	**9**	(0.05-10.)	**0.62**	0.57	**2.766667**	3.794799	**137.1614**	4.75	**9.08**	0	**0**
Lead	(10/14/1975-05/18/1976)	**2**	(0.006-0.025)	**0.0155**	0.0095	**0.0155**	0.0134	**86.6776**	0.0203	**0.0241**	0	**0**
Manganese	(10/14/1975-09/29/1982)	**11**	(0.005-2.7)	**1.02**	1.015	**1.124091**	1.114656	**99.16071**	2.18	**2.5**	0	**0**
Mercury	(10/14/1975-05/18/1976)	**2**	(0.0002-0.001)	**0.0006**	0.0004	**0.00060**	0.00057	**94.28090**	0.00080	**0.00096**	0	**0**
Selenium	(10/14/1975-09/29/1982)	**11**	(0.00005-0.005)	**0.0004**	0.00035	**0.002**	0.002	**131.698**	0.003	**0.005**	0	**0**
Zinc	(10/14/1975-05/18/1976)	**2**	(0.05-0.11)	**0.08**	0.03	**0.080**	0.042	**53.033**	0.095	**0.107**	0	**0**
Chloride	(10/14/1975-09/29/1982)	**11**	(1.5-430.)	**113**	15	**135**	112	**83**	125	**329**	0	**0**
Fluoride	(10/14/1975-09/29/1982)	**11**	(0.1-0.89)	**0.3**	0.2	**0.35**	0.24	**70.59**	0.45	**0.75**	0	**0**
Nitrate	(10/14/1975-09/29/1982)	**11**	(0.5-4.56)	**1.03**	0.27	**1.23**	1.14	**92.84**	1.14	**2.93**	0	**0**
Sulfate	(10/14/1975-09/29/1982)	**11**	(2453.-9810.)	**9308**	332	**8535**	2221	**26**	9600	**9785**	11	**100**
TDS - 180°C	(10/14/1975-09/29/1982)	**11**	(5629.-16000.)	**15210**	490	**14381**	2957	**21**	15650	**15950**	11	**100**
Radium (pCi/l)												

Appendix F: Groundwater Data Summary

Alluvial Quality Data (all Values are dissolved (mg/L) unless otherwise indicated)

Cottonwood Alluvial Wells GM-16	Dates	**n**	Range	**Median**	MAD	**Average**	Standard Deviation	**Percent Relative Standard Deviation**	Q3	**95th Percentile**	**Livestock Criteria Exceedance**	
											n	**%**
pH	(03/27/1975-03/27/1975)	**1**	(7.1-7.1)	**7.1**	0	**7.10**			7.10	**7.10**	0	**0**
Conductivity (umho/cm)	(03/27/1975-03/27/1975)	**1**	(4500.-4500.)	**4500**	0	**4500**			4500	**4500**	0	**0**
Arsenic	(03/27/1975-03/27/1975)	**1**	(0.4-0.4)	**0.4**	0	**0.400**			0.400	**0.400**	1	**100**
Boron	(03/27/1975-03/27/1975)	**1**	(1.2-1.2)	**1.2**	0	**1.20**			1.20	**1.20**	0	**0**
Cadmium	(03/27/1975-03/27/1975)	**1**	(0.01-0.01)	**0.01**	0	**0.0100**			0.0100	**0.0100**	0	**0**
Chromium												
Copper	(03/27/1975-03/27/1975)	**1**	(0.02-0.02)	**0.02**	0	**0.020**			0.020	**0.020**	0	**0**
Iron (total)												
Lead	(03/27/1975-03/27/1975)	**1**	(0.005-0.005)	**0.005**	0	**0.0050**			0.0050	**0.0050**	0	**0**
Manganese	(03/27/1975-03/27/1975)	**1**	(0.23-0.23)	**0.23**	0	**0.23**			0.23	**0.23**	0	**0**
Mercury	(03/27/1975-03/27/1975)	**1**	(0.0029-0.0029)	**0.0029**	0	**0.00290**			0.00290	**0.00290**	0	**0**
Selenium	(03/27/1975-03/27/1975)	**1**	(0.25-0.25)	**0.25**	0	**0.250**			0.250	**0.250**	1	**100**
Zinc	(03/27/1975-03/27/1975)	**1**	(0.062-0.062)	**0.062**	0	**0.062**			0.062	**0.062**	0	**0**
Chloride	(03/27/1975-03/27/1975)	**1**	(650.-650.)	**650**	0	**650**			650	**650**	1	**100**
Fluoride	(03/27/1975-03/27/1975)	**1**	(1.3-1.3)	**1.3**	0	**1.30**			1.30	**1.30**	0	**0**
Nitrate	(03/27/1975-03/27/1975)	**1**	(0.5-0.5)	**0.5**	0	**0.50**			0.50	**0.50**	0	**0**
Sulfate	(03/27/1975-03/27/1975)	**1**	(2300.-2300.)	**2300**	0	**2300**			2300	**2300**	1	**100**
TDS - 180°C	(03/27/1975-03/27/1975)	**1**	(4823.-4823.)	**4823**	0	**4823**			4823	**4823**	1	**100**
Radium (pCi/l)												

Appendix F: Groundwater Data Summary

Alluvial Quality Data (all Values are dissolved (mg/L) unless otherwise indicated)

Cottonwood Alluvial Wells QACW-2	Dates	**n**	Range	**Median**	MAD	**Average**	Standard Deviation	**Percent Relative Standard Deviation**	Q3	**95th Percentile**	**Livestock Criteria Exceedance**	
											n	**%**
pH	(11/16/1974-03/23/1989)	**9**	(7.2-8.3)	**7.9**	0.26	**7.81**	0.35	**4.47**	7.95	**8.26**	0	**0**
Conductivity (umho/cm)	(11/16/1974-03/23/1989)	**9**	(1720.-4910.)	**2300**	400	**2692**	991	**37**	3200	**4266**	0	**0**
Arsenic	(11/16/1974-03/23/1989)	**9**	(0.0005-0.25)	**0.002**	0.0015	**0.046**	0.091	**197.166**	0.005	**0.210**	1	**11**
Boron	(11/16/1974-03/23/1989)	**13**	(0.01-1.4)	**0.11**	0.06	**0.25**	0.36	**143.10**	0.23	**0.80**	0	**0**
Cadmium	(11/16/1974-03/23/1989)	**8**	(0.0005-0.005)	**0.00275**	0.00225	**0.0030**	0.0019	**62.9941**	0.0050	**0.0050**	0	**0**
Chromium											0	**0**
Copper	(11/16/1974-03/04/1977)	**4**	(0.005-0.02)	**0.0105**	0.005	**0.012**	0.007	**62.906**	0.016	**0.019**	0	**0**
Iron (total)	(09/10/1979-09/25/1980)	**4**	(0.01-0.25)	**0.03**	0.015	**0.08**	0.114018	**142.5219**	0.0925	**0.2185**	0	**0**
Lead	(11/16/1974-03/04/1977)	**4**	(0.0005-0.065)	**0.013**	0.01225	**0.0229**	0.0303	**132.5532**	0.0350	**0.0590**	0	**0**
Manganese	(11/16/1974-03/23/1989)	**14**	(0.005-4.1)	**0.1**	0.06	**0.471786**	1.073745	**227.5918**	0.305	**2.02**	0	**0**
Mercury	(11/16/1974-03/04/1977)	**4**	(0.000043-0.0006)	**0.000225**	0.000104	**0.00027**	0.00024	**86.00488**	0.00034	**0.00055**	0	**0**
Selenium	(11/16/1974-03/23/1989)	**9**	(0.0005-0.15)	**0.003**	0.002	**0.021**	0.049	**230.439**	0.005	**0.100**	1	**11**
Zinc	(11/16/1974-03/23/1989)	**9**	(0.025-2.43)	**0.025**	0	**0.324**	0.793	**244.798**	0.065	**1.550**	0	**0**
Chloride	(11/16/1974-03/23/1989)	**14**	(0.7-800.)	**28.2**	16.7	**93**	208	**223**	48	**378**	1	**7**
Fluoride	(11/16/1974-03/23/1989)	**14**	(0.76-6.2)	**2.35**	0.71	**2.84**	1.40	**49.16**	3.78	**4.90**	10	**71**
Nitrate	(08/06/1975-09/25/1980)	**7**	(0.005-0.85)	**0.18**	0.16	**0.27**	0.33	**119.95**	0.40	**0.78**	0	**0**
Sulfate	(11/16/1974-03/23/1989)	**14**	(740.-3750.)	**1226.5**	286.5	**1552**	845	**54**	1738	**3068**	9	**64**
TDS - 180°C	(11/16/1974-03/23/1989)	**14**	(210.5-6160.)	**2305**	607.5	**2604**	1449	**56**	2898	**4971**	3	**21**
Radium (pCi/l)	(03/24/1988-03/23/1989)	**5**	(0.2-2.6)	**1.4**	0.7	**1.40**	0.98	**70**	2.1	**2.5**	0	**0**

Appendix F: Groundwater Data Summary

Alluvial Quality Data (all Values are dissolved (mg/L) unless otherwise indicated)

Cottonwood Alluvial Wells QACW-2B	Dates	**n**	Range	**Median**	MAD	**Average**	Standard Deviation	**Percent Relative Standard Deviation**	Q3	**95th Percentile**	**Livestock Criteria Exceedance**	
											n	%
pH	(06/18/1987-03/10/1999)	**34**	(7.1-8.39)	**7.8**	0.195	**7.78**	0.27	**3.44**	7.98	**8.12**	0	**0**
Conductivity (umho/cm)	(06/18/1987-03/10/1999)	**32**	(2810.-4600.)	**3740**	240	**3782**	418	**11**	4008	**4501**	0	**0**
Arsenic	(06/18/1987-03/10/1999)	**24**	(0.0005-0.192)	**0.0005**	0	**0.009**	0.039	**429.120**	0.003	**0.005**	0	**0**
Boron	(06/18/1987-03/10/1999)	**32**	(0.005-0.68)	**0.13**	0.03	**0.14**	0.11	**83.78**	0.15	**0.24**	0	**0**
Cadmium	(06/18/1987-03/10/1999)	**33**	(0.0005-0.02)	**0.0025**	0.0015	**0.0027**	0.0037	**138.9303**	0.0025	**0.0076**	0	**0**
Chromium	(09/19/1990-03/10/1999)	**12**	(0.005-0.12)	**0.0075**	0.0025	**0.016667**	0.032637	**195.82**	0.01	**0.0595**	0	**0**
Copper	(12/11/1997-03/10/1999)	**7**	(0.0005-0.15)	**0.03**	0.025	**0.036**	0.052	**145.586**	0.030	**0.114**	0	**0**
Iron (total)	(03/28/1995-03/10/1999)	**16**	(0.17-41.4)	**1.04**	0.84	**5.0925**	11.54266	**226.6601**	2.2	**29.85**	0	**0**
Lead	(09/19/1990-03/10/1999)	**21**	(0.0025-0.1)	**0.0025**	0	**0.0099**	0.0213	**214.8081**	0.0100	**0.0250**	0	**0**
Manganese	(06/18/1987-03/10/1999)	**33**	(0.005-4.95)	**0.11**	0.09	**0.615242**	1.015789	**165.1039**	0.7	**2.446**	0	**0**
Mercury	(12/11/1997-03/10/1999)	**7**	(0.0005-0.002)	**0.0005**	0	**0.00086**	0.00056	**64.90734**	0.00100	**0.00170**	0	**0**
Selenium	(06/18/1987-03/10/1999)	**33**	(0.0005-0.005)	**0.0025**	0.0005	**0.002**	0.001	**46.202**	0.003	**0.004**	0	**0**
Zinc	(06/18/1987-03/10/1999)	**24**	(0.0125-21.9)	**0.59**	0.3355	**1.700**	4.439	**261.071**	0.996	**4.908**	0	**0**
Chloride	(06/18/1987-03/10/1999)	**33**	(77.-250.)	**138**	18	**141**	33	**23**	150	**198**	0	**0**
Fluoride	(06/18/1987-03/10/1999)	**32**	(0.92-4.75)	**1.38**	0.115	**1.67**	0.78	**46.99**	1.78	**3.25**	5	**16**
Nitrate	(03/14/1991-03/27/1997)	**7**	(0.07-2.6)	**0.09**	0	**0.44**	0.95	**213.96**	0.09	**1.85**	0	**0**
Sulfate	(06/18/1987-03/10/1999)	**32**	(1150.-2260.)	**1605**	175	**1666**	273	**16**	1835	**2155**	32	**100**
TDS - 180°C	(06/18/1987-12/08/1998)	**32**	(2590.-3800.)	**3015**	330	**3013**	361	**12**	3175	**3725**	17	**53**
Radium (pCi/l)	(06/18/1987-06/09/1992)	**12**	(0.1-6.8)	**1.2**	1	**1.94**	1.94	**100**	3	**5.04**	0	**0**

Appendix F: Groundwater Data Summary

Alluvial Quality Data (all Values are dissolved (mg/L) unless otherwise indicated)

Pinnabete Alluvial Wells (GM-22, PA-1,	Dates	n	Range	Median	MAD	Average	Standard Deviation	Percent Relative Standard	Q3	95th Percentile	Livestock Criteria	
											n	%
pH	(11/16/1974-11/21/2008)	**24**	(7.19-8.2)	**7.5**	0.115	**7.55**	0.26	**3.40**	7.63	**8.07**	0	**0**
Conductivity (umho/cm)	(11/16/1974-06/15/2004)	**6**	(1610.-4040.)	**3420**	485	**3123**	932	**30**	3763	**3973**	0	**0**
Arsenic	(11/16/1974-11/21/2008)	**22**	(0.00025-0.25)	**0.0025**	0.0015	**0.021**	0.060	**284.923**	0.003	**0.144**	1	**5**
Boron	(11/16/1974-11/21/2008)	**22**	(0.1-2.1)	**0.2**	0.015	**0.36**	0.44	**119.56**	0.30	**0.92**	0	**0**
Cadmium	(11/16/1974-11/21/2008)	**22**	(0.000025-0.005)	**0.0005**	0.000475	**0.0007**	0.0014	**203.8603**	0.0005	**0.0048**	0	**0**
Chromium	(09/12/1991-11/21/2008)	**18**	(0.0005-0.03)	**0.005**	0.001	**0.007028**	0.008612	**122.5377**	0.005	**0.03**	0	**0**
Copper	(11/16/1974-11/21/2008)	**22**	(0.003-0.0508)	**0.00865**	0.00365	**0.012**	0.011	**90.903**	0.015	**0.023**	0	**0**
Iron (total)	(03/28/1995-11/21/2008)	**18**	(0.13-63.9)	**3.535**	2.11	**12.85167**	19.45777	**151.4027**	14.163	**54.805**	0	**0**
Lead	(11/16/1974-11/21/2008)	**22**	(0.00005-0.065)	**0.0015**	0.0013	**0.0076**	0.0179	**235.1724**	0.0025	**0.0545**	0	**0**
Manganese	(11/16/1974-11/21/2008)	**22**	(0.003-1.33)	**0.114**	0.076	**0.182486**	0.286864	**157.1974**	0.159	**0.4864**	0	**0**
Mercury	(11/16/1974-11/21/2008)	**22**	(0.000022-0.0005)	**0.0002**	0.0001	**0.00028**	0.00019	**68.76062**	0.00050	**0.00050**	0	**0**
Selenium	(11/16/1974-11/21/2008)	**24**	(0.0007-0.15)	**0.006**	0.0035	**0.014**	0.030	**218.292**	0.012	**0.024**	1	**4**
Zinc	(11/16/1974-11/21/2008)	**22**	(0.002-0.41)	**0.0125**	0.0105	**0.050**	0.092	**185.035**	0.048	**0.178**	0	**0**
Chloride	(11/16/1974-11/21/2008)	**24**	(13.-800.)	**25.5**	9	**61**	158	**261**	37	**63**	1	**4**
Fluoride	(11/16/1974-11/21/2008)	**22**	(1.51-5.7)	**2.48**	0.325	**2.63**	0.82	**31.05**	2.89	**3.29**	19	**86**
Nitrate	(06/27/1975-11/21/2008)	**19**	(0.025-9.)	**0.08**	0.05	**0.85**	2.14	**251.93**	0.49	**4.23**	0	**0**
Sulfate	(11/16/1974-11/21/2008)	**24**	(805.-2400.)	**1552.1**	470	**1488**	508	**34**	1943	**2193**	18	**75**
TDS - 180°C	(11/16/1974-11/21/2008)	**24**	(1500.-4310.)	**2981**	666.5	**2684**	866	**32**	3440	**3681**	11	**46**
Radium (pCi/l)	(12/11/1991-11/21/2008)	**16**	(0.58-29.64)	**1.8**	0.97	**5.32**	7.58	**143**	5.675	**16.8975**	0	**0**

Appendix F: Groundwater Data Summary

Alluvial Quality Data (all Values are dissolved (mg/L) unless otherwise indicated)

Pinnabete Alluvial Wells GM-22	Dates	**n**	Range	**Median**	MAD	**Average**	Standard Deviation	**Percent Relative Standard Deviation**	Q3	**95th Percentile**	**Livestock Criteria Exceedance**	
											n	**%**
pH	(11/16/1974-03/04/1977)	**4**	(7.2-8.2)	**7.75**	0.4	**7.73**	0.50	**6.46**	8.13	**8.19**	0	**0**
Conductivity (umho/cm)	(11/16/1974-03/04/1977)	**4**	(1610.-3770.)	**3420**	335	**3055**	1012	**33**	3748	**3766**	0	**0**
Arsenic	(11/16/1974-03/04/1977)	**4**	(0.005-0.25)	**0.09**	0.0725	**0.109**	0.113	**104.330**	0.175	**0.235**	1	**25**
Boron	(11/16/1974-03/04/1977)	**4**	(0.1-0.93)	**0.34**	0.15	**0.43**	0.36	**83.50**	0.53	**0.85**	0	**0**
Cadmium	(11/16/1974-03/04/1977)	**4**	(0.0005-0.005)	**0.00275**	0.00225	**0.0028**	0.0026	**94.4755**	0.0050	**0.0050**	0	**0**
Chromium												
Copper	(11/16/1974-03/04/1977)	**4**	(0.003-0.015)	**0.009**	0.005	**0.009**	0.006	**65.420**	0.014	**0.015**	0	**0**
Iron (total)												
Lead	(11/16/1974-03/04/1977)	**4**	(0.0005-0.065)	**0.0405**	0.02	**0.0366**	0.0296	**80.6992**	0.0583	**0.0637**	0	**0**
Manganese	(11/16/1974-03/04/1977)	**4**	(0.003-0.165)	**0.038**	0.0215	**0.061**	0.071568	**117.3248**	0.0758	**0.14715**	0	**0**
Mercury	(11/16/1974-03/04/1977)	**4**	(0.000022-0.0005)	**0.000225**	0.000114	**0.00024**	0.00020	**81.19555**	0.00031	**0.00046**	0	**0**
Selenium	(11/16/1974-03/04/1977)	**4**	(0.005-0.15)	**0.015**	0.01	**0.046**	0.070	**150.932**	0.056	**0.131**	1	**25**
Zinc	(11/16/1974-03/04/1977)	**4**	(0.031-0.41)	**0.095**	0.0545	**0.158**	0.175	**110.781**	0.208	**0.370**	0	**0**
Chloride	(11/16/1974-03/04/1977)	**4**	(13.-800.)	**21.5**	6.5	**214**	391	**183**	220	**684**	1	**25**
Fluoride	(11/16/1974-03/04/1977)	**4**	(1.51-5.7)	**1.9**	0.245	**2.75**	1.98	**71.76**	2.93	**5.15**	1	**25**
Nitrate	(06/27/1975-03/04/1977)	**3**	(0.8-9.)	**3.7**	2.9	**4.50**	4.16	**92.40**	6.35	**8.47**	0	**0**
Sulfate	(11/16/1974-03/04/1977)	**4**	(1153.-2000.)	**1667.1**	222.9	**1622**	362	**22**	1835	**1967**	4	**100**
TDS - 180°C	(11/16/1974-03/04/1977)	**4**	(1952.-3695.)	**3124**	361.5	**2974**	743	**25**	3381	**3632**	2	**50**
Radium (pCi/l)												

Appendix F: Groundwater Data Summary

Alluvial Quality Data (all Values are dissolved (mg/L) unless otherwise indicated)

Pinnabete Alluvial Wells PA-1	Dates	**n**	Range	**Median**	MAD	**Average**	Standard Deviation	**Percent Relative Standard Deviation**	Q3	**95th Percentile**	**Livestock Criteria Exceedance**	
											n	**%**
pH	(11/16/1974-11/21/2008)	**10**	(7.48-7.78)	**7.57**	0.07	**7.59**	0.10	**1.31**	7.66	**7.74**	0	**0**
Conductivity (umho/cm)	(11/16/1974-06/15/2004)	**1**	(2480.-2480.)	**2480**	0	**2480**			2480	**2480**	0	**0**
Arsenic	(11/16/1974-11/21/2008)	**9**	(0.00025-0.0025)	**0.0008**	0.00055	**0.001**	0.001	**73.284**	0.003	**0.003**	0	**0**
Boron	(11/16/1974-11/21/2008)	**9**	(0.17-0.787)	**0.2**	0	**0.26**	0.20	**74.40**	0.20	**0.56**	0	**0**
Cadmium	(11/16/1974-11/21/2008)	**9**	(0.000025-0.0005)	**0.000025**	0	**0.0002**	0.0003	**106.0293**	0.0005	**0.0005**	0	**0**
Chromium	(09/12/1991-11/21/2008)	**9**	(0.0005-0.03)	**0.005**	0.001	**0.006556**	0.008984	**137.0466**	0.005	**0.02**	0	**0**
Copper	(11/16/1974-11/21/2008)	**9**	(0.005-0.0151)	**0.0079**	0.0029	**0.008**	0.004	**43.402**	0.010	**0.013**	0	**0**
Iron (total)	(03/28/1995-11/21/2008)	**9**	(0.25-53.2)	**4.43**	4.18	**15.81333**	19.25661	**121.7745**	17.5	**48.68**	0	**0**
Lead	(11/16/1974-11/21/2008)	**9**	(0.00005-0.0025)	**0.0003**	0.00025	**0.0012**	0.0012	**102.9723**	0.0025	**0.0025**	0	**0**
Manganese	(11/16/1974-11/21/2008)	**9**	(0.005-0.488)	**0.087**	0.07	**0.125889**	0.152955	**121.4997**	0.138	**0.38**	0	**0**
Mercury	(11/16/1974-11/21/2008)	**9**	(0.0001-0.0005)	**0.0002**	0.0001	**0.00029**	0.00020	**70.18572**	0.00050	**0.00050**	0	**0**
Selenium	(11/16/1974-11/21/2008)	**10**	(0.0025-0.014)	**0.005**	0.001	**0.005**	0.003	**61.698**	0.006	**0.010**	0	**0**
Zinc	(11/16/1974-11/21/2008)	**9**	(0.002-0.053)	**0.007**	0.005	**0.018**	0.020	**109.606**	0.037	**0.049**	0	**0**
Chloride	(11/16/1974-11/21/2008)	**10**	(14.-36.)	**20**	5	**22**	7	**33**	25	**33**	0	**0**
Fluoride	(11/16/1974-11/21/2008)	**9**	(2.1-3.)	**2.36**	0.16	**2.39**	0.27	**11.43**	2.49	**2.81**	9	**100**
Nitrate	(06/27/1975-11/21/2008)	**8**	(0.025-0.72)	**0.05**	0.0225	**0.21**	0.30	**142.30**	0.24	**0.70**	0	**0**
Sulfate	(11/16/1974-11/21/2008)	**10**	(805.-1280.)	**950**	100	**983**	149	**15**	1055	**1217**	4	**40**
TDS - 180°C	(11/16/1974-11/21/2008)	**10**	(1500.-4310.)	**1705**	80	**1986**	832	**42**	1900	**3284**	1	**10**
Radium (pCi/l)	(12/11/1991-11/21/2008)	**8**	(0.58-12.65)	**2.0975**	1.2975	**4.44**	4.88	**110**	6.1875	**12.265**	0	**0**

Appendix F: Groundwater Data Summary

Alluvial Quality Data (all Values are dissolved (mg/L) unless otherwise indicated)

Pinnabete Alluvial Wells PA-2	Dates	**n**	Range	**Median**	MAD	**Average**	Standard Deviation	**Percent Relative Standard Deviation**	Q3	**95th Percentile**	**Livestock Criteria Exceedance**	
											n	**%**
pH	(03/30/1998-11/20/2008)	**10**	(7.19-7.9)	**7.405**	0.1	**7.43**	0.21	**2.85**	7.50	**7.77**	0	**0**
Conductivity (umho/cm)	(06/15/2004-06/15/2004)	**1**	(4040.-4040.)	**4040**	0	**4040**			4040	**4040**	0	**0**
Arsenic	(03/30/1998-11/20/2008)	**9**	(0.0007-0.0027)	**0.0025**	0.0002	**0.002**	0.001	**42.303**	0.003	**0.003**	0	**0**
Boron	(03/30/1998-11/20/2008)	**9**	(0.19-2.1)	**0.2**	0.01	**0.44**	0.63	**143.68**	0.30	**1.38**	0	**0**
Cadmium	(03/30/1998-11/20/2008)	**9**	(0.000025-0.0005)	**0.000025**	0	**0.0002**	0.0003	**106.0293**	0.0005	**0.0005**	0	**0**
Chromium	(03/30/1998-11/20/2008)	**9**	(0.0005-0.03)	**0.005**	0.001	**0.0075**	0.008739	**116.5237**	0.006	**0.0216**	0	**0**
Copper	(03/30/1998-11/20/2008)	**9**	(0.005-0.0508)	**0.0116**	0.0066	**0.017**	0.015	**91.121**	0.023	**0.040**	0	**0**
Iron (total)	(03/30/1998-11/20/2008)	**9**	(0.13-63.9)	**3.03**	1.17	**9.89**	20.34657	**205.7287**	5.61	**40.96**	0	**0**
Lead	(03/30/1998-11/20/2008)	**9**	(0.00005-0.0025)	**0.0002**	0.00015	**0.0012**	0.0013	**108.4845**	0.0025	**0.0025**	0	**0**
Manganese	(03/30/1998-11/20/2008)	**9**	(0.0277-1.33)	**0.135**	0.045	**0.293078**	0.407376	**138.9993**	0.22	**0.9804**	0	**0**
Mercury	(03/30/1998-11/20/2008)	**9**	(0.0001-0.0005)	**0.0002**	0.0001	**0.00029**	0.00020	**70.18572**	0.00050	**0.00050**	0	**0**
Selenium	(03/30/1998-11/20/2008)	**10**	(0.0007-0.018)	**0.0095**	0.004	**0.009**	0.006	**65.054**	0.012	**0.016**	0	**0**
Zinc	(03/30/1998-11/20/2008)	**9**	(0.003-0.18)	**0.009**	0.005	**0.033**	0.057	**170.686**	0.025	**0.128**	0	**0**
Chloride	(03/30/1998-11/20/2008)	**10**	(22.-65.)	**36.5**	7.5	**38**	13	**35**	44	**59**	0	**0**
Fluoride	(03/30/1998-11/20/2008)	**9**	(2.4-3.3)	**2.81**	0.29	**2.82**	0.31	**11.06**	3.06	**3.22**	9	**100**
Nitrate	(03/30/1998-11/20/2008)	**8**	(0.025-0.32)	**0.08**	0.03	**0.12**	0.11	**87.64**	0.15	**0.30**	0	**0**
Sulfate	(03/30/1998-11/20/2008)	**10**	(1550.-2400.)	**1945**	230	**1941**	273	**14**	2138	**2310**	10	**100**
TDS - 180°C	(03/30/1998-11/20/2008)	**10**	(2780.-3600.)	**3285**	255	**3266**	295	**9**	3530	**3591**	8	**80**
Radium (pCi/l)	(03/30/1998-11/20/2008)	**8**	(0.64-29.64)	**1.8**	0.835	**6.19**	9.88	**160**	4.6625	**22.591**	0	**0**

Appendix F - Groundwater Data Summary

Fruitland Formation, Spoil, and CCB Well Tables (all Values are dissolved (mg/L) unless otherwise indicated)

Baseline Fruitland Coals Combined	Dates	**n**	Range	**Median**	MAD	**Average**	Standard Deviation	**Percent Relative Standard Deviation**	Q3	**95th Percentile**	**Exceedance of Livestock Criteria** n	**Exceedance of Livestock Criteria** %
pH	(07/08/1984-07/10/1984)	**203**	(7.03-8.06)	**7.8**	0.27	**7.9**	0.7	**9**	8.1	**8.7**	8	**4**
Conductivity (umho/cm)	(07/08/1984-07/10/1984)	**180**	(5300.-46500.)	**12150**	3950	**12342**	5805	**47**	15925	**23300**		
Boron	(07/08/1984-07/10/1984)	**193**	(1.23-1.57)	**0.53**	0.14	**0.55**	0.22	**40**	0.68	**0.84**		
Iron (total)		**143**		**0.77**	0.67	**6.05**	30.76	**508**	4.02	**15.28**		
Manganese	(07/08/1984-07/10/1984)	**194**	(0.11-2.93)	**0.1**	0.088	**0.532**	2.589	**487**	0.318	**1.587**		
Selenium	(07/08/1984-07/10/1984)	**194**	(0.0005-0.0005)	**0.0025**	0	**0.003**	0.007	**223**	0.003	**0.008**		
Chloride	(07/08/1984-07/10/1984)	**194**	(2210.-28200.)	**3670**	1310	**3482**	2372	**68**	4593	**7937**	165	**85**
Fluoride	(07/08/1984-07/10/1984)	**193**	(0.92-1.08)	**1.4**	0.48	**1.37**	0.67	**49**	1.78	**2.50**	31	**16**
Sulfate	(07/08/1984-07/10/1984)	**194**	(5.-5.)	**15.75**	13.25	**294**	677	**230**	88	**2267**	22	**11**
TDS - 180°C	(07/08/1984-07/10/1984)	**194**	(7370.-50810.)	**7260**	2055	**7161**	3212	**45**	8575	**13400**	170	**88**

Baseline Fruitland Coals KF2007-01	Dates	**n**	Range	**Median**	MAD	**Average**	Standard Deviation	**Percent Relative Standard Deviation**	Q3	**95th Percentile**	**Exceedance of Livestock Criteria** n	**Exceedance of Livestock Criteria** %
pH	(08/16/2007-11/20/2008)	**5**	(8.12-9.56)	**8.75**	0.34	**8.8**	0.5	**6**	9.1	**9.5**	2	**40**
Conductivity (umho/cm)												
Boron	(08/16/2007-11/20/2008)	**5**	(0.2-0.4)	**0.329**	0.071	**0.33**	0.08	**25**	0.40	**0.40**		
Iron (total)	(08/16/2007-11/20/2008)	**5**	(0.025-1.2)	**0.29**	0.205	**0.39**	0.47	**123**	0.33	**1.03**		**0**
Manganese	(08/16/2007-11/20/2008)	**5**	(0.0025-0.013)	**0.0075**	5E-04	**0.008**	0.004	**49**	0.008	**0.012**		
Selenium	(08/16/2007-11/20/2008)	**5**	(0.004-0.006)	**0.005**	0.001	**0.005**	0.001	**17**	0.005	**0.006**		
Chloride	(08/16/2007-11/20/2008)	**5**	(278.-364.)	**338**	24	**332**	35	**11**	362	**364**		
Fluoride	(08/16/2007-11/20/2008)	**5**	(2.6-3.3)	**2.7**	0.1	**2.86**	0.32	**11**	3.10	**3.26**	5	**100**
Sulfate	(08/16/2007-11/20/2008)	**5**	(315.-2050.)	**740**	425	**1021**	694	**68**	1380	**1916**	2	**40**
TDS - 180°C	(08/16/2007-11/20/2008)	**5**	(2750.-5160.)	**3460**	670	**3750**	931	**25**	4130	**4954**	4	**80**

Appendix F - Groundwater Data Summary

Fruitland Formation, Spoil, and CCB Well Tables (all Values are dissolved (mg/L) unless otherwise indicated)

Baseline Fruitland Coals KF98-02	Dates	**n**	Range	**Median**	MAD	**Average**	Standard Deviation	**Percent Relative Standard Deviation**	Q3	**95th Percentile**	**Exceedance of Livestock Criteria**	
											n	%
pH	(03/29/1998-11/20/2008)	**8**	(7.53-12.6)	**8.06**	0.4	**9.2**	2.0	**22**	10.2	**12.4**	3	**38**
Conductivity (umho/cm)												
Boron	(03/29/1998-11/20/2008)	**8**	(0.09-1.47)	**0.4**	0.1	**0.49**	0.42	**85**	0.46	**1.13**		
Iron (total)	(03/29/1998-11/20/2008)	**8**	(0.14-1.01)	**0.485**	0.075	**0.55**	0.28	**51**	0.62	**0.97**		**0**
Manganese	(03/29/1998-11/20/2008)	**8**	(0.0025-0.045)	**0.008**	0.006	**0.017**	0.018	**107**	0.030	**0.045**		**0**
Selenium	(03/29/1998-11/20/2008)	**8**	(0.005-0.0333)	**0.008**	0.001	**0.011**	0.009	**88**	0.008	**0.025**		
Chloride	(03/29/1998-11/20/2008)	**8**	(170.-1280.)	**925**	280	**814**	383	**47**	1015	**1256**	6	**75**
Fluoride	(03/29/1998-11/20/2008)	**8**	(0.2-2.31)	**1.65**	0.2	**1.51**	0.61	**41**	1.80	**2.13**	1	**13**
Sulfate	(03/29/1998-11/20/2008)	**8**	(36.-796.)	**119**	39	**202**	248	**123**	165	**605**		
TDS - 180°C	(03/29/1998-11/20/2008)	**8**	(2220.-4100.)	**3160**	355	**3321**	623	**19**	3830	**4079**	7	**88**

Baseline Fruitland Coals KF84-21A	Dates	**n**	Range	**Median**	MAD	**Average**	Standard Deviation	**Percent Relative Standard Deviation**	Q3	**95th Percentile**	**Exceedance of Livestock Criteria**	
											n	%
pH	(07/09/1984-09/12/2001)	**32**	(6.8-8.3)	**7.9**	0.1	**7.9**	0.3	**3**	8.1	**8.2**		
Conductivity (umho/cm)	(07/09/1984-09/12/2001)	**31**	(6610.-16800.)	**14200**	1200	**13755**	2272	**17**	14750	**16600**		
Boron	(07/09/1984-09/12/2001)	**31**	(0.36-1.12)	**0.6**	0.05	**0.63**	0.14	**23**	0.65	**0.90**		
Iron (total)	(09/08/1993-09/12/2001)	**22**	(0.01-1.36)	**0.1**	0.075	**0.22**	0.30	**135**	0.24	**0.50**		**0**
Manganese	(07/09/1984-09/12/2001)	**31**	(0.0025-0.1)	**0.025**	0.015	**0.045**	0.039	**86**	0.099	**0.100**		**0**
Selenium	(07/09/1984-09/12/2001)	**31**	(0.0005-0.05)	**0.0025**	0	**0.005**	0.012	**245**	0.003	**0.027**		
Chloride	(07/09/1984-09/12/2001)	**31**	(2860.-5960.)	**4440**	130	**4394**	429	**10**	4495	**4675**	31	**100**
Fluoride	(07/09/1984-09/12/2001)	**31**	(0.94-2.38)	**1.54**	0.09	**1.62**	0.27	**17**	1.75	**2.13**	2	**6**
Sulfate	(07/09/1984-09/12/2001)	**31**	(5.-316.)	**64**	21	**74**	71	**95**	82	**223**		
TDS - 180°C	(07/09/1984-09/12/2001)	**31**	(5730.-9800.)	**8380**	140	**8291**	615	**7**	8515	**8780**	31	**100**

Appendix F - Groundwater Data Summary

Fruitland Formation, Spoil, and CCB Well Tables (all Values are dissolved (mg/L) unless otherwise indicated)

Baseline Fruitland Coals Kf84-21c	Dates	**n**	Range	**Median**	MAD	**Average**	Standard Deviation	**Percent Relative Standard Deviation**	Q3	**95th Percentile**	**Exceedance of Livestock Criteria**	
											n	%
pH	(07/09/1984-07/09/1984)	**1**	(8.08-8.08)	**8.08**	0	**8.1**			8.1	**8.1**		
Conductivity (umho/cm)	(07/09/1984-07/09/1984)	**1**	(12600.-12600.)	**12600**	0	**12600**			12600	**12600**		
Boron	(07/09/1984-07/09/1984)	**1**	(0.63-0.63)	**0.63**	0	**0.63**			0.63	**0.63**		
Iron (total)		**1**										
Manganese	(07/09/1984-07/09/1984)	**1**	(0.38-0.38)	**0.38**	0	**0.380**			0.380	**0.380**		**0**
Selenium	(07/09/1984-07/09/1984)	**1**	(0.0005-0.0005)	**0.0005**	0	**0.001**			0.001	**0.001**		
Chloride	(07/09/1984-07/09/1984)	**1**	(3980.-3980.)	**3980**	0	**3980**			3980	**3980**	1	**100**
Fluoride	(07/09/1984-07/09/1984)	**1**	(1.79-1.79)	**1.79**	0	**1.79**			1.79	**1.79**		
Sulfate	(07/09/1984-07/09/1984)	**1**	(184.-184.)	**184**	0	**184**			184	**184**		
TDS - 180°C	(07/09/1984-07/09/1984)	**1**	(8505.-8505.)	**8505**	0	**8505**			8505	**8505**	1	**100**

Baseline Fruitland Coals KF84-22A	Dates	**n**	Range	**Median**	MAD	**Average**	Standard Deviation	**Percent Relative Standard Deviation**	Q3	**95th Percentile**	**Exceedance of Livestock Criteria**	
											n	%
pH	(09/12/1991-09/18/2001)	**23**	(7.44-9.3)	**8**	0.05	**8.1**	0.3	**4**	8.1	**8.2**	1	**4**
Conductivity (umho/cm)	(09/12/1991-09/18/2001)	**21**	(4900.-14500.)	**6560**	390	**7070**	2059	**29**	14750	**16600**		
Boron	(09/12/1991-09/18/2001)	**21**	(0.15-0.58)	**0.26**	0.03	**0.29**	0.11	**37**	0.65	**0.90**		
Iron (total)	(09/08/1993-09/18/2001)	**19**	(0.06-8.02)	**0.42**	0.31	**0.98**	1.86	**190**	0.24	**0.50**		**0**
Manganese	(09/12/1991-09/18/2001)	**21**	(0.005-0.1)	**0.0125**	0.004	**0.030**	0.035	**116**	0.099	**0.100**		**0**
Selenium	(09/12/1991-09/18/2001)	**21**	(0.0005-0.05)	**0.0025**	0	**0.005**	0.011	**224**	0.003	**0.027**		
Chloride	(09/12/1991-09/18/2001)	**21**	(167.-4250.)	**290**	53	**601**	1064	**177**	4495	**4675**	2	**10**
Fluoride	(09/12/1991-09/18/2001)	**21**	(0.8-3.52)	**2.19**	0.08	**2.29**	0.56	**24**	1.75	**2.13**	19	**90**
Sulfate	(09/12/1991-09/18/2001)	**21**	(5.-2600.)	**2230**	210	**1934**	700	**36**	82	**223**	19	**90**
TDS - 180°C	(09/12/1991-09/18/2001)	**21**	(4080.-8540.)	**4680**	220	**4861**	944	**19**	8515	**8780**	21	**100**

Appendix F - Groundwater Data Summary

Fruitland Formation, Spoil, and CCB Well Tables (all Values are dissolved (mg/L) unless otherwise indicated)

Baseline Fruitland Coals KF84-22B	Dates	n	Range	Median	MAD	Average	Standard Deviation	Percent Relative Standard Deviation	Q3	95th Percentile	Exceedance of Livestock Criteria	
											n	%
pH	(07/10/1984-09/18/2001)	27	(6.8-8.05)	7.4	0.1	7.5	0.3	3	7.5	8.0		
Conductivity (umho/cm)	(07/10/1984-09/18/2001)	25	(4010.-38000.)	10900	400	11616	5736	49	11300	12460		
Boron	(07/10/1984-09/18/2001)	25	(0.28-0.54)	0.39	0.02	0.39	0.06	14	0.41	0.50		
Iron (total)	(09/08/1993-09/18/2001)	23	(0.025-4.93)	1.13	0.97	1.98	1.75	88	3.90	4.76		
Manganese	(07/10/1984-09/18/2001)	26	(0.01-0.67)	0.3	0.105	0.275	0.167	61	0.378	0.605		
Selenium	(07/10/1984-09/18/2001)	26	(0.0005-0.05)	0.0025	0	0.005	0.010	214	0.003	0.019		
Chloride	(07/10/1984-09/18/2001)	26	(0.25-3364.)	3210	80	2953	788	27	3260	3353	25	96
Fluoride	(07/10/1984-09/18/2001)	25	(0.67-1.7)	0.89	0.09	0.93	0.21	23	0.99	1.24		
Sulfate	(07/10/1984-09/18/2001)	26	(0.5-115.)	5	2.5	12	24	195	7	46		
TDS - 180°C	(07/10/1984-09/18/2001)	26	(18.-6370.)	6115	145	5671	1366	24	6188	6350	24	92

Baseline Fruitland Coals Kf84-22d	Dates	n	Range	Median	MAD	Average	Standard Deviation	Percent Relative Standard Deviation	Q3	95th Percentile	Exceedance of Livestock Criteria	
											n	%
pH	(07/09/1984-07/09/1984)	1	(7.94-7.94)	7.94	0	7.9			7.9	7.9		
Conductivity (umho/cm)	(07/09/1984-07/09/1984)	1	(13000.-13000.)	13000	0	13000			13000	13000		
Boron	(07/09/1984-07/09/1984)	1	(0.5-0.5)	0.5	0	0.50			0.50	0.50		
Iron (total)												
Manganese	(07/09/1984-07/09/1984)	1	(0.016-0.016)	0.016	0	0.016			0.016	0.016		0
Selenium	(07/09/1984-07/09/1984)	1	(0.0005-0.0005)	0.0005	0	0.001			0.001	0.001		
Chloride	(07/09/1984-07/09/1984)	1	(3420.-3420.)	3420	0	3420			3420	3420	25	100
Fluoride	(07/09/1984-07/09/1984)	1	(1.28-1.28)	1.28	0	1.28			1.28	1.28		
Sulfate	(07/09/1984-07/09/1984)	1	(5.-5.)	5	0	5			5	5		
TDS - 180°C	(07/09/1984-07/09/1984)	1	(8610.-8610.)	8610	0	8610			8610	8610	24	100

Appendix F - Groundwater Data Summary

Fruitland Formation, Spoil, and CCB Well Tables (all Values are dissolved (mg/L) unless otherwise indicated)

Baseline Fruitland Coals Kf84-22d	Dates	**n**	Range	**Median**	MAD	**Average**	Standard Deviation	**Percent Relative Standard Deviation**	Q3	**95th Percentile**	**Exceedance of Livestock Criteria** n	**Exceedance of Livestock Criteria** %
pH	(07/09/1984-07/09/1984)	**1**	(7.94-7.94)	**7.94**	0	**7.9**			7.9	**7.9**		
Conductivity (umho/cm)	(07/09/1984-07/09/1984)	**1**	(13000.-13000.)	**13000**	0	**13000**			13000	**13000**		
Boron	(07/09/1984-07/09/1984)	**1**	(0.5-0.5)	**0.5**	0	**0.50**			0.50	**0.50**		
Iron (total)												
Manganese	(07/09/1984-07/09/1984)	**1**	(0.016-0.016)	**0.016**	0	**0.016**			0.016	**0.016**		**0**
Selenium	(07/09/1984-07/09/1984)	**1**	(0.0005-0.0005)	**0.0005**	0	**0.001**			0.001	**0.001**		
Chloride	(07/09/1984-07/09/1984)	**1**	(3420.-3420.)	**3420**	0	**3420**			3420	**3420**	25	**100**
Fluoride	(07/09/1984-07/09/1984)	**1**	(1.28-1.28)	**1.28**	0	**1.28**			1.28	**1.28**		
Sulfate	(07/09/1984-07/09/1984)	**1**	(5.-5.)	**5**	0	**5**			5	**5**		
TDS - 180°C	(07/09/1984-07/09/1984)	**1**	(8610.-8610.)	**8610**	0	**8610**			8610	**8610**	24	**100**

Baseline Fruitland Coals Kf84-22e	Dates	**n**	Range	**Median**	MAD	**Average**	Standard Deviation	**Percent Relative Standard Deviation**	Q3	**95th Percentile**	**Exceedance of Livestock Criteria** n	**Exceedance of Livestock Criteria** %
pH	(07/09/1984-07/09/1984)	**2**	(7.86-8.1)	**7.98**	0.12	**8.0**	0.2	**2**	8.0	**8.1**		
Conductivity (umho/cm)	(07/09/1984-07/09/1984)	**2**	(12000.-12800.)	**12400**	400	**12400**	566	**5**	12600	**12760**		
Boron	(07/09/1984-07/09/1984)		(0.46-0.56)	**0.51**	0.05	**0.51**	0.07	**14**	0.54	**0.56**		
Iron (total)		**2**										
Manganese	(07/09/1984-07/09/1984)	**2**	(0.13-0.14)	**0.135**	0.005	**0.135**	0.007	**5**	0.138	**0.140**		**0**
Selenium	(07/09/1984-07/09/1984)	**2**	(0.0005-0.0005)	**0.0005**	0	**0.001**	0.000		0.001	**0.001**		
Chloride	(07/09/1984-07/09/1984)	**2**	(4070.-4300.)	**4185**	115	**4185**	163	**4**	4243	**4289**	2	**100**
Fluoride	(07/09/1984-07/09/1984)	**2**	(1.03-1.43)	**1.23**	0.2	**1.23**	0.28	**23**	1.33	**1.41**		
Sulfate	(07/09/1984-07/09/1984)	**2**	(5.-44.)	**24.5**	19.5	**25**	28	**113**	34	**42**		
TDS - 180°C	(07/09/1984-07/09/1984)	**2**	(8035.-8275.)	**8155**	120	**8155**	170	**2**	8215	**8263**	2	**100**

Appendix F - Groundwater Data Summary

Fruitland Formation, Spoil, and CCB Well Tables (all Values are dissolved (mg/L) unless otherwise indicated)

Baseline Fruitland Coals KF84-20A	Dates	**n**	Range	**Median**	MAD	**Average**	Standard Deviation	**Percent Relative Standard Deviation**	Q3	**95th Percentile**	**Exceedance of Livestock Criteria**	
											n	**%**
pH	(07/10/1984-12/18/2001)	**27**	(7.6-10.05)	**7.85**	0.15	**8.2**	0.6	**8**	8.4	**9.5**	2	**7**
Conductivity (umho/cm)	(07/10/1984-12/18/2001)	**26**	(4240.-16100.)	**12525**	725	**11692**	2388	**20**	13100	**13475**		
Boron	(07/10/1984-12/18/2001)	**26**	(0.42-1.28)	**0.545**	0.05	**0.57**	0.16	**28**	0.58	**0.71**		
Iron (total)	(09/08/1993-12/18/2001)	**17**	(0.1-15.1)	**2.73**	2.3	**4.39**	4.42	**101**	6.80	**11.90**		**0**
Manganese	(07/10/1984-12/18/2001)	**26**	(0.007-0.22)	**0.1**	0.011	**0.093**	0.044	**47**	0.108	**0.148**		**0**
Selenium	(07/10/1984-12/18/2001)	**26**	(0.0005-0.0025)	**0.00175**	8E-04	**0.002**	0.001	**66**	0.003	**0.003**		
Chloride	(07/10/1984-12/18/2001)	**26**	(700.-4400.)	**3715**	253	**3532**	730	**21**	3942	**4130**	26	**100**
Fluoride	(07/10/1984-12/18/2001)	**26**	(1.13-2.3)	**1.39**	0.13	**1.47**	0.27	**18**	1.62	**1.91**	1	**4**
Sulfate	(07/10/1984-12/18/2001)	**26**	(0.5-823.)	**5**	2.5	**46**	161	**348**	18	**123**		
TDS - 180°C	(07/10/1984-12/18/2001)	**26**	(2775.-7670.)	**7260**	210	**6752**	1284	**19**	7425	**7658**	25	**96**

Baseline Fruitland Coals KF84-20C	Dates	**n**	Range	**Median**	MAD	**Average**	Standard Deviation	**Percent Relative Standard Deviation**	Q3	**95th Percentile**	**Exceedance of Livestock Criteria**	
											n	**%**
pH	(09/16/1985-12/26/2001)	**24**	(7.6-8.65)	**7.865**	0.165	**8.0**	0.3	**4**	8.0	**8.5**		
Conductivity (umho/cm)	(09/16/1985-12/26/2001)	**23**	(3650.-6140.)	**4370**	180	**4355**	477	**11**	4690	**4792**		
Boron	(09/16/1985-12/26/2001)	**23**	(0.025-0.67)	**0.42**	0.05	**0.42**	0.11	**27**	0.05	**0.52**		
Iron (total)	(09/08/1993-12/26/2001)	**16**	(0.18-13.5)	**0.64**	0.295	**2.24**	4.09	**183**	3.10	**12.00**		**0**
Manganese	(09/16/1985-12/26/2001)	**23**	(0.03-0.305)	**0.082**	0.032	**0.096**	0.076	**79**		**0.290**		**0**
Selenium	(09/16/1985-12/26/2001)	**23**	(0.0005-0.008)	**0.0025**	0.002	**0.002**	0.002	**91**	0.009	**0.003**		
Chloride	(09/16/1985-12/26/2001)	**23**	(8.4-1090.)	**715**	28	**686**	197	**29**	750	**821**	21	**91**
Fluoride	(09/16/1985-12/26/2001)	**23**	(0.53-2.44)	**1.74**	0.14	**1.73**	0.37	**22**	1.80	**2.14**	3	**13**
Sulfate	(09/16/1985-12/26/2001)	**23**	(2.5-2600.)	**7**	4.5	**162**	552	**340**	5	**666**	1	**4**
TDS - 180°C	(09/16/1985-12/26/2001)	**23**	(2570.-5300.)	**2770**	140	**2974**	695	**23**	2665	**4723**	4	**17**

Appendix F - Groundwater Data Summary

Fruitland Formation, Spoil, and CCB Well Tables (all Values are dissolved (mg/L) unless otherwise indicated)

Baseline Fruitland Coals KF84-18B	Dates	**n**	Range	**Median**	MAD	**Average**	Standard Deviation	**Percent Relative Standard Deviation**	Q3	**95th Percentile**	**Exceedance of Livestock Criteria**	
											n	%
pH	(07/10/1984-09/26/2000)	**26**	(6.8-8.05)	**7.1**	0.25	**7.3**	0.4	**6**	7.7	**7.9**		
Conductivity (umho/cm)	(07/10/1984-09/26/2000)	**25**	(10000.-18600.)	**15900**	1100	**14935**	2385	**16**	16500	**18200**		
Boron	(07/10/1984-09/26/2000)	**25**	(0.49-1.2)	**0.73**	0.05	**0.74**	0.13	**18**	0.77	**0.90**		
Iron (total)	(09/08/1993-09/26/2000)	**16**	(0.3-362.)	**11.55**	4.515	**35.84**	88.16	**246**	16.88	**135.50**		**0**
Manganese	(07/10/1984-09/26/2000)	**25**	(0.1-6.)	**0.38**	0.12	**0.845**	1.498	**177**	0.500	**4.620**		**0**
Selenium	(07/10/1984-09/26/2000)	**25**	(0.0005-0.0025)	**0.0025**	0	**0.002**	0.001	**61**	0.003	**0.003**		
Chloride	(07/10/1984-09/26/2000)	**25**	(3560.-6050.)	**4900**	300	**4907**	512	**10**	5210	**5488**	25	**100**
Fluoride	(07/10/1984-09/26/2000)	**25**	(0.34-1.66)	**0.44**	0.06	**0.55**	0.29	**53**	0.61	**1.02**		
Sulfate	(07/10/1984-09/26/2000)	**25**	(2.-156.)	**5**	2.5	**24**	42	**178**	17	**135**		
TDS - 180°C	(07/10/1984-09/26/2000)	**25**	(7100.-12410.)	**9300**	250	**9128**	972	**11**	9460	**9924**	25	**100**

Baseline Fruitland Coals KF84-18A	Dates	**n**	Range	**Median**	MAD	**Average**	Standard Deviation	**Percent Relative Standard Deviation**	Q3	**95th Percentile**	**Exceedance of Livestock Criteria**	
											n	%
pH	(09/16/1985-12/19/2001)	**6**	(7.2-8.05)	**7.45**	0.21	**7.5**	0.3	**3**	7.7	**8.0**		
Conductivity (umho/cm)	(09/16/1985-12/19/2001)	**6**	(2380.-25300.)	**22900**	1700	**21131**	4481	**21**	23300	**24600**		
Boron	(09/16/1985-12/19/2001)	**1**	(0.64-1.32)	**0.72**	0.05	**0.77**	0.15	**19**	0.79	**1.00**		
Iron (total)	(09/08/1993-12/19/2001)	**1**	(0.1-21.1)	**3.8**	1.51	**6.23**	5.94	**95**	5.70	**17.26**		**0**
Manganese	(09/16/1985-12/19/2001)	**1**	(0.2-35.)	**1.33**	0.18	**2.694**	6.746	**250**	1.600	**2.184**		**0**
Selenium	(09/16/1985-12/19/2001)	**6**	(0.0005-0.005)	**0.0025**	0	**0.002**	0.001	**66**	0.003	**0.003**		
Chloride	(09/16/1985-12/19/2001)	**6**	(6680.-8370.)	**7900**	185	**7825**	395	**5**	8060	**8340**	25	**100**
Fluoride	(09/16/1985-12/19/2001)	**1**	(0.57-1.5)	**0.67**	0.08	**0.77**	0.23	**29**	0.92	**1.05**		
Sulfate	(09/16/1985-12/19/2001)	**3**	(2.5-729.)	**5**	2.5	**52**	148	**282**	17	**161**		
TDS - 180°C	(09/16/1985-12/19/2001)	**6**	(11400.-14100.)	**13400**	100	**13270**	544	**4**	13500	**13800**	25	**100**

Appendix F - Groundwater Data Summary

Fruitland Formation, Spoil, and CCB Well Tables (all Values are dissolved (mg/L) unless otherwise indicated)

Non-Baseline Fruitland Combined	Dates	n	Range	Median	MAD	Average	Standard Deviation	Percent Relative Standard Deviation	Q3	95th Percentile	Exceedance of Criteria			
											Livestock		Baseline Fruitland	
											n	%	n	%
pH	(12/12/1983-12/20/2010)	**171**	(7.06-8.68)	**7.74**	0.24	**7.8**	0.3	**4**	8.0	**8.3**			12	**7**
Conductivity (umho/cm)	(12/12/1983-12/20/2010)	**168**	(2030.-26900.)	**11000**	2000	**11815**	4056	**34**	13800	**18550**			7	**4**
Boron	(12/12/1983-12/20/2010)	**149**	(0.03-5.)	**1.07**	0.14	**1.09**	0.45	**41**	1.23	**1.50**			137	**92**
Iron (total)	(09/08/1993-12/20/2010)	**124**	-(0.3-76.2)	**0.275**	0.205	**2.24**	8.71	**388**	0.76	**8.92**			11	**9**
Manganese	(12/12/1983-12/20/2010)	**147**	-(0.2-1.5)	**0.025**		**0.068**	0.152	**224**	0.100	**0.228**			7	**5**
Selenium	(12/12/1983-12/20/2010)	**167**	-(0.005-0.093)	**0.0025**	5E-04	**0.006**	0.012	**209**	0.003	**0.034**	1	**1**	32	**19**
Chloride	(12/12/1983-12/20/2010)	**168**	(26.-8400.)	**2257.5**	1240	**2272**	1734	**76**	3340	**4905**	131	**78**	3	**2**
Fluoride	(12/12/1983-12/20/2010)	**149**	(0.005-5.3)	**1.1**	0.4	**1.38**	0.80	**58**	1.70	**2.80**	25	**17**	20	**13**
Sulfate	(12/12/1983-12/20/2010)	**159**	(0.5-5400.)	**264**	259	**939**	1450	**154**	1000	**4342**	39	**25**	102	**64**
TDS - 180°C	(12/12/1983-12/20/2010)	**164**	(1450.-14100.)	**7330**	1300	**7432**	2028	**27**	8323	**10200**	160	**98**	4	**2**

Non-Baseline Fruitland Bitsui 2	Dates	n	Range	Median	MAD	Average	Standard Deviation	Percent Relative Standard Deviation	Q3	95th Percentile	Exceedance of Criteria			
											Livestock		Baseline Fruitland	
											n	%	n	%
pH	(03/02/1995-12/20/2010)	**27**	(7.5-8.5)	**8**	0.1	**8.0**	0.2	**2**	8.1	**8.3**			2	**7**
Conductivity (umho/cm)	(03/02/1995-12/20/2010)	**26**	(2030.-12100.)	**8095**	595	**8476**	1713	**20**	9463	**10475**				
Boron	(03/02/1995-12/20/2010)	**26**	(0.27-1.1)	**0.985**	0.05	**0.94**	0.15	**16**	1.01	**1.06**			25	**96**
Iron (total)	(03/02/1995-12/20/2010)	**26**	(0.025-0.7)	**0.105**	0.045	**0.18**	0.18	**99**	0.19	**0.54**				
Manganese	(03/02/1995-12/20/2010)	**26**	(0.0025-0.025)	**0.0058**	0.003	**0.008**	0.006	**76**	0.010	**0.024**				
Selenium	(03/02/1995-12/20/2010)	**26**	(0.0005-0.041)	**0.0025**	0	**0.006**	0.009	**149**	0.004	**0.022**			7	**27**
Chloride	(03/02/1995-12/20/2010)	**26**	(130.-1270.)	**1160**	60	**1076**	243	**23**	1215	**1258**	25	**96**		
Fluoride	(03/02/1995-12/20/2010)	**26**	(0.79-2.66)	**1.7**	0.1	**1.66**	0.34	**21**	1.77	**1.97**	1	**4**	1	**4**
Sulfate	(03/02/1995-12/20/2010)	**26**	(4.5-1700.)	**165**	153	**535**	605	**113**	1150	**1450**	7	**27**	19	**73**
TDS - 180°C	(03/02/1995-12/20/2010)	**26**	(1450.-6500.)	**5145**	185	**5375**	975	**18**	6128	**6400**	25	**96**		

Appendix F - Groundwater Data Summary

Fruitland Formation, Spoil, and CCB Well Tables (all Values are dissolved (mg/L) unless otherwise indicated)

Non-Baseline Fruitland Bitsui 3	Dates	n	Range	Median	MAD	Average	Standard Deviation	Percent Relative Standard Deviation	Q3	95th Percentile	Exceedance of Criteria: Livestock n	Exceedance of Criteria: Livestock %	Exceedance of Criteria: Baseline Fruitland n	Exceedance of Criteria: Baseline Fruitland %
pH	(03/02/1995-12/21/2009)	**22**	(7.3-7.83)	**7.535**	0.065	**7.5**	0.1	**2**	7.6	**7.8**				
Conductivity (umho/cm)	(03/02/1995-12/21/2009)	**21**	(11900.-15000.)	**12900**	400	**13133**	867	**7**	13800	**14600**				
Boron	(03/02/1995-12/21/2009)	**21**	(0.9-1.22)	**1.07**	0.04	**1.07**	0.09	**8**	1.10	**1.20**			21	**100**
Iron (total)	(03/02/1995-12/21/2009)	**21**	(0.12-1.18)	**0.35**	0.17	**0.44**	0.29	**67**	0.60	**0.87**				
Manganese	(03/02/1995-12/21/2009)	**21**	(0.0025-0.025)	**0.005**	0.003	**0.009**	0.007	**86**	0.010	**0.025**				
Selenium	(03/02/1995-12/21/2009)	**21**	(0.0005-0.036)	**0.0025**	0	**0.006**	0.010	**162**	0.003	**0.035**			5	**24**
Chloride	(03/02/1995-12/21/2009)	**21**	(2420.-3600.)	**2820**	220	**2892**	331	**11**	3070	**3540**	21	**100**		
Fluoride	(03/02/1995-12/21/2009)	**21**	(0.005-1.3)	**1.01**	0.09	**0.97**	0.27	**28**	1.10	**1.27**				
Sulfate	(03/02/1995-12/21/2009)	**21**	(5.-640.)	**317**	213	**288**	235	**82**	509	**604**			14	**67**
TDS - 180°C	(03/02/1995-12/21/2009)	**17**	(7360.-8240.)	**7960**	180	**7866**	276	**4**	8100	**8224**	17	**100**		

Non-Baseline Fruitland Kf83-1	Dates	n	Range	Median	MAD	Average	Standard Deviation	Percent Relative Standard Deviation	Q3	95th Percentile	Exceedance of Criteria: Livestock n	Exceedance of Criteria: Livestock %	Exceedance of Criteria: Baseline Fruitland n	Exceedance of Criteria: Baseline Fruitland %
pH	(12/12/1983-09/26/2002)	**41**	(7.245-8.68)	**7.7**	0.1	**7.8**	0.3	**4**	8.0	**8.5**			4	**10**
Conductivity (umho/cm)	(12/12/1983-09/26/2002)	**41**	(9000.-13300.)	**10800**	900	**10663**	1048	**10**	11600	**11900**				
Boron	(12/12/1983-09/26/2002)	**41**	(0.1-5.)	**1.01**	0.08	**1.09**	0.67	**62**	1.08	**1.23**			38	**93**
Iron (total)	(09/08/1993-09/26/2002)	**32**	-(0.3-1.06)	**0.155**	0.11	**0.23**	0.29	**126**	0.28	**0.85**				
Manganese	(12/12/1983-09/26/2002)	**41**	-(0.2-0.21)	**0.02**	0.01	**0.030**	0.057	**188**	0.030	**0.100**				
Selenium	(12/12/1983-09/26/2002)	**41**	-(0.005-0.05)	**0.0025**	0	**0.003**	0.009	**329**	0.003	**0.003**			2	**5**
Chloride	(12/12/1983-09/26/2002)	**41**	(46.-2760.)	**2255**	355	**2008**	687	**34**	2485	**2680**	39	**95**		
Fluoride	(12/12/1983-09/26/2002)	**41**	(0.83-1.57)	**1.07**	0.14	**1.15**	0.22	**19**	1.30	**1.57**				
Sulfate	(12/12/1983-09/26/2002)	**41**	(5.-1260.)	**340**	209	**372**	329	**88**	411	**1000**	2	**5**	36	**88**
TDS - 180°C	(12/12/1983-09/26/2002)	**41**	(5670.-7750.)	**7100**	240	**6883**	611	**9**	7330	**7460**	41	**100**		

Appendix F - Groundwater Data Summary

Fruitland Formation, Spoil, and CCB Well Tables (all Values are dissolved (mg/L) unless otherwise indicated)

Non-Baseline Fruitland KF84	Dates	n	Range	Median	MAD	Average	Standard Deviation	Percent Relative Standard Deviation	Q3	95th Percentile	Exceedance of Criteria: Livestock n	Livestock %	Baseline Fruitland n	Baseline Fruitland %
pH	(09/17/1986-09/30/2001)	**25**	(7.605-8.56)	**7.8**	0.1	**7.9**	0.3	**3**	8.2	**8.3**			2	**8**
Conductivity (umho/cm)	(09/17/1986-09/30/2001)	**24**	(6400.-22000.)	**10000**	515	**10415**	2845	**27**	10425	**21805**			1	**4**
Boron	(09/17/1986-09/30/2001)	**24**	(0.03-1.66)	**1.3**	0.075	**1.26**	0.30	**24**	1.38	**1.64**			23	**96**
Iron (total)	(09/08/1993-09/30/2001)	**18**	(0.41-76.2)	**1.675**	1.105	**11.68**	19.81	**170**	13.94	**1.56**			8	**44**
Manganese	(09/17/1986-09/30/2001)	**24**	(0.03-1.5)	**0.134**	0.044	**0.237**	0.303	**128**	0.252	**0.195**			6	**25**
Selenium	(09/17/1986-09/30/2001)	**24**	(0.0005-0.016)	**0.0025**	0	**0.002**	0.003	**131**	0.003	**0.004**			1	**4**
Chloride	(09/17/1986-09/30/2001)	**24**	(181.-503.)	**326.5**	44	**326**	72	**22**	366	**5004**				
Fluoride	(09/17/1986-09/30/2001)	**24**	(0.45-5.3)	**2.7**	0.195	**2.75**	0.86	**31**	2.89	**0.91**	23	**96**	19	**79**
Sulfate	(09/17/1986-09/30/2001)	**24**	(2500.-5400.)	**3955**	492.5	**4014**	688	**17**	4490	**115**	24	**100**	24	**100**
TDS - 180°C	(09/17/1986-09/30/2001)	**24**	(6060.-9390.)	**7760**	425	**7788**	784	**10**	8190	**10445**	24	**100**		

Non-Baseline Fruitland KF84-16	Dates	n	Range	Median	MAD	Average	Standard Deviation	Percent Relative Standard Deviation	Q3	95th Percentile	Exceedance of Criteria: Livestock n	Livestock %	Baseline Fruitland n	Baseline Fruitland %
pH	(07/10/1984-09/24/2002)	**32**	(7.3-8.65)	**7.55**	0.18	**7.6**	0.3	**4**	7.7	**8.3**			2	**6**
Conductivity (umho/cm)	(07/10/1984-09/24/2002)	**32**	(13000.-23500.)	**16455**	1300	**16575**	2487	**15**	17125	**21805**			3	**9**
Boron	(07/10/1984-09/24/2002)	**32**	(0.3-1.88)	**1.26**	0.075	**1.25**	0.29	**23**	1.35	**1.64**			29	**91**
Iron (total)	(09/08/1993-09/24/2002)	**23**	(0.025-2.76)	**0.37**	0.24	**0.57**	0.62	**109**	0.70	**1.56**			1	**4**
Manganese	(07/10/1984-09/24/2002)	**32**	(0.008-0.42)	**0.05**	0.03	**0.076**	0.079	**105**	0.100	**0.195**			1	**3**
Selenium	(07/10/1984-09/24/2002)	**31**	(0.0005-0.01)	**0.0025**	0	**0.002**	0.002	**82**	0.003	**0.004**			2	**6**
Chloride	(07/10/1984-09/24/2002)	**32**	(3510.-5300.)	**4551**	160	**4524**	346	**8**	4705	**5004**	32	**100**		
Fluoride	(07/10/1984-09/24/2002)	**32**	(0.4-0.95)	**0.69**	0.06	**0.70**	0.12	**18**	0.75	**0.91**				
Sulfate	(07/10/1984-09/24/2002)	**32**	(0.5-599.)	**15.5**	10.5	**40**	106	**264**	22	**115**			3	**9**
TDS - 180°C	(07/10/1984-09/24/2002)	**32**	(9400.-11400.)	**9955**	145	**10033**	351	**3**	10125	**10445**	32	**100**	1	**3**

Appendix F - Groundwater Data Summary

Fruitland Formation, Spoil, and CCB Well Tables (all Values are dissolved (mg/L) unless otherwise indicated)

Non-Baseline Fruitland SJKF84 #5	Dates	n	Range	Median	MAD	Average	Standard Deviation	Percent Relative Standard Deviation	Q3	95th Percentile	Exceedance of Criteria			
											Livestock		Baseline Fruitland	
											n	%	n	%
pH	(07/10/1984-07/10/1984)	**1**	(8.12-8.12)	**8.12**	0	**8.1**			8.1	**8.1**				
Conductivity (umho/cm)	(07/10/1984-07/10/1984)	**1**	(5900.-5900.)	**5900**	0	**5900**			5900	**5900**				
Boron	(07/10/1984-07/10/1984)	**1**	(1.23-1.23)	**1.23**	0	**1.23**			1.23	**1.23**			1	**100**
Iron (total)														
Manganese	(07/10/1984-07/10/1984)	**1**	(0.17-0.17)	**0.17**	0	**0.170**			0.170	**0.170**				
Selenium	(07/10/1984-07/10/1984)	**1**	(0.0005-0.0005)	**0.0005**	0	**0.001**			0.001	**0.001**				
Chloride	(07/10/1984-07/10/1984)	**1**	(360.-360.)	**360**	0	**360**			360	**360**				
Fluoride	(07/10/1984-07/10/1984)	**1**	(2.07-2.07)	**2.07**	0	**2.07**			2.07	**2.07**	1	**100**		
Sulfate	(07/10/1984-07/10/1984)	**1**	(5.-5.)	**5**	0	**5**			5	**5**				
TDS - 180°C	(07/10/1984-07/10/1984)	**1**	(4470.-4470.)	**4470**	0	**4470**			4470	**4470**	1	**100**		

Non-Baseline Fruitland KF84-18A	Dates	n	Range	Median	MAD	Average	Standard Deviation	Percent Relative Standard Deviation	Q3	95th Percentile	Exceedance of Criteria			
											Livestock		Baseline Fruitland	
											n	%	n	%
pH	(09/28/2005-09/30/2008)	**3**	(7.27-7.34)	**7.29**	0.02	**7.3**	0.0	**0**	7.3	**7.3**				
Conductivity (umho/cm)	(09/28/2005-09/30/2008)	**3**	(26300.-26900.)	**26500**	200	**26567**	306	**1**	26700	**26860**			3	**100**
Boron														
Iron (total)														
Manganese														
Selenium	(09/28/2005-09/30/2008)	**3**	(0.046-0.093)	**0.047**	0.001	**0.062**	0.027	**43**	0.070	**0.088**	1	**33**	3	**100**
Chloride	(09/28/2005-09/30/2008)	**3**	(7800.-8400.)	**8300**	100	**8167**	321	**4**	8350	**8390**	3	**100**	3	**100**
Fluoride														
Sulfate	(09/28/2005-09/28/2005)	**1**	(5.-5.)	**5**	0	**5**			5	**5**				
TDS - 180°C	(09/28/2005-09/30/2008)	**3**	(13800.-14100.)	**13800**	0	**13900**	173	**1**	13950	**14070**	3	**100**	3	**100**

Appendix F - Groundwater Data Summary

Fruitland Formation, Spoil, and CCB Well Tables (all Values are dissolved (mg/L) unless otherwise indicated)

Non-Baseline Fruitland KF84-18B	Dates	n	Range	Median	MAD	Average	Standard Deviation	Percent Relative Standard Deviation	Q3	95th Percentile	Exceedance of Criteria			
											Livestock		Baseline Fruitland	
											n	%	n	%
pH	(09/27/2002-09/24/2003)	**2**	(7.06-7.2)	**7.13**	0.07	**7.1**	0.1	**1**	7.2	**7.2**			2	**100**
Conductivity (umho/cm)	(09/27/2002-09/24/2003)	**2**	(17200.-17900.)	**17550**	350	**17550**	495	**3**	17725	**17865**				
Boron	(09/27/2002-09/27/2002)	**1**	(0.1-0.1)	**0.1**	0	**0.10**			0.10	**0.10**				
Iron (total)	(09/27/2002-09/27/2002)	**1**	(28.-28.)	**28**	0	**28.00**			28.00	**28.00**			1	**100**
Manganese														
Selenium	(09/27/2002-09/24/2003)	**2**	(0.0005-0.001)	**0.00075**	3E-04	**0.001**	0.000	**47**	0.001	**0.001**				
Chloride	(09/27/2002-09/24/2003)	**2**	(4950.-4960.)	**4955**	5	**4955**	7	**0**	4958	**4960**	2	**100**		
Fluoride	(09/27/2002-09/27/2002)	**1**	(0.4-0.4)	**0.4**	0	**0.40**			0.40	**0.40**				
Sulfate	(09/27/2002-09/24/2003)	**2**	(5.-5.)	**5**	0	**5**	0		5	**5**				
TDS - 180°C	(09/27/2002-09/24/2003)	**2**	(9130.-9200.)	**9165**	35	**9165**	49	**1**	9183	**9197**	2	**100**		

Non-Baseline Fruitland KF84-20C	Dates	n	Range	Median	MAD	Average	Standard Deviation	Percent Relative Standard Deviation	Q3	95th Percentile	Exceedance of Criteria			
											Livestock		Baseline Fruitland	
											n	%	n	%
pH	(09/26/2002-09/29/2008)	**3**	(7.81-7.96)	**7.94**	0.02	**7.9**	0.1	**1**	8.0	**8.0**				
Conductivity (umho/cm)	(09/26/2002-09/29/2008)	**3**	(4470.-4870.)	**4510**	40	**4617**	220	**5**	4690	**4834**				
Boron	(09/26/2002-09/26/2002)	**1**	(0.05-0.05)	**0.05**	0	**0.05**			0.05	**0.05**				
Iron (total)	(09/26/2002-09/26/2002)	**1**	(3.1-3.1)	**3.1**	0	**3.10**			3.10	**3.10**			1	**100**
Manganese														
Selenium	(09/26/2002-09/29/2008)	**3**	(0.001-0.011)	**0.007**	0.004	**0.006**	0.005	**79**	0.009	**0.011**			2	**67**
Chloride	(09/26/2002-09/29/2008)	**3**	(720.-770.)	**730**	10	**740**	26	**4**	750	**766**	3	**100**		
Fluoride	(09/26/2002-09/26/2002)	**1**	(1.8-1.8)	**1.8**	0	**1.80**			1.80	**1.80**				
Sulfate	(09/26/2002-09/28/2005)	**2**	(5.-5.)	**5**	0	**5**	0		5	**5**				
TDS - 180°C	(09/26/2002-09/29/2008)	**3**	(2620.-2690.)	**2640**	20	**2650**	36	**1**	2665	**2685**				

Appendix F - Groundwater Data Summary

Fruitland Formation, Spoil, and CCB Well Tables (all Values are dissolved (mg/L) unless otherwise indicated)

Non-Baseline Fruitland KF84-22A	Dates	**n**	Range	**Median**	MAD	**Average**	Standard Deviation	**Percent Relative Standard Deviation**	Q3	**95th Percentile**	**Exceedance of Criteria**			
											Livestock		**Baseline Fruitland**	
											n	**%**	n	**%**
pH	(09/24/2002-09/24/2008)	**9**	(7.97-8.19)	**8.09**		**8.1**	0.1	**1**	8.2	**8.2**				
Conductivity (umho/cm)	(09/24/2002-09/24/2008)	**9**	(7120.-8030.)	**7430**		**7424**	266	**4**	7480	**7810**				
Boron	(09/23/2002-09/23/2002)	**1**	(0.05-0.05)	**0.05**		**0.05**			0.05	**0.05**				
Iron (total)	(09/23/2002-09/23/2002)	**1**	(0.8-0.8)	**0.8**		**0.80**			0.80	**0.80**				
Manganese	(09/23/2002-09/23/2002)	**1**	(0.025-0.025)	**0.025**		**0.025**			0.025	**0.025**				
Selenium	(09/23/2002-09/24/2008)	**9**	(0.0005-0.047)	**0.012**		**0.015**	0.016	**107**	0.017	**0.041**			6	**67**
Chloride	(09/24/2002-09/24/2008)	**9**	(26.-230.)	**216**		**188**	65	**34**	220	**228**				
Fluoride	(09/24/2002-09/24/2002)	**1**	(1.1-1.1)	**1.1**		**1.10**			1.10	**1.10**				
Sulfate	(09/24/2002-09/29/2006)	**6**	(2300.-3050.)	**2800**		**2725**	252	**9**	2800	**2988**	6	**100**	6	**100**
TDS - 180°C	(09/24/2002-09/24/2008)	**9**	(4870.-5540.)	**5100**		**5180**	212	**4**	5330	**5456**	9	**100**		

Non-Baseline Fruitland KF84-22B	Dates	**n**	Range	**Median**	MAD	**Average**	Standard Deviation	**Percent Relative Standard Deviation**	Q3	**95th Percentile**	**Exceedance of Criteria**			
											Livestock		**Baseline Fruitland**	
											n	**%**	n	**%**
pH	(09/24/2002-09/24/2008)	**6**	(7.42-7.9)	**7.52**	0.07	**7.6**	0.2	**2**	7.6	**7.8**				
Conductivity (umho/cm)	(09/24/2002-09/24/2008)	**6**	(11400.-11900.)	**11650**	200	**11633**	225	**2**	11800	**11875**				
Boron	(09/24/2002-09/24/2002)	**1**	(0.05-0.05)	**0.05**	0	**0.05**			0.05	**0.05**				
Iron (total)	(09/24/2002-09/24/2002)	**1**	(1.5-1.5)	**1.5**	0	**1.50**			1.50	**1.50**				
Manganese	(09/24/2002-09/24/2002)	**1**	(0.025-0.025)	**0.025**	0	**0.025**			0.025	**0.025**				
Selenium	(09/24/2002-09/24/2008)	**6**	(0.0005-0.038)	**0.0195**	0.013	**0.018**	0.015	**85**	0.026	**0.035**			4	**67**
Chloride	(09/24/2002-09/24/2008)	**6**	(3000.-3340.)	**3280**	60	**3220**	149	**5**	3340	**3340**	6	**100**		
Fluoride	(09/24/2002-09/24/2002)	**1**	(0.8-0.8)	**0.8**	0	**0.80**			0.80	**0.80**				
Sulfate	(09/24/2002-09/27/2005)	**3**	(5.-5.)	**5**	0	**5**	0		5	**5**				
TDS - 180°C	(09/24/2002-09/24/2008)	**6**	(5840.-6210.)	**6030**	125	**6013**	143	**2**	6090	**6185**	6	**100**		

Appendix F - Groundwater Data Summary

Fruitland Formation, Spoil, and CCB Well Tables (all Values are dissolved (mg/L) unless otherwise indicated)

Spoils Wells Combined	Dates	**n**	Range	**Median**	MAD	**Average**	Standard Deviation	**Percent Relative Standard Deviation**	Q3	**95th Percentile**	**Exceedance of Criteria**			
											Livestock		**Baseline Fruitland**	
											n	%	n	%
pH	(01/26/1996-12/21/2010)	**64**	(6.5-8.4)	**6.975**	0.275	**7.1**	0.4	**6**	7.4	**7.7**			41	**64**
Conductivity (umho/cm)	(01/26/1996-12/21/2010)	**63**	(430.-24600.)	**17200**	1200	**16872**	3590	**21**	18400	**21290**			5	**8**
Boron	(01/26/1996-12/21/2010)	**63**	(0.11-4.7)	**1.54**	0.34	**1.67**	0.69	**42**	1.90	**2.61**			62	**98**
Iron (total)	(01/26/1996-12/21/2010)	**63**	(0.06-20.)	**1.09**	0.75	**2.50**	4.16	**166**	2.20	**11.43**		**0**	17	**27**
Manganese	(01/26/1996-12/21/2010)	**63**	(0.0025-7.05)	**2.99**	2.61	**2.717**	2.321	**85**	4.558	**6.081**		**0**	40	**63**
Selenium	(01/26/1996-12/21/2010)	**63**	(0.0005-0.2)	**0.0025**	0.002	**0.013**	0.035	**270**	0.013	**0.027**	2	**3**	21	**33**
Chloride	(01/26/1996-12/21/2010)	**63**	(45.7-1330.)	**530**	166	**658**	327	**50**	980	**1221**	28	**44**		
Fluoride	(01/26/1996-12/21/2010)	**63**	(0.2-1.34)	**0.3**	0.04	**0.56**	0.36	**65**	1.00	**1.12**				
Sulfate	(01/26/1996-12/21/2010)	**63**	(3550.-15500.)	**7920**	1920	**7779**	2502	**32**	9293	**11380**	63	**100**	63	**100**
TDS - 180°C	(01/26/1996-12/21/2010)	**61**	(1160.-18000.)	**14600**	1600	**13880**	2530	**18**	15300	**16700**	60	**98**	57	**93**

Spoils Wells Bitsui 4	Dates	**n**	Range	**Median**	MAD	**Average**	Standard Deviation	**Percent Relative Standard Deviation**	Q3	**95th Percentile**	**Exceedance of Criteria**			
											Livestock		**Baseline Fruitland**	
											n	%	n	%
pH	(01/26/1996-12/21/2010)	**21**	(6.62-7.7)	**6.8**	0.1	**6.9**	0.3	**4**	7.0	**7.7**			19	**90**
Conductivity (umho/cm)	(01/26/1996-12/21/2010)	**20**	(14400.-24600.)	**18100**	950	**18395**	2205	**12**	18975	**21845**			3	**15**
Boron	(01/26/1996-12/21/2010)	**20**	(1.3-2.5)	**1.685**	0.19	**1.73**	0.34	**19**	1.76	**2.31**			20	**100**
Iron (total)	(01/26/1996-12/21/2010)	**20**	(0.67-18.6)	**2.76**	1.92	**4.78**	5.23	**109**	5.98	**16.70**			13	**65**
Manganese	(01/26/1996-12/21/2010)	**20**	(2.08-7.05)	**3.65**	1.033	**3.869**	1.393	**36**	4.754	**5.920**			20	**100**
Selenium	(01/26/1996-12/21/2010)	**20**	(0.0005-0.2)	**0.0025**	0.002	**0.016**	0.044	**273**	0.013	**0.029**	1	**5**	7	**35**
Chloride	(01/26/1996-12/21/2010)	**20**	(45.7-696.)	**504**	63.5	**491**	145	**30**	563	**661**	5	**25**		
Fluoride	(01/26/1996-12/21/2010)	**20**	(0.2-0.34)	**0.3**	0	**0.30**	0.03	**10**	0.31	**0.33**				
Sulfate	(01/26/1996-12/21/2010)	**20**	(6680.-13500.)	**8900**	520	**9286**	1491	**16**	9595	**11505**	20	**100**	20	**100**
TDS - 180°C	(01/26/1996-12/21/2010)	**20**	(13100.-17500.)	**15150**	450	**15335**	995	**6**	15875	**16740**	20	**100**	20	**100**

Appendix F - Groundwater Data Summary

Fruitland Formation, Spoil, and CCB Well Tables (all Values are dissolved (mg/L) unless otherwise indicated)

Spoils Wells Bitsui 5	Dates	n	Range	Median	MAD	Average	Standard Deviation	Percent Relative Standard Deviation	Q3	95th Percentile	Exceedance of Criteria			
											Livestock		Baseline Fruitland	
											n	%	n	%
pH	(02/13/1996-12/20/2010)	**23**	(7.25-8.4)	**7.45**	0.1	**7.6**	0.3	**4**	7.6	**8.2**			2	**9**
Conductivity (umho/cm)	(02/13/1996-12/20/2010)	**23**	(13000.-19300.)	**16200**	1000	**16070**	1494	**9**	16850	**19090**				
Boron	(02/13/1996-12/20/2010)	**23**	(0.11-1.7)	**1.11**	0.09	**1.12**	0.27	**24**	1.20	**1.33**			22	**96**
Iron (total)	(02/13/1996-12/20/2010)	**23**	(0.06-2.05)	**0.31**	0.12	**0.42**	0.50	**119**	0.40	**1.70**				
Manganese	(02/13/1996-12/20/2010)	**23**	(0.0025-0.41)	**0.108**	0.025	**0.115**	0.077	**67**	0.132	**0.169**			1	**4**
Selenium	(02/13/1996-12/20/2010)	**23**	(0.0005-0.2)	**0.0025**	0.002	**0.015**	0.041	**280**	0.011	**0.027**	1	**4**	7	**30**
Chloride	(02/13/1996-12/20/2010)	**23**	(650.-1330.)	**1020**	115	**1041**	174	**17**	1205	**1314**	23	**100**		
Fluoride	(02/13/1996-12/20/2010)	**23**	(0.8-1.22)	**1**	0.04	**1.00**	0.09	**9**	1.03	**1.12**				
Sulfate	(02/13/1996-12/20/2010)	**23**	(3550.-6200.)	**5030**	570	**5173**	750	**14**	5800	**6190**	23	**100**	23	**100**
TDS - 180°C	(02/13/1996-12/20/2010)	**21**	(1160.-12700.)	**11800**	400	**11298**	2397	**21**	12200	**12500**	20	**95**	17	**81**

Spoils Wells Bitsui 6	Dates	n	Range	Median	MAD	Average	Standard Deviation	Percent Relative Standard Deviation	Q3	95th Percentile	Exceedance of Criteria			
											Livestock		Baseline Fruitland	
											n	%	n	%
pH	(02/12/1996-12/02/2010)	**20**	(6.5-7.25)	**6.8**	0.1	**6.8**	0.2	**3**	6.9	**7.1**			20	**100**
Conductivity (umho/cm)	(02/12/1996-12/02/2010)	**20**	(430.-23200.)	**17600**	1400	**16271**	5569	**34**	18525	**21395**			2	**10**
Boron	(02/12/1996-12/02/2010)	**20**	(1.38-4.7)	**2.07**	0.47	**2.24**	0.81	**36**	2.46	**3.47**			20	**100**
Iron (total)	(02/12/1996-12/02/2010)	**20**	(0.41-20.)	**1.33**	0.31	**2.63**	4.26	**162**	1.86	**5.37**			4	**20**
Manganese	(02/12/1996-12/02/2010)	**20**	(0.13-7.05)	**4.55795**	1.042	**4.558**	1.573	**35**	5.600	**6.623**			19	**95**
Selenium	(02/12/1996-12/02/2010)	**20**	(0.0005-0.042)	**0.0025**	0.002	**0.008**	0.010	**129**	0.013	**0.021**			7	**35**
Chloride	(02/12/1996-12/02/2010)	**20**	(56.9-490.)	**396**	37	**384**	91	**24**	433	**471**				
Fluoride	(02/12/1996-12/02/2010)	**20**	(0.2-1.34)	**0.285**	0.02	**0.32**	0.24	**77**	0.30	**0.38**				
Sulfate	(02/12/1996-12/02/2010)	**20**	(4700.-15500.)	**8850**	1040	**9268**	2145	**23**	10010	**11795**	20	**100**	20	**100**
TDS - 180°C	(02/12/1996-12/02/2010)	**20**	(12200.-18000.)	**14850**	900	**15135**	1385	**9**	16200	**16860**	20	**100**	20	**100**

Appendix F - Groundwater Data Summary

Fruitland Formation, Spoil, and CCB Well Tables (all Values are dissolved (mg/L) unless otherwise indicated)

CCB Wells Combined	Dates	**n**	Range	**Median**	MAD	**Average**	Standard Deviation	**Percent Relative Standard Deviation**	Q3	**95th Percentile**	**Exceedance of Criteria**			
											Livestock		**Baseline Fruitland**	
											n	%	n	%
pH	(03/01/1995-12/02/2010)	**43**	(4.7-10.1)	**8.7**	0.2	**8.4**	0.9	**11**	8.8	**9.9**	7	**16**	30	**70**
Conductivity (umho/cm)	(03/01/1995-12/02/2010)	**40**	(868.-25900.)	**15550**	7450	**12679**	8558	**67**	19225	**24235**			8	**20**
Boron	(03/01/1995-12/02/2010)	**38**	(0.96-23.2)	**10.25**	3.36	**10.60**	6.00	**57**	15.53	**18.81**	31	**82**	38	**100**
Iron (total)	(03/01/1995-12/02/2010)	**40**	(0.12-216.)	**1.16**	0.75	**12.41**	36.49	**294**	7.18	**48.00**			16	**40**
Manganese	(03/01/1995-12/02/2010)	**39**	(0.001-2.68)	**0.11**	0.09	**0.409**	0.725	**177**	0.265	**2.377**			10	**26**
Selenium	(03/01/1995-12/02/2010)	**39**	(0.0005-0.141)	**0.009**	0.007	**0.027**	0.037	**137**	0.029	**0.100**	8	**21**	32	**82**
Chloride	(03/01/1995-12/02/2010)	**40**	(5.-2310.)	**900**	856.6	**1056**	845	**80**	1840	**2051**	26	**65**		
Fluoride	(03/01/1995-12/02/2010)	**40**	(0.58-5.1)	**2.61**	0.96	**2.79**	1.33	**48**	3.83	**4.92**	30	**75**	25	**63**
Sulfate	(03/01/1995-12/02/2010)	**40**	(261.-14000.)	**6325**	1615	**4835**	3307	**68**	7055	**8315**	31	**78**	40	**100**
TDS - 180°C	(03/01/1995-12/02/2010)	**34**	(1500.-18700.)	**14200**	2100	**10996**	5403	**49**	15150	**16360**	30	**88**	20	**59**

CCB Wells Bitsui 1	Dates	**n**	Range	**Median**	MAD	**Average**	Standard Deviation	**Percent Relative Standard Deviation**	Q3	**95th Percentile**	**Exceedance of Criteria**			
											Livestock		**Baseline Fruitland**	
											n	%	n	%
pH	(03/01/1995-12/02/2010)	**28**	(7.23-8.9)	**8.7**	0.1	**8.5**	0.5	**6**	8.8	**8.9**			23	**82**
Conductivity (umho/cm)	(03/01/1995-12/02/2010)	**26**	(868.-25900.)	**18200**	2950	**17987**	5447	**30**	22200	**24725**			26	**100**
Boron	(03/01/1995-12/02/2010)	**25**	(6.98-23.2)	**10.5**	1.75	**11.86**	4.07	**34**	13.70	**18.34**	25	**100**	22	**88**
Iron (total)	(03/01/1995-12/02/2010)	**26**	(0.12-21.4)	**0.66**	0.33	**2.62**	4.83	**185**	1.61	**12.19**			26	**100**
Manganese	(03/01/1995-12/02/2010)	**26**	(0.02-2.68)	**0.2**	0.1	**0.602**	0.826	**137**	0.579	**2.415**			26	**100**
Selenium	(03/01/1995-12/02/2010)	**26**	(0.0005-0.09)	**0.006**	0.004	**0.010**	0.017	**169**	0.011	**0.027**	1	**4**	26	**100**
Chloride	(03/01/1995-12/02/2010)	**26**	(5.-2310.)	**1830**	150	**1529**	653	**43**	1965	**2065**	24	**92**	26	**100**
Fluoride	(03/01/1995-12/02/2010)	**26**	(0.58-4.39)	**2.25**	0.425	**2.11**	0.87	**41**	2.62	**3.03**	17	**65**	26	**100**
Sulfate	(03/01/1995-12/02/2010)	**26**	(261.-14000.)	**6995**	569	**6838**	2201	**32**	7556	**8525**	25	**96**	26	**100**
TDS - 180°C	(03/01/1995-12/02/2010)	**25**	(8430.-18700.)	**14600**	700	**13906**	2536	**18**	15300	**17080**	25	**100**	25	**100**

Appendix F - Groundwater Data Summary

Fruitland Formation, Spoil, and CCB Well Tables (all Values are dissolved (mg/L) unless otherwise indicated)

CCB Wells Watson-4	Dates	n	Range	Median	MAD	Average	Standard Deviation	Percent Relative Standard Deviation	Q3	95th Percentile	Exceedance of Criteria: Livestock n	Livestock %	Baseline Fruitland n	Baseline Fruitland %
pH	(03/02/1995-10/10/1996)	**6**	(9.145-10.1)	**9.8**	0.2	**9.7**	0.3	**4**	9.9	**10.1**	6	**100**	6	**100**
Conductivity (umho/cm)	(03/02/1995-10/10/1996)	**6**	(2610.-5480.)	**4195**	665	**4042**	1021	**25**	4520	**5248**			6	**100**
Boron	(03/02/1995-10/10/1996)	**6**	(8.9-20.)	**17.4**	1.45	**16.33**	3.92	**24**	18.43	**19.65**	6	**100**	6	**100**
Iron (total)	(03/02/1995-10/10/1996)	**6**	(11.-216.)	**34.85**	21.55	**66.38**	78.30	**118**	76.00	**183.50**			6	**100**
Manganese	(03/02/1995-10/10/1996)	**6**	(0.001-0.01)	**0.01**	0	**0.008**	0.004	**50**	0.010	**0.010**			6	**100**
Selenium	(03/02/1995-10/10/1996)	**6**	(0.006-0.05)	**0.017**	0.01	**0.021**	0.016	**77**	0.027	**0.045**			6	**100**
Chloride	(03/02/1995-10/10/1996)	**6**	(123.-647.)	**248**	101.5	**341**	228	**67**	522	**638**	2	**33**	6	**100**
Fluoride	(03/02/1995-10/10/1996)	**6**	(3.17-4.46)	**3.625**	0.29	**3.75**	0.47	**12**	4.02	**4.37**	6	**100**	6	**100**
Sulfate	(03/02/1995-10/10/1996)	**6**	(1620.-2100.)	**2020**	65	**1940**	189	**10**	2068	**2093**	6	**100**	6	**100**
TDS - 180°C	(03/02/1995-10/10/1996)	**6**	(2900.-4160.)	**3620**	240	**3617**	435	**12**	3875	**4105**	5	**83**	6	**100**

CCB Wells Custer-2	Dates	n	Range	Median	MAD	Average	Standard Deviation	Percent Relative Standard Deviation	Q3	95th Percentile	Exceedance of Criteria: Livestock n	Livestock %	Baseline Fruitland n	Baseline Fruitland %
pH	(07/18/1997-07/18/1997)	**1**	(7.9-7.9)	**7.9**	0	**7.9**			7.9	**7.9**				
Conductivity (umho/cm)	(07/18/1997-07/18/1997)	**1**	(1110.-1110.)	**1110**	0	**1110**			1110	**1110**			1	**100**
Boron														
Iron (total)	(07/18/1997-07/18/1997)	**1**	(1.11-1.11)	**1.11**	0	**1.11**			1.11	**1.11**			1	**100**
Manganese														
Selenium														
Chloride	(07/18/1997-07/18/1997)	**1**	(36.-36.)	**36**	0	**36**			36	**36**			1	**100**
Fluoride	(07/18/1997-07/18/1997)	**1**	(0.98-0.98)	**0.98**	0	**0.98**			0.98	**0.98**			1	**100**
Sulfate	(07/18/1997-07/18/1997)	**1**	(440.-440.)	**440**	0	**440**			440	**440**			1	**100**
TDS - 180°C														

Appendix F - Groundwater Data Summary

Fruitland Formation, Spoil, and CCB Well Tables (all Values are dissolved (mg/L) unless otherwise indicated)

CCB Wells Doby-2	Dates	**n**	Range	**Median**	MAD	**Average**	Standard Deviation	**Percent Relative Standard Deviation**	Q3	**95th Percentile**	**Exceedance of Criteria**			
											Livestock		**Baseline Fruitland**	
											n	**%**	n	**%**
pH	(01/21/1997-06/14/1999)	**8**	(4.7-7.7)	**7.5**	0.1	**7.2**	1.0	**14**	7.6	**7.7**	1	**13**	1	**13**
Conductivity (umho/cm)	(01/21/1997-06/14/1999)	**7**	(1780.-2110.)	**2070**	40	**2020**	118	**6**	2100	**2107**			7	**100**
Boron	(01/21/1997-06/14/1999)	**7**	(0.96-1.56)	**1.14**	0.06	**1.19**	0.18	**16**	1.22	**1.46**			7	**100**
Iron (total)	(01/21/1997-06/14/1999)	**7**	(0.58-10.4)	**2.3**	1.64	**4.14**	4.32	**104**	6.85	**10.34**			7	**100**
Manganese	(01/21/1997-06/14/1999)	**7**	(0.01-0.07)	**0.027**	0.006	**0.035**	0.022	**63**	0.045	**0.067**			7	**100**
Selenium	(01/21/1997-06/14/1999)	**7**	(0.057-0.141)	**0.09**	0.016	**0.093**	0.028	**30**	0.107	**0.133**	7	**100**	7	**100**
Chloride	(01/21/1997-06/14/1999)	**7**	(41.2-78.)	**50**	8.8	**55**	15	**26**	66	**75**			7	**100**
Fluoride	(01/21/1997-06/14/1999)	**7**	(4.42-5.1)	**4.9**	0.2	**4.76**	0.26	**6**	4.92	**5.05**	7	**100**	7	**100**
Sulfate	(01/21/1997-06/14/1999)	**7**	(365.-610.)	**488**	112	**504**	103	**20**	601	**607**			7	**100**
TDS - 180°C	(01/21/1997-03/12/1997)	**3**	(1500.-1530.)	**1510**	10	**1513**	15	**1**	1520	**1528**			3	**100**

Appendix F - Groundwater Data Summary

PCS Summary Tables (all Values are dissolved (mg/L) unless otherwise indicated)

PCS Baseline Combined	Dates	**n**	Range	**Median**	MAD	**Average**	Standard Deviation	**Percent Relative Standard Deviation**	Q3	**95th Percentile**	**Exceedance of Livestock Criteria**	
											n	**%**
pH	(11/16/1974-	**52**	(11.8-7.)	**8**	0.4	**8.3**	1.0	**12**	8.6	**10.1**	10	**19**
Conductivity (umho/cm)	(11/16/1974- 03/04/1977)	**20**	(20500.-3620.)	**9590**	2740	**9893**	4297	**43**	11950	**16700**		
Boron	(11/16/1974-	**51**	(37.-0.05)	**0.7**	0.28	**1.51**	5.09	**338**	1.00	**2.02**	1	**2**
Iron (total)	(11/16/1974-	**18**	(533.-0.01)	**0.805**	0.77	**32.37**	125.13	**386**	2.32	**105.02**		
Manganese	(11/16/1974-	**45**	(0.34-0.001)	**0.06**	0.03	**0.077**	0.075	**97**	0.088	**0.242**		
Selenium	(11/16/1974-	**51**	(0.25-0.001)	**0.005**	0	**0.032**	0.073	**232**	0.007	**0.250**	6	**12**
Chloride	(11/16/1974-	**51**	(9000.-39.)	**970**	650	**1755**	2279	**130**	1450	**7080**	31	**61**
Fluoride	(11/16/1974-	**43**	(4.9-0.2)	**1.5**	0.45	**1.72**	0.92	**54**	2.00	**3.29**	10	**23**
Sulfate	(11/16/1974-	**51**	(4535.-0.5)	**2500**	800	**2359**	1198	**51**	3325	**3950**	42	**82**
TDS - 180°C	(11/16/1974-	**51**	(18746.-800.)	**6140**	790	**7214**	3262	**45**	7440	**14418**	50	**98**

PCS Baseline GM-11	Dates	**n**	Range	**Median**	MAD	**Average**	Standard Deviation	**Percent Relative Standard Deviation**	Q3	**95th Percentile**	**Exceedance of Livestock Criteria**	
											n	**%**
pH	(03/25/1975-	4	(8.05-7.5)	**7.6**	0.05	**7.7**	0.2	**3**	7.7	**8.0**		
Conductivity (umho/cm)	(03/25/1975- 03/04/1977)	4	(16500.-11700.)	**14715**	1750	**14408**	2435	**17**	16448	**16490**		
Boron	(03/25/1975-	4	(1.2-0.2)	**0.99**	0.11	**0.85**	0.44	**52**	1.05	**1.17**		
Iron (total)												
Manganese	(03/25/1975-	4	(0.34-0.08)	**0.18**	0.075	**0.195**	0.115	**59**	0.258	**0.324**		
Selenium	(03/25/1975-	4	(0.25-0.005)	**0.0375**	0.0325	**0.083**	0.116	**140**	0.115	**0.223**	2	**50**
Chloride	(03/25/1975-	4	(9000.-6420.)	**7267.5**	677.5	**7489**	1160	**15**	8081	**8816**	4	**100**
Fluoride	(03/25/1975-	4	(1.6-0.8)	**1.07**	0.2	**1.14**	0.35	**31**	1.30	**1.54**		
Sulfate	(03/25/1975-	4	(3065.-375.)	**2450**	432.5	**2085**	1194	**57**	2791	**3010**	3	**75**
TDS - 180°C	(03/25/1975-	4	(18746.-13870.)	**15963**	1545	**16136**	2160	**13**	17407	**18478**	4	**100**

Appendix F - Groundwater Data Summary

PCS Summary Tables (all Values are dissolved (mg/L) unless otherwise indicated)

PCS Baseline GM-14	Dates	n	Range	Median	MAD	Average	Standard Deviation	Percent Relative Standard Deviation	Q3	95th Percentile	Exceedance of Livestock Criteria	
											n	%
pH	(03/25/1975-	**2**	(8.-7.7)	**7.85**	0.15	**7.9**	0.2	**3**	7.9	**8.0**		
Conductivity (umho/cm)	(03/25/1975-05/20/1976)	**2**	(9350.-6100.)	**7725**	1625	**7725**	2298	**30**	8538	**9188**		
Boron	(03/25/1975-	**2**	(0.97-0.61)	**0.79**	0.18	**0.79**	0.25	**32**	0.88	**0.95**		
Iron (total)												
Manganese	(03/25/1975-	**2**	(0.059-0.026)	**0.0425**	0.0165	**0.043**	0.023	**55**	0.051	**0.057**		
Selenium	(03/25/1975-	**2**	(0.25-0.005)	**0.1275**	0.1225	**0.128**	0.173	**136**	0.189	**0.238**	1	**50**
Chloride	(03/25/1975-	**2**	(3400.-2430.)	**2915**	485	**2915**	686	**24**	3158	**3352**	2	**100**
Fluoride	(03/25/1975-	**2**	(1.2-1.19)	**1.195**	0.005	**1.20**	0.01	**1**	1.20	**1.20**		
Sulfate	(03/25/1975-	**2**	(0.91-0.5)	**0.705**	0.205	**1**	0	**41**	1	**1**		
TDS - 180°C	(03/25/1975-	**2**	(6732.-5078.)	**5905**	827	**5905**	1170	**20**	6319	**6649**	2	**100**

PCS Baseline GM-15	Dates	n	Range	Median	MAD	Average	Standard Deviation	Percent Relative Standard Deviation	Q3	95th Percentile	Exceedance of Livestock Criteria	
											n	%
pH	(03/27/1975-	**2**	(9.2-8.92)	**9.06**	0.14	**9.1**	0.2	**2**	9.1	**9.2**	1	**50**
Conductivity (umho/cm)	(03/27/1975-05/20/1976)	**2**	(12700.-9880.)	**11290**	1410	**11290**	1994	**18**	11995	**12559**		
Boron	(03/27/1975-	**2**	(0.83-0.81)	**0.82**	0.01	**0.82**	0.01	**2**	0.83	**0.83**		
Iron (total)												
Manganese	(03/27/1975-	**2**	(0.079-0.014)	**0.0465**	0.0325	**0.047**	0.046	**99**	0.063	**0.076**		
Selenium	(03/27/1975-	**2**	(0.25-0.005)	**0.1275**	0.1225	**0.128**	0.173	**136**	0.189	**0.238**	1	**50**
Chloride	(03/27/1975-	**2**	(7400.-3910.)	**5655**	1745	**5655**	2468	**44**	6528	**7226**	2	**100**
Fluoride	(03/27/1975-	**2**	(2.26-2.)	**2.13**	0.13	**2.13**	0.18	**9**	2.20	**2.25**	1	**50**
Sulfate	(03/27/1975-	**2**	(386.-330.)	**358**	28	**358**	40	**11**	372	**383**		
TDS - 180°C	(03/27/1975-	**2**	(10879.-8101.)	**9490**	1389	**9490**	1964	**21**	10185	**10740**	2	**100**

Appendix F - Groundwater Data Summary

PCS Summary Tables (all Values are dissolved (mg/L) unless otherwise indicated)

PCS Baseline GM-19	Dates	n	Range	Median	MAD	Average	Standard Deviation	Percent Relative Standard Deviation	Q3	95th Percentile	Exceedance of Livestock Criteria	
											n	%
pH	(11/16/1974-	**4**	(8.1-7.5)	**7.865**	0.135	**7.8**	0.2	**3**	8.0	**8.1**		
Conductivity (umho/cm)												
Boron	(11/16/1974-	**4**	(1.03-0.3)	**0.94**	0.075	**0.80**	0.34	**43**	1.01	**1.03**		
Iron (total)	(11/16/1974-	**1**	(0.01-0.01)	**0.01**	0	**0.01**			0.01	**0.01**		
Manganese	(11/16/1974-	**4**	(0.245-0.06)	**0.099**	0.025	**0.126**	0.082	**65**	0.144	**0.225**		
Selenium	(11/16/1974-	**4**	(0.025-0.002)	**0.005**	0.0015	**0.009**	0.011	**115**	0.010	**0.022**		
Chloride	(11/16/1974-	**4**	(1077.-534.8)	**844**	204.5	**825**	265	**32**	1034	**1068**	3	**75**
Fluoride	(11/16/1974-	**4**	(1.7-0.76)	**1.195**	0.365	**1.21**	0.45	**37**	1.54	**1.67**		
Sulfate	(11/16/1974-	**4**	(4535.-3685.)	**4025**	182.5	**4068**	351	**9**	4171	**4462**	4	**100**
TDS - 180°C	(11/16/1974-	**4**	(9270.-7810.)	**8804.5**	416.5	**8672**	685	**8**	9197	**9255**	4	**100**

PCS Baseline GM-20	Dates	n	Range	Median	MAD	Average	Standard Deviation	Percent Relative Standard Deviation	Q3	95th Percentile	Exceedance of Livestock Criteria	
											n	%
pH	(11/16/1974-	**8**	(11.8-7.)	**8.65**	1	**9.0**	1.6	**18**	9.7	**11.5**	3	**38**
Conductivity (umho/cm)	(06/27/1975- 06/27/1975)	**1**	(8755.-8755.)	**8755**	0	**8755**			8755	**8755**		
Boron	(11/16/1974-	**7**	(2.24-0.2)	**0.88**	0.32	**0.90**	0.70	**77**	1.05	**1.93**		
Iron (total)	(11/16/1974-	**1**	(0.03-0.03)	**0.03**	0	**0.03**			0.03	**0.03**		
Manganese	(11/16/1974-	**6**	(0.29-0.008)	**0.0305**	0.0225	**0.088**	0.114	**130**	0.129	**0.258**		
Selenium	(11/16/1974-	**7**	(0.025-0.001)	**0.005**	0	**0.007**	0.008	**109**	0.005	**0.019**		
Chloride	(11/16/1974-	**7**	(2118.-757.)	**1280**	250	**1243**	462	**37**	1355	**1912**	7	**100**
Fluoride	(11/16/1974-	**3**	(2.-1.8)	**1.95**	0.05	**1.92**	0.10	**5**	1.98	**2.00**		
Sulfate	(11/16/1974-	**7**	(2380.-1725.)	**1880**	155	**1992**	244	**12**	2150	**2341**	7	**100**
TDS - 180°C	(11/16/1974-	**7**	(5880.-5033.)	**5711**	169	**5511**	382	**7**	5822	**5863**	7	**100**

Appendix F - Groundwater Data Summary

PCS Summary Tables (all Values are dissolved (mg/L) unless otherwise indicated)

PCS Baseline GM-21	Dates	**n**	Range	**Median**	MAD	**Average**	Standard Deviation	**Percent Relative Standard Deviation**	Q3	**95th Percentile**	**Exceedance of Livestock Criteria**	
											n	%
pH	(11/16/1974-	**4**	(7.9-7.)	**7.25**	0.15	**7.4**	0.4	**5**	7.5	**7.8**		
Conductivity (umho/cm)												
Boron	(11/16/1974-	**4**	(1.1-0.7)	**0.94**	0.11	**0.92**	0.17	**19**	1.03	**1.09**		
Iron (total)	(11/16/1974-	**1**	(0.41-0.41)	**0.41**	0	**0.41**			0.41	**0.41**		
Manganese	(11/16/1974-	**3**	(0.07-0.03)	**0.05**	0.02	**0.050**	0.020	**40**	0.060	**0.068**		
Selenium	(11/16/1974-	**4**	(0.025-0.001)	**0.005**	0.002	**0.009**	0.011	**120**	0.010	**0.022**		
Chloride	(11/16/1974-	**4**	(780.-118.)	**398**	264	**424**	339	**80**	680	**760**	2	**50**
Fluoride	(11/16/1974-	**2**	(0.4-0.2)	**0.3**	0.1	**0.30**	0.14	**47**	0.35	**0.39**		
Sulfate	(11/16/1974-	**4**	(3740.-2502.)	**3112.5**	549	**3117**	643	**21**	3635	**3719**	4	**100**
TDS - 180°C	(11/16/1974-	**4**	(6923.-6140.)	**6497**	242	**6514**	337	**5**	6699	**6878**	4	**100**

PCS Baseline GM-28	Dates	**n**	Range	**Median**	MAD	**Average**	Standard Deviation	**Percent Relative Standard Deviation**	Q3	**95th Percentile**	**Exceedance of Livestock Criteria**	
											n	%
pH	(11/16/1974-	**2**	(8.85-8.1)	**8.475**	0.375	**8.5**	0.5	**6**	8.7	**8.8**		
Conductivity (umho/cm)	(11/16/1974- 08/04/1976)	**2**	(10100.-9830.)	**9965**	135	**9965**	191	**2**	10033	**10087**		
Boron	(11/16/1974-	**2**	(0.5-0.05)	**0.275**	0.225	**0.28**	0.32	**116**	0.39	**0.48**		
Iron (total)												
Manganese	(11/16/1974-	**2**	(0.16-0.001)	**0.0805**	0.0795	**0.081**	0.112	**140**	0.120	**0.152**		
Selenium	(11/16/1974-	**2**	(0.025-0.005)	**0.015**	0.01	**0.015**	0.014	**94**	0.020	**0.024**		
Chloride	(11/16/1974-	**2**	(4560.-240.)	**2400**	2160	**2400**	3055	**127**	3480	**4344**	1	**50**
Fluoride	(11/16/1974-	**2**	(1.1-0.8)	**0.95**	0.15	**0.95**	0.21	**22**	1.03	**1.09**		
Sulfate	(11/16/1974-	**2**	(754.-630.)	**692**	62	**692**	88	**13**	723	**748**		
TDS - 180°C	(11/16/1974-	**2**	(4659.-4334.)	**4496.5**	162.5	**4497**	230	**5**	4578	**4643**	2	**100**

Appendix F - Groundwater Data Summary

PCS Summary Tables (all Values are dissolved (mg/L) unless otherwise indicated)

PCS Baseline GM-30A	Dates	**n**	Range	**Median**	MAD	**Average**	Standard Deviation	**Percent Relative Standard Deviation**	Q3	**95th Percentile**	**Exceedance of Livestock Criteria**	
											n	**%**
pH	29108	**3**	(7.6-7.5)	**7.5**	0	**7.5**	0.1	**1**	7.6	**7.6**		
Conductivity (umho/cm)												
Boron	29108	**3**	(0.96-0.46)	**0.6**	0.14	**0.67**	0.26	**38**	0.78	**0.92**		
Iron (total)	29108	**1**	(0.02-0.02)	**0.02**	0	**0.02**			0.02	**0.02**		
Manganese	29108	**2**	(0.07-0.04)	**0.055**	0.015	**0.055**	0.021	**39**	0.063	**0.069**		
Selenium	29108	**3**	(0.005-0.002)	**0.005**	0	**0.004**	0.002	**43**	0.005	**0.005**	4	**133**
Chloride	29108	**3**	(1215.-1120.)	**1203**	12	**1179**	52	**4**	1209	**1214**	22	**733**
Fluoride	29108	**1**	(0.95-0.95)	**0.95**	0	**0.95**			0.95	**0.95**	1	**100**
Sulfate	29108	**3**	(3105.-422.)	**3100**	5	**2209**	1548	**70**	3103	**3105**	18	**600**
TDS - 180°C	29108	**3**	(7070.-6573.)	**6930**	140	**6858**	256	**4**	7000	**7056**	26	**867**

PCS Baseline GM-5	Dates	**n**	Range	**Median**	MAD	**Average**	Standard Deviation	**Percent Relative Standard Deviation**	Q3	**95th Percentile**	**Exceedance of Livestock Criteria**	
											n	**%**
pH	(03/24/1975-	**3**	(9.1-8.)	**8.3**	0.3	**8.5**	0.6	**7**	8.7	**9.0**	1	**33**
Conductivity (umho/cm)	(03/24/1975-03/03/1977)	**3**	(10200.-3620.)	**6900**	3280	**6907**	3290	**48**	8550	**9870**		
Boron	(03/24/1975-	**3**	(2.4-0.5)	**1.3**	0.8	**1.40**	0.95	**68**	1.85	**2.29**		
Iron (total)												
Manganese	(03/24/1975-	**3**	(0.092-0.012)	**0.09**	0.002	**0.065**	0.046	**71**	0.091	**0.092**		
Selenium	(03/24/1975-	**3**	(0.25-0.005)	**0.005**	0	**0.087**	0.141	**163**	0.128	**0.226**	1	**33**
Chloride	(03/24/1975-	**3**	(5174.-1100.)	**5000**	174	**3758**	2304	**61**	5087	**5157**	3	**100**
Fluoride	(03/24/1975-	**3**	(3.7-1.05)	**2.4**	1.3	**2.38**	1.33	**56**	3.05	**3.57**	2	**67**
Sulfate	(03/24/1975-	**3**	(3541.-2452.)	**3400**	141	**3131**	592	**19**	3471	**3527**	3	**100**
TDS - 180°C	(03/24/1975-	**3**	(12982.-7894.)	**11156**	1826	**10677**	2578	**24**	12069	**12799**	3	**100**

Appendix F - Groundwater Data Summary

PCS Summary Tables (all Values are dissolved (mg/L) unless otherwise indicated)

PCS Baseline GM-6	Dates	n	Range	Median	MAD	Average	Standard Deviation	Percent Relative Standard Deviation	Q3	95th Percentile	Exceedance of Livestock Criteria	
											n	%
pH	(08/03/1976-	**2**	(8.2-7.8)	**8**	0.2	**8.0**	0.3	**4**	8.1	**8.2**		
Conductivity (umho/cm)	(08/03/1976- 03/04/1977)	**2**	(20500.-4100.)	**12300**	8200	**12300**	11597	**94**	16400	**19680**		
Boron	(08/03/1976-	**2**	(1.8-0.05)	**0.925**	0.875	**0.93**	1.24	**134**	1.36	**1.71**		
Iron (total)												
Manganese	(08/03/1976-	**2**	(0.069-0.021)	**0.045**	0.024	**0.045**	0.034	**75**	0.057	**0.067**		
Selenium	(08/03/1976-	**2**	(0.005-0.005)	**0.005**	0	**0.005**	0.000		0.005	**0.005**		
Chloride	(08/03/1976-	**2**	(323.6-320.)	**321.8**	1.8	**322**	3	**1**	323	**323**		
Fluoride	(08/03/1976-	**2**	(4.9-2.74)	**3.82**	1.08	**3.82**	1.53	**40**	4.36	**4.79**	2	**100**
Sulfate	(08/03/1976-	**2**	(3541.-2193.)	**2867**	674	**2867**	953	**33**	3204	**3474**	2	**100**
TDS - 180°C	(08/03/1976-	**2**	(6487.-4970.)	**5728.5**	758.5	**5729**	1073	**19**	6108	**6411**	2	**100**

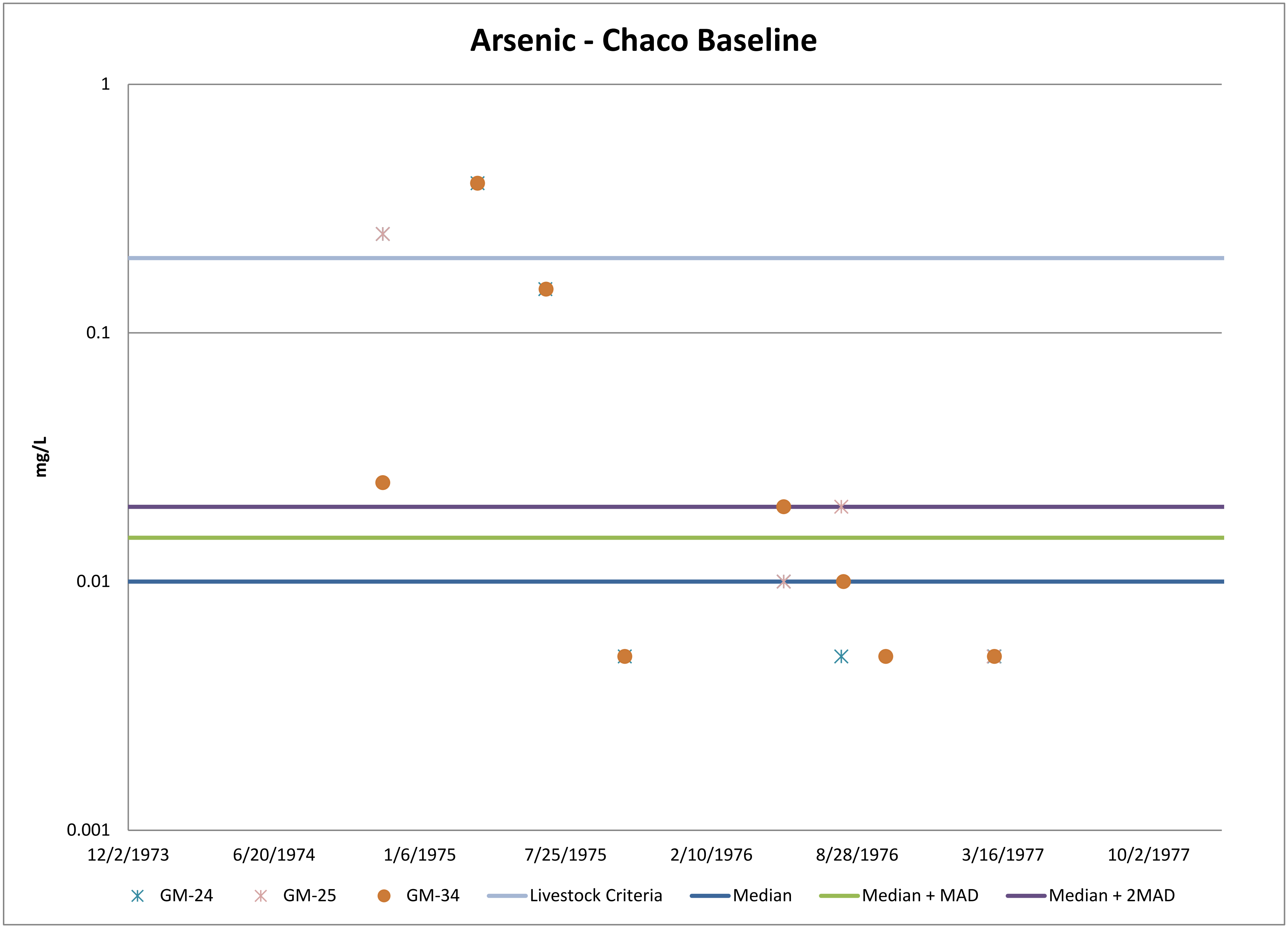
PCS Baseline GM-8	Dates	n	Range	Median	MAD	Average	Standard Deviation	Percent Relative Standard Deviation	Q3	95th Percentile	Exceedance of Livestock Criteria	
											n	%
pH	(03/24/1975-	**4**	(8.2-7.9)	**8.045**		**8.0**	0.1	**2**	8.1	**8.2**		
Conductivity (umho/cm)	(03/24/1975- 10/06/1976)	**4**	(7800.-6800.)	**6930**	130	**7177**	544	**8**	7148	**7670**		
Boron	(03/24/1975-	**4**	(37.-1.)	**1.1**	0.1	**13.03**	20.76	**159**	10.38	**31.68**	1	**25**
Iron (total)												
Manganese	(03/24/1975-	**3**	(0.11-0.008)	**0.059**	0.051	**0.059**	0.072	**122**	0.089	**0.106**		
Selenium	(03/24/1975-	**4**	(0.005-0.005)	**0.005**	0	**0.005**	0.000		0.066	**0.213**	1	**25**
Chloride	(03/24/1975-	**4**	(1470.-970.)	**1010**	40	**1150**	278	**24**	1193	**1415**	4	**100**
Fluoride	(03/24/1975-	**4**	(3.2-2.87)	**3.1**	0.1	**3.06**	0.17	**6**	3.23	**3.29**	4	**100**
Sulfate	(03/24/1975-	**4**	(2203.-1100.)	**1670**	533	**1658**	552	**33**	1803	**2123**	4	**100**
TDS - 180°C	(03/24/1975-	**4**	(5764.-5220.)	**5506**	258	**5497**	272	**5**	5571	**5725**	4	**100**

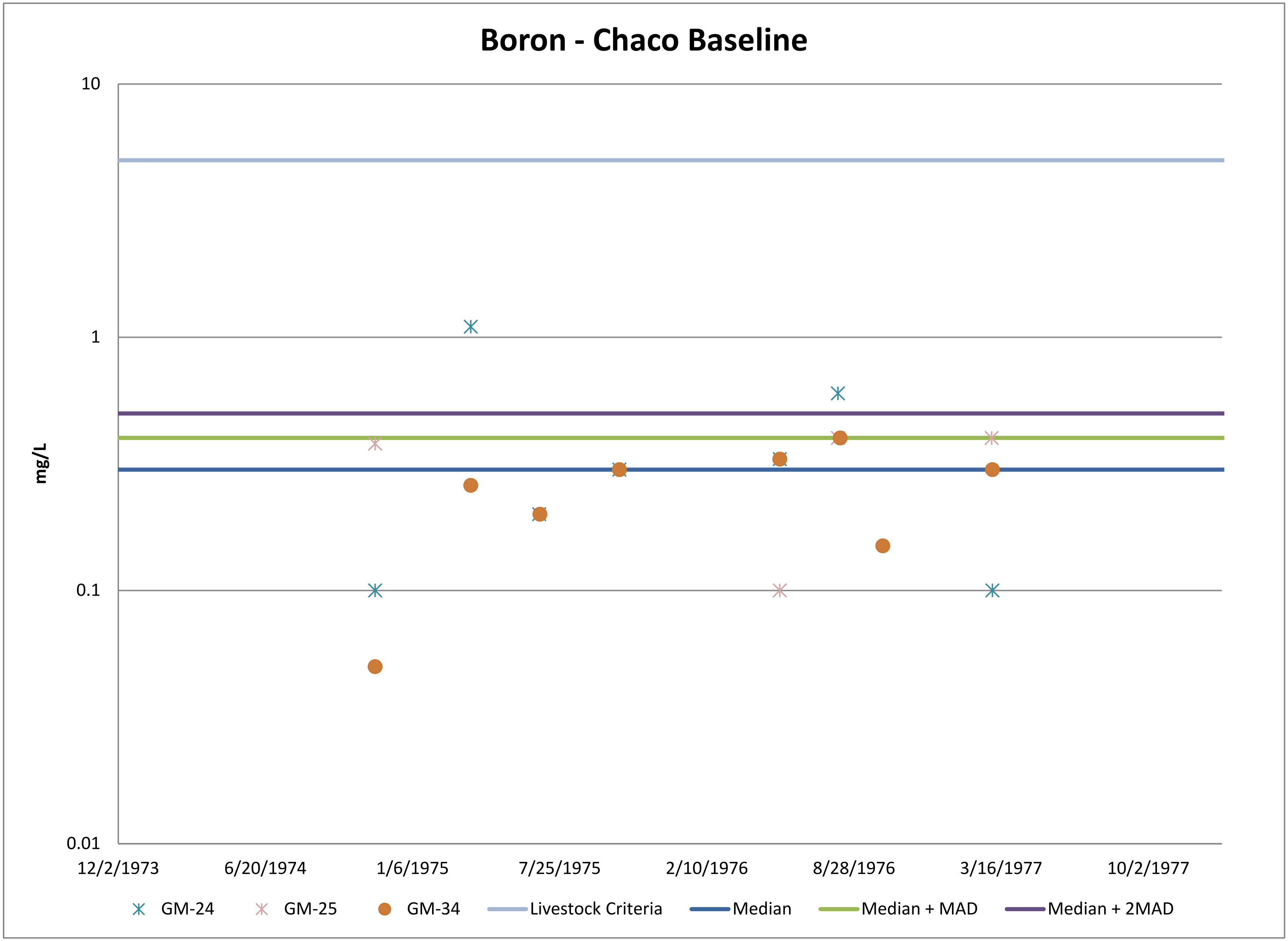
Appendix F - Groundwater Data Summary

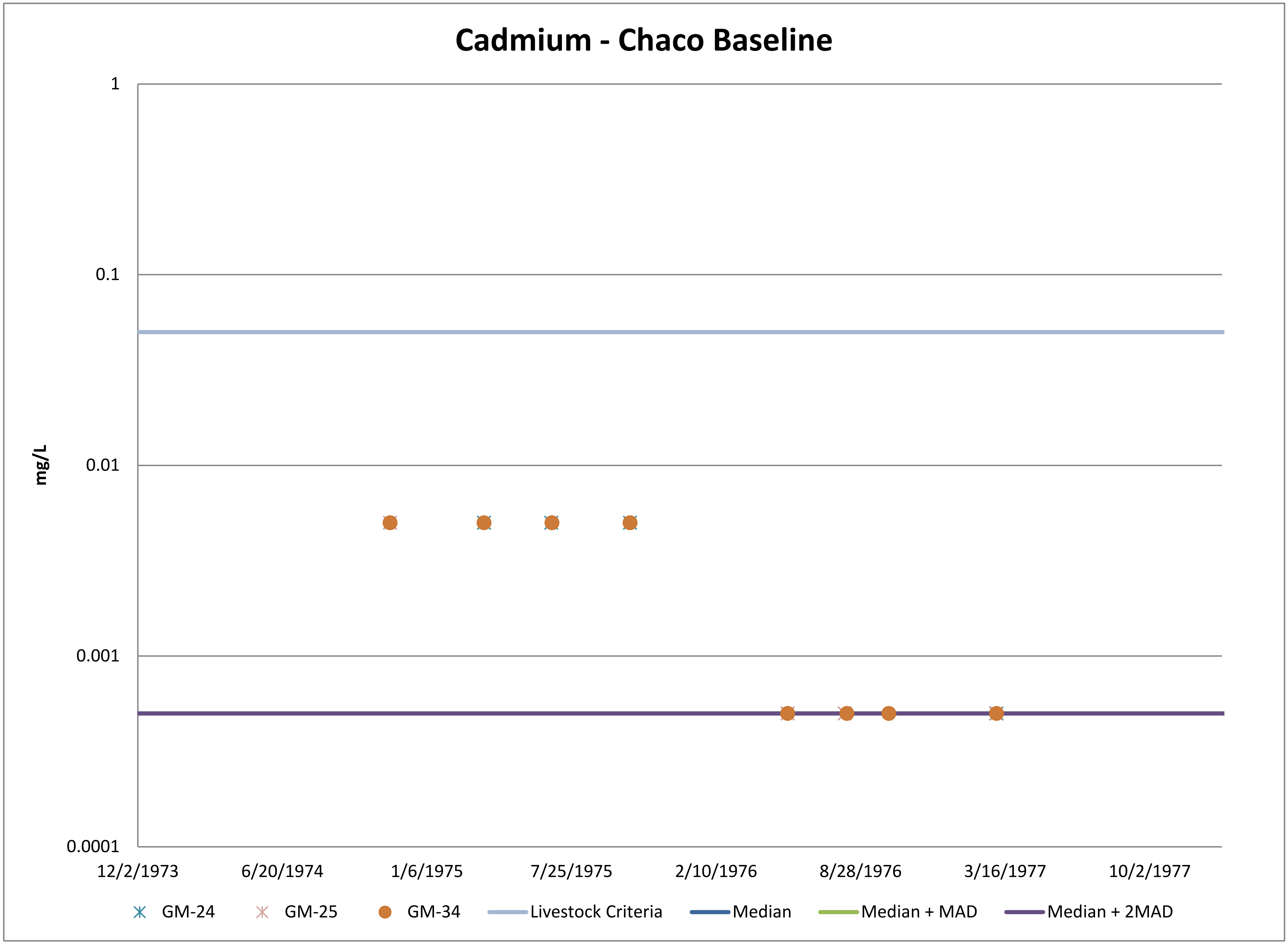
PCS Summary Tables (all Values are dissolved (mg/L) unless otherwise indicated)

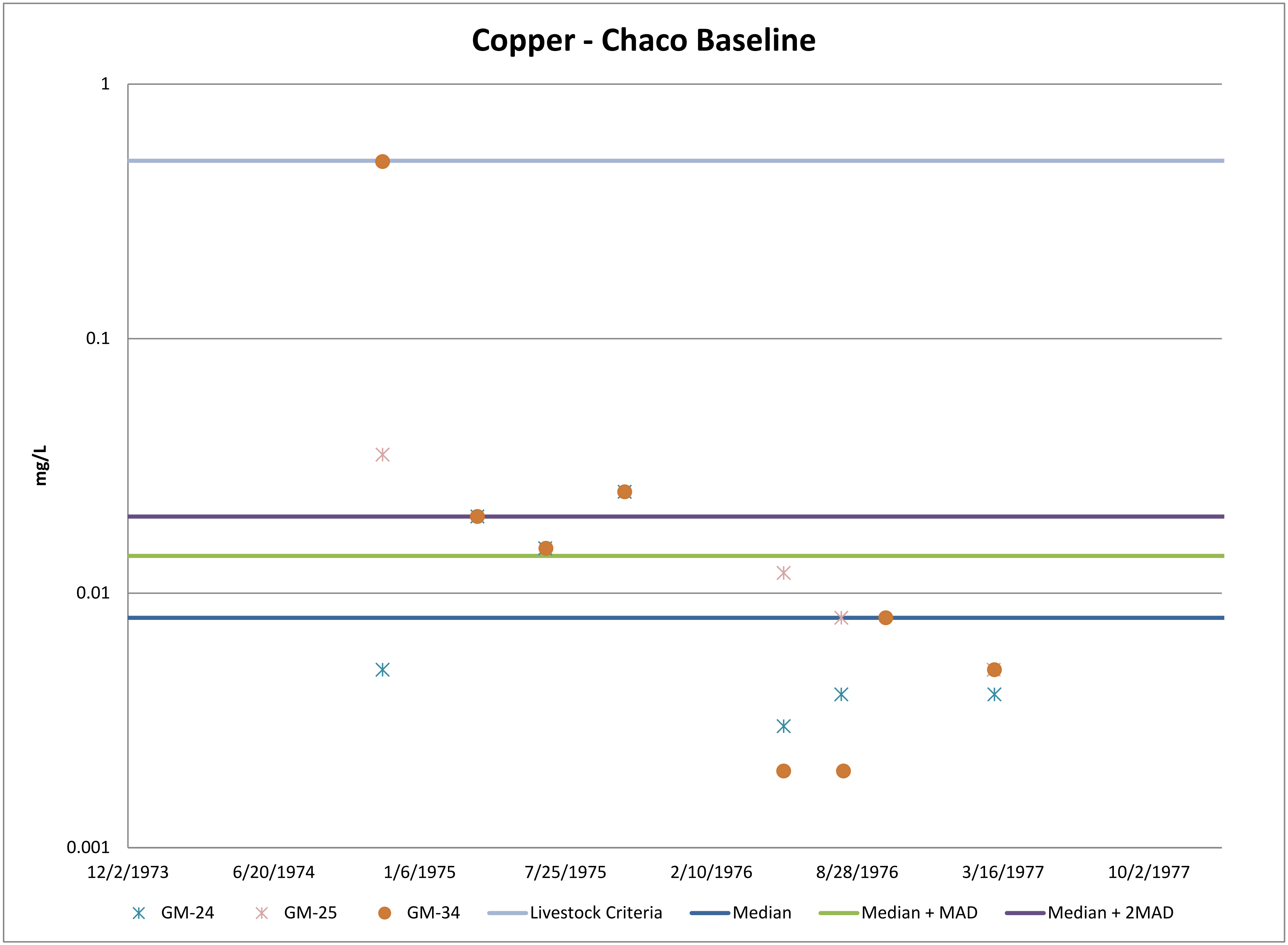
PCS Baseline KPC-2007-01	Dates	**n**	Range	**Median**	MAD	**Average**	Standard Deviation	**Percent Relative Standard Deviation**	Q3	**95th Percentile**	**Exceedance of Livestock Criteria**	
											n	%
pH	(08/16/2007-	**6**	(10.3-8.19)	**9.48**	0.595	**9.3**	0.9	**9**	9.8	**10.2**	4	**67**
Conductivity (umho/cm)												
Boron	(08/16/2007-	**6**	(0.6-0.3)	**0.4645**	0.05	**0.45**	0.10	**23**	0.50	**0.58**		
Iron (total)	(08/16/2007-	**6**	(533.-0.0892)	**1.02**	0.7	**89.48**	217.28	**243**	1.46	**400.14**		
Manganese	(08/16/2007-	**4**	(0.0785-0.022)	**0.0292**	0.006	**0.040**	0.026	**66**	0.045	**0.072**		
Selenium	(08/16/2007-	**6**	(0.008-0.003)	**0.005**	0.0015	**0.006**	0.002	**39**	0.008	**0.008**		
Chloride	(08/16/2007-	**6**	(580.-292.)	**342.5**	35	**373**	107	**29**	372	**529**		
Fluoride	(08/16/2007-	**6**	(1.8-1.5)	**1.6**	0.1	**1.62**	0.12	**7**	1.68	**1.78**		
Sulfate	(08/16/2007-	**6**	(2900.-2000.)	**2625**	225	**2550**	338	**13**	2788	**2875**	6	**100**
TDS - 180°C	(08/16/2007-	**6**	(6790.-5640.)	**5820**	175	**6000**	452	**8**	6165	**6663**	6	**100**

PCS Baseline KPC-98-01	Dates	**n**	Range	**Median**	MAD	**Average**	Standard Deviation	**Percent Relative Standard Deviation**	Q3	**95th Percentile**	**Exceedance of Livestock Criteria**	
											n	%
pH	(03/29/1998-	**8**	(9.1-7.7)	**7.785**	0.07	**8.0**	0.5	**6**	7.9	**8.7**	1	**13**
Conductivity (umho/cm)												
Boron	(03/29/1998-	**8**	(1.11-0.12)	**0.655**	0.05	**0.64**	0.27	**42**	0.70	**0.97**		
Iron (total)	(03/29/1998-	**8**	(29.5-0.16)	**2.125**	1.53	**5.68**	9.91	**175**	3.93	**21.84**		
Manganese	(03/29/1998-	**8**	(0.08-0.013)	**0.0545**	0.0142	**0.051**	0.021	**41**	0.064	**0.076**		
Selenium	(03/29/1998-	**8**	(0.011-0.0025)	**0.005**	0.0013	**0.005**	0.003	**54**	0.005	**0.009**		
Chloride	(03/29/1998-	**8**	(310.-39.)	**227**	16	**209**	78	**37**	238	**287**		
Fluoride	(03/29/1998-	**8**	(2.29-1.13)	**1.4**	0.1	**1.48**	0.35	**24**	1.50	**2.01**	1	**13**
Sulfate	(03/29/1998-	**8**	(3900.-350.)	**3325**	275	**3010**	1136	**38**	3500	**3865**	7	**88**
TDS - 180°C	(03/29/1998-	**8**	(6640.-800.)	**5975**	270	**5308**	1896	**36**	6135	**6542**	7	**88**


Arsenic - Chaco Baseline
mg/L
1
0.1
0.01
0.001
12/2/1973
6/20/1974
1/6/1975
7/25/1975
2/10/1976
8/28/1976
3/16/1977
10/2/1977
GM-24
GM-25
GM-34
Livestock Criteria
Median
Median + MAD
Median + 2MAD

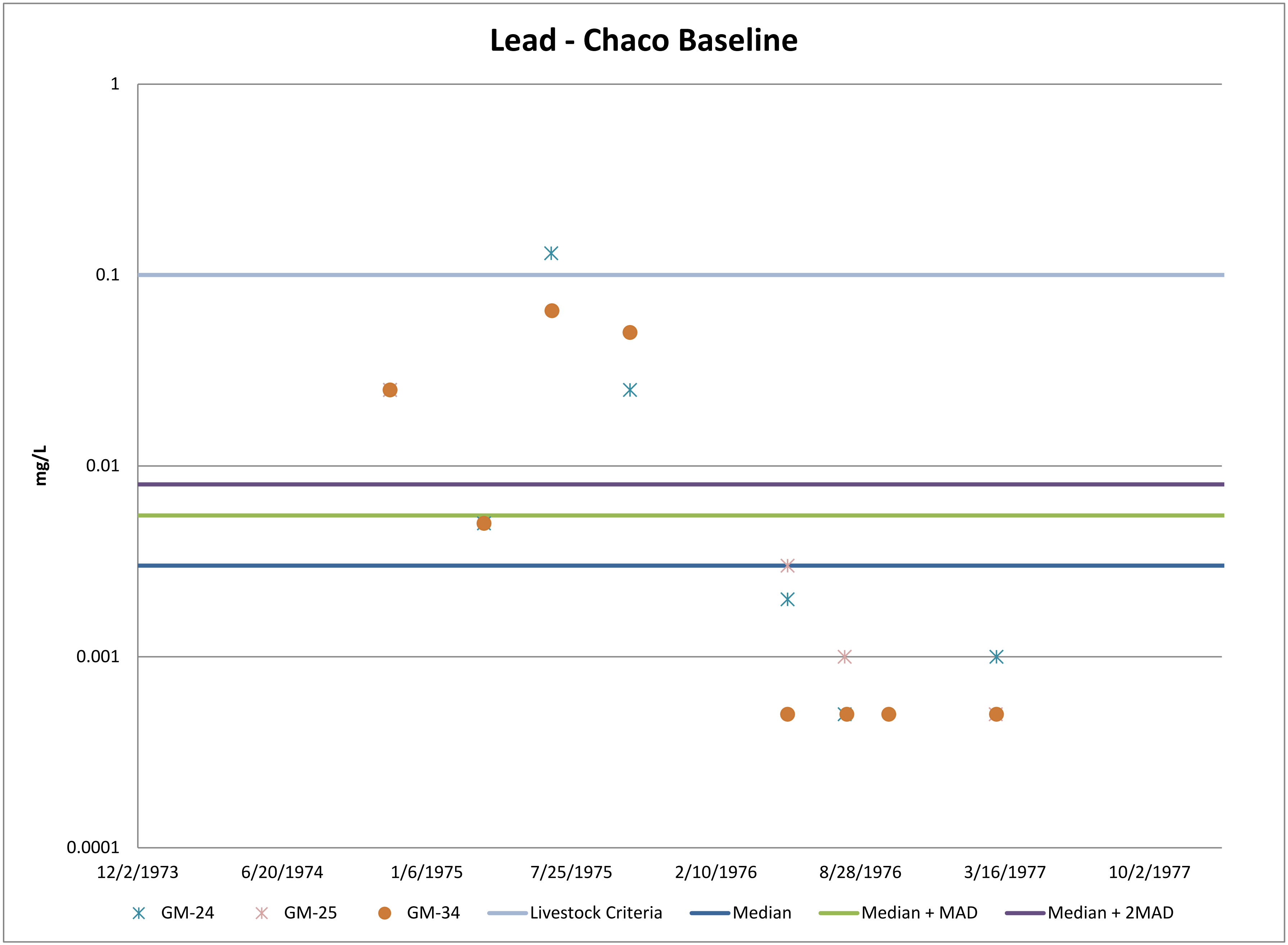

Boron - Chaco Baseline
mg/L
10
1
0.1
0.01
12/2/1973
6/20/1974
1/6/1975
7/25/1975
2/10/1976
8/28/1976
3/16/1977
10/2/1977
GM-24
GM-25
GM-34
Livestock Criteria
Median
Median + MAD
Median + 2MAD

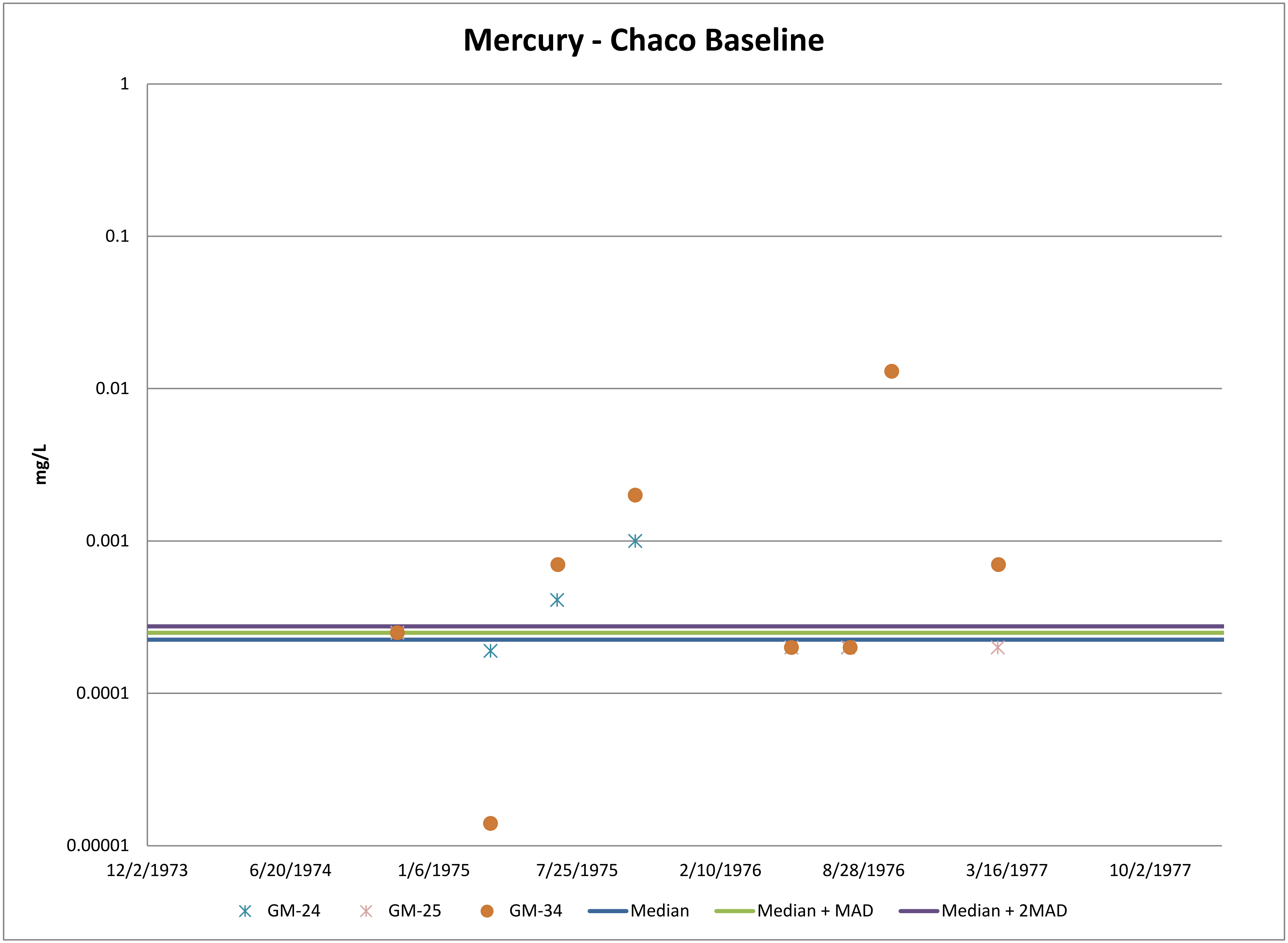

Cadmium - Chaco Baseline
mg/L
1
0.1
0.01
0.001
0.0001
12/2/1973
6/20/1974
1/6/1975
7/25/1975
2/10/1976
8/28/1976
3/16/1977
10/2/1977
GM-24
GM-25
GM-34
Livestock Criteria
Median
Median + MAD
Median + 2MAD

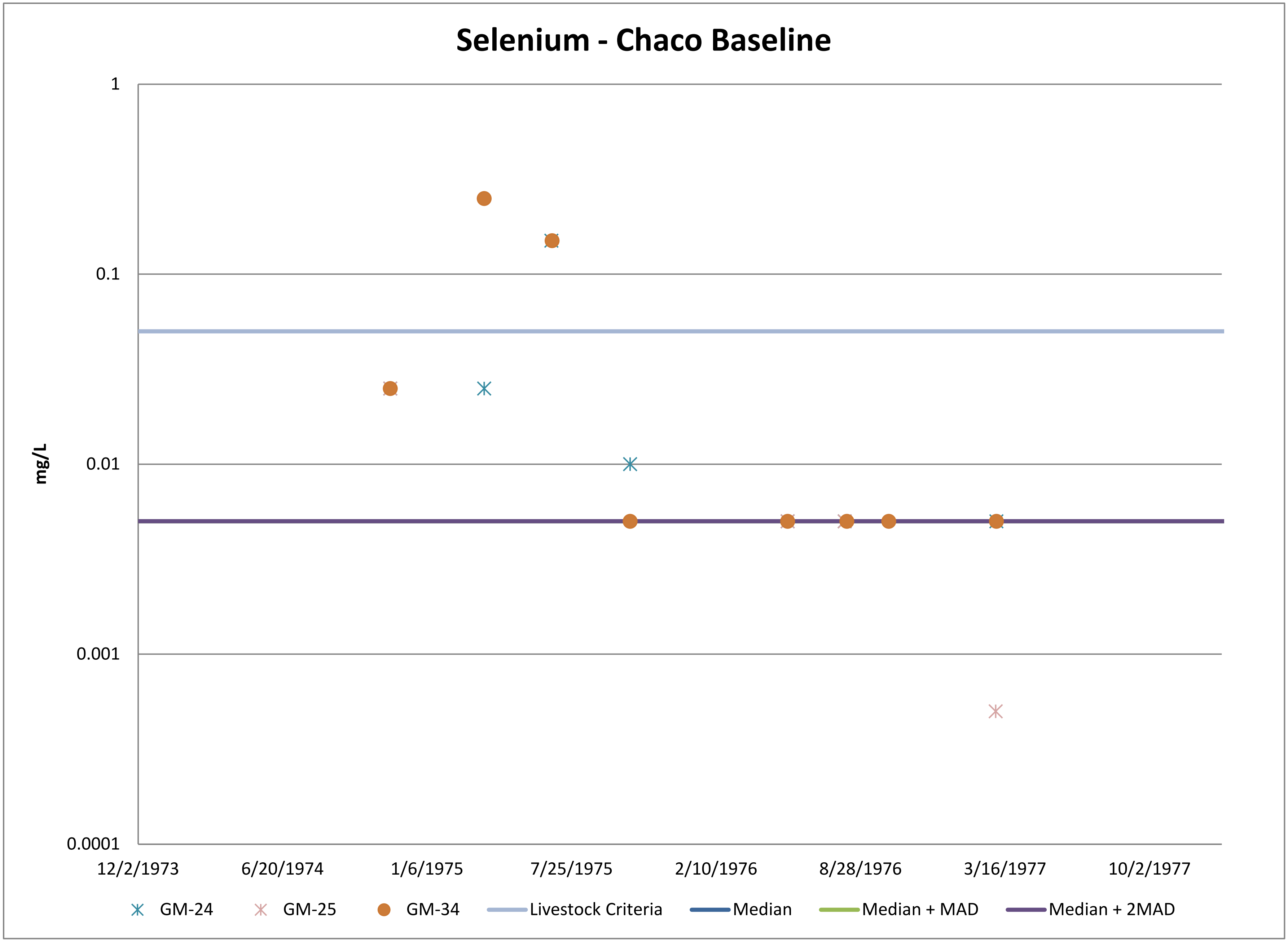

Copper - Chaco Baseline
mg/L
1
0.1
0.01
0.001
12/2/1973
6/20/1974
1/6/1975
7/25/1975
2/10/1976
8/28/1976
3/16/1977
10/2/1977
GM-24
GM-25
GM-34
Livestock Criteria
Median
Median + MAD
Median + 2MAD

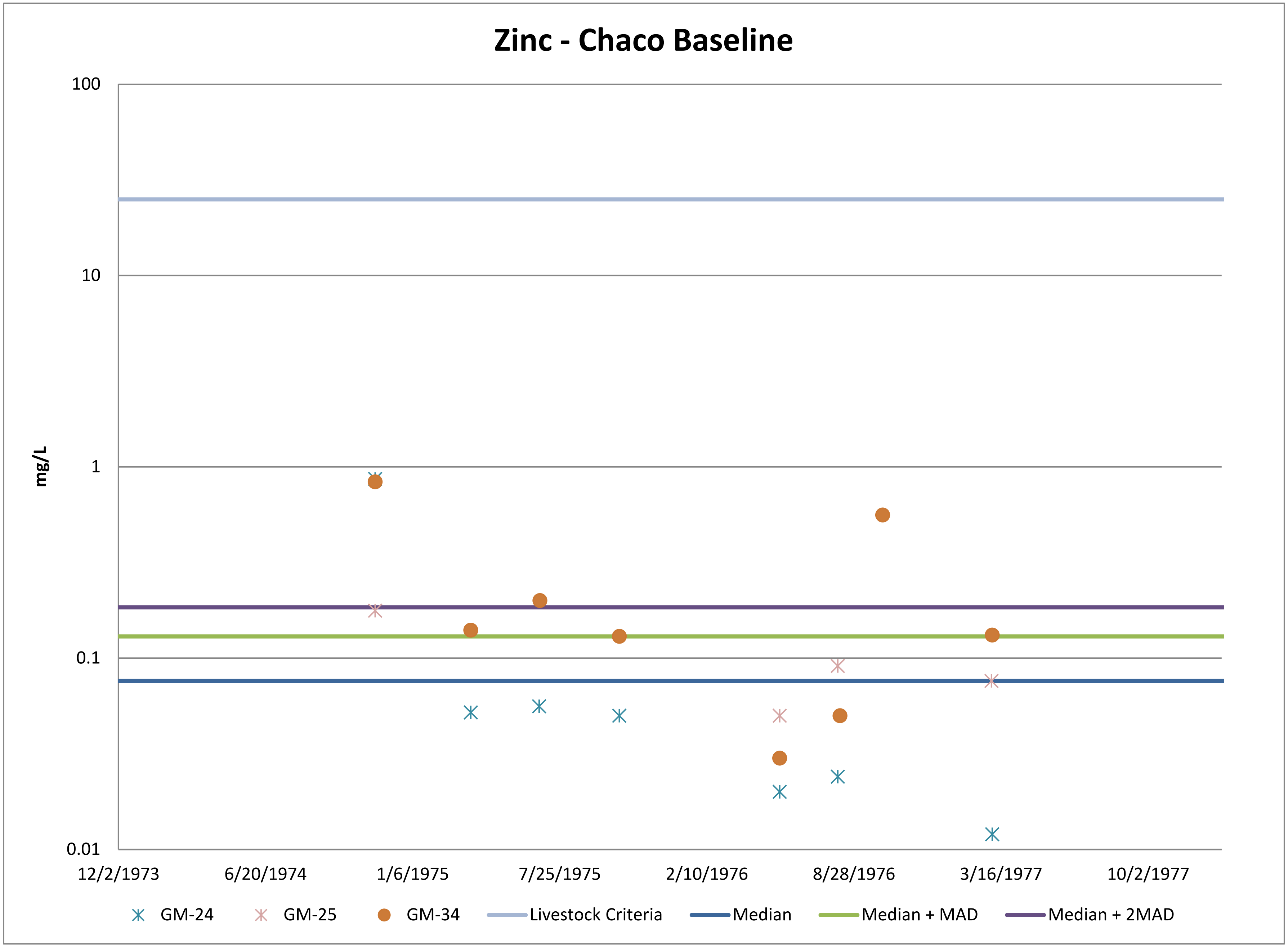
Appendix F - Groundwater Data Summary

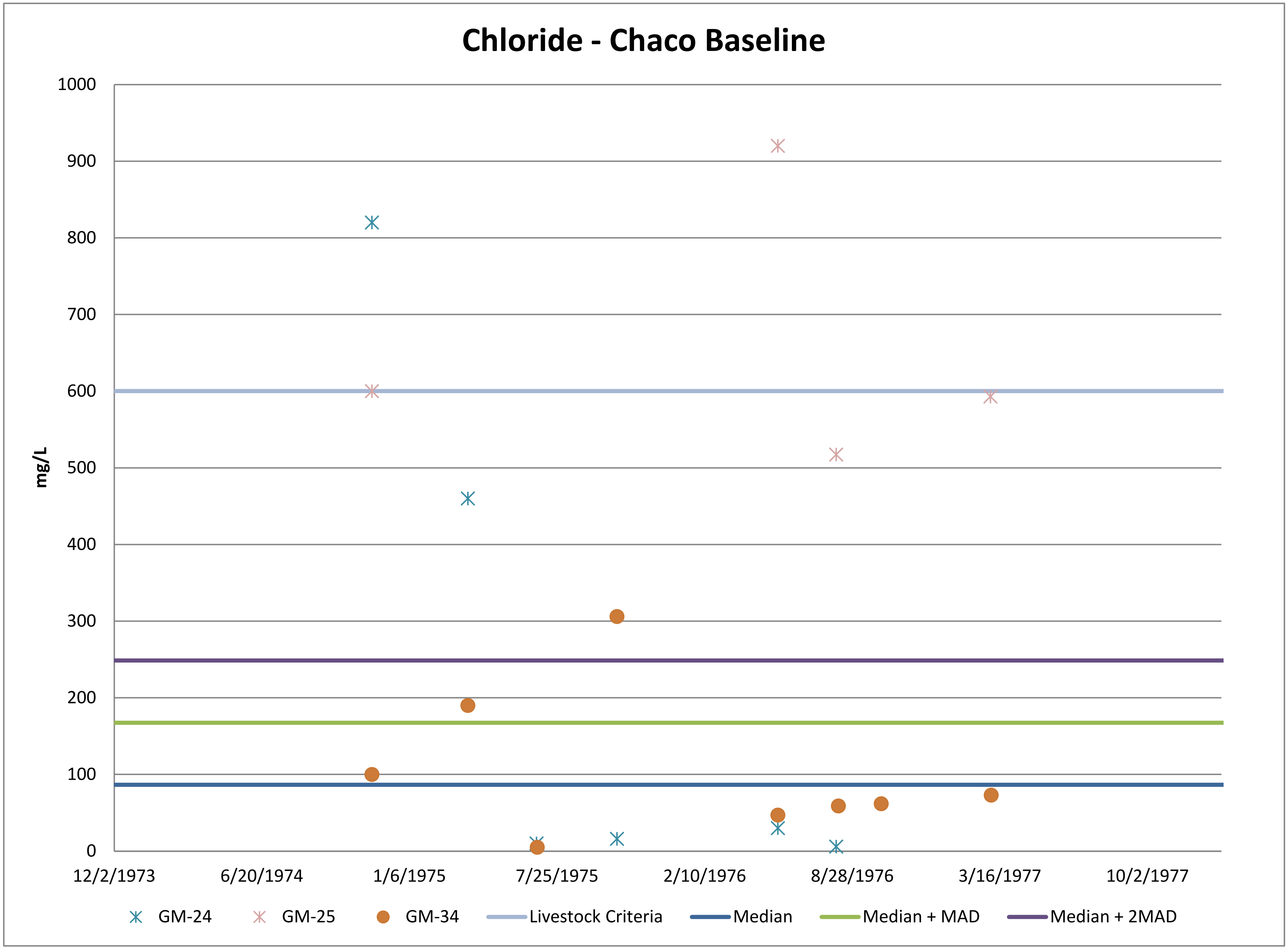
Chaco Alluvial Graphs

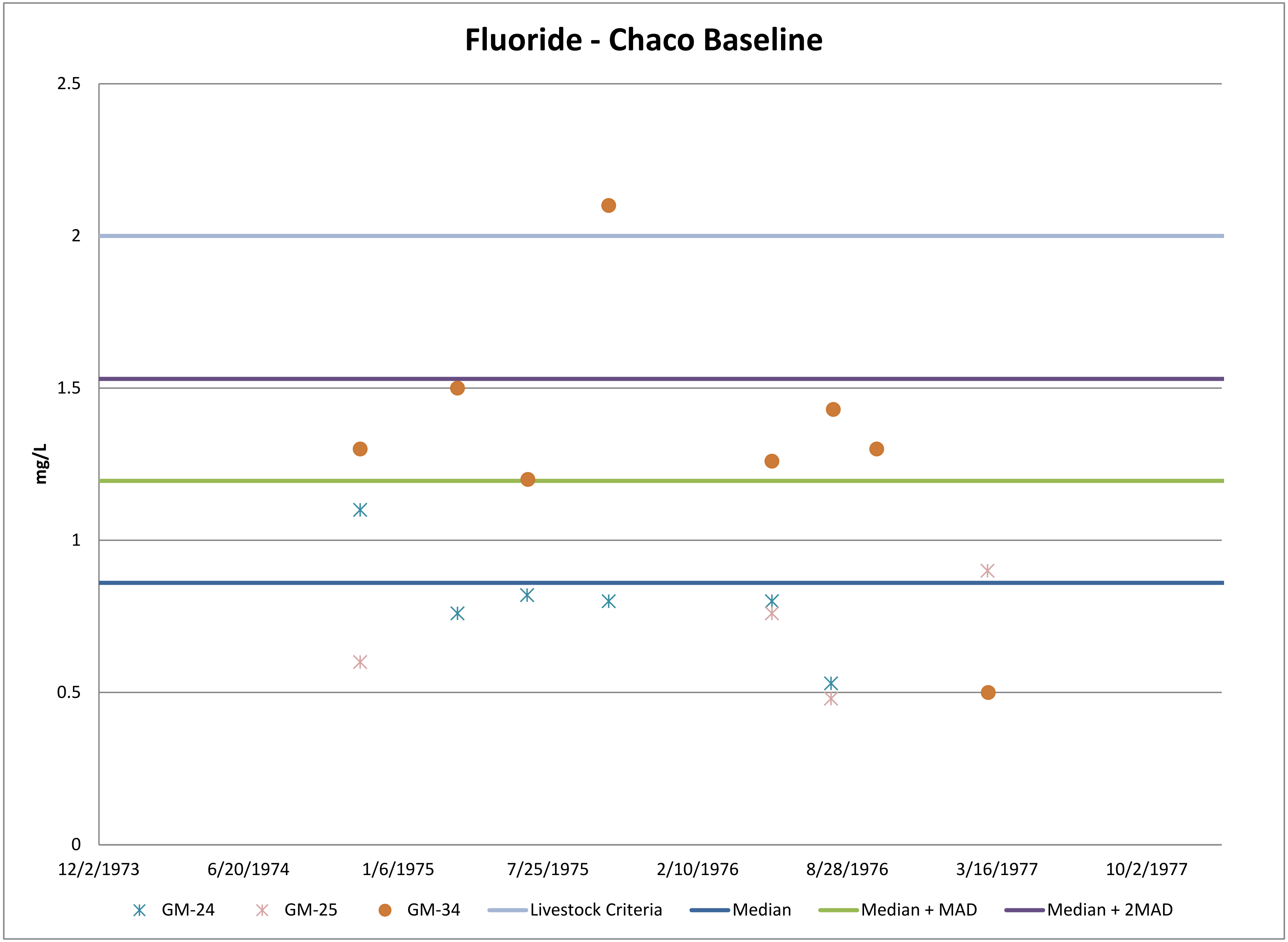


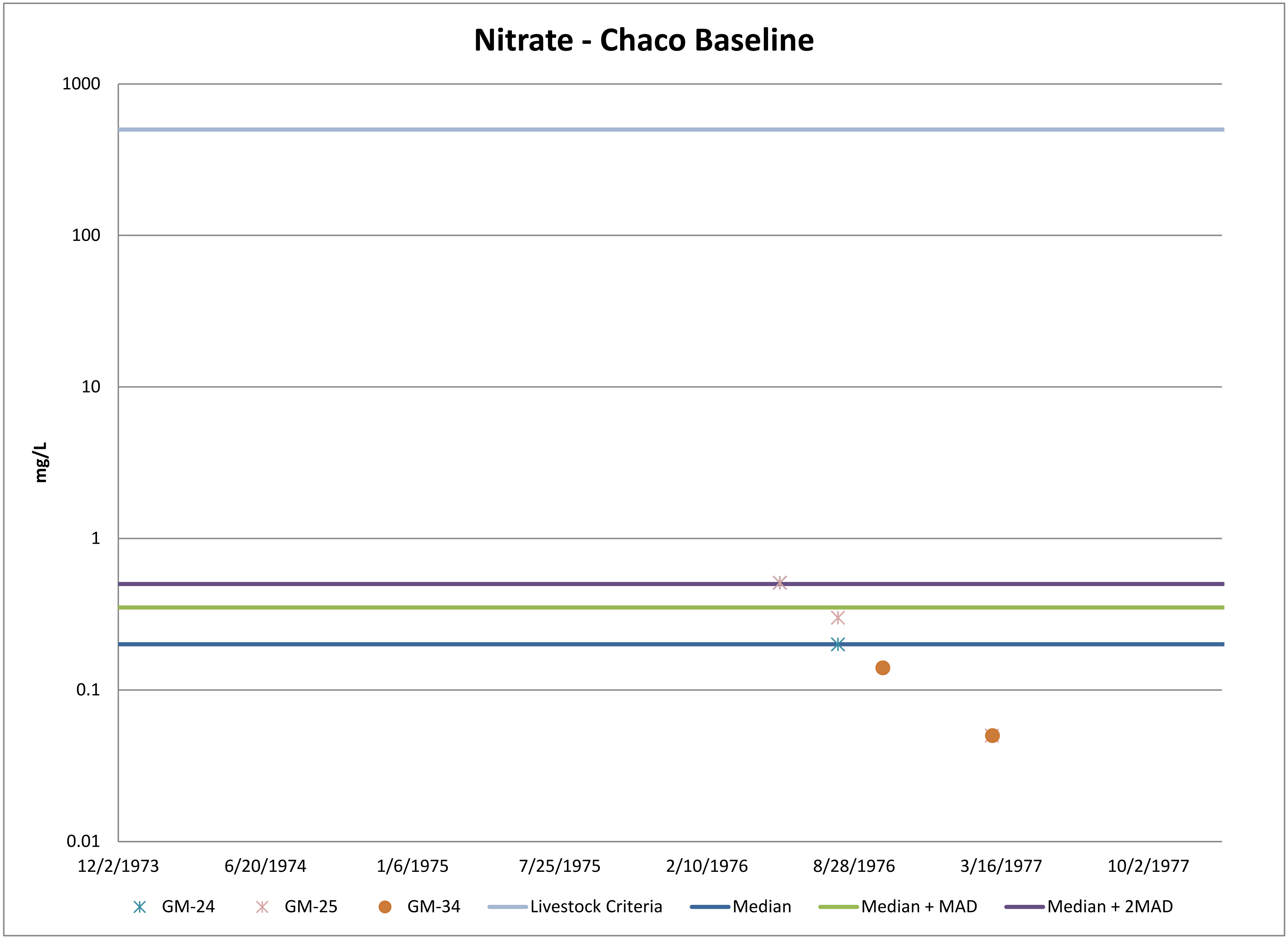

Mercury - Chaco Baseline
mg/L
1
0.1
0.01
0.001
0.0001
0.00001
12/2/1973
6/20/1974
1/6/1975
7/25/1975
2/10/1976
8/28/1976
3/16/1977
10/2/1977
GM-24
GM-25
GM-34
Median
Median + MAD
Median + 2MAD

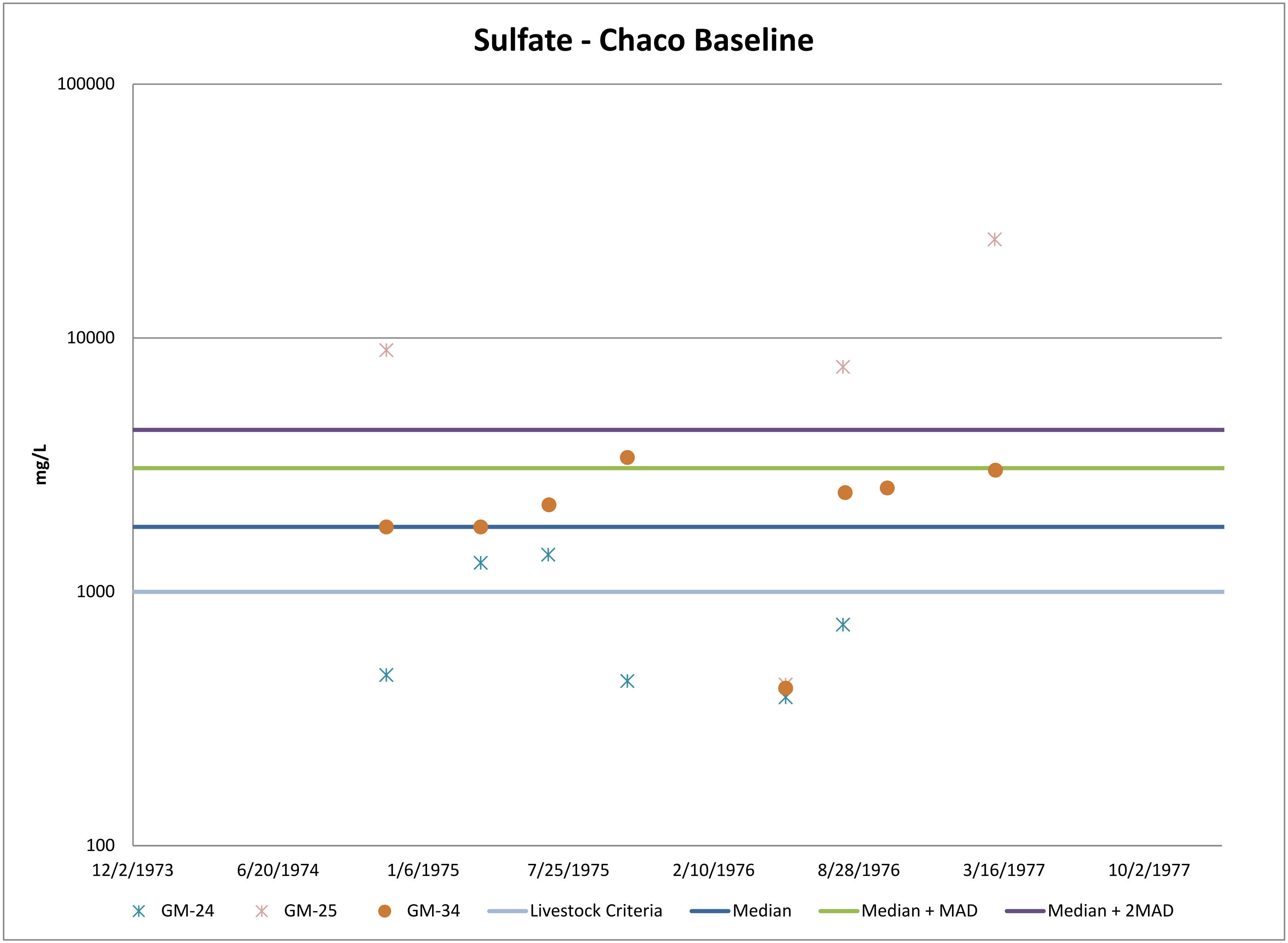

Selenium - Chaco Baseline
mg/L
1
0.1
0.01
0.001
0.0001
12/2/1973
6/20/1974
1/6/1975
7/25/1975
2/10/1976
8/28/1976
3/16/1977
10/2/1977
GM-24
GM-25
GM-34
Livestock Criteria
Median
Median + MAD
Median + 2MAD

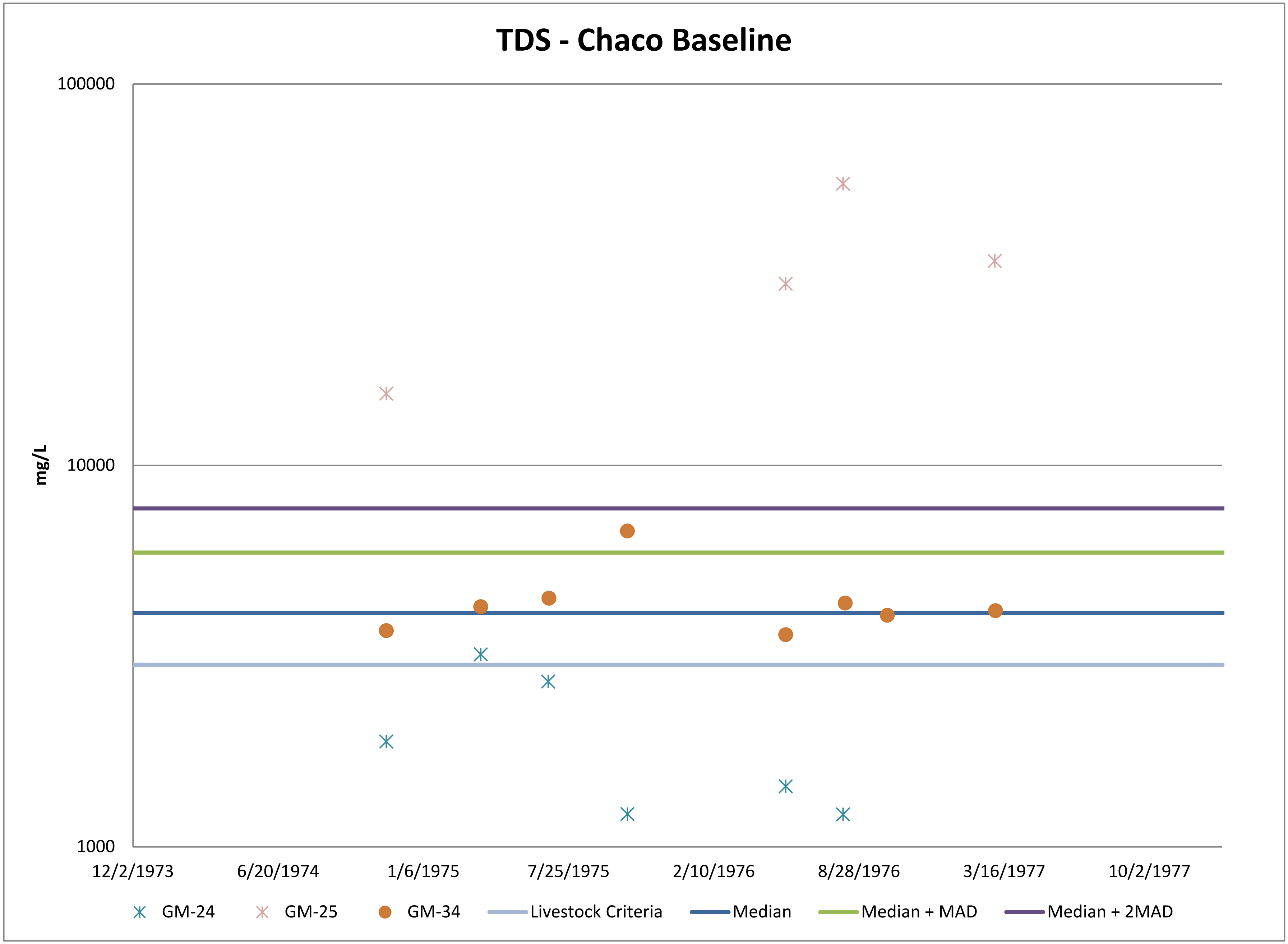

Zinc - Chaco Baseline
100
10
1
0.1
0.01
mg/L
12/2/1973
6/20/1974
1/6/1975
7/25/1975
2/10/1976
8/28/1976
3/16/1977
10/2/1977
GM-24
GM-25
GM-34
Livestock Criteria
Median
Median + MAD
Median + 2MAD

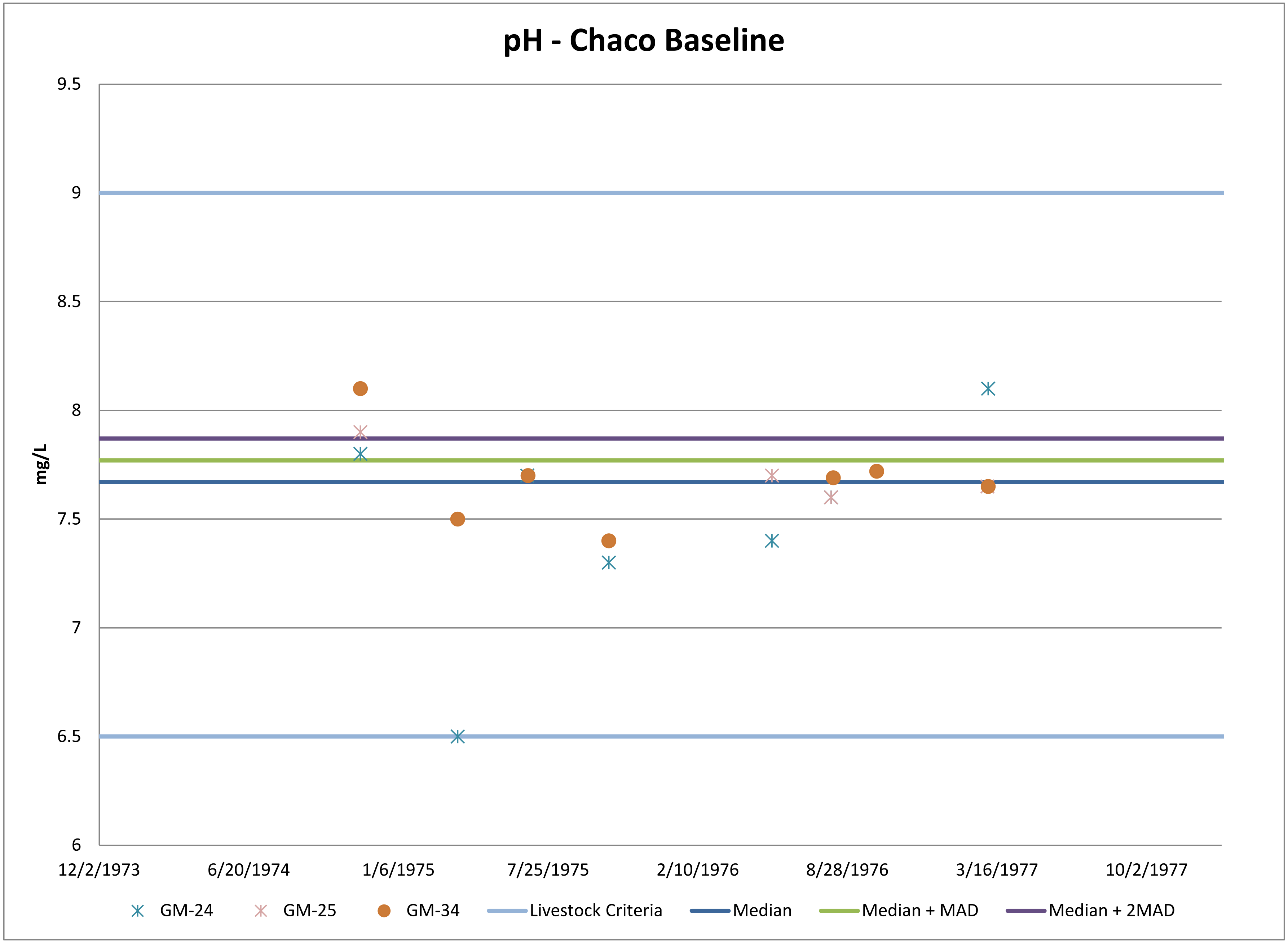

Chloride - Chaco Baseline
mg/L
1000
900
800
700
600
500
400
300
200
100
0
12/2/1973
6/20/1974
1/6/1975
7/25/1975
2/10/1976
8/28/1976
3/16/1977
10/2/1977
GM-24
GM-25
GM-34
Livestock Criteria
Median
Median + MAD
Median + 2MAD

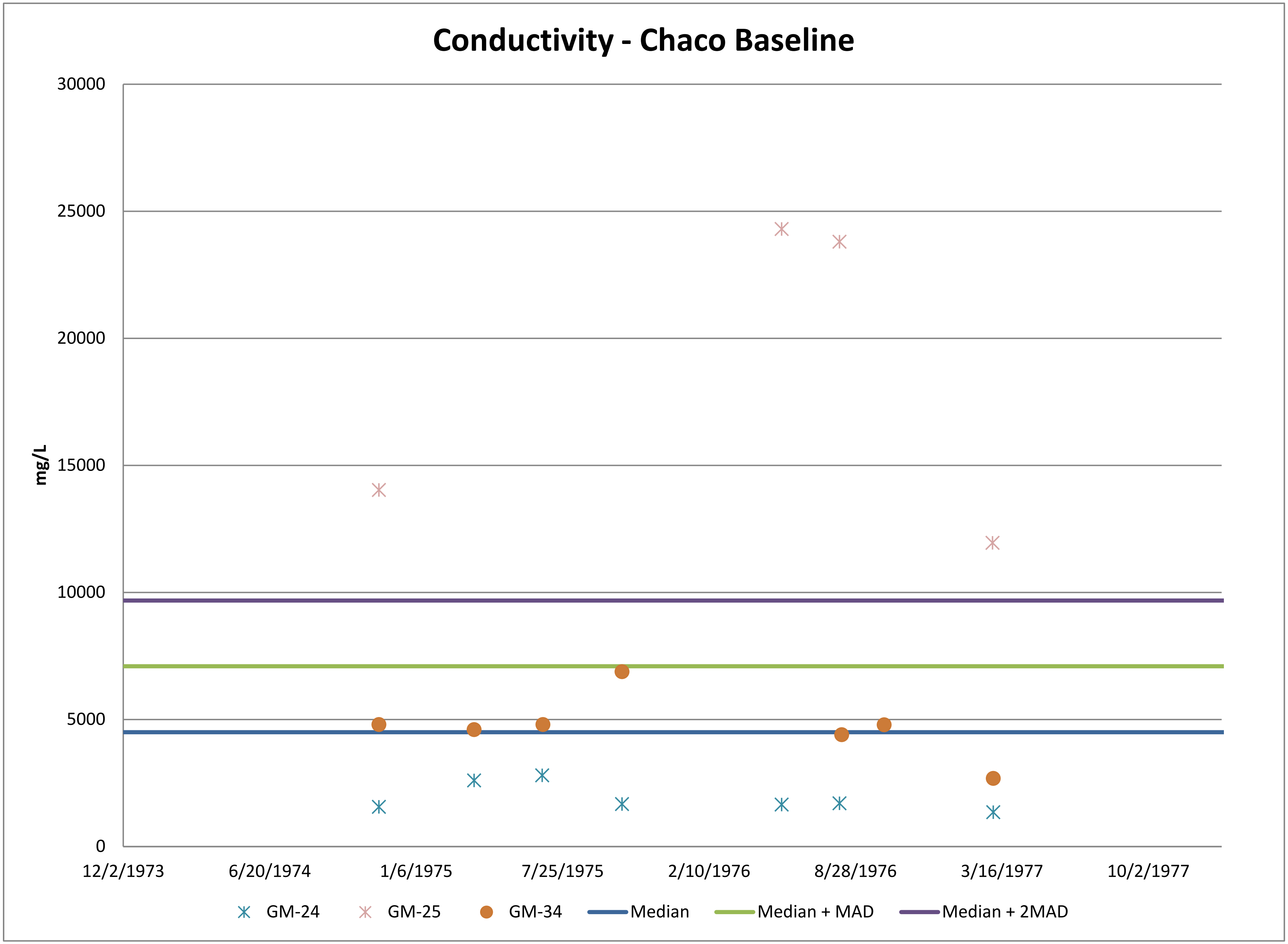

Fluoride - Chaco Baseline
mg/L
2.5
2
1.5
1
0.5
0
12/2/1973
6/20/1974
1/6/1975
7/25/1975
2/10/1976
8/28/1976
3/16/1977
10/2/1977
GM-24
GM-25
GM-34
Livestock Criteria
Median
Median + MAD
Median + 2MAD

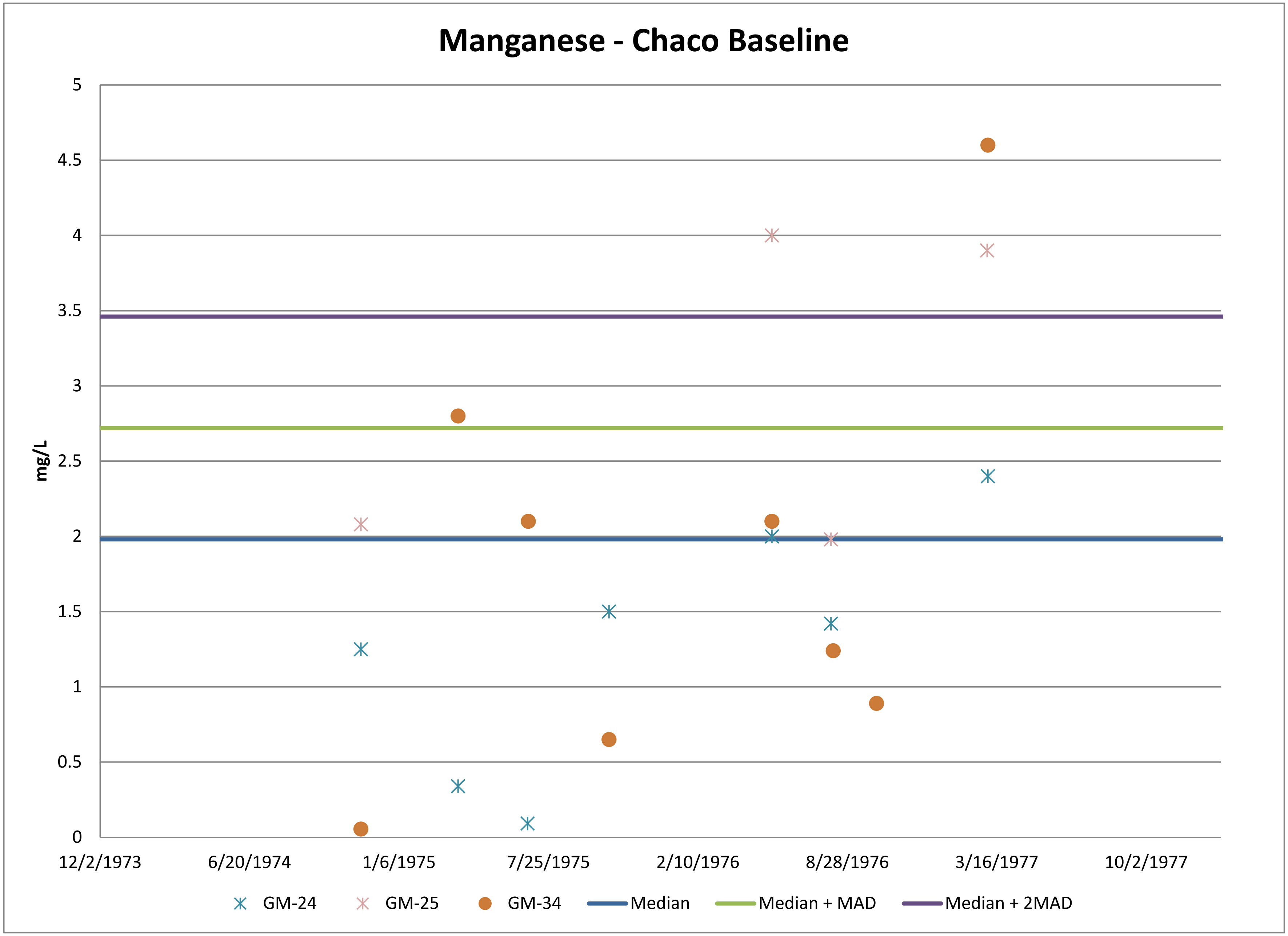

Nitrate - Chaco Baseline
1000
100
10
1
0.1
0.01
mg/L
12/2/1973
6/20/1974
1/6/1975
7/25/1975
2/10/1976
8/28/1976
3/16/1977
10/2/1977
GM-24
GM-25
GM-34
Livestock Criteria
Median
Median + MAD
Median + 2MAD

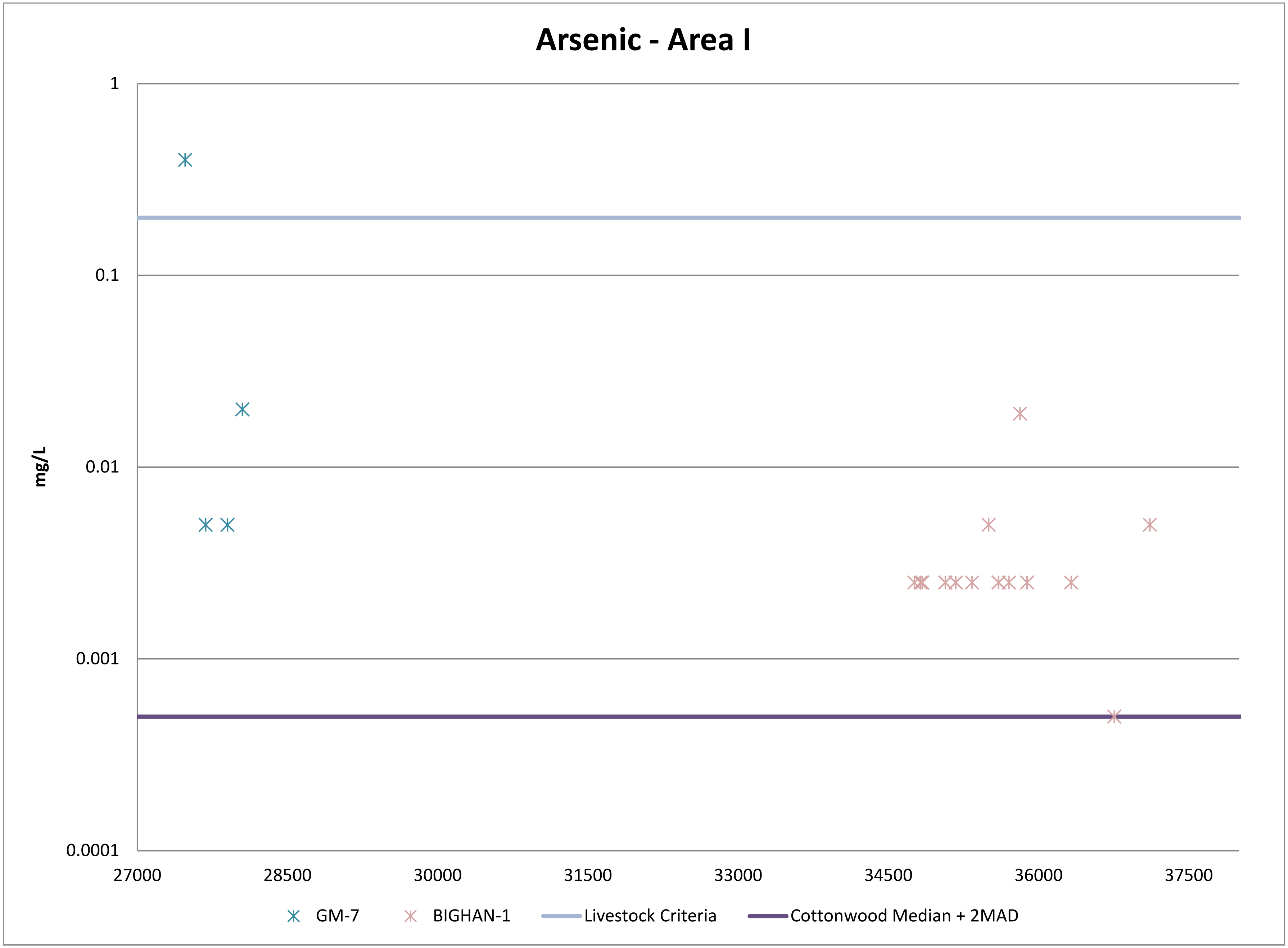

Sulfate - Chaco Baseline
100000
10000
1000
100
mg/L
12/2/1973
6/20/1974
1/6/1975
7/25/1975
2/10/1976
8/28/1976
3/16/1977
10/2/1977
GM-24
GM-25
GM-34
Livestock Criteria
Median
Median + MAD
Median + 2MAD

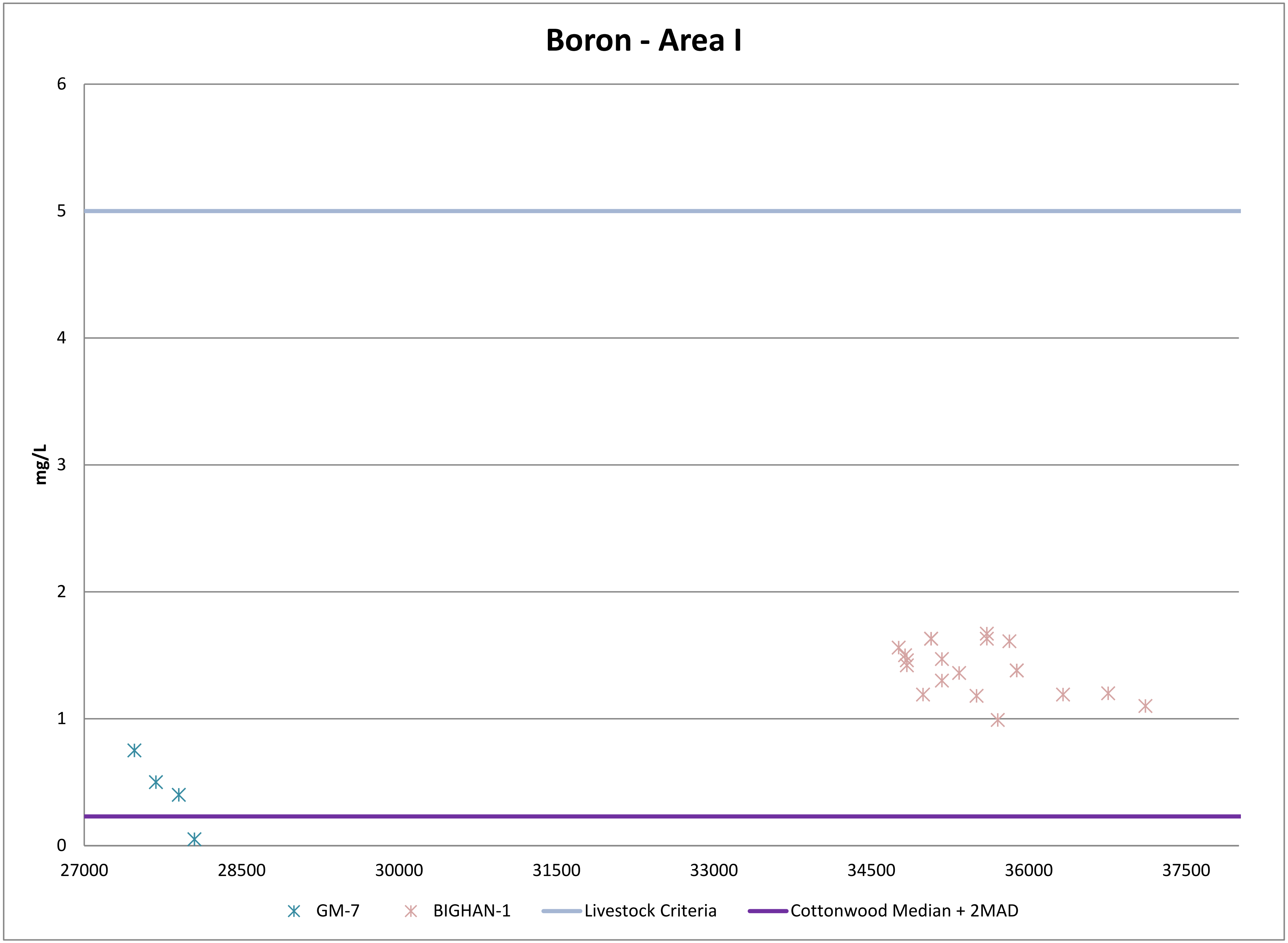

TDS - Chaco Baseline
mg/L
100000
10000
1000
12/2/1973
6/20/1974
1/6/1975
7/25/1975
2/10/1976
8/28/1976
3/16/1977
10/2/1977
GM-24
GM-25
GM-34
Livestock Criteria
Median
Median + MAD
Median + 2MAD

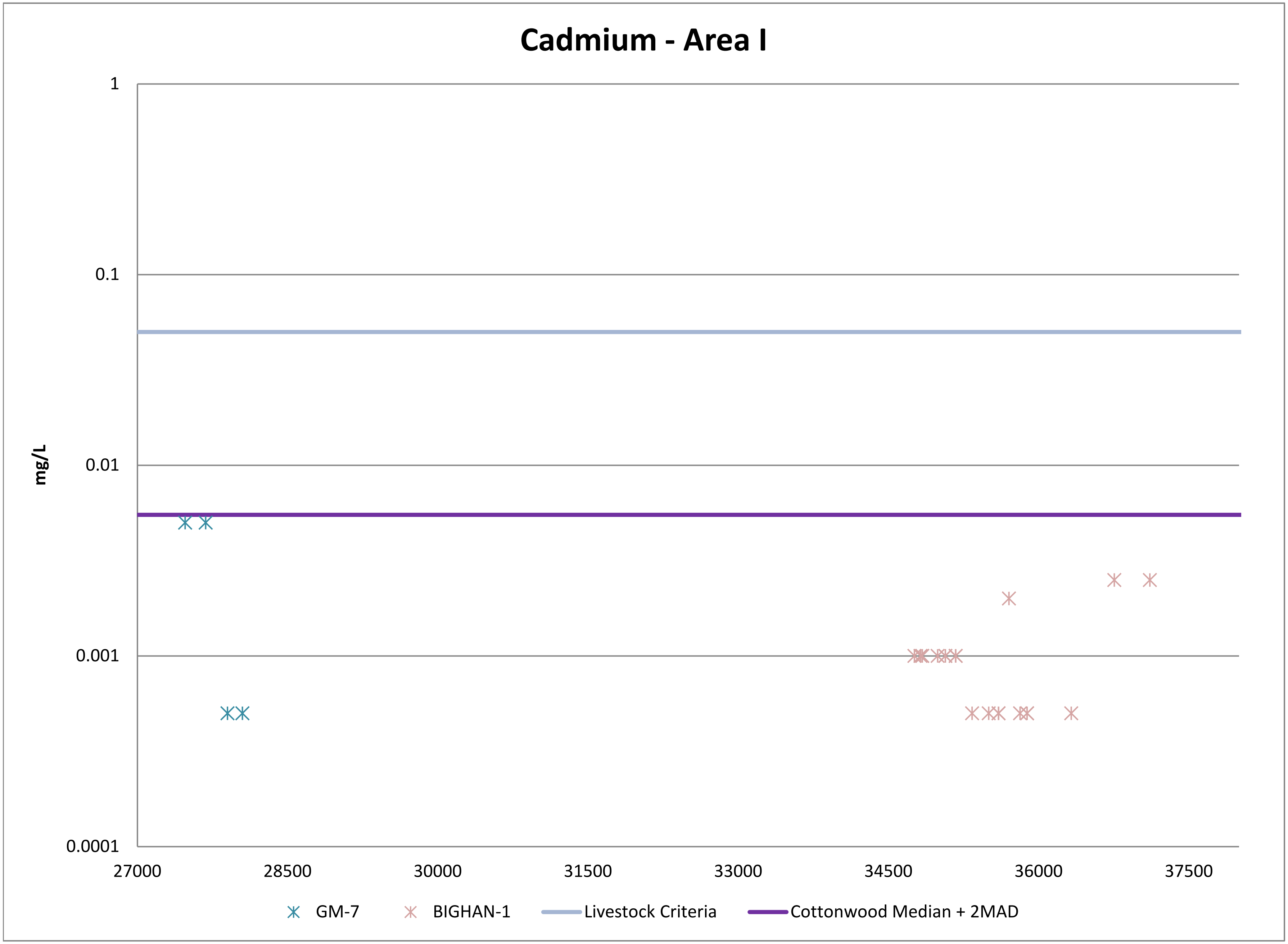

pH - Chaco Baseline
mg/L
9.5
9
8.5
8
7.5
7
6.5
6
12/2/1973
6/20/1974
1/6/1975
7/25/1975
2/10/1976
8/28/1976
3/16/1977
10/2/1977
GM-24
GM-25
GM-34
Livestock Criteria
Median
Median + MAD
Median + 2MAD

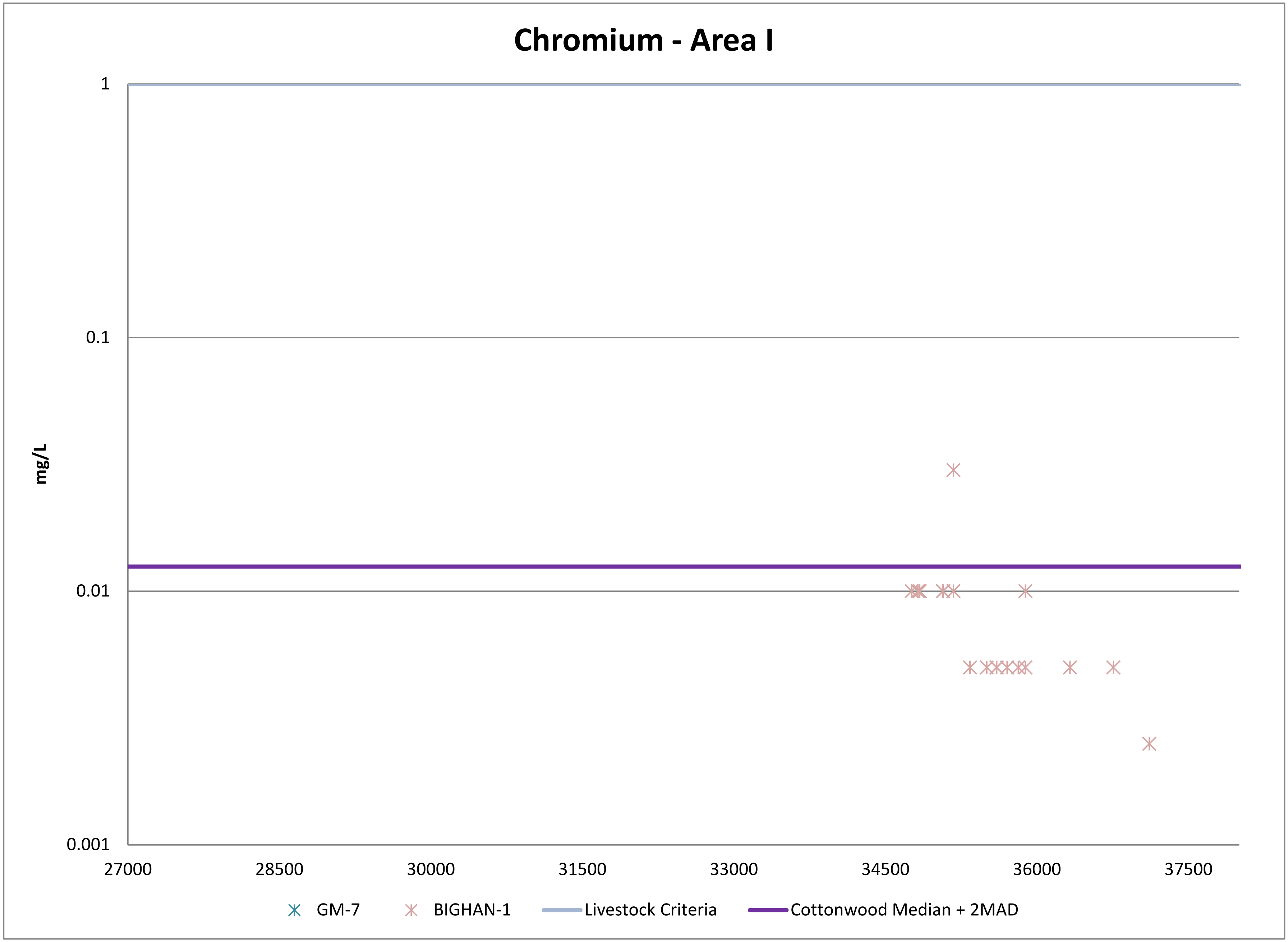

Conductivity - Chaco Baseline
30000
25000
20000
15000
10000
5000
0
mg/L
12/2/1973
6/20/1974
1/6/1975
7/25/1975
2/10/1976
8/28/1976
3/16/1977
10/2/1977
GM-24
GM-25
GM-34
Median
Median + MAD
Median + 2MAD

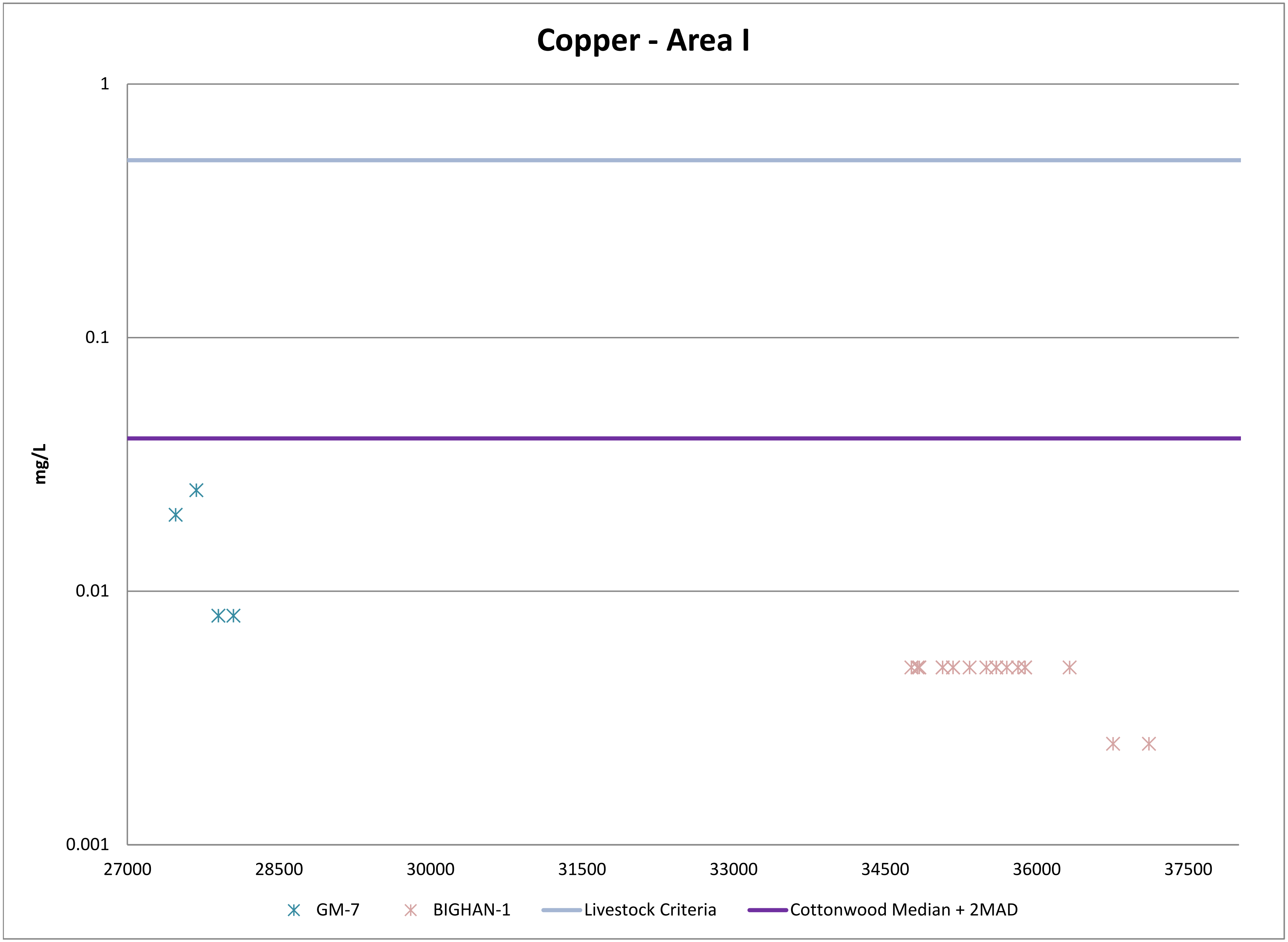

Manganese - Chaco Baseline
mg/L
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
12/2/1973
6/20/1974
1/6/1975
7/25/1975
2/10/1976
8/28/1976
3/16/1977
10/2/1977
GM-24
GM-25
GM-34
Median
Median + MAD
Median + 2MAD

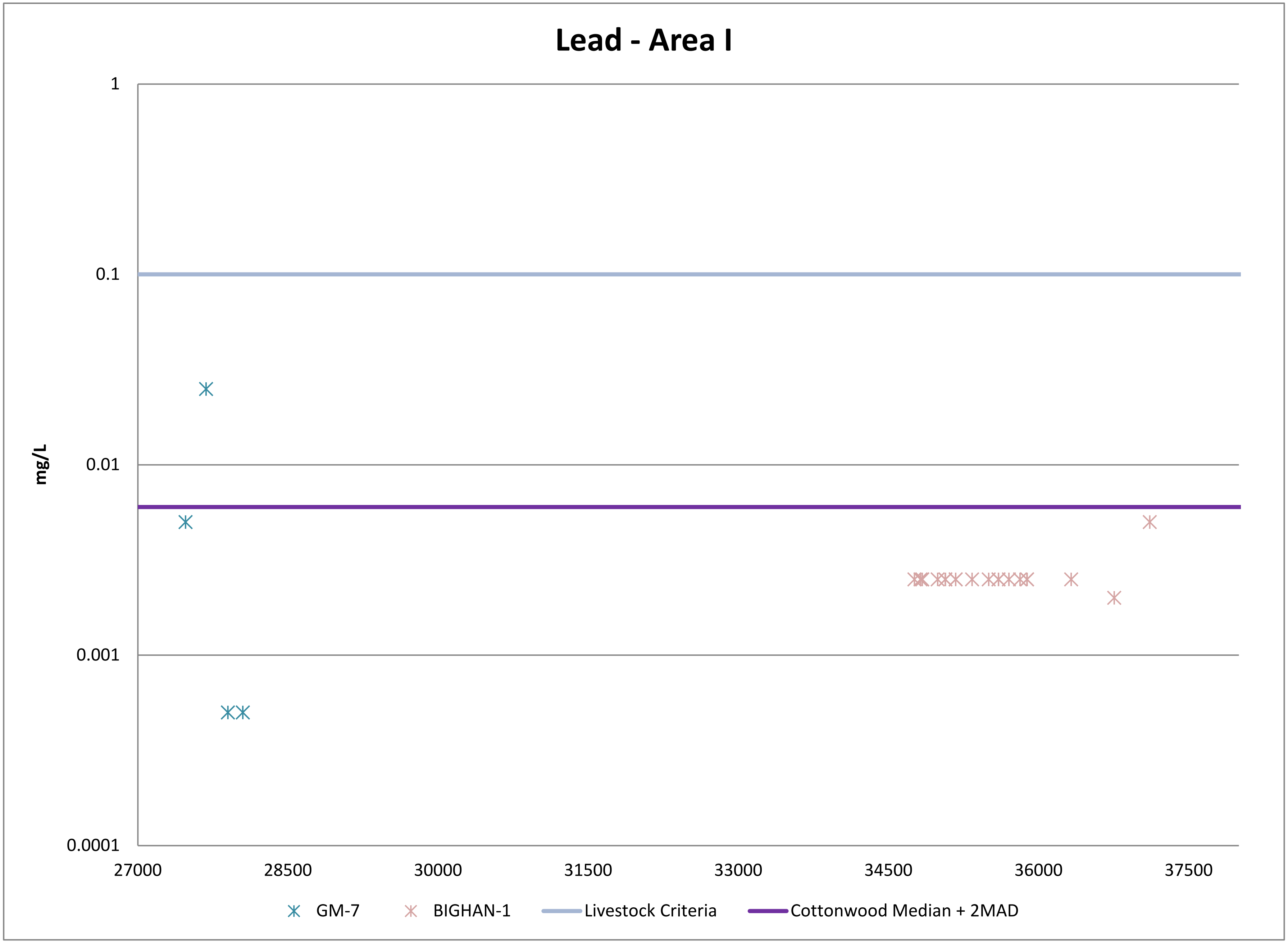

Arsenic - Area I
mg/L
1
0.1
0.01
0.001
0.0001
27000
28500
30000
31500
33000
34500
36000
37500
GM-7
BIGHAN-1
Livestock Criteria
Cottonwood Median + 2MAD

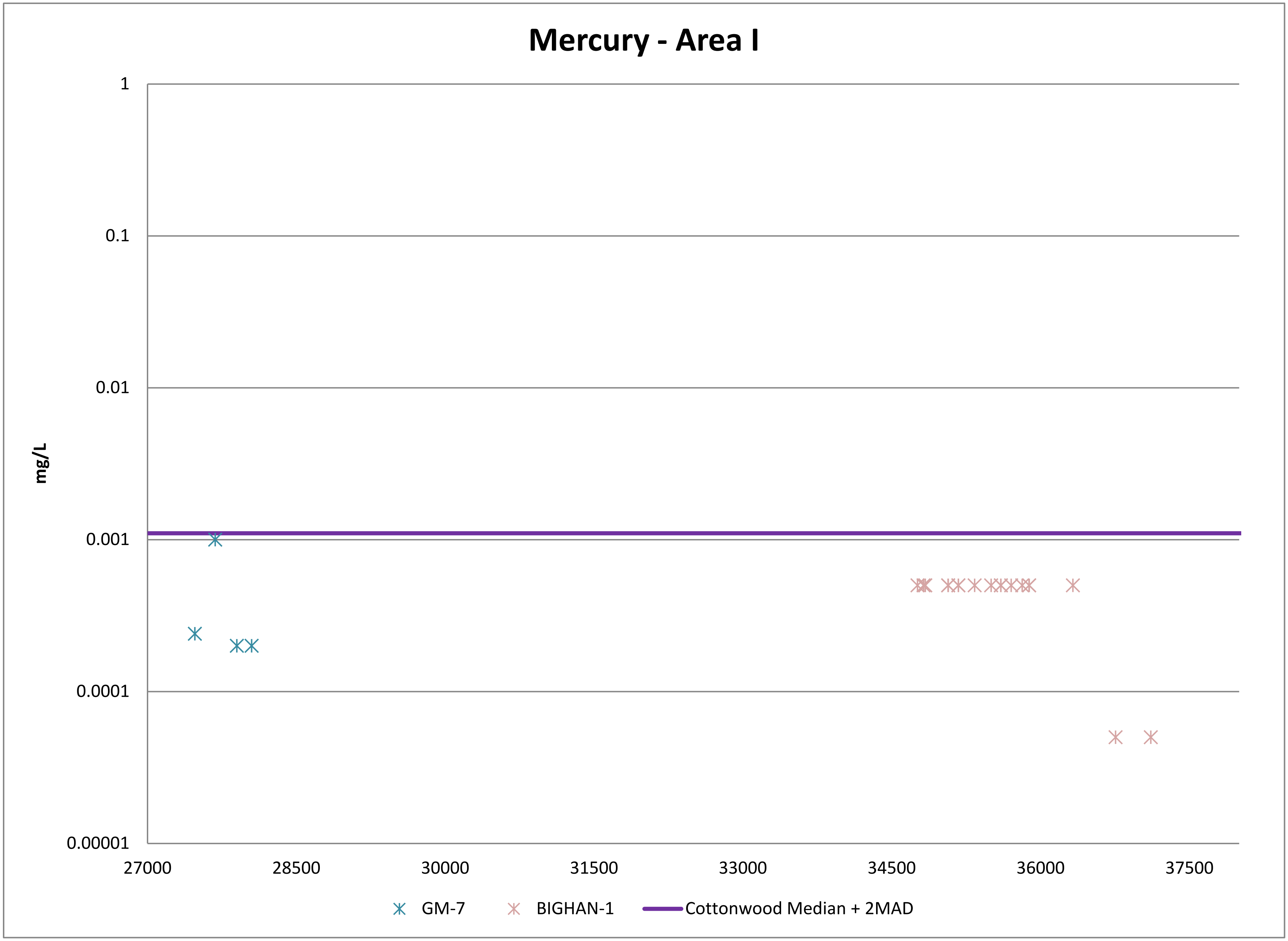

Boron - Area I
mg/L
0
1
2
3
4
5
6
27000
28500
30000
31500
33000
34500
36000
37500
GM-7
BIGHAN-1
Livestock Criteria
Cottonwood Median + 2MAD

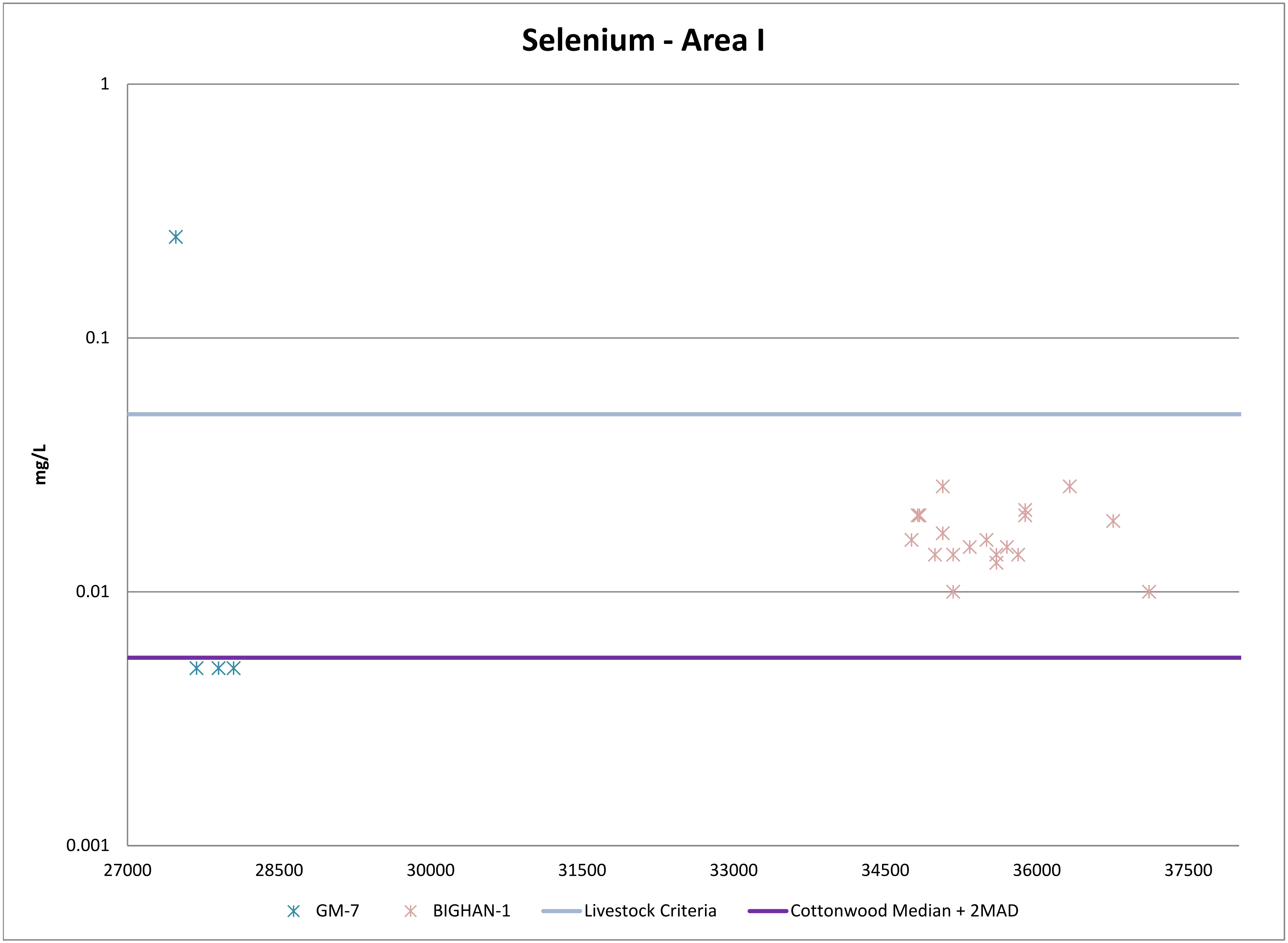

Cadmium - Area I
mg/L
1
0.1
0.01
0.001
0.0001
27000
28500
30000
31500
33000
34500
36000
37500
GM-7
BIGHAN-1
Livestock Criteria
Cottonwood Median + 2MAD

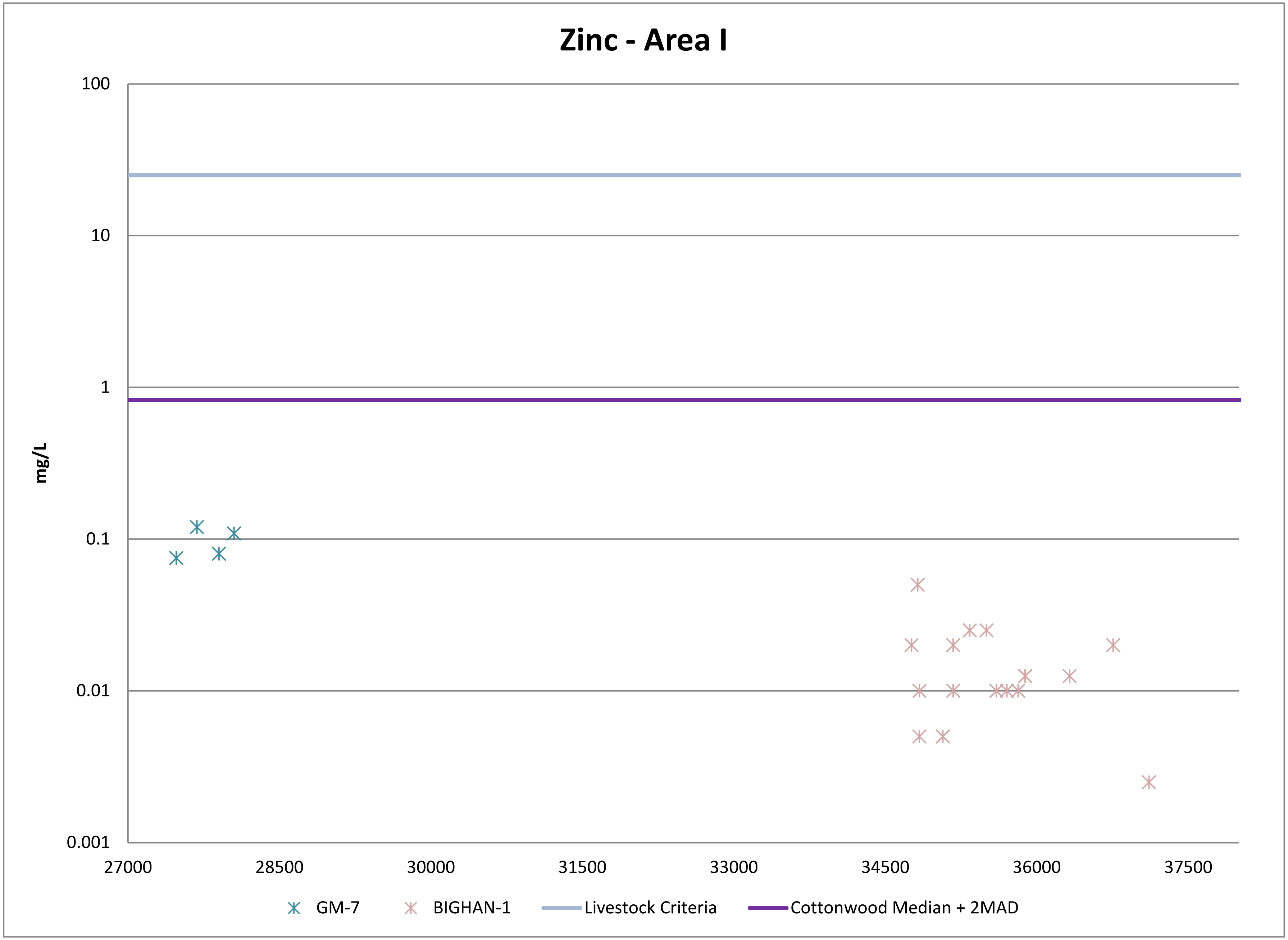

Chromium - Area I
1
0.1
0.01
0.001
mg/L
27000
28500
30000
31500
33000
34500
36000
37500
GM-7
BIGHAN-1
Livestock Criteria
Cottonwood Median + 2MAD

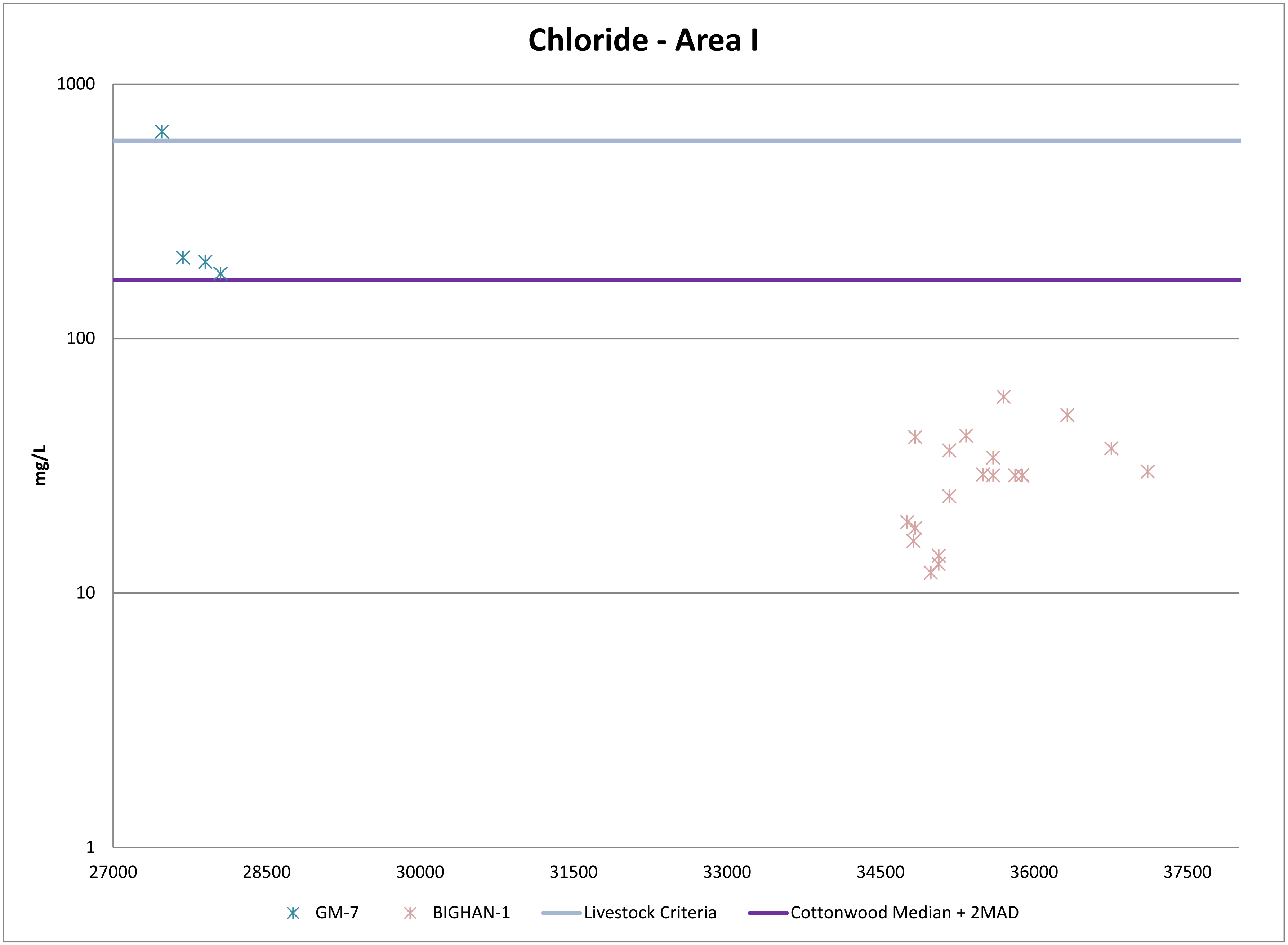

Copper - Area I
1
0.1
0.01
0.001
mg/L
27000
28500
30000
31500
33000
34500
36000
37500
GM-7
BIGHAN-1
Livestock Criteria
Cottonwood Median + 2MAD

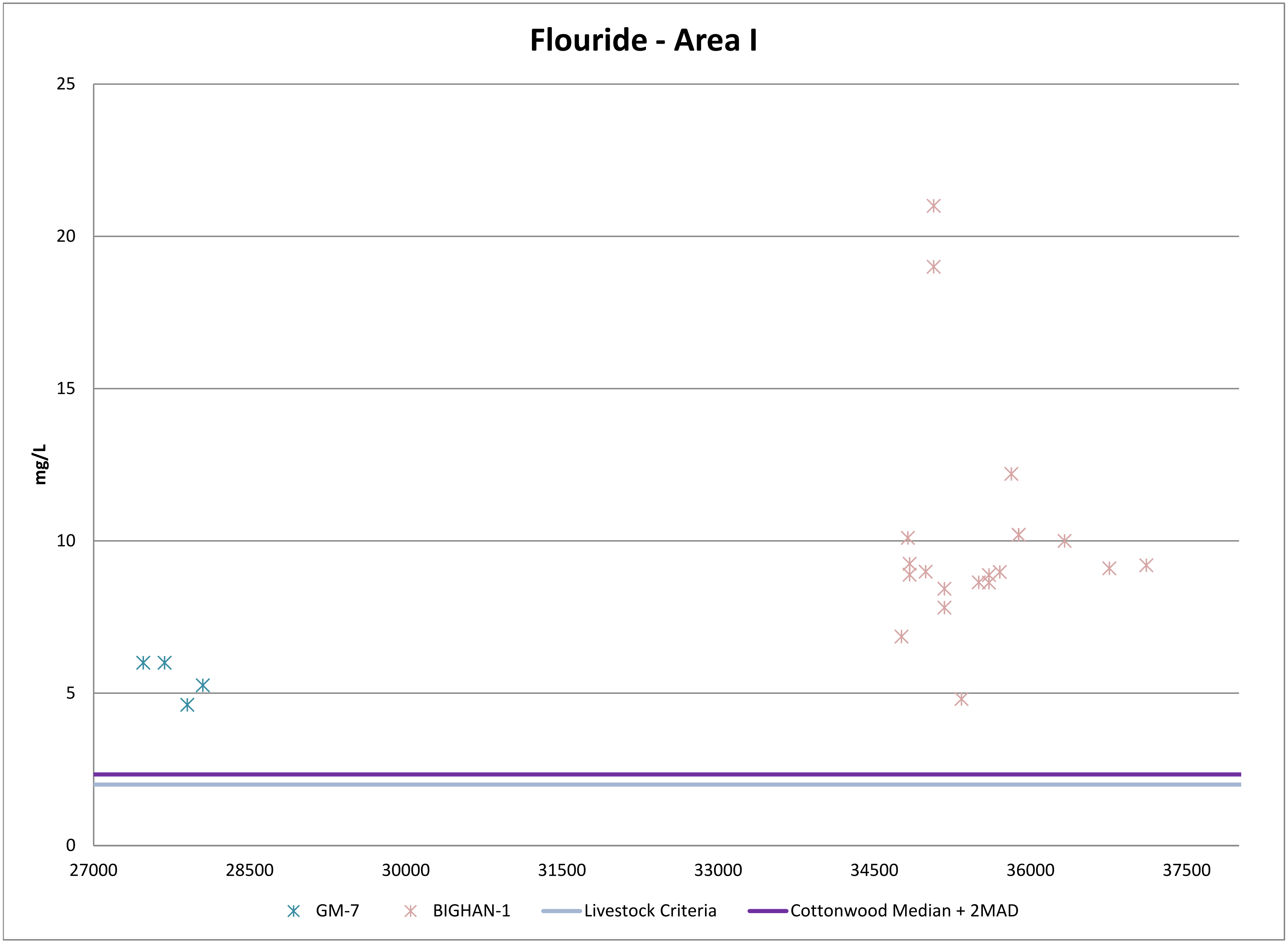

Lead - Area I
mg/L
1
0.1
0.01
0.001
0.0001
27000
28500
30000
31500
33000
34500
36000
37500
GM-7
BIGHAN-1
Livestock Criteria
Cottonwood Median + 2MAD

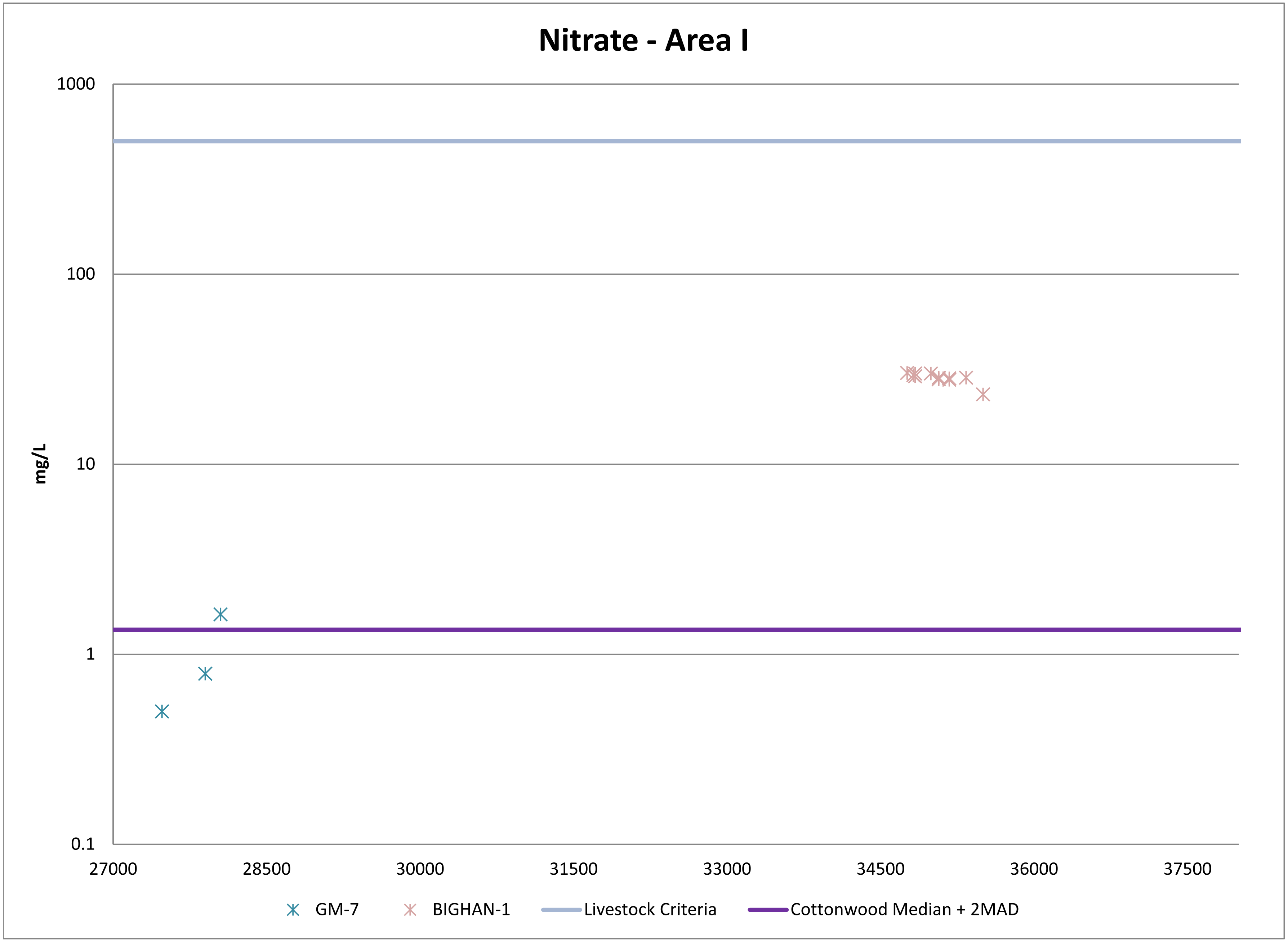

Mercury - Area I
mg/L
1
0.1
0.01
0.001
0.0001
0.00001
27000
28500
30000
31500
33000
34500
36000
37500
GM-7
BIGHAN-1
Cottonwood Median + 2MAD

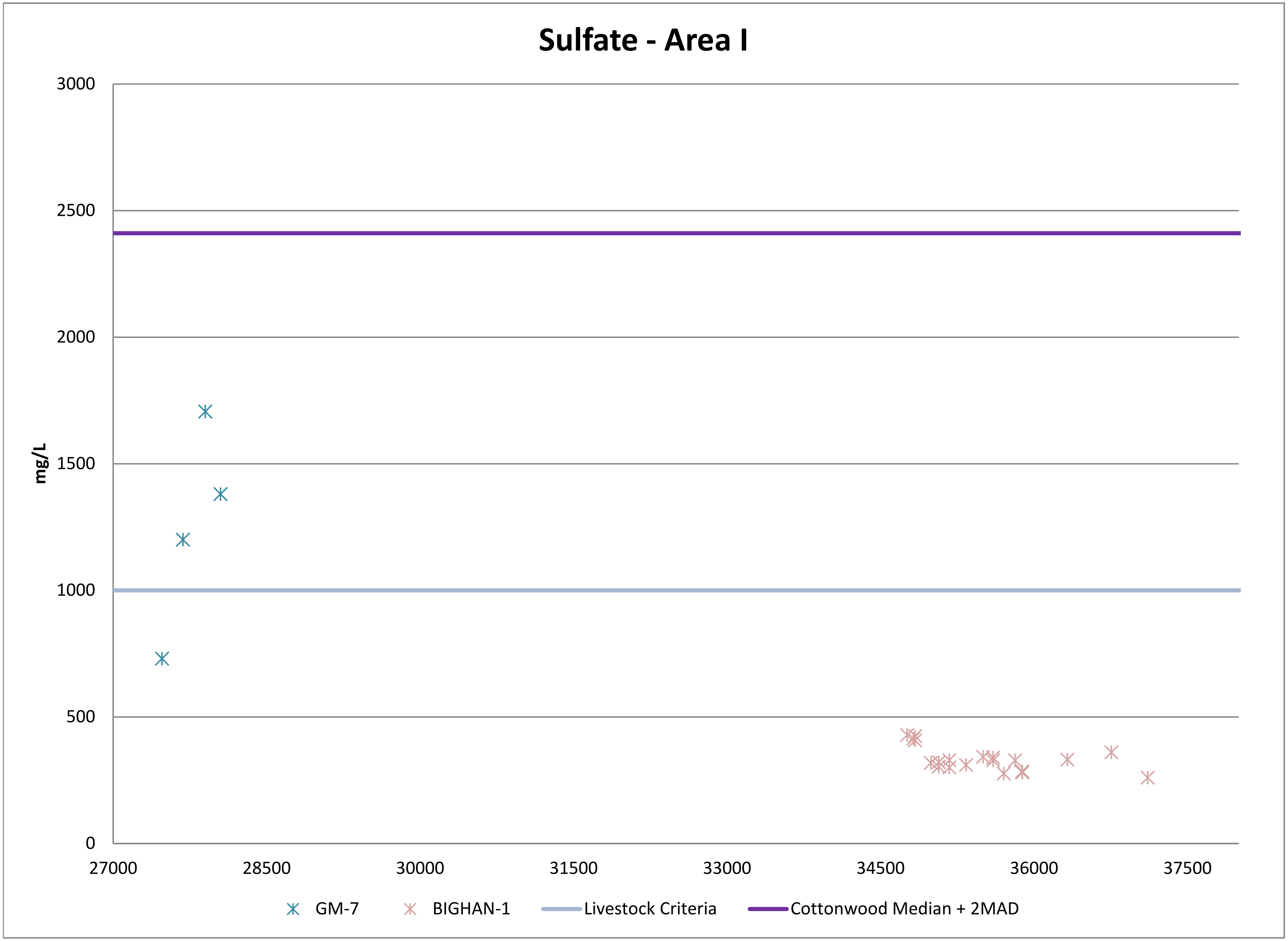

Selenium - Area I
mg/L
1
0.1
0.01
0.001
27000
28500
30000
31500
33000
34500
36000
37500
GM-7
BIGHAN-1
Livestock Criteria
Cottonwood Median + 2MAD

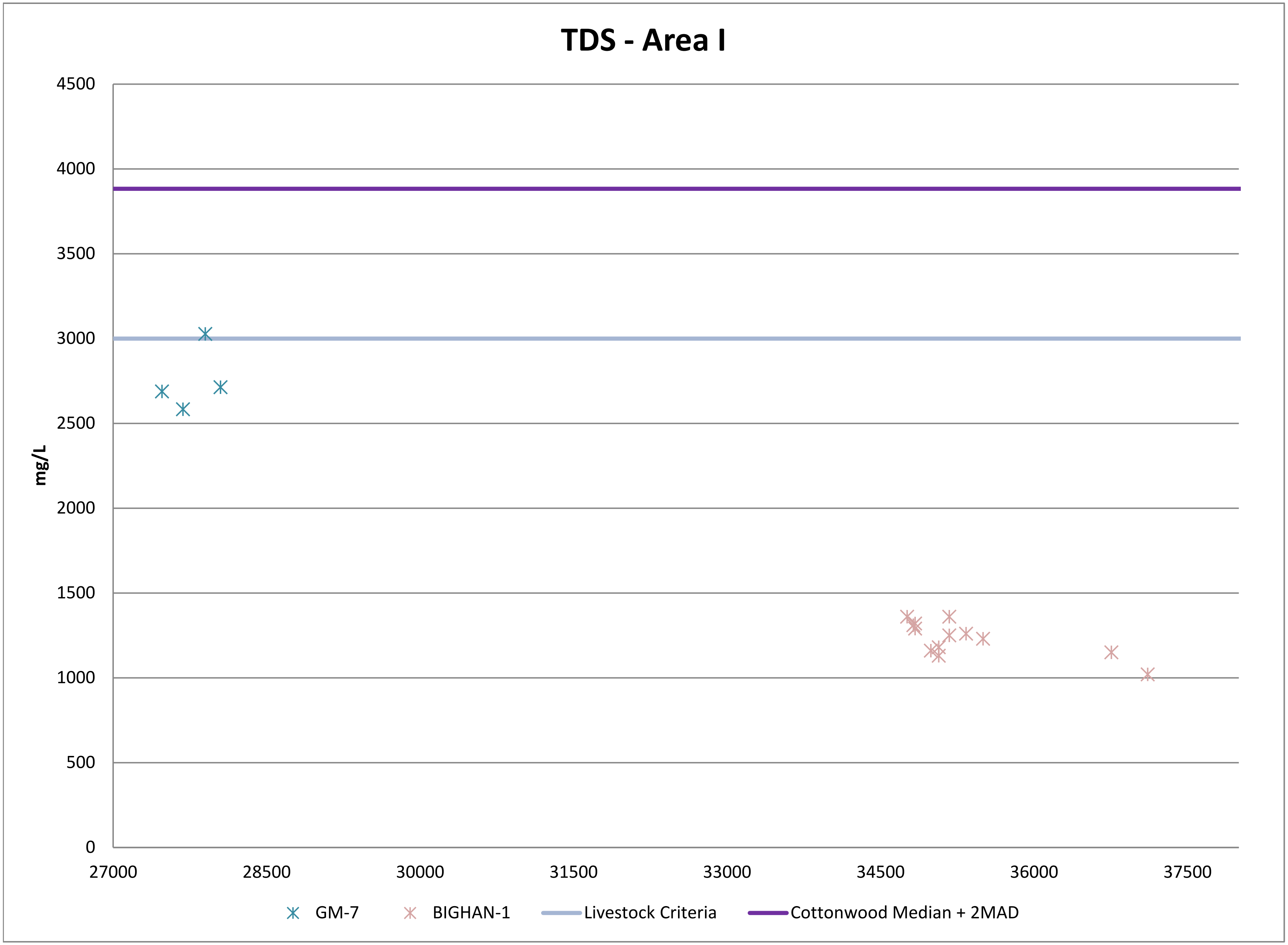

Zinc - Area I
100
10
1
0.1
0.01
0.001
mg/L
27000
28500
30000
31500
33000
34500
36000
37500
GM-7
BIGHAN-1
Livestock Criteria
Cottonwood Median + 2MAD

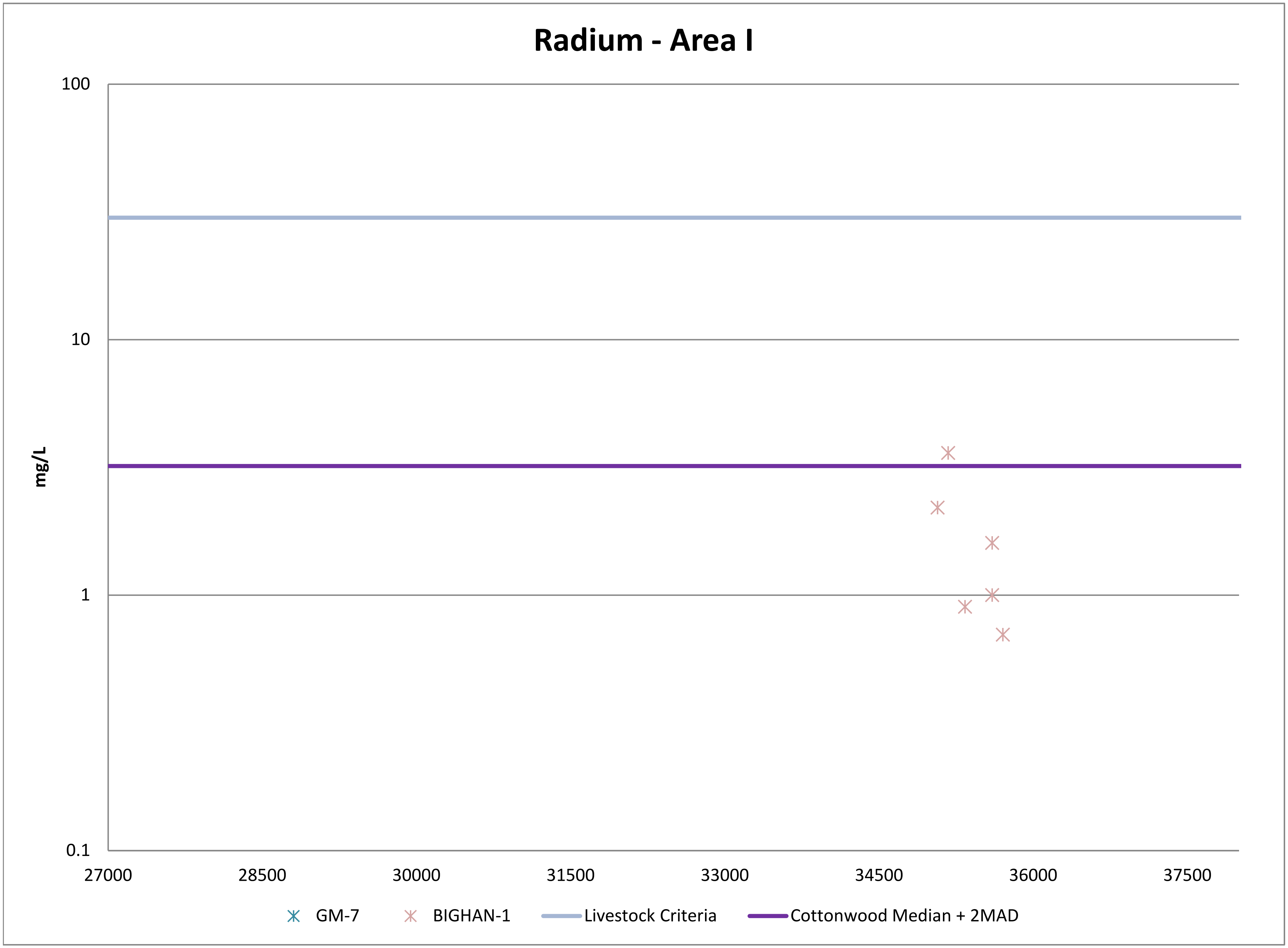

Chloride - Area I
mg/L
1000
100
10
1
27000
28500
30000
31500
33000
34500
36000
37500
GM-7
BIGHAN-1
Livestock Criteria
Cottonwood Median + 2MAD

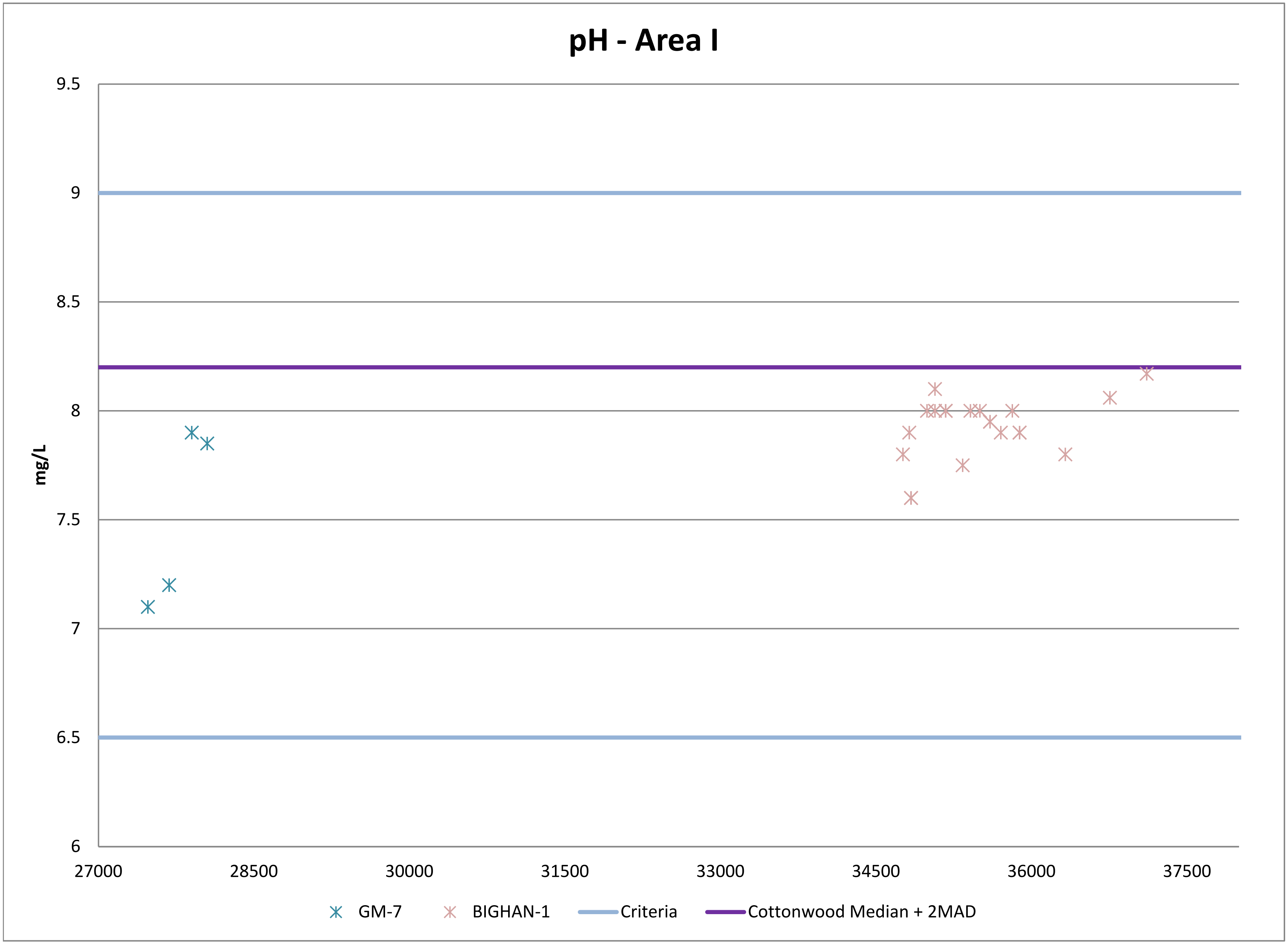

Flouride - Area I
mg/L
25
20
15
10
5
0
27000
28500
30000
31500
33000
34500
36000
37500
GM-7
BIGHAN-1
Livestock Criteria
Cottonwood Median + 2MAD

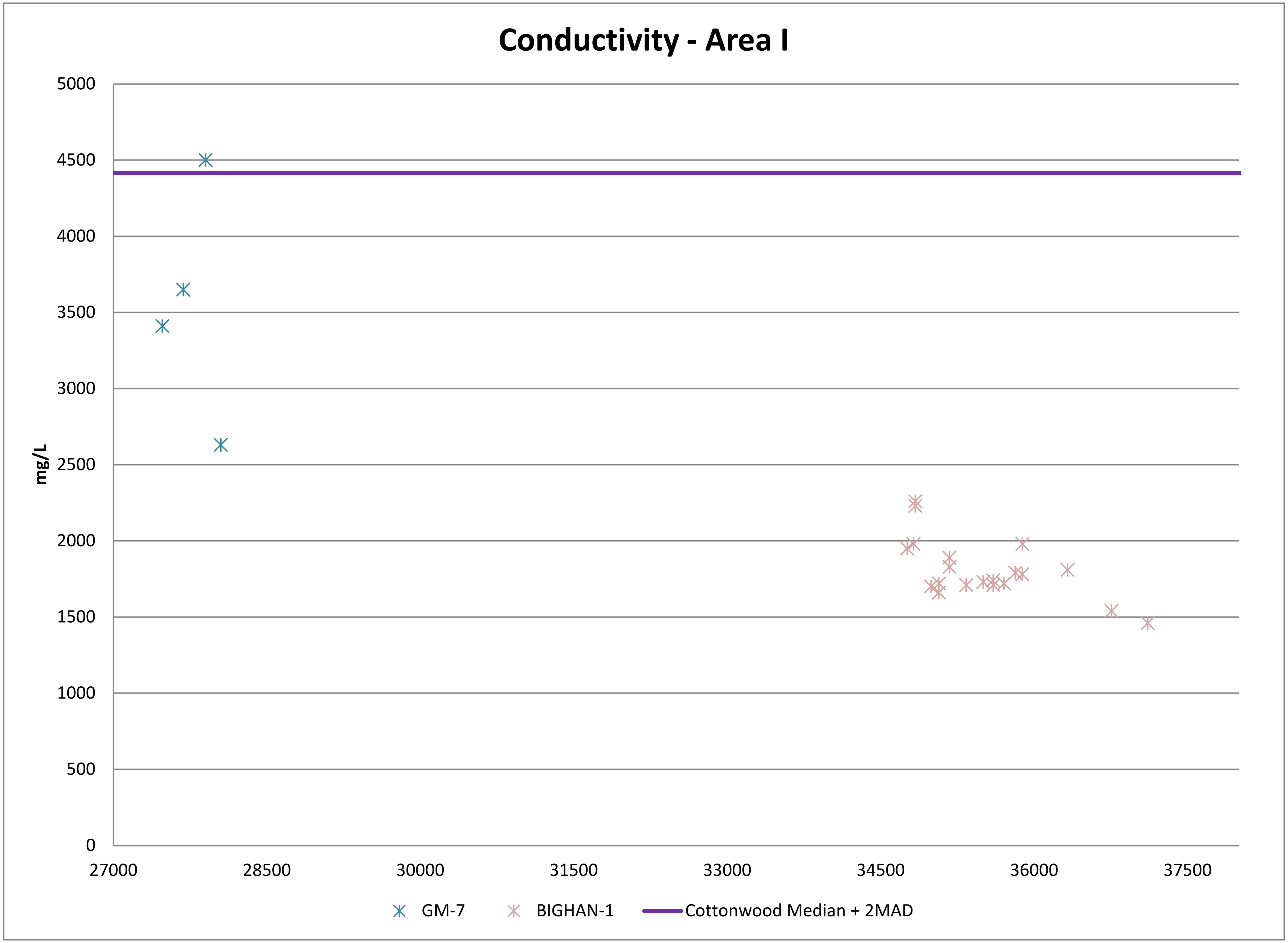

Nitrate - Area I
1000
100
10
1
0.1
mg/L
27000
28500
30000
31500
33000
34500
36000
37500
GM-7
BIGHAN-1
Livestock Criteria
Cottonwood Median + 2MAD

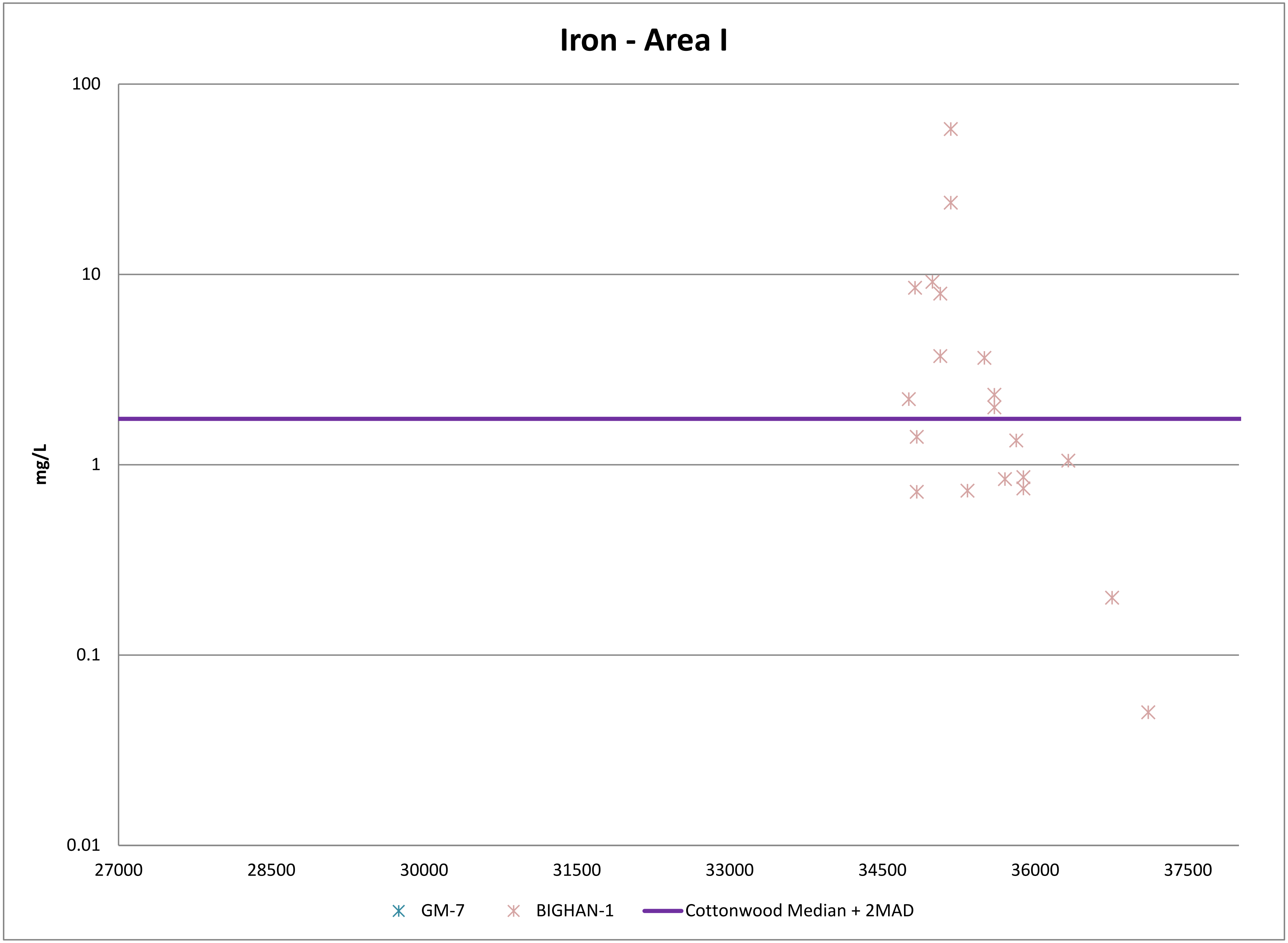

Sulfate - Area I
mg/L
3000
2500
2000
1500
1000
500
0
27000
28500
30000
31500
33000
34500
36000
37500
GM-7
BIGHAN-1
Livestock Criteria
Cottonwood Median + 2MAD

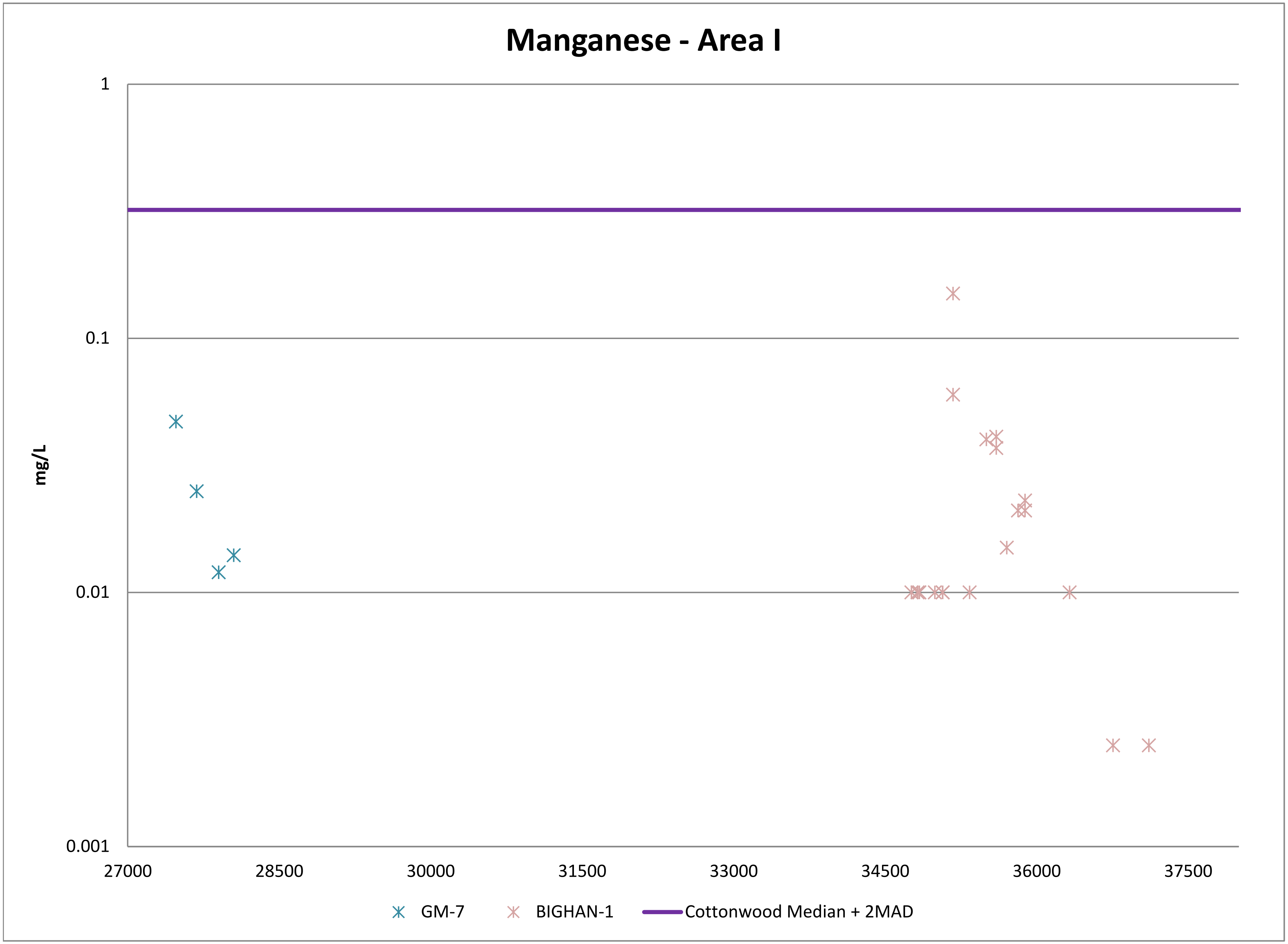

TDS - Area I
mg/L
4500
4000
3500
3000
2500
2000
1500
1000
500
0
27000
28500
30000
31500
33000
34500
36000
37500
GM-7
BIGHAN-1
Livestock Criteria
Cottonwood Median + 2MAD

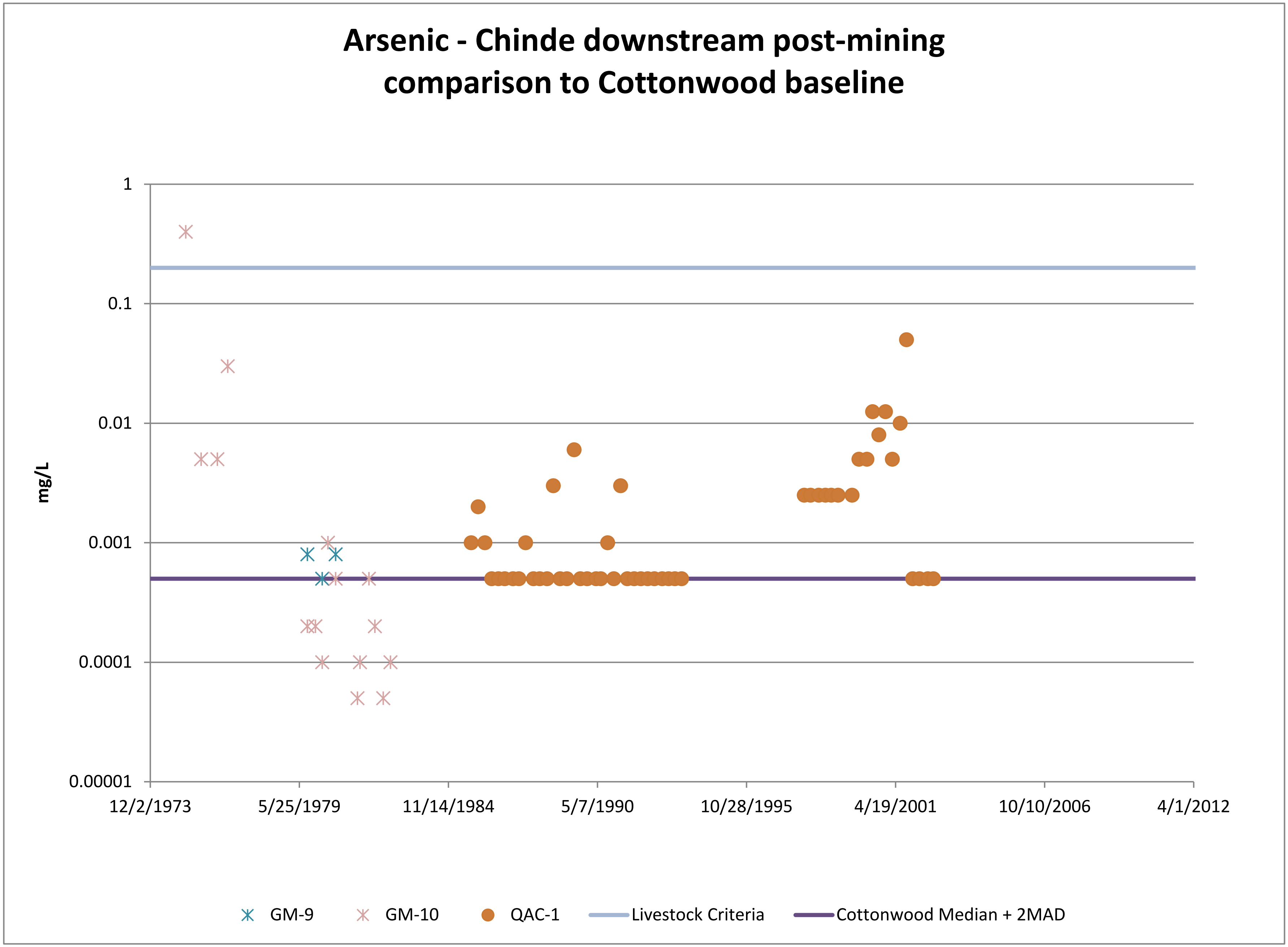

Radium - Area I
100
10
1
0.1
mg/L
27000
28500
30000
31500
33000
34500
36000
37500
GM-7
BIGHAN-1
Livestock Criteria
Cottonwood Median + 2MAD

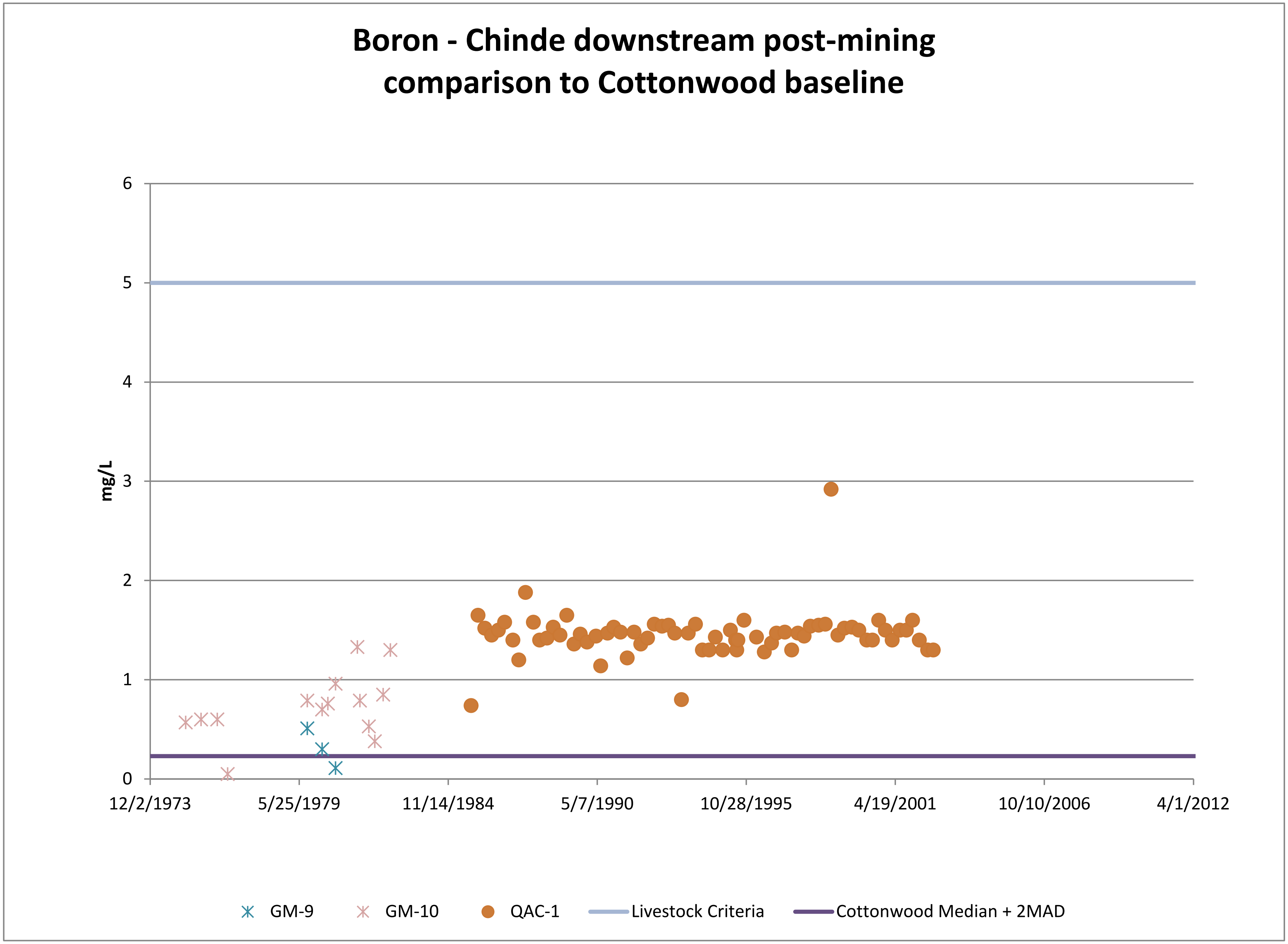

pH - Area I
9.5
9
8.5
8
7.5
7
6.5
6
mg/L
27000
28500
30000
31500
33000
34500
36000
37500
GM-7
BIGHAN-1
Criteria
Cottonwood Median + 2MAD

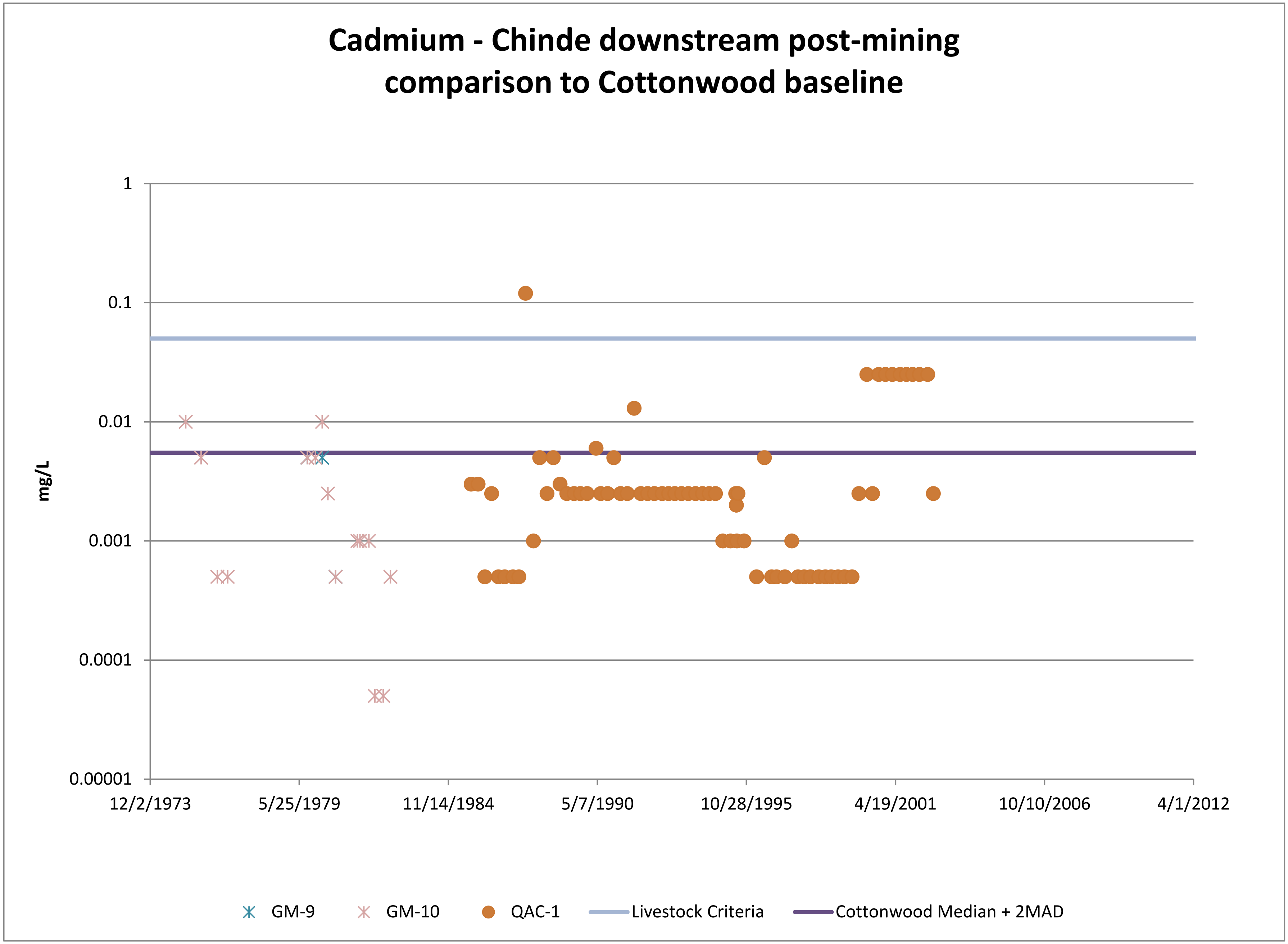

Conductivity - Area I
mg/L
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
27000
28500
30000
31500
33000
34500
36000
37500
GM-7
BIGHAN-1
Cottonwood Median + 2MAD

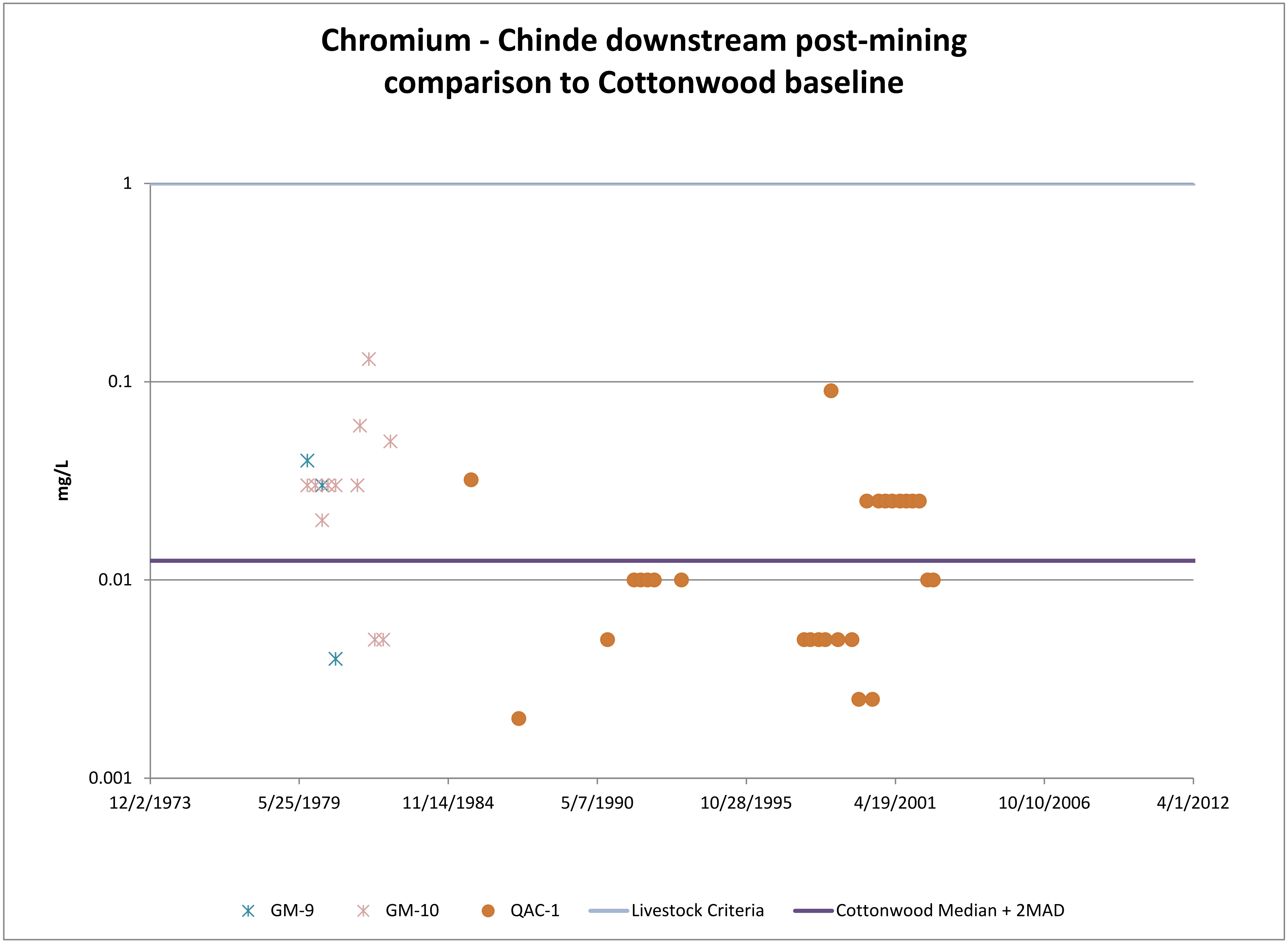

Iron - Area I
100
10
1
0.1
0.01
mg/L
27000
28500
30000
31500
33000
34500
36000
37500
GM-7
BIGHAN-1
Cottonwood Median + 2MAD

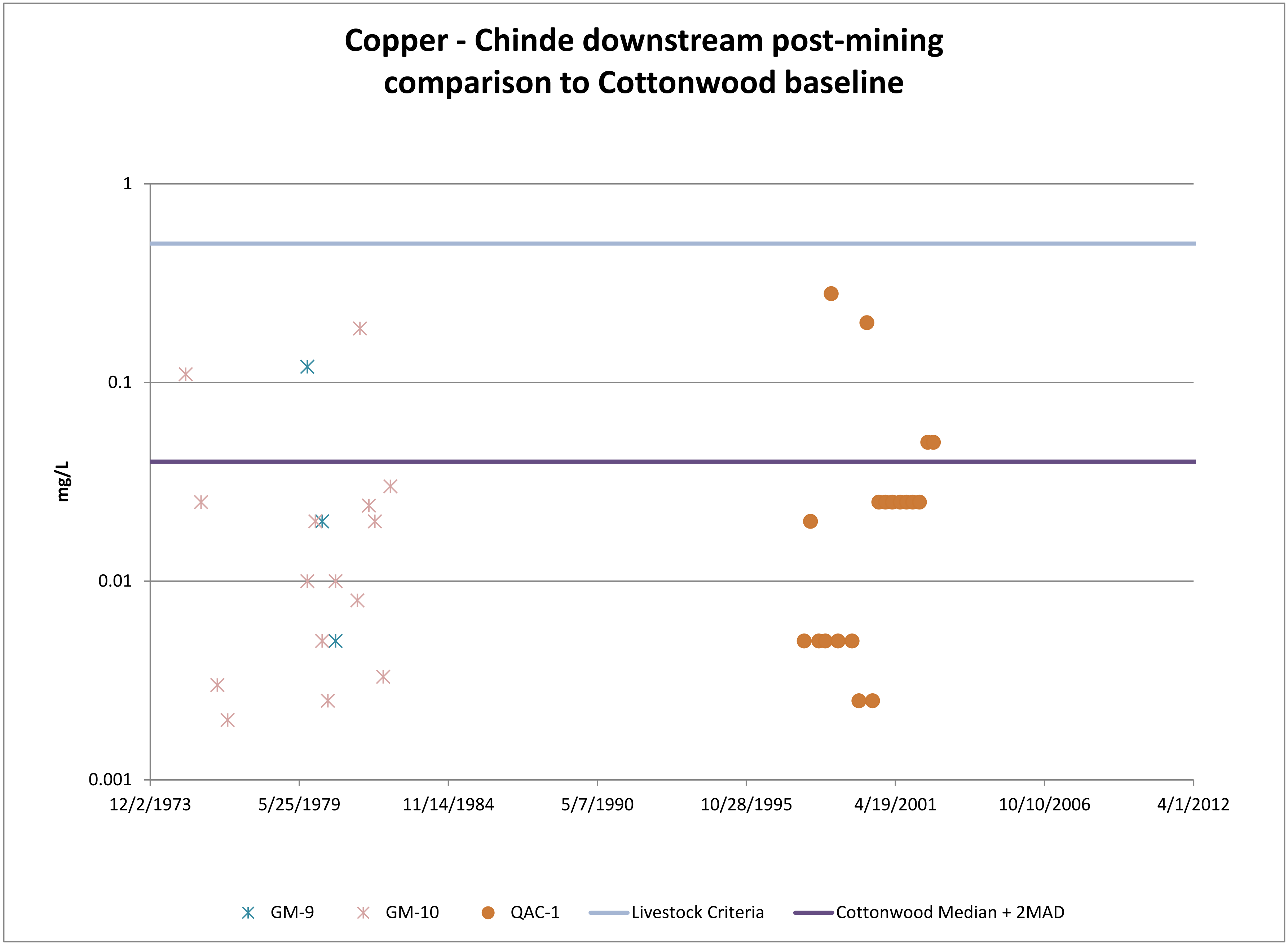

Manganese - Area I
1
0.1
0.01
0.001
mg/L
27000
28500
30000
31500
33000
34500
36000
37500
GM-7
BIGHAN-1
Cottonwood Median + 2MAD

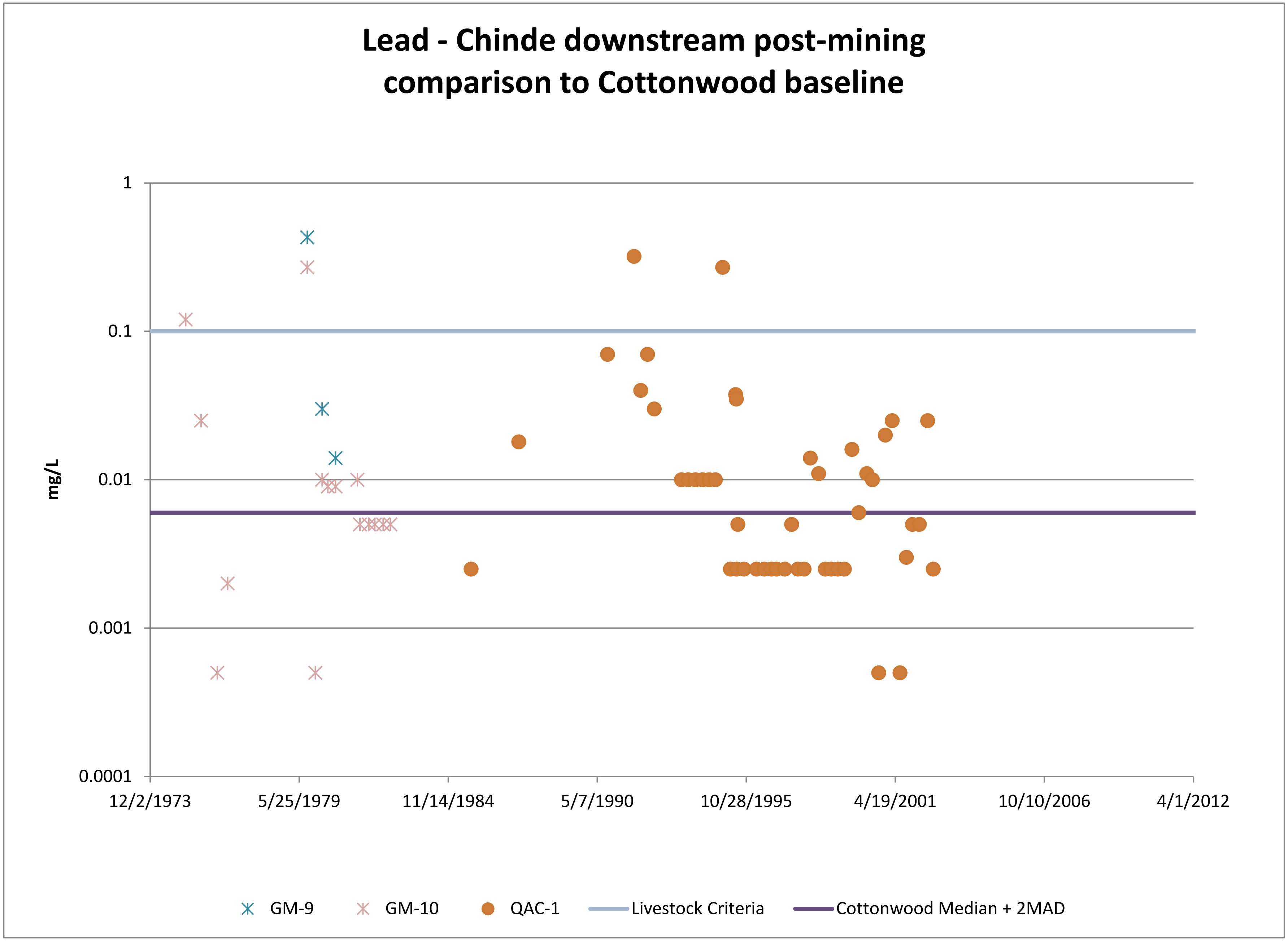

Arsenic - Chinde downstream post-mining comparison to Cottonwood baseline
mg/L
1
0.1
0.01
0.001
0.0001
0.00001
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-9
GM-10
QAC-1
Livestock Criteria
Cottonwood Median + 2MAD

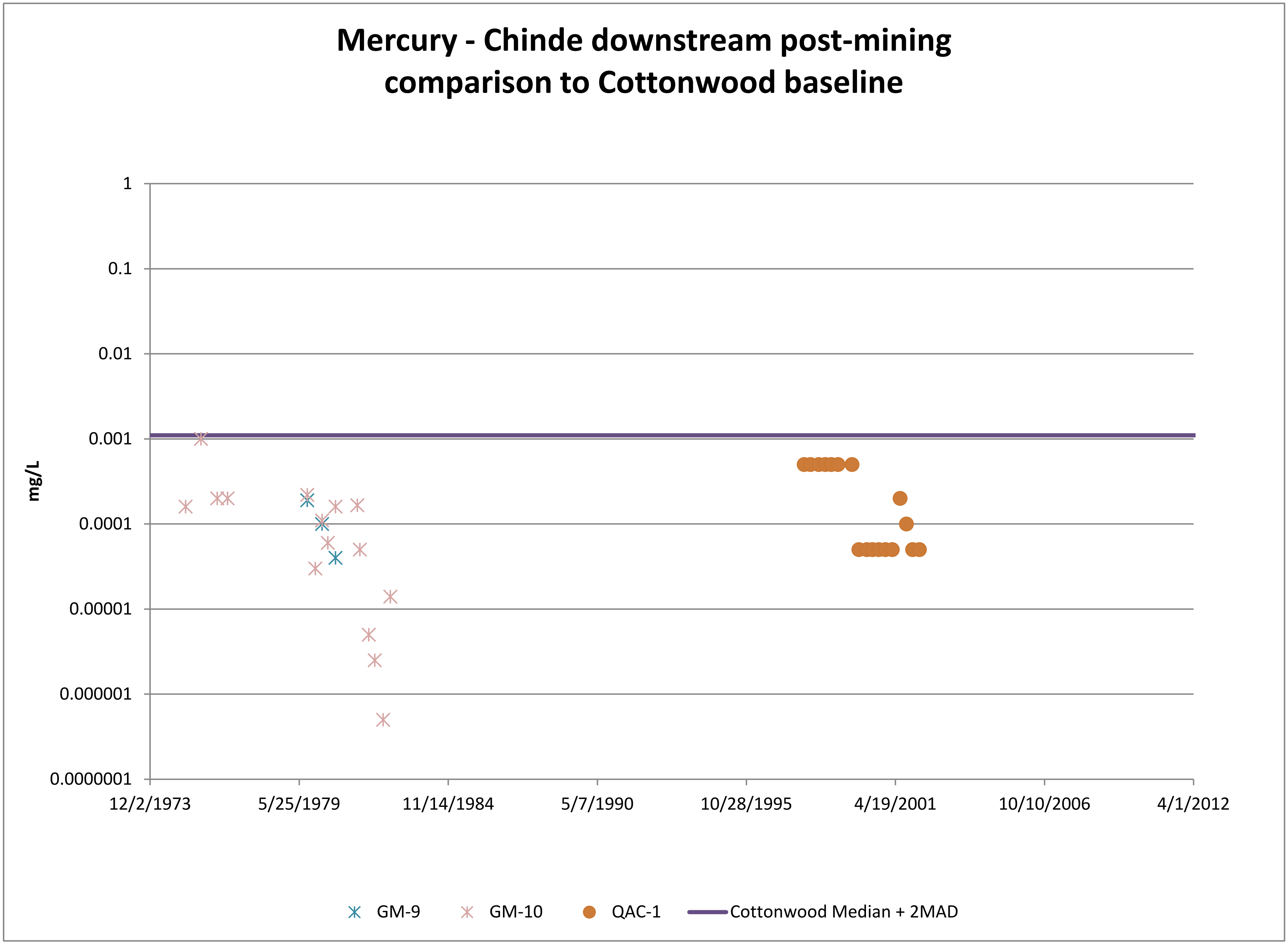

Boron - Chinde downstream post-mining comparison to Cottonwood baseline
mg/L
6
5
4
3
2
1
0
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-9
GM-10
QAC-1
Livestock Criteria
Cottonwood Median + 2MAD

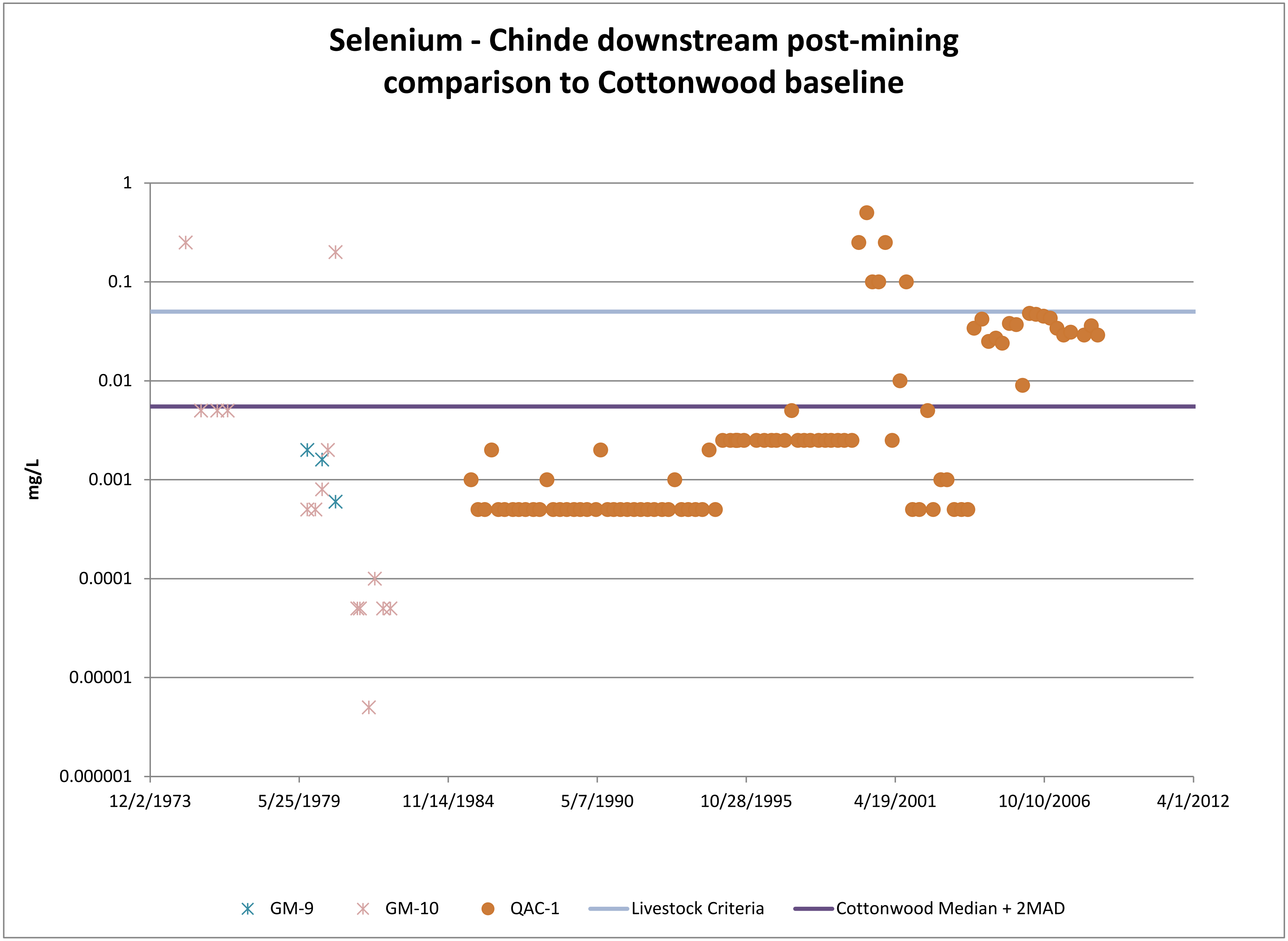

Cadmium - Chinde downstream post-mining comparison to Cottonwood baseline
mg/L
1
0.1
0.01
0.001
0.0001
0.00001
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-9
GM-10
QAC-1
Livestock Criteria
Cottonwood Median + 2MAD

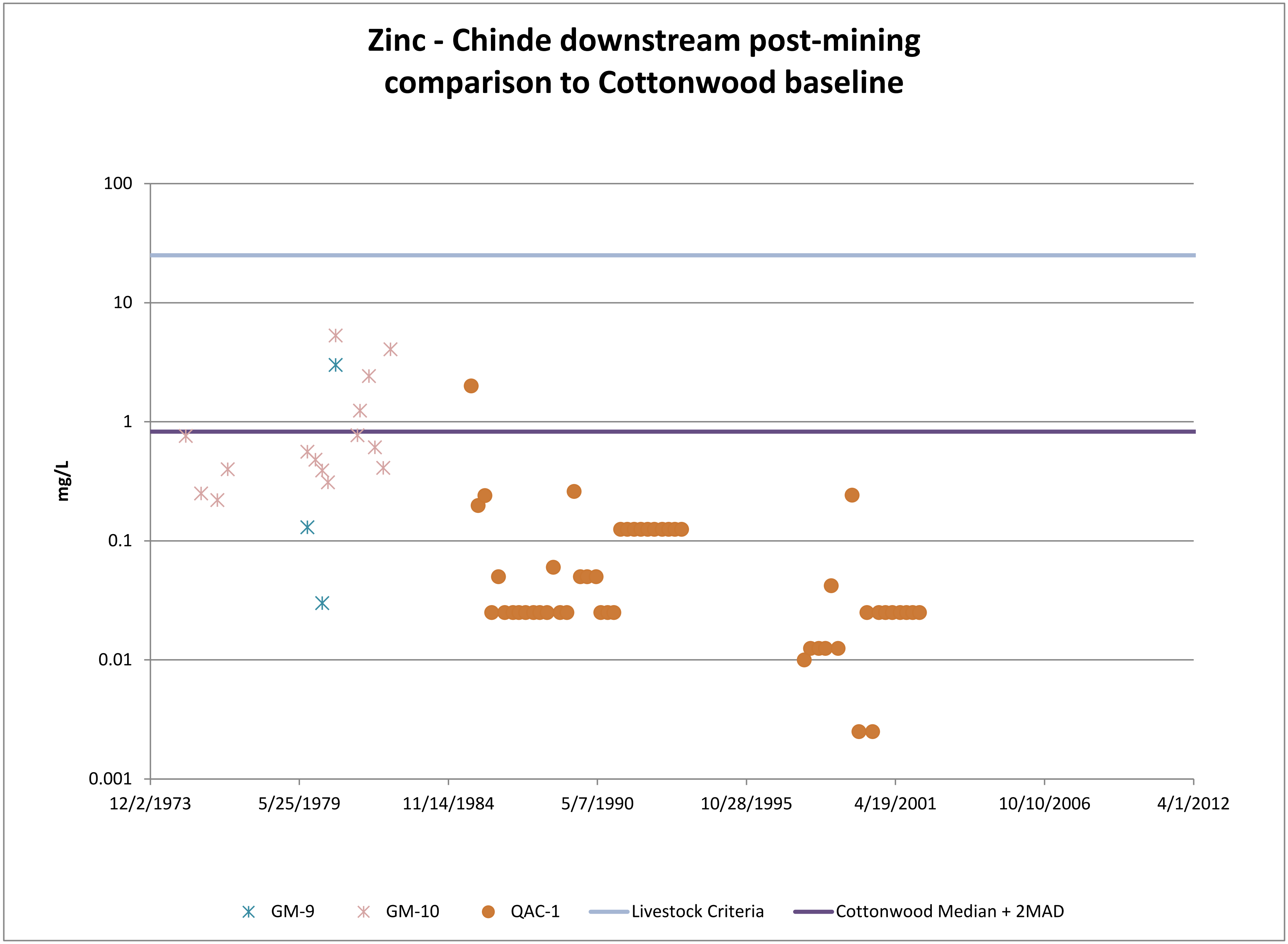

Chromium - Chinde downstream post-mining comparison to Cottonwood baseline
mg/L
1
0.1
0.01
0.001
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-9
GM-10
QAC-1
Livestock Criteria
Cottonwood Median + 2MAD

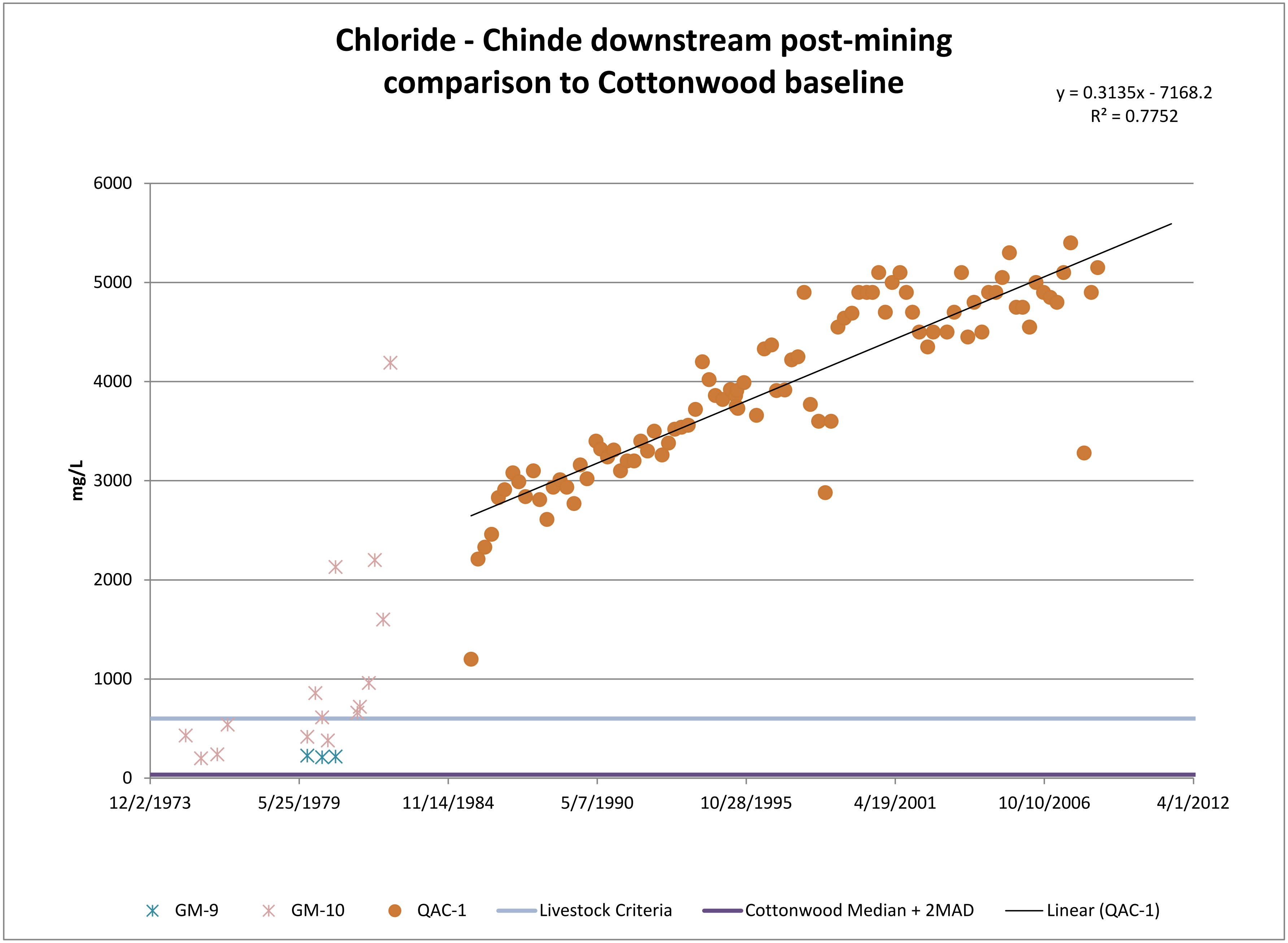

Copper - Chinde downstream post-mining comparison to Cottonwood baseline
mg/L
1
0.1
0.01
0.001
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-9
GM-10
QAC-1
Livestock Criteria
Cottonwood Median + 2MAD

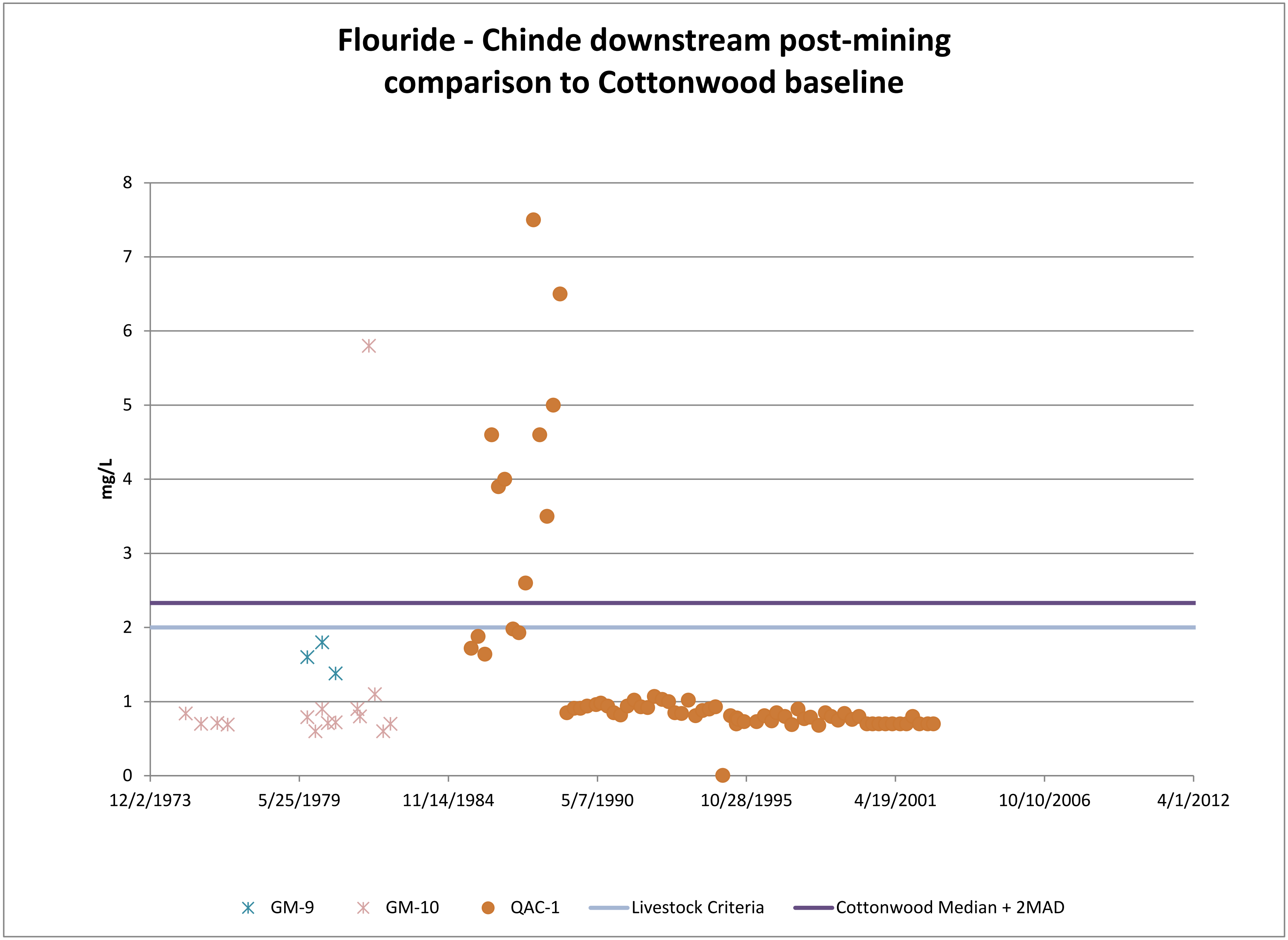

Lead - Chinde downstream post-mining comparison to Cottonwood baseline
mg/L
1
0.1
0.01
0.001
0.0001
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-9
GM-10
QAC-1
Livestock Criteria
Cottonwood Median + 2MAD

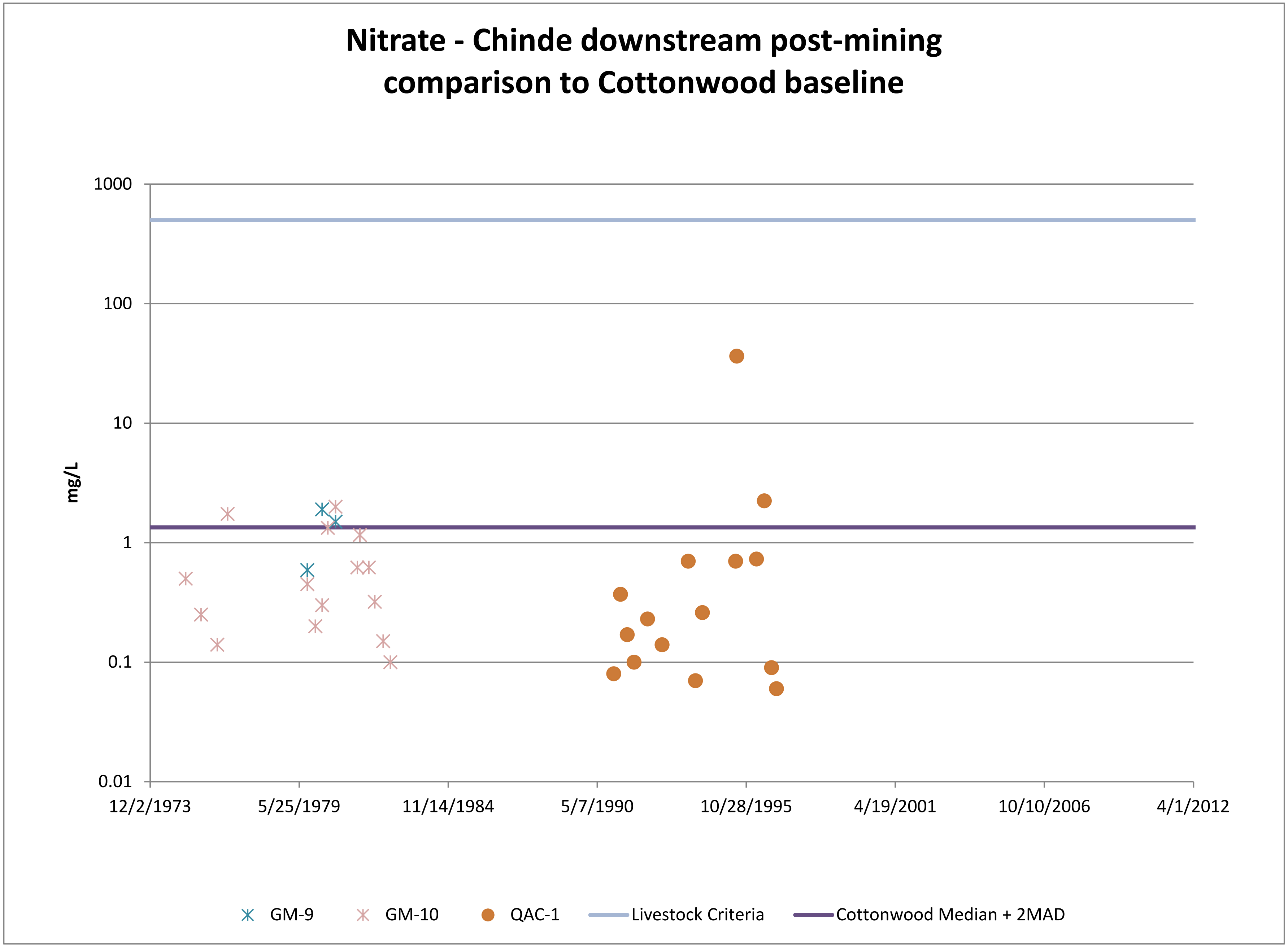

Mercury - Chinde downstream post-mining comparison to Cottonwood baseline
mg/L
1
0.1
0.01
0.001
0.0001
0.00001
0.000001
0.0000001
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-9
GM-10
QAC-1
Cottonwood Median + 2MAD

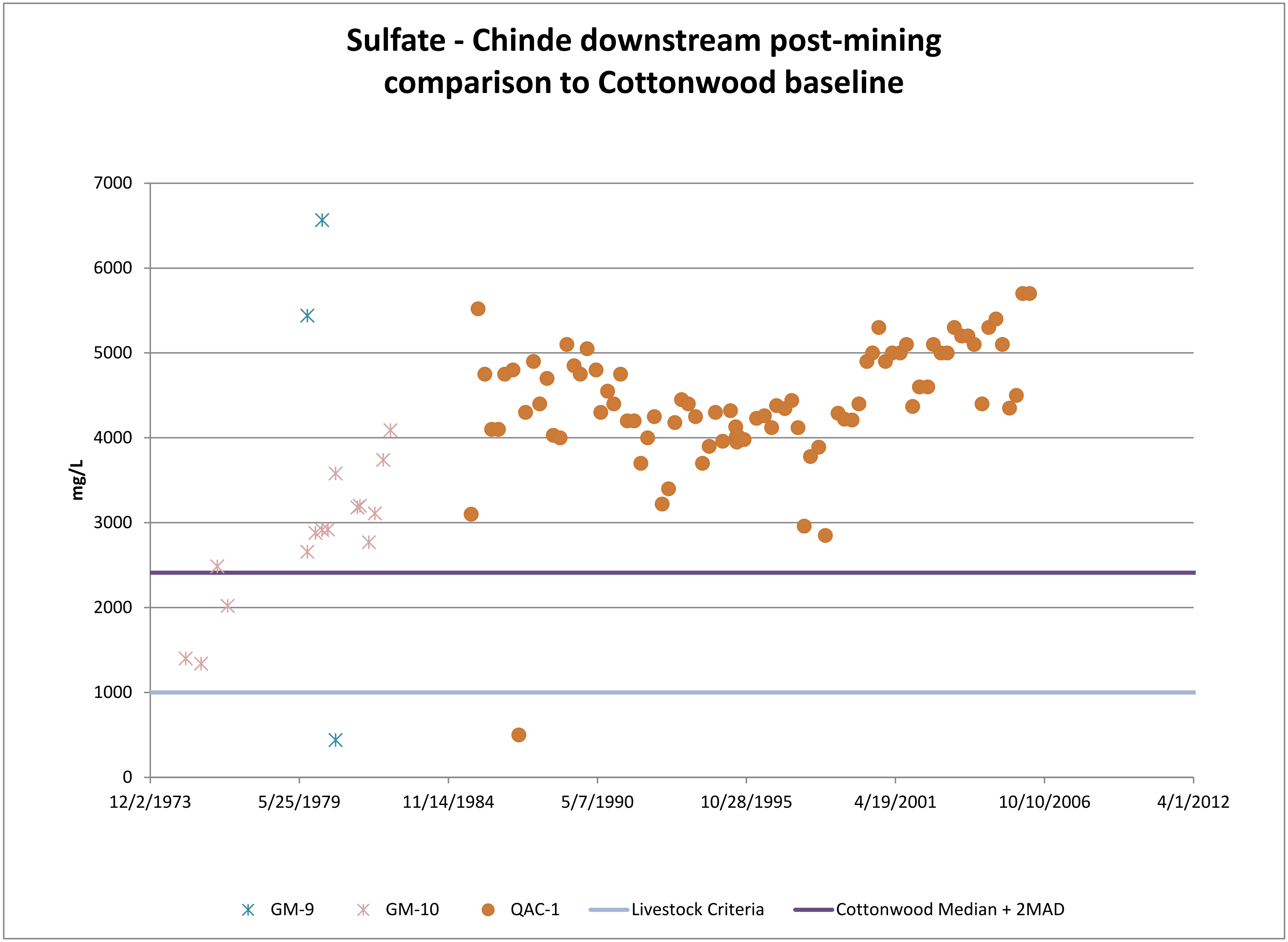

Selenium - Chinde downstream post-mining comparison to Cottonwood baseline
mg/L
1
0.1
0.01
0.001
0.0001
0.00001
0.000001
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-9
GM-10
QAC-1
Livestock Criteria
Cottonwood Median + 2MAD

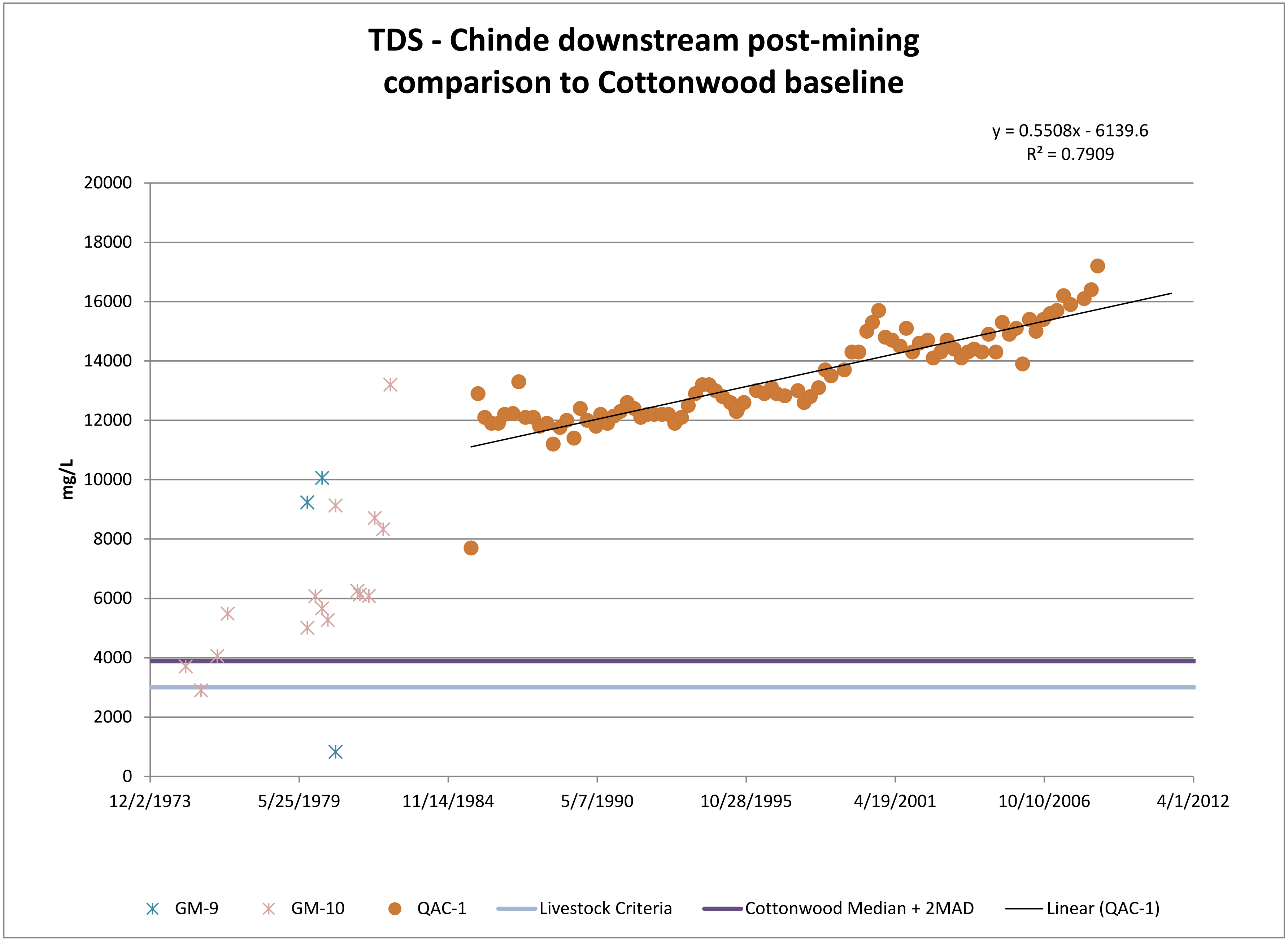

Zinc - Chinde downstream post-mining comparison to Cottonwood baseline
100
10
1
0.1
0.01
0.001
mg/L
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-9
GM-10
QAC-1
Livestock Criteria
Cottonwood Median + 2MAD

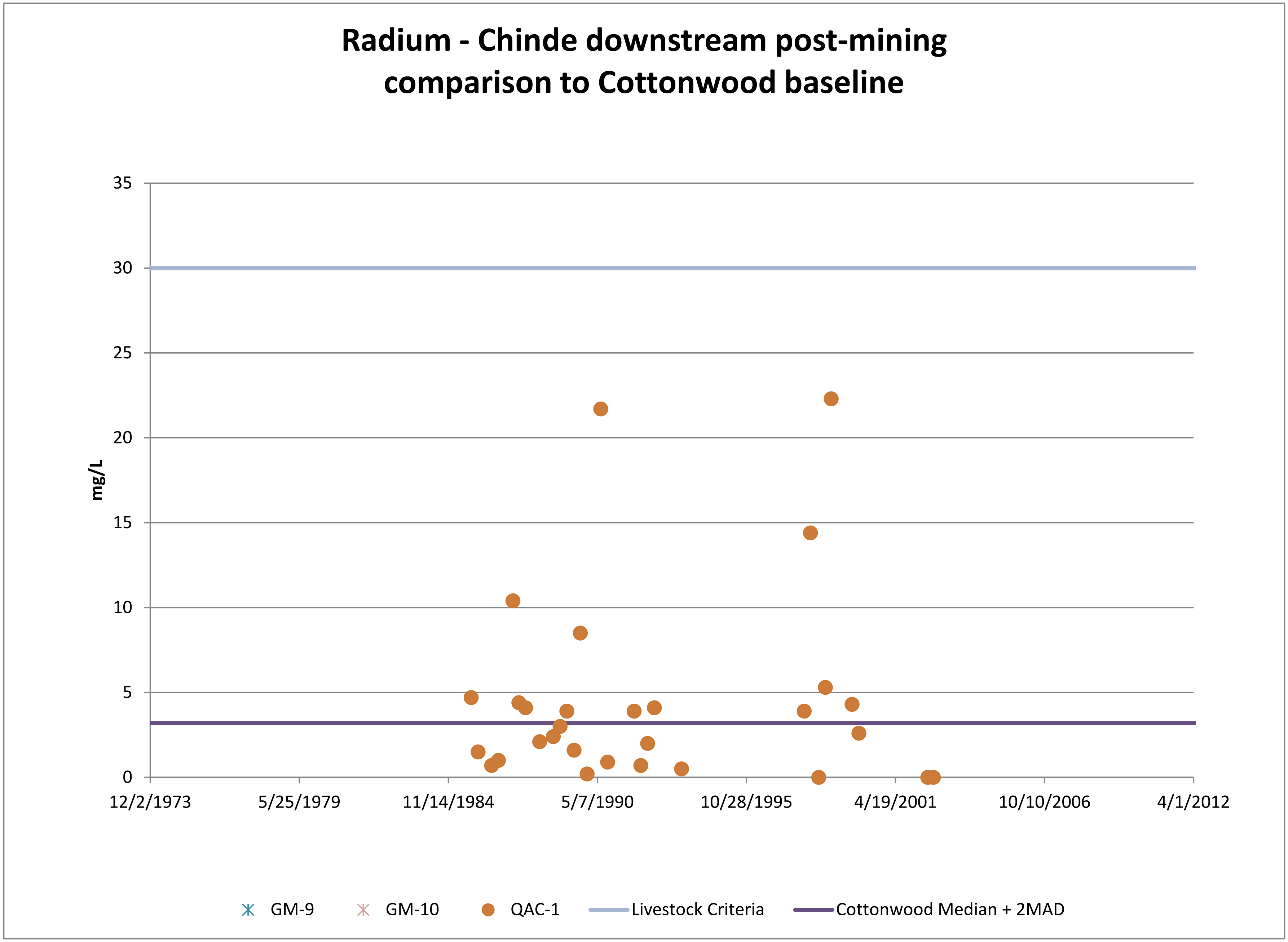

Chloride - Chinde downstream post-mining comparison to Cottonwood baseline
y = 0.3135x - 7168.2
R² = 0.7752
mg/L
6000
5000
4000
3000
2000
1000
0
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-9
GM-10
QAC-1
Livestock Criteria
Cottonwood Median + 2MAD
Linear (QAC-1)

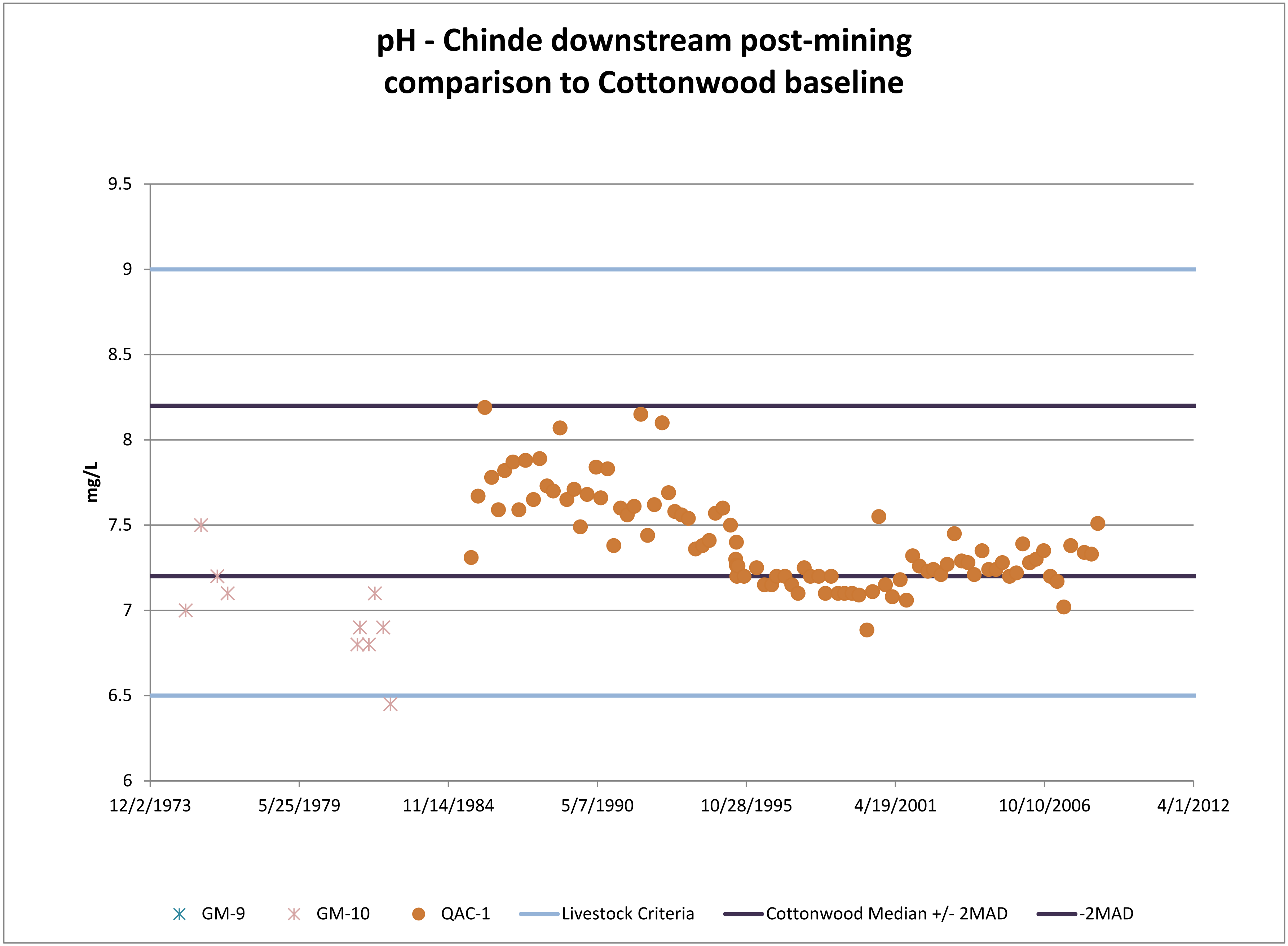

Flouride - Chinde downstream post-mining comparison to Cottonwood baseline
mg/L
0
1
2
3
4
5
6
7
8
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-9
GM-10
QAC-1
Livestock Criteria
Cottonwood Median + 2MAD

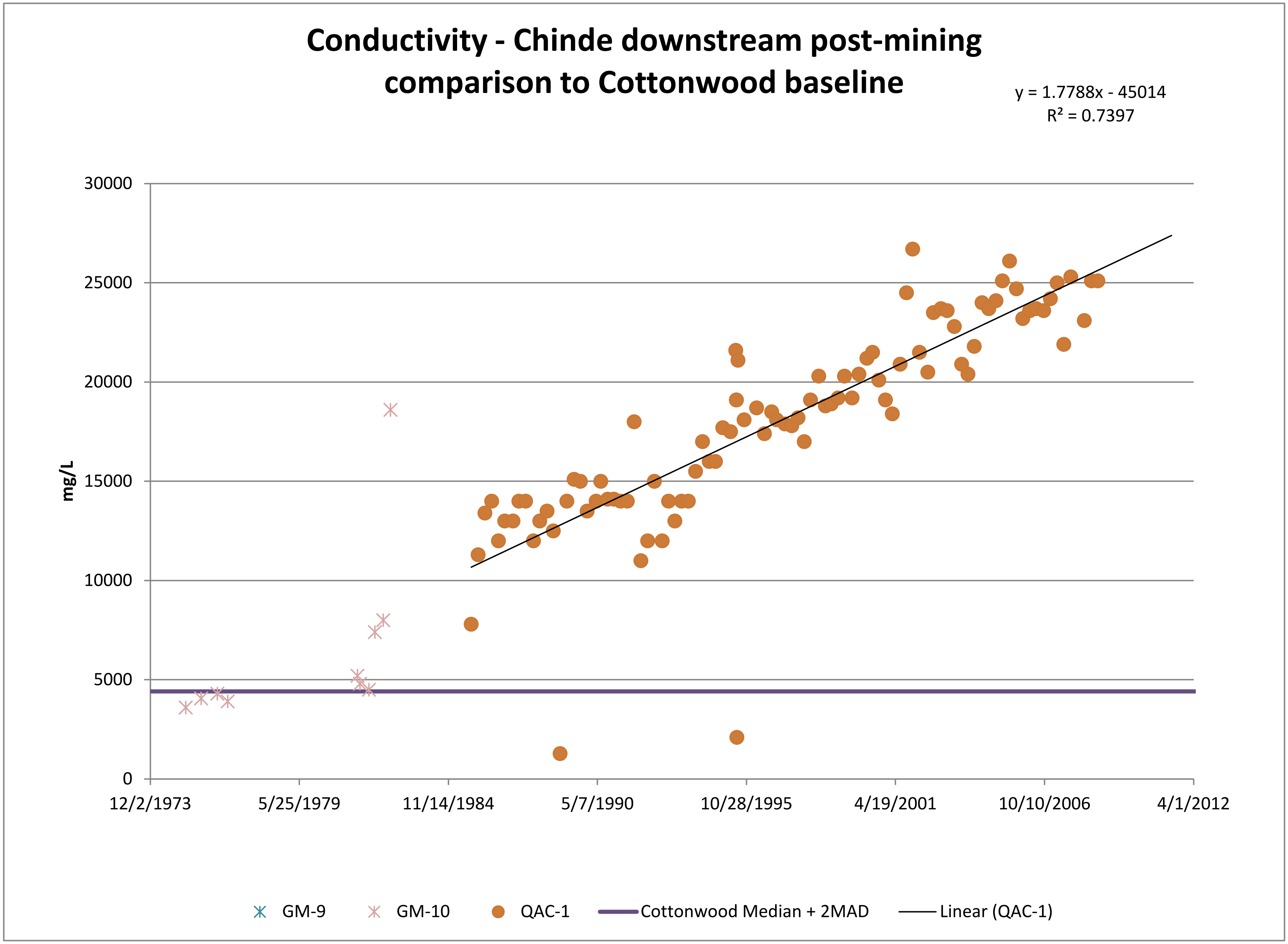

Nitrate - Chinde downstream post-mining comparison to Cottonwood baseline
mg/L
1000
100
10
1
0.1
0.01
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-9
GM-10
QAC-1
Livestock Criteria
Cottonwood Median + 2MAD

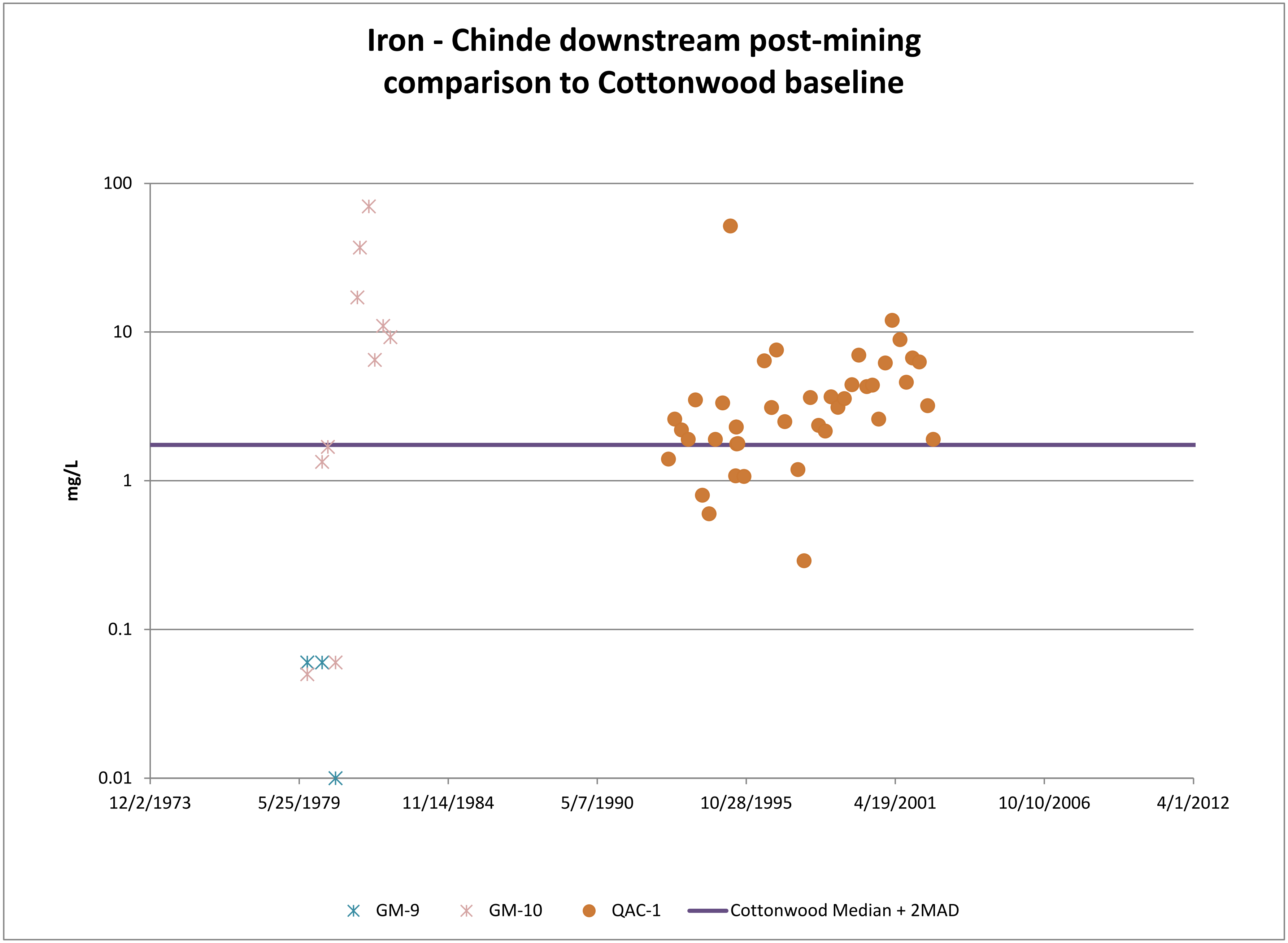

Sulfate - Chinde downstream post-mining comparison to Cottonwood baseline
mg/L
7000
6000
5000
4000
3000
2000
1000
0
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-9
GM-10
QAC-1
Livestock Criteria
Cottonwood Median + 2MAD

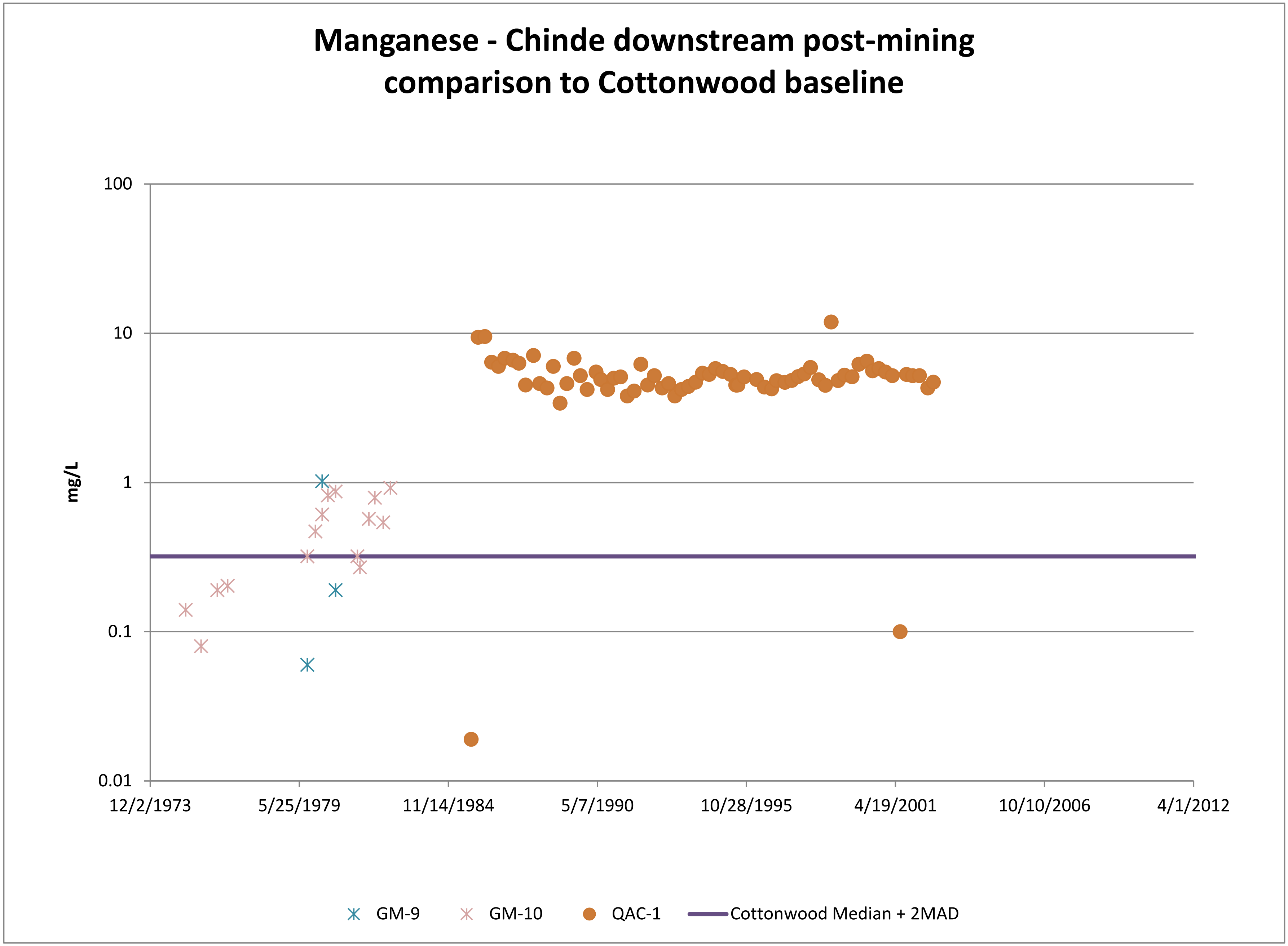

TDS - Chinde downstream post-mining comparison to Cottonwood baseline
y = 0.5508x - 6139.6
R^2 = 0.7909
mg/L
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-9
GM-10
QAC-1
Livestock Criteria
Cottonwood Median + 2MAD
Linear (QAC-1)

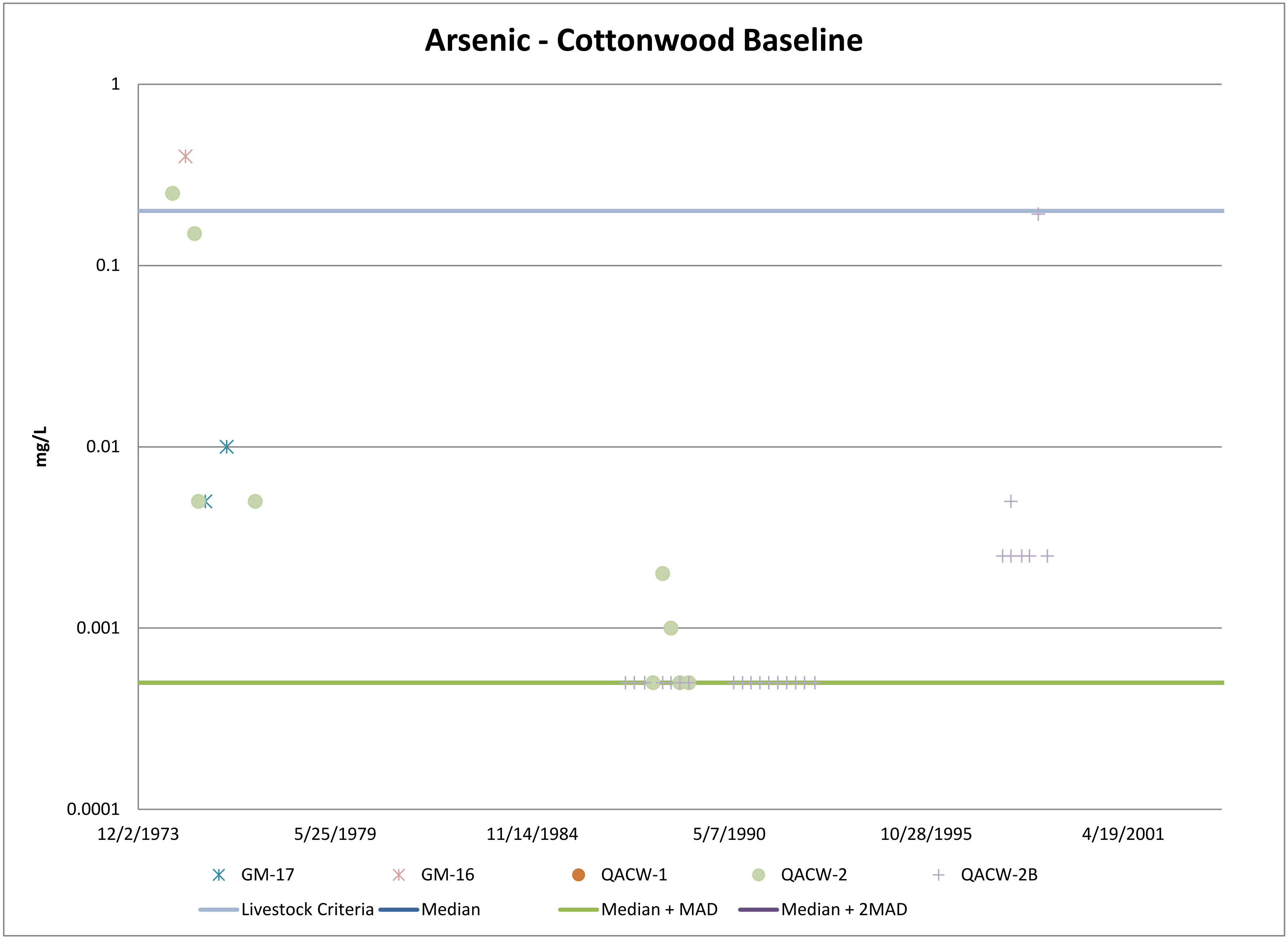

Radium - Chinde downstream post-mining comparison to Cottonwood baseline
mg/L
35
30
25
20
15
10
5
0
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-9
GM-10
QAC-1
Livestock Criteria
Cottonwood Median + 2MAD

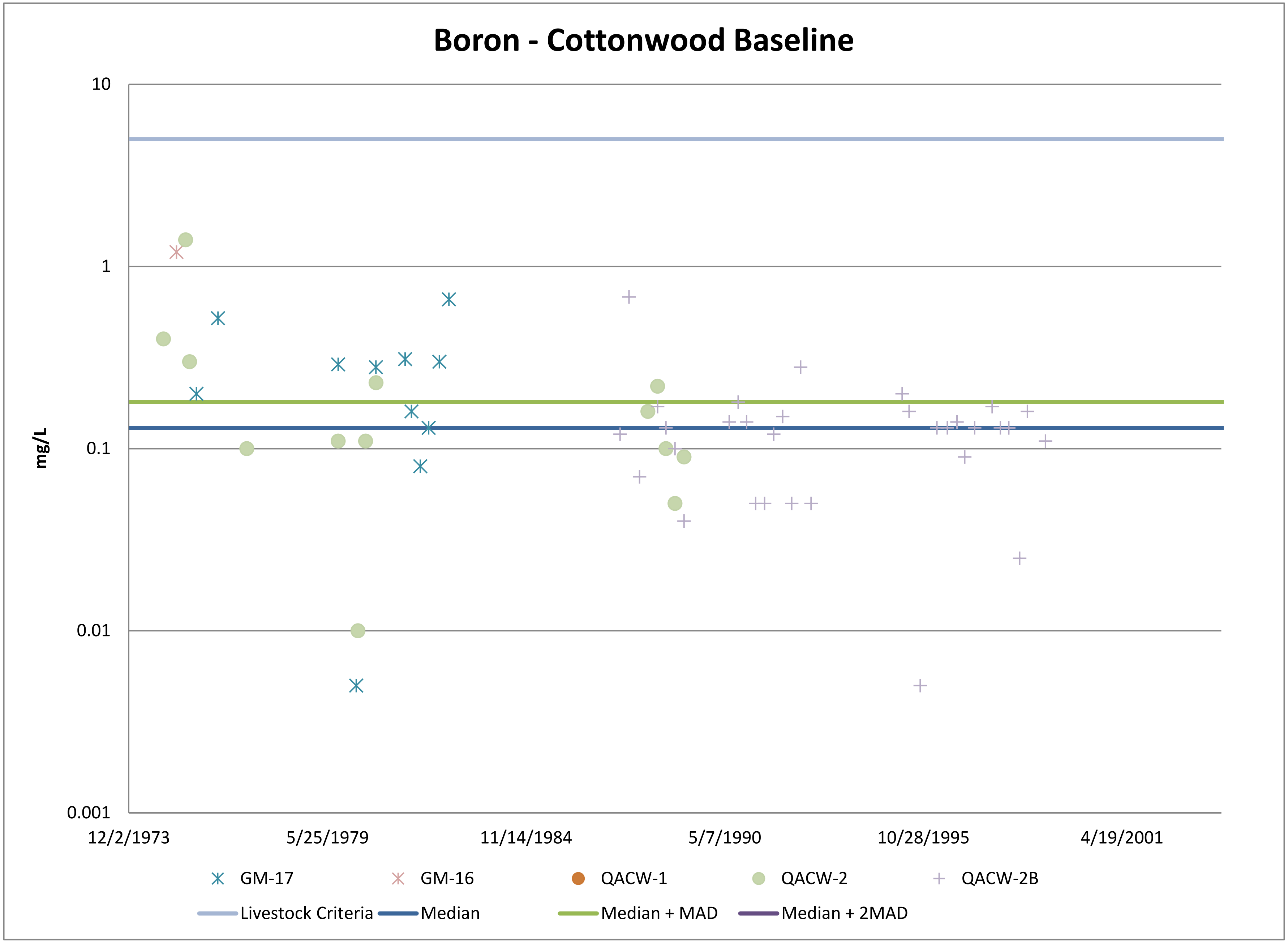

pH - Chinde downstream post-mining comparison to Cottonwood baseline
9.5
9
8.5
8
7.5
7
6.5
6
mg/L
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-9
GM-10
QAC-1
Livestock Criteria
Cottonwood Median +/- 2MAD
-2MAD

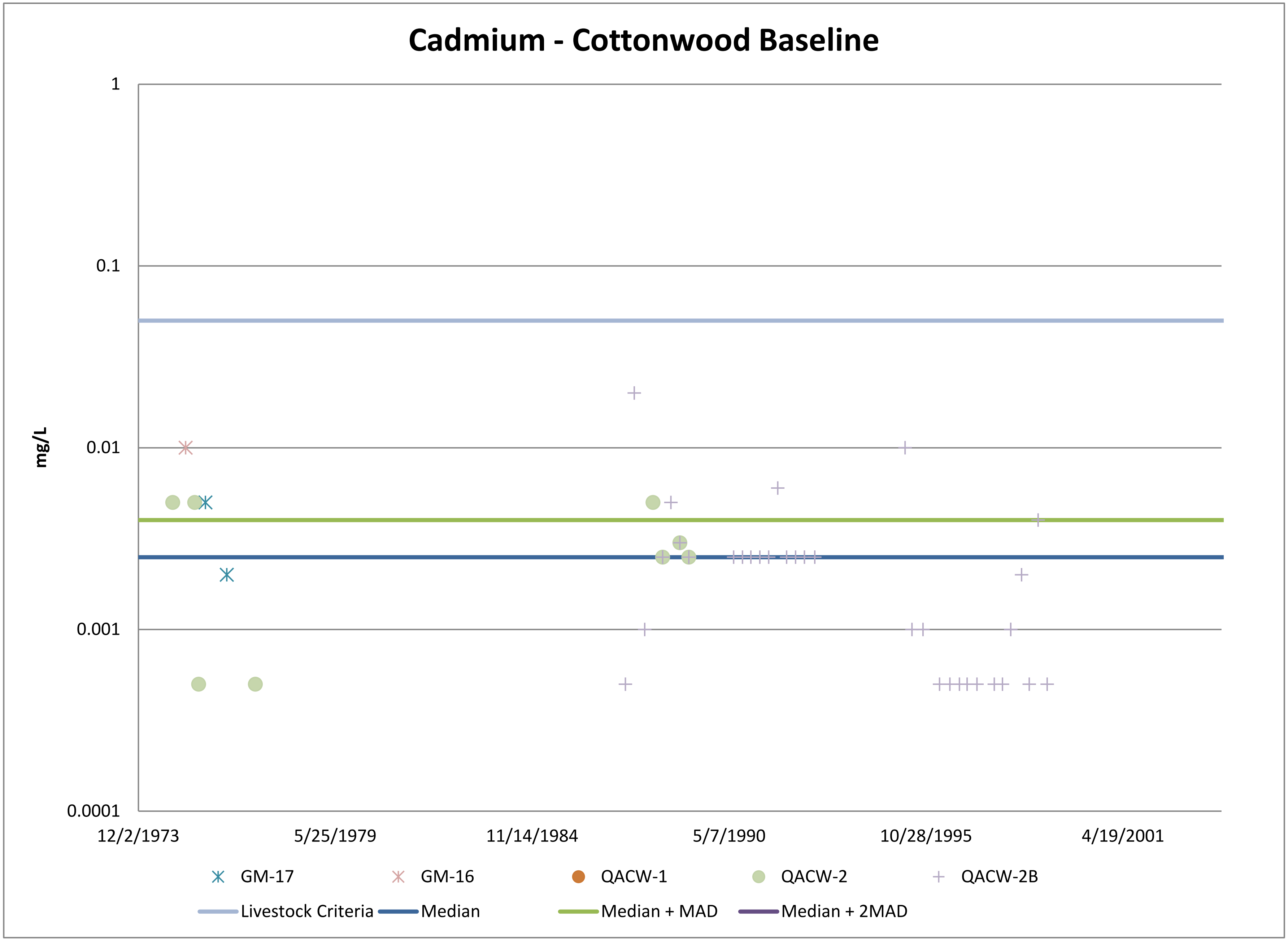

Conductivity - Chinde downstream post-mining comparison to Cottonwood baseline
y = 1.7788x - 45014
R² = 0.7397
mg/L
30000
25000
20000
15000
10000
5000
0
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-9
GM-10
QAC-1
Cottonwood Median + 2MAD
Linear (QAC-1)

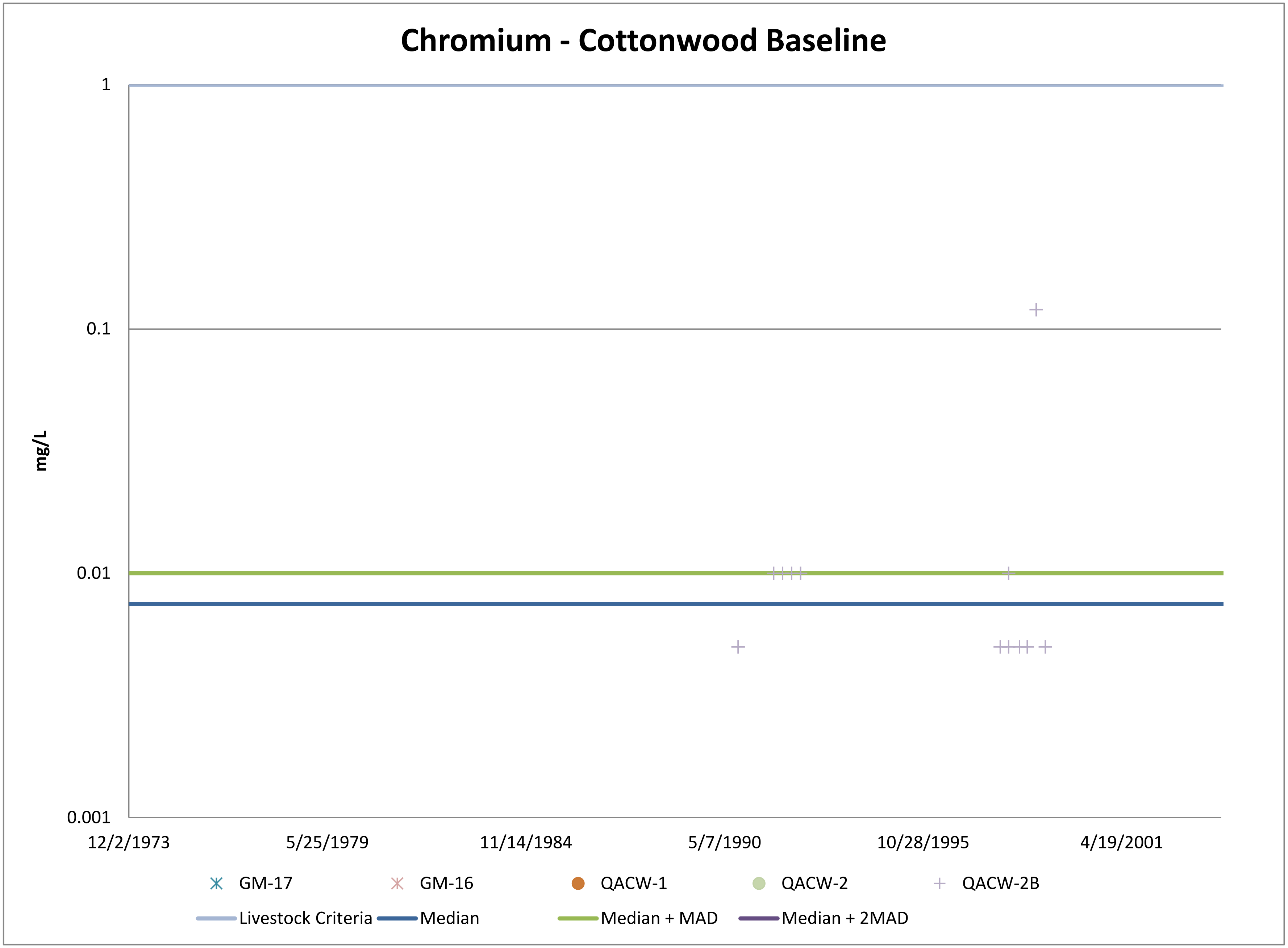

Iron - Chinde downstream post-mining comparison to Cottonwood baseline
mg/L
100
10
1
0.1
0.01
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-9
GM-10
QAC-1
Cottonwood Median + 2MAD

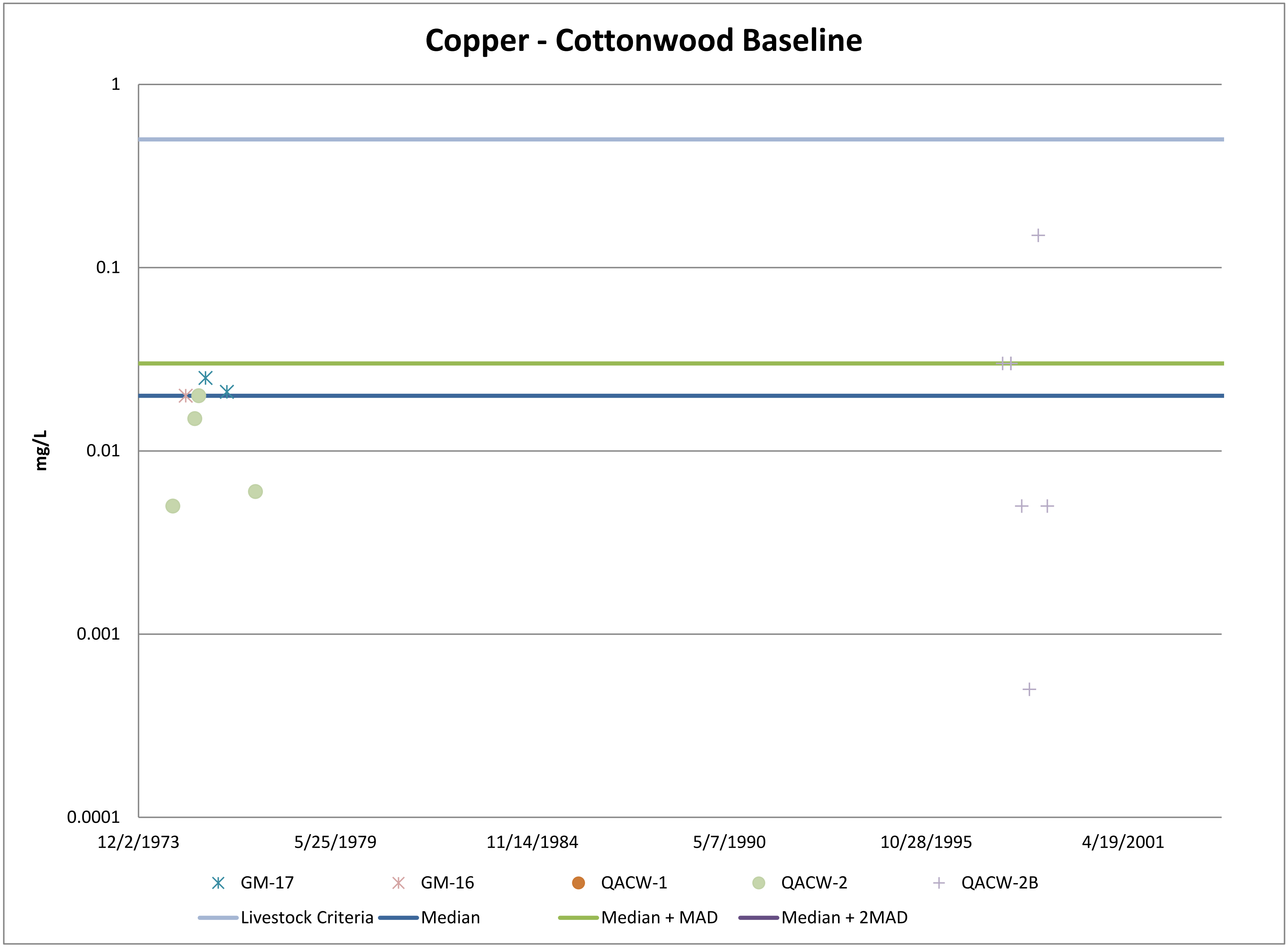

Manganese - Chinde downstream post-mining comparison to Cottonwood baseline
mg/L
100
10
1
0.1
0.01
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-9
GM-10
QAC-1
Cottonwood Median + 2MAD

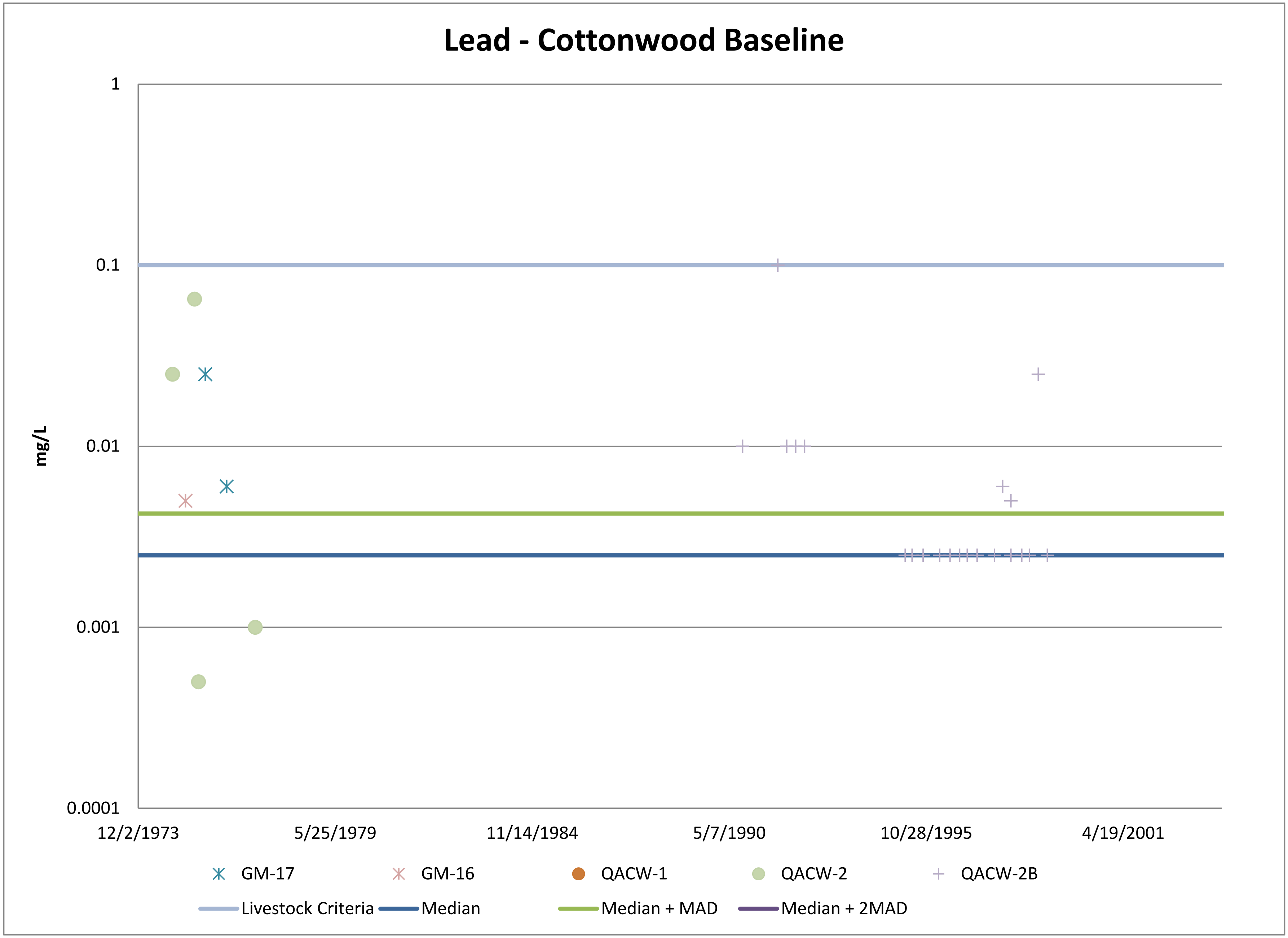

Arsenic - Cottonwood Baseline
mg/L
1
0.1
0.01
0.001
0.0001
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
GM-17
GM-16
QACW-1
QACW-2
QACW-2B
Livestock Criteria
Median
Median + MAD
Median + 2MAD

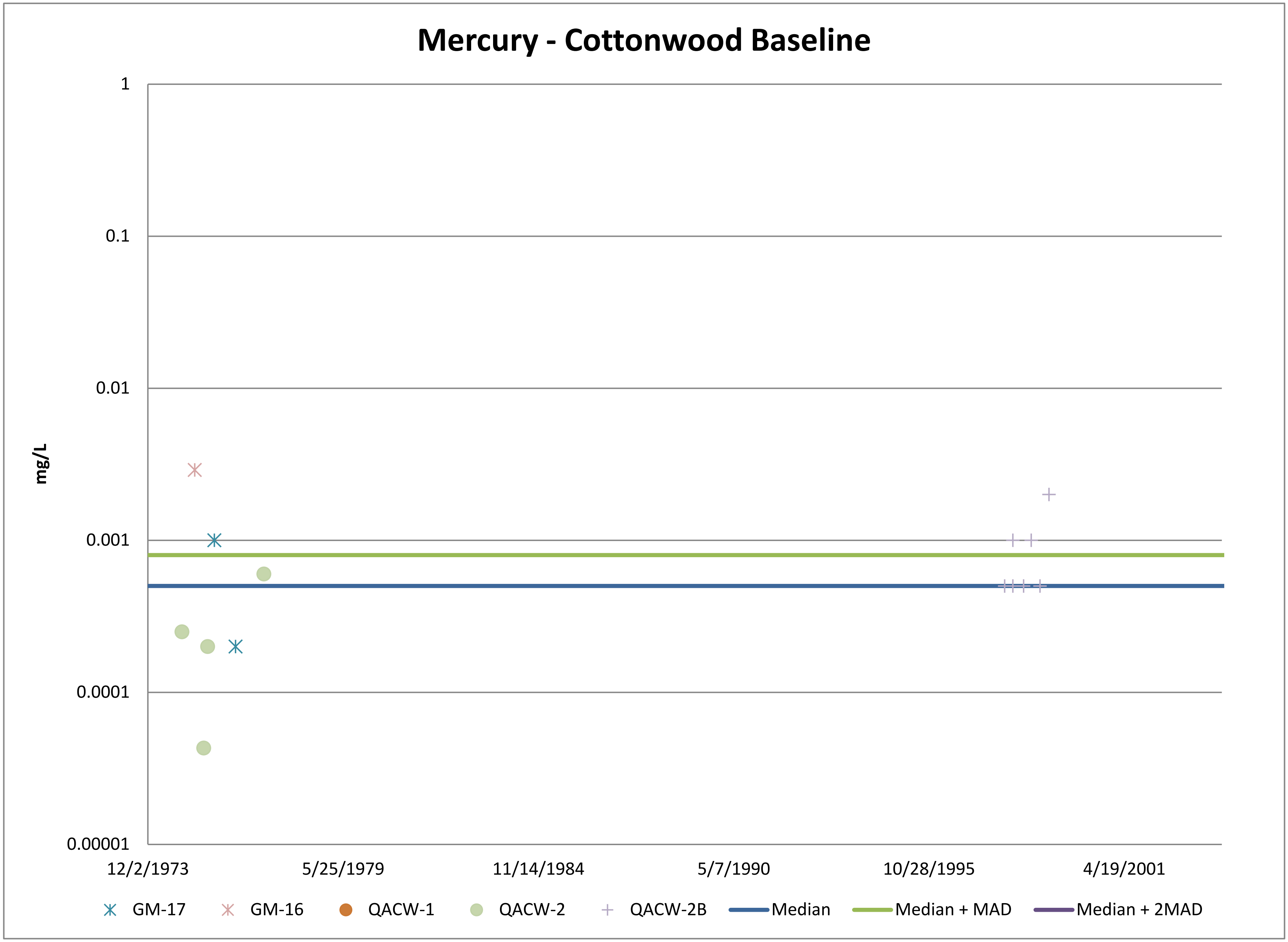

Boron - Cottonwood Baseline
10
1
0.1
0.01
0.001
mg/L
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
GM-17
GM-16
QACW-1
QACW-2
QACW-2B
Livestock Criteria
Median
Median + MAD
Median + 2MAD

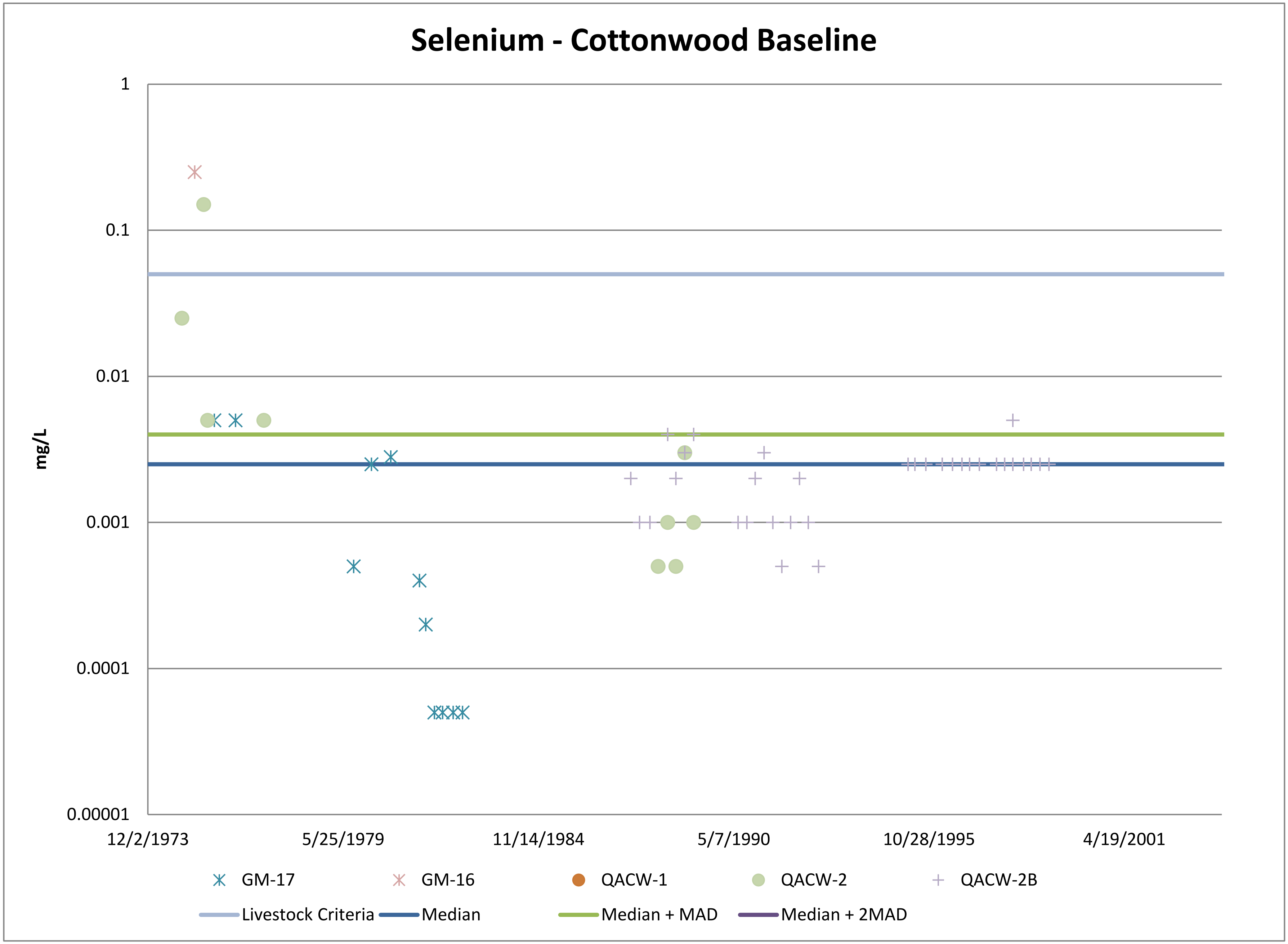

Cadmium - Cottonwood Baseline
mg/L
1
0.1
0.01
0.001
0.0001
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
GM-17
GM-16
QACW-1
QACW-2
QACW-2B
Livestock Criteria
Median
Median + MAD
Median + 2MAD

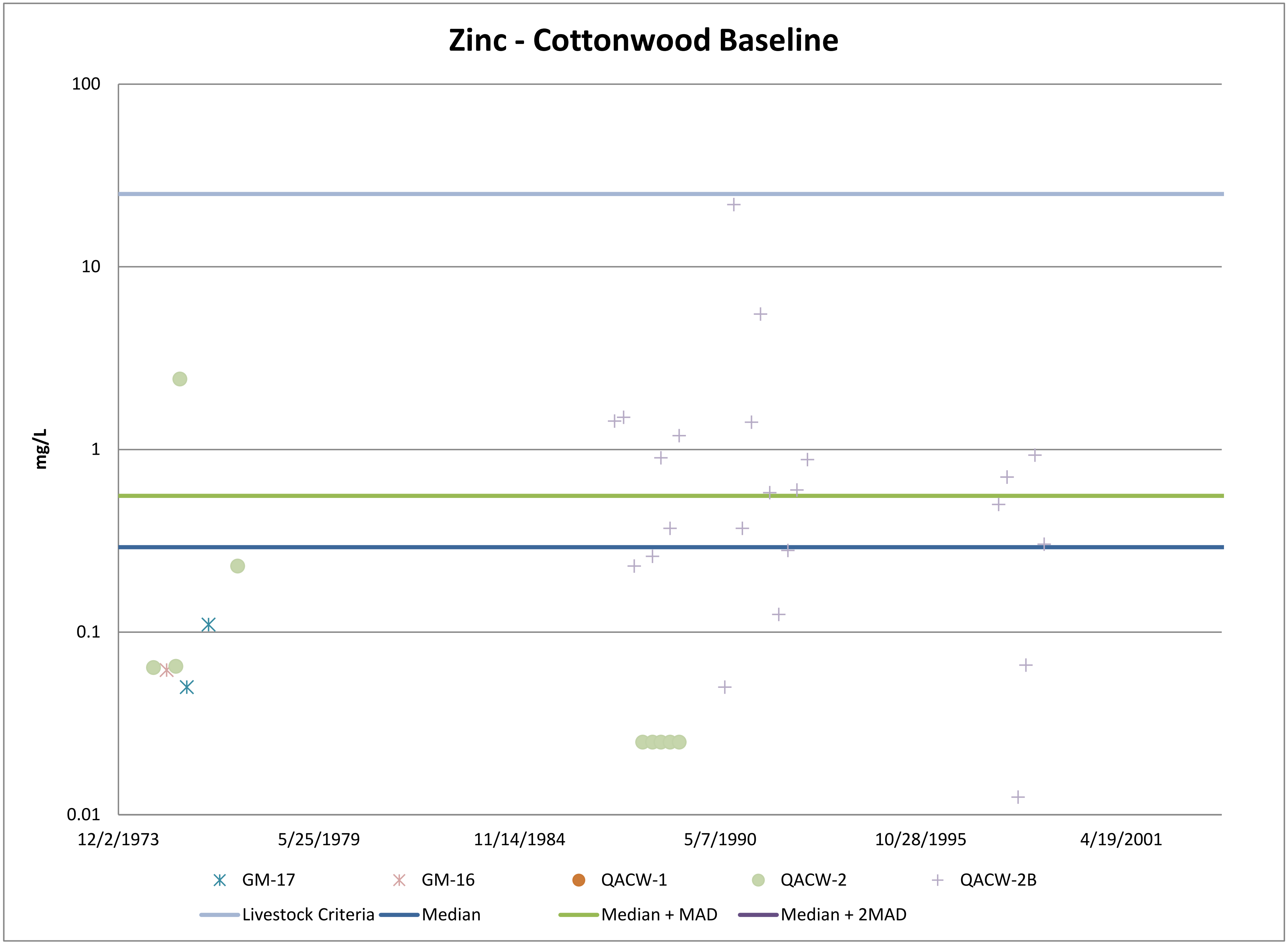

Chromium - Cottonwood Baseline
mg/L
1
0.1
0.01
0.001
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
GM-17
GM-16
QACW-1
QACW-2
QACW-2B
Livestock Criteria
Median
Median + MAD
Median + 2MAD

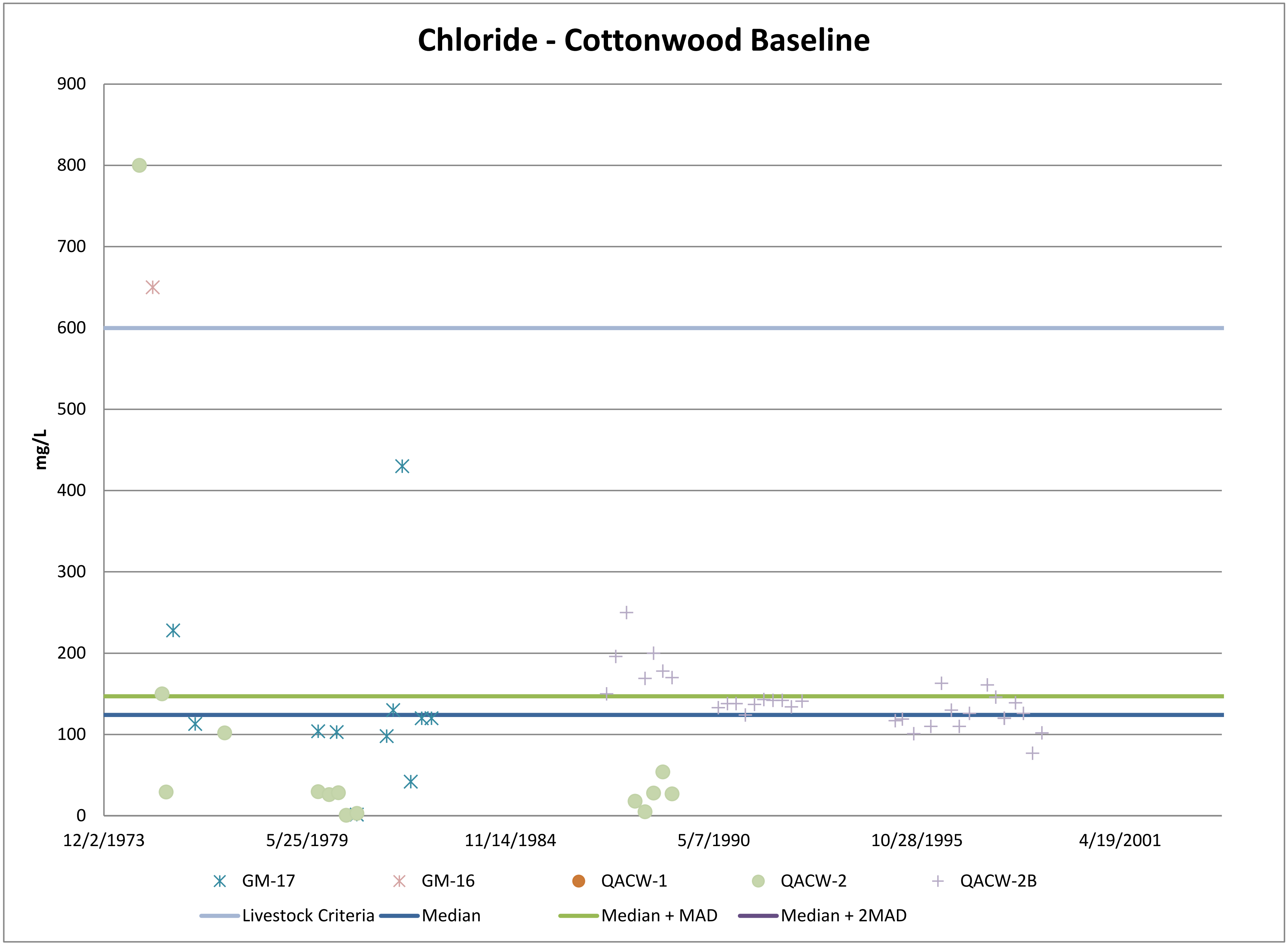

Copper - Cottonwood Baseline
1
0.1
0.01
0.001
0.0001
mg/L
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
GM-17
GM-16
QACW-1
QACW-2
QACW-2B
Livestock Criteria
Median
Median + MAD
Median + 2MAD

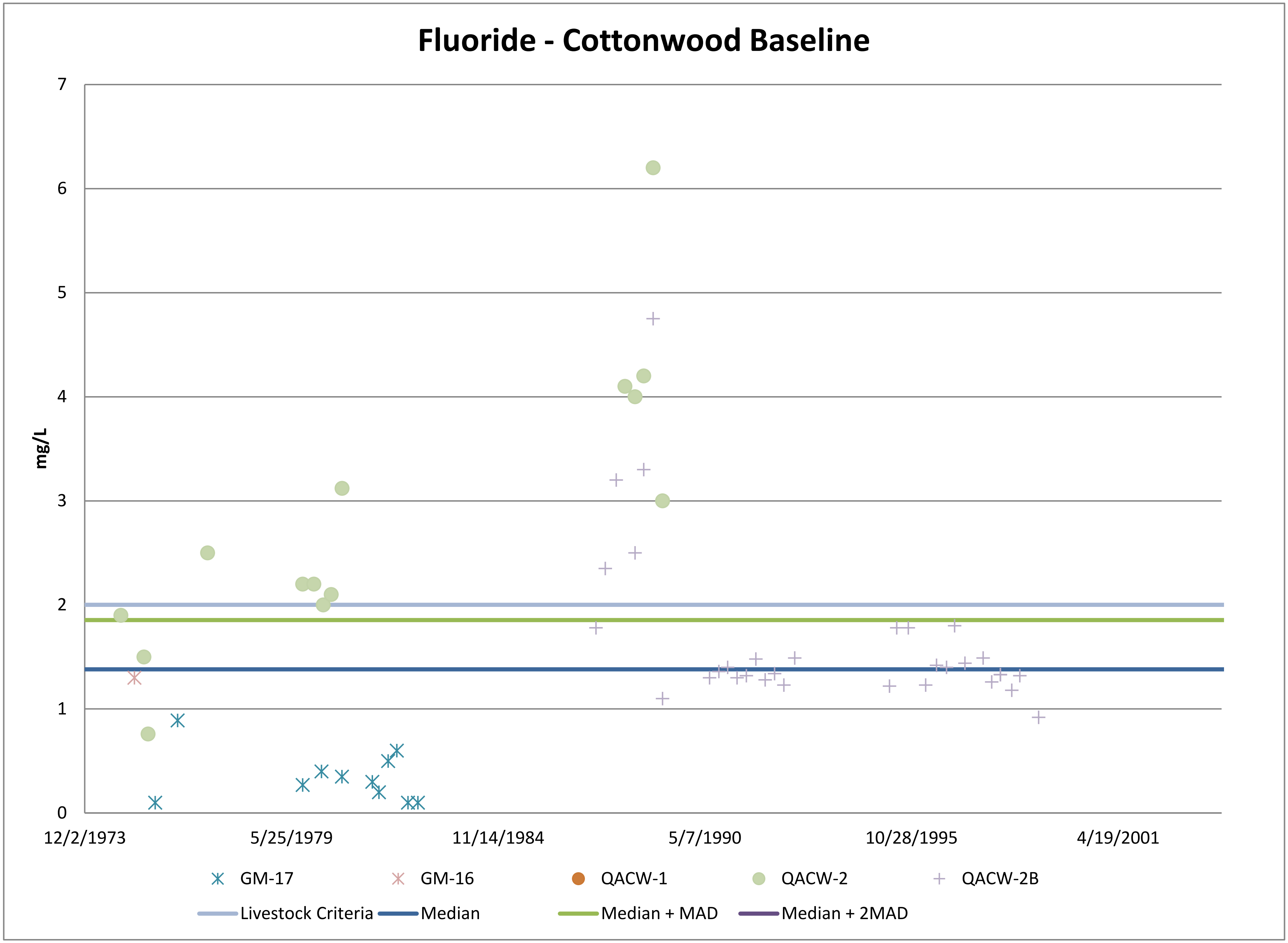

Lead - Cottonwood Baseline
mg/L
1
0.1
0.01
0.001
0.0001
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
GM-17
GM-16
QACW-1
QACW-2
QACW-2B
Livestock Criteria
Median
Median + MAD
Median + 2MAD

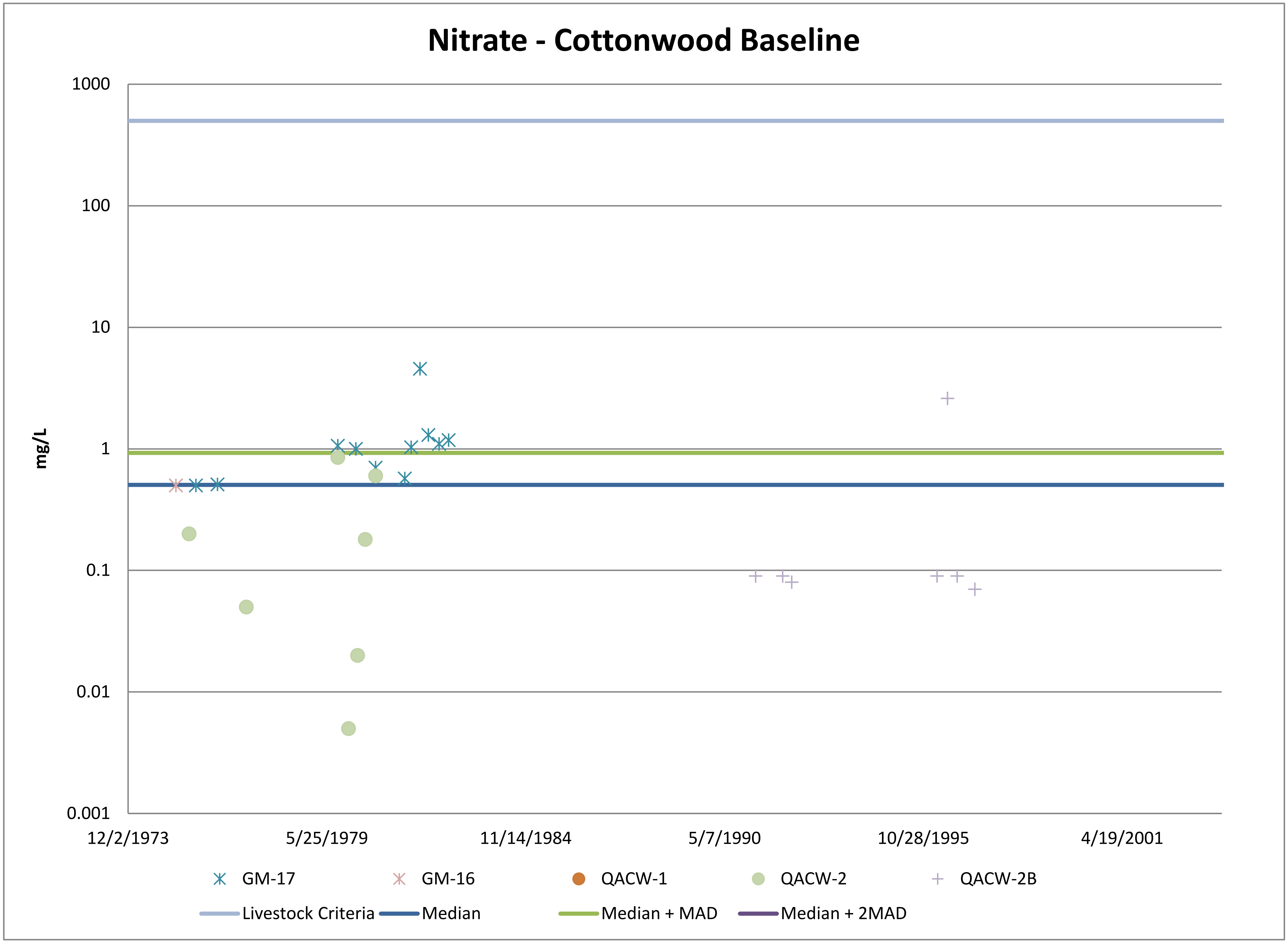

Mercury - Cottonwood Baseline
mg/L
1
0.1
0.01
0.001
0.0001
0.00001
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
GM-17
GM-16
QACW-1
QACW-2
QACW-2B
Median
Median + MAD
Median + 2MAD

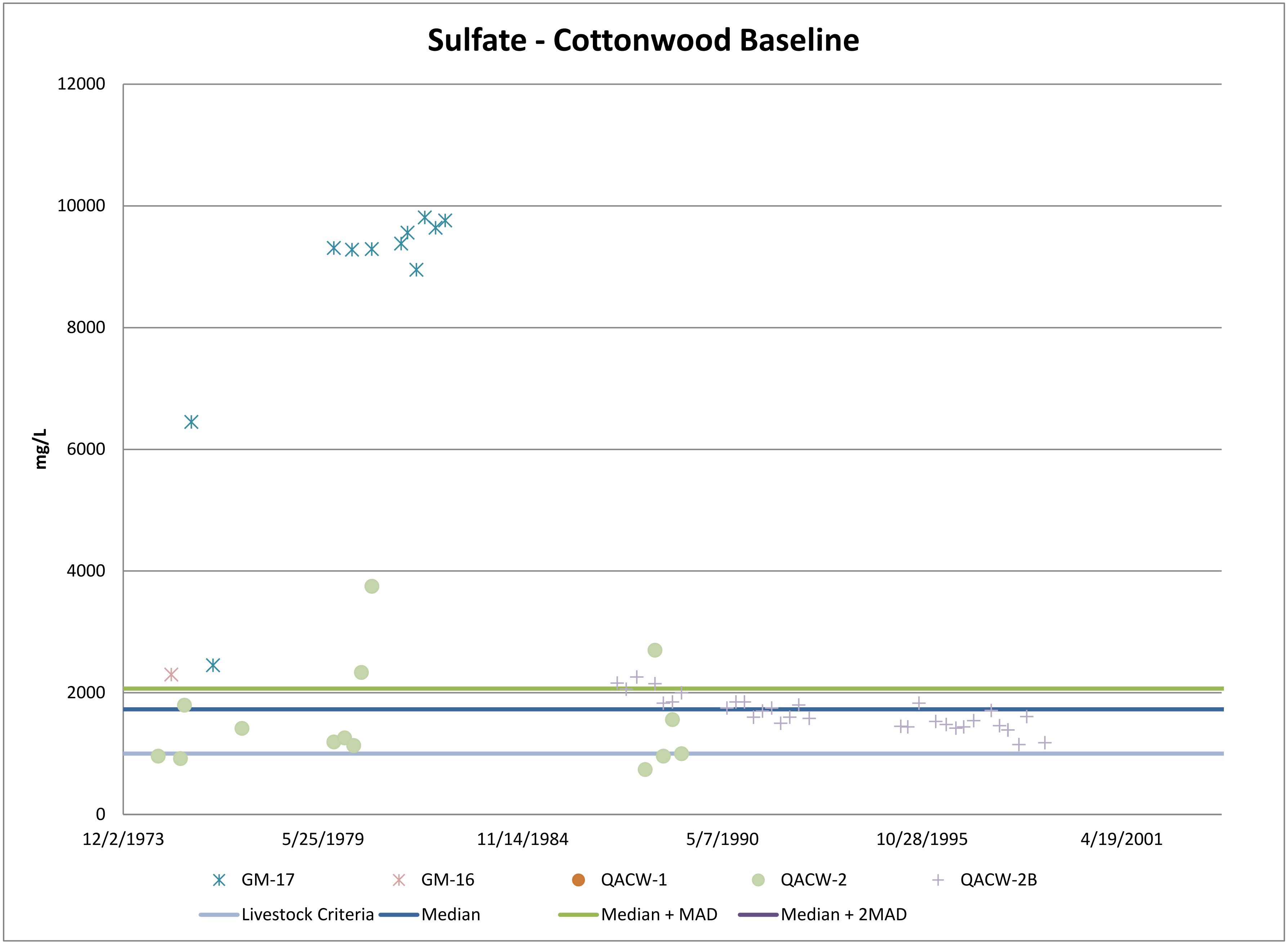

Selenium - Cottonwood Baseline
mg/L
1
0.1
0.01
0.001
0.0001
0.00001
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
GM-17
GM-16
QACW-1
QACW-2
QACW-2B
Livestock Criteria
Median
Median + MAD
Median + 2MAD

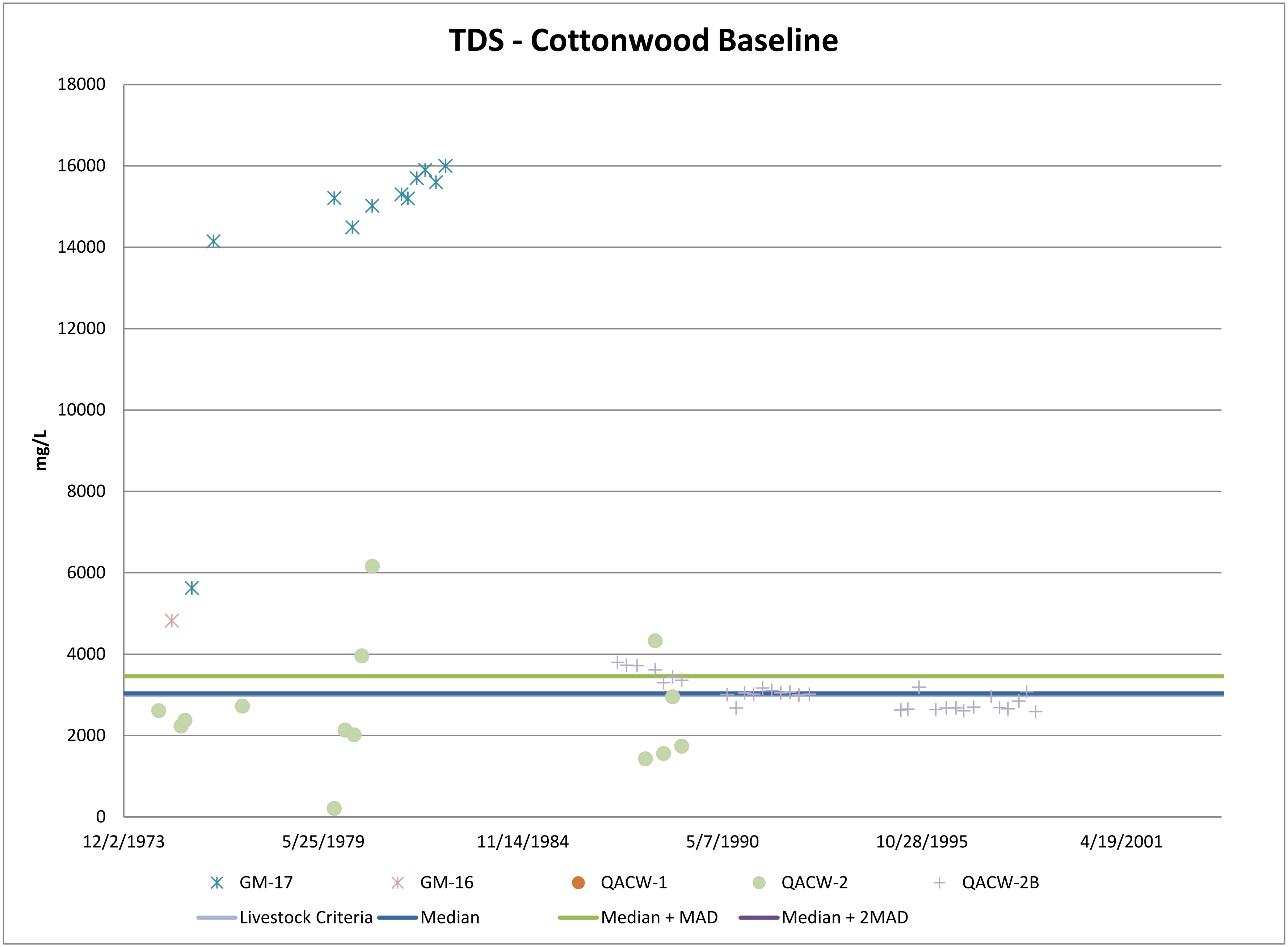

Zinc - Cottonwood Baseline
100
10
1
0.1
0.01
mg/L
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
GM-17
GM-16
QACW-1
QACW-2
QACW-2B
Livestock Criteria
Median
Median + MAD
Median + 2MAD

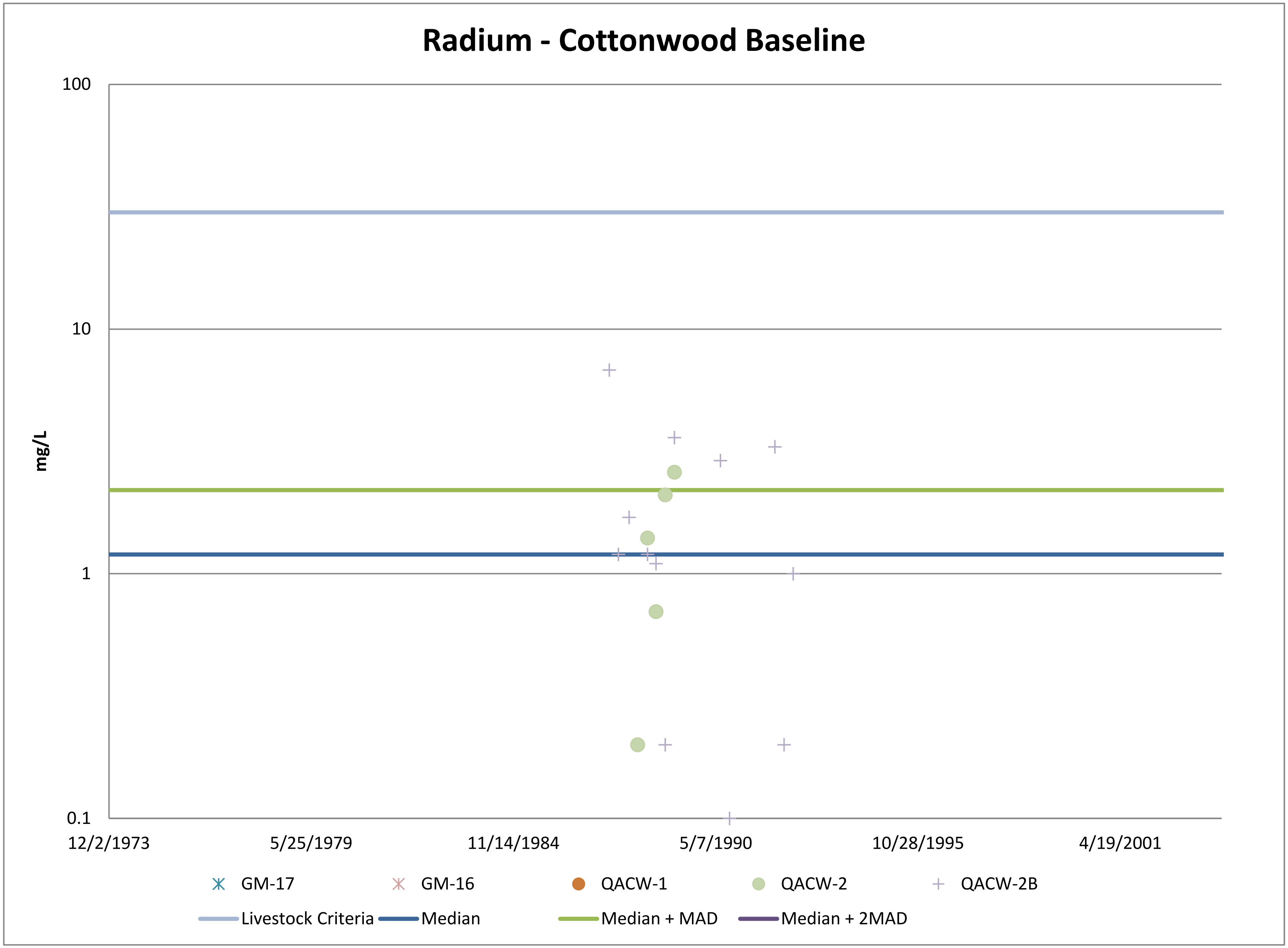

Chloride - Cottonwood Baseline
mg/L
900
800
700
600
500
400
300
200
100
0
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
GM-17
GM-16
QACW-1
QACW-2
QACW-2B
Livestock Criteria
Median
Median + MAD
Median + 2MAD

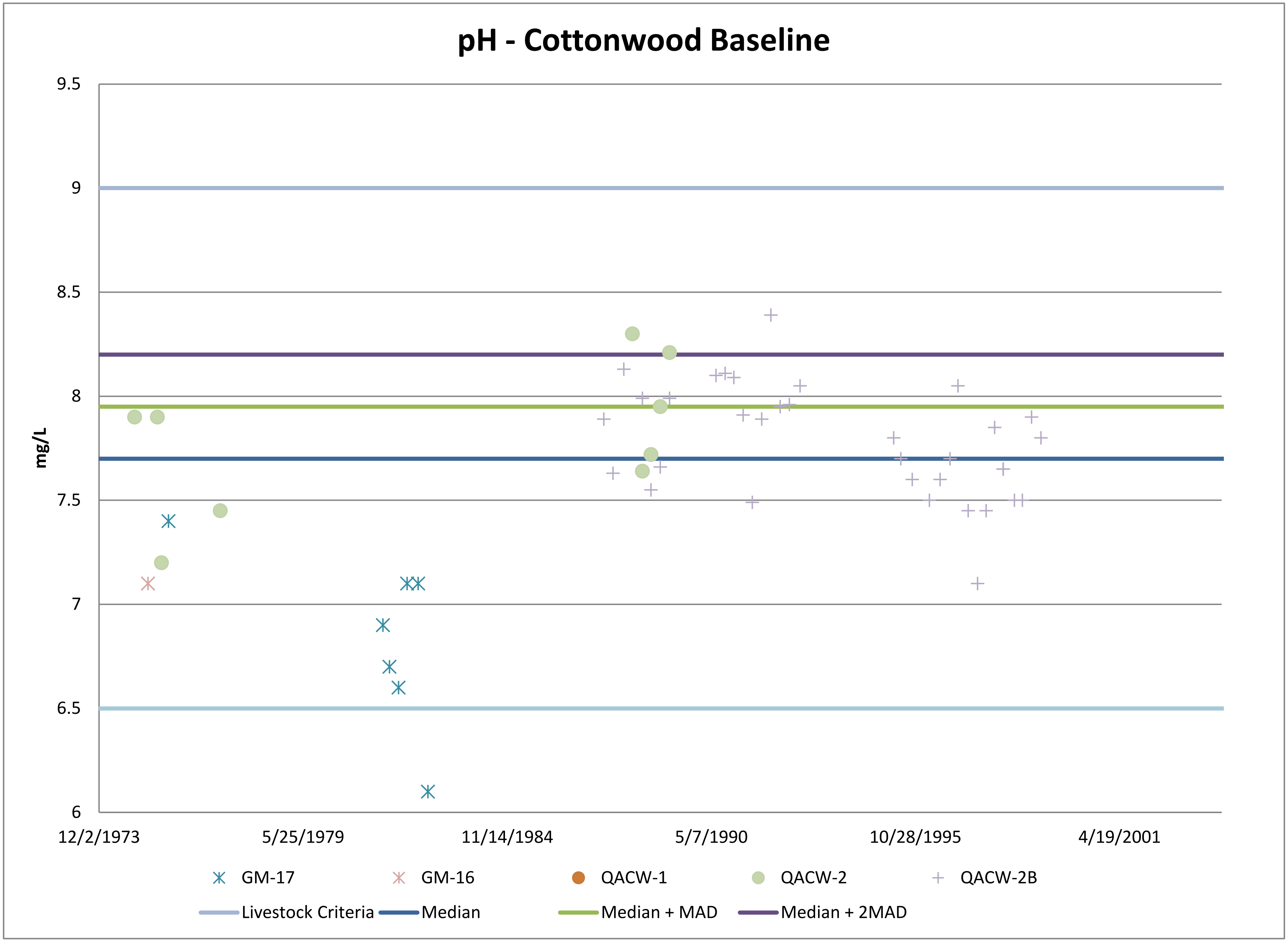

Fluoride - Cottonwood Baseline
mg/L
0
1
2
3
4
5
6
7
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
GM-17
GM-16
QACW-1
QACW-2
QACW-2B
Livestock Criteria
Median
Median + MAD
Median + 2MAD

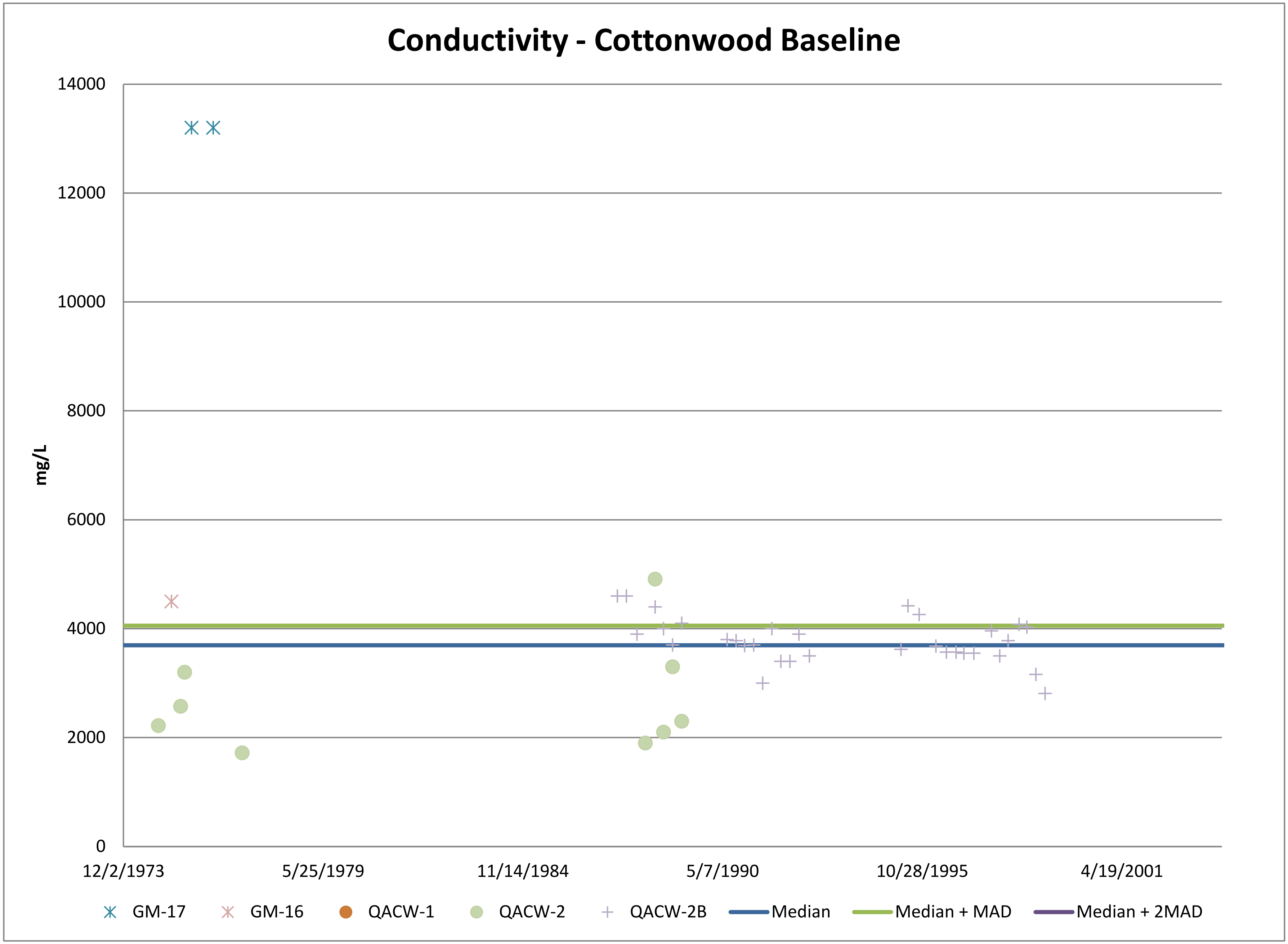

Nitrate - Cottonwood Baseline
mg/L
1000
100
10
1
0.1
0.01
0.001
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
GM-17
GM-16
QACW-1
QACW-2
QACW-2B
Livestock Criteria
Median
Median + MAD
Median + 2MAD

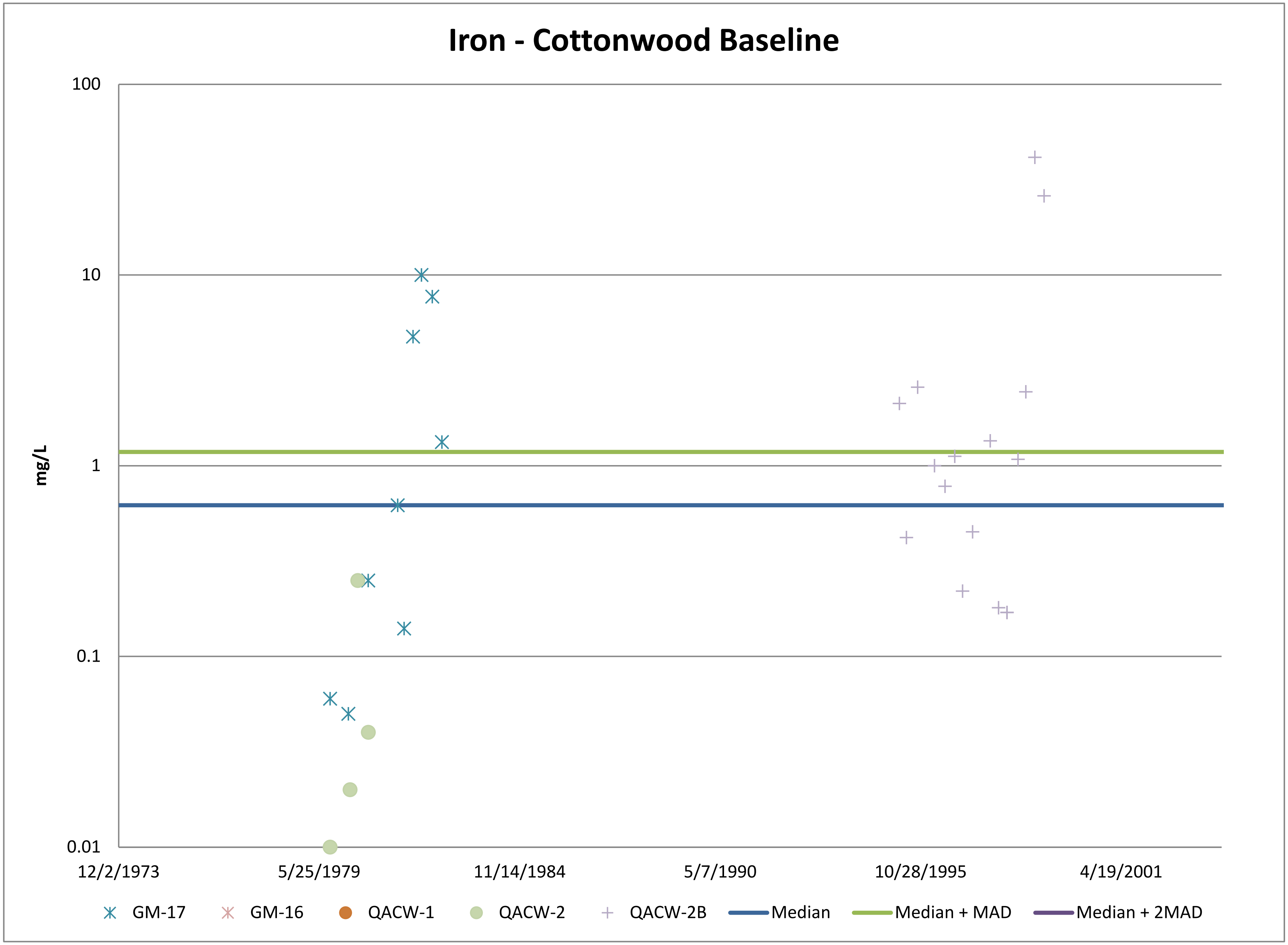

Sulfate - Cottonwood Baseline
mg/L
12000
10000
8000
6000
4000
2000
0
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
GM-17
GM-16
QACW-1
QACW-2
QACW-2B
Livestock Criteria
Median
Median + MAD
Median + 2MAD

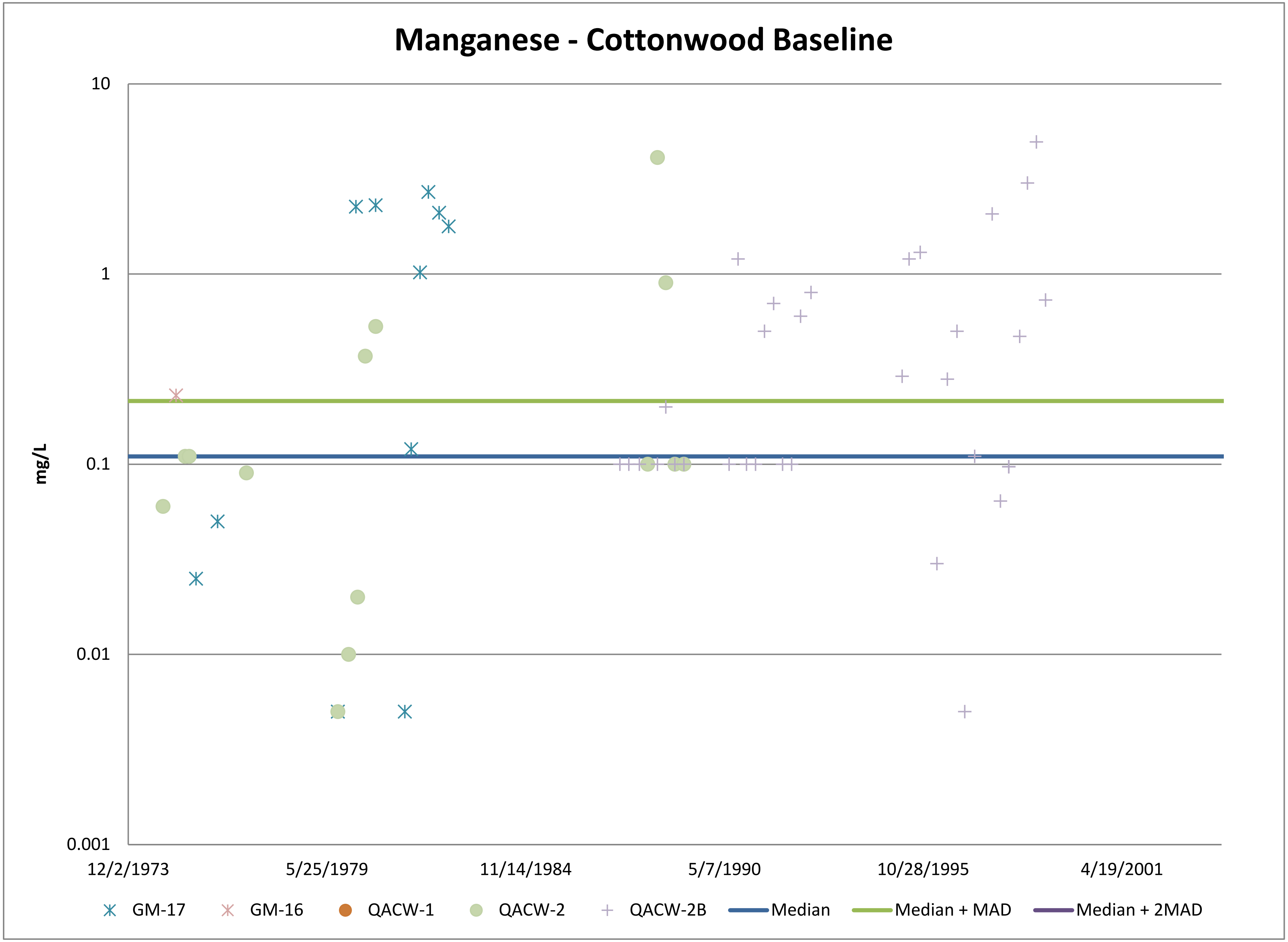

TDS - Cottonwood Baseline
mg/L
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
GM-17
GM-16
QACW-1
QACW-2
QACW-2B
Livestock Criteria
Median
Median + MAD
Median + 2MAD

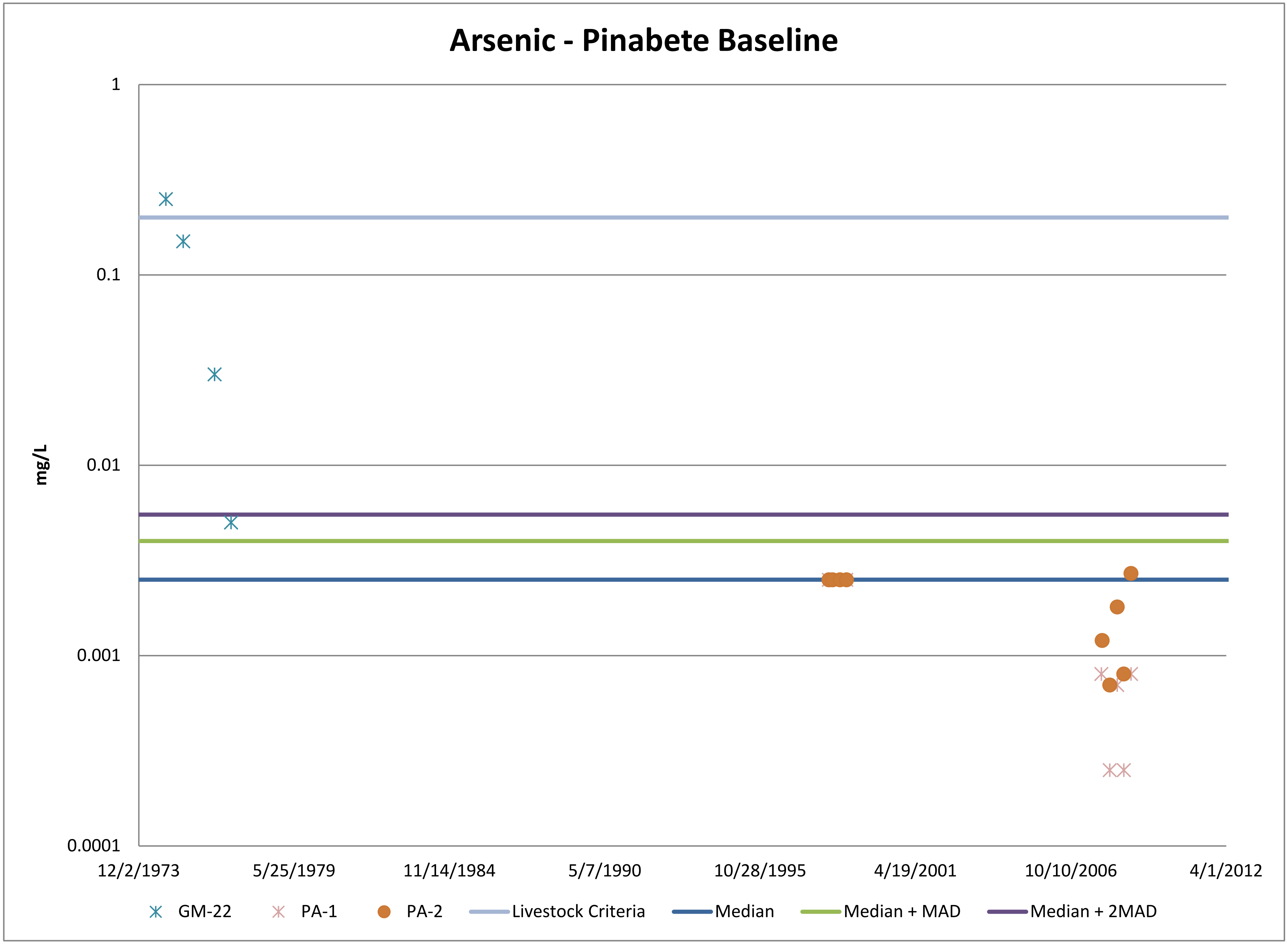

Radium - Cottonwood Baseline
100
10
1
0.1
mg/L
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
GM-17
GM-16
QACW-1
QACW-2
QACW-2B
Livestock Criteria
Median
Median + MAD
Median + 2MAD

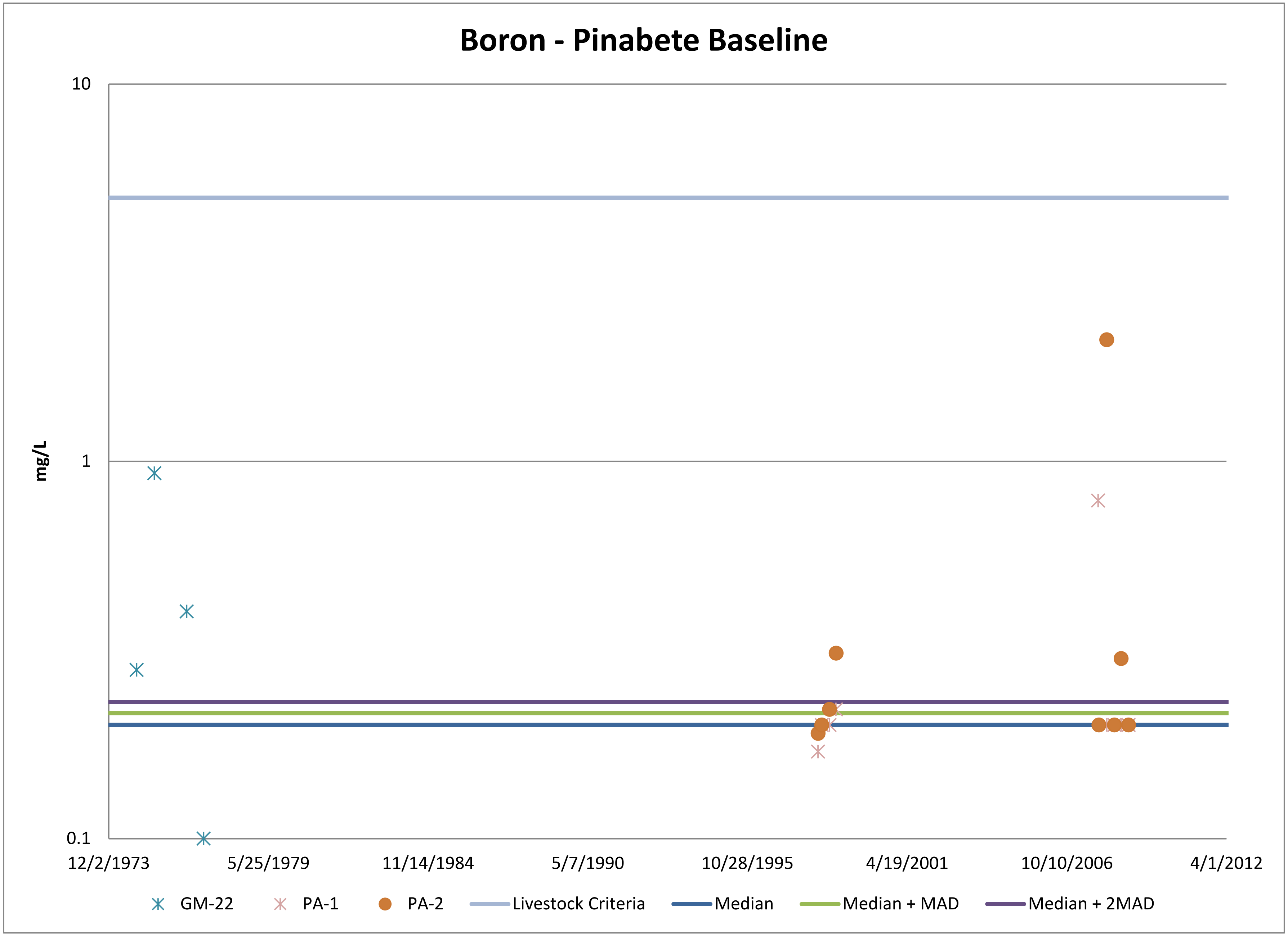

pH - Cottonwood Baseline
mg/L
9.5
9
8.5
8
7.5
7
6.5
6
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
GM-17
GM-16
QACW-1
QACW-2
QACW-2B
Livestock Criteria
Median
Median + MAD
Median + 2MAD

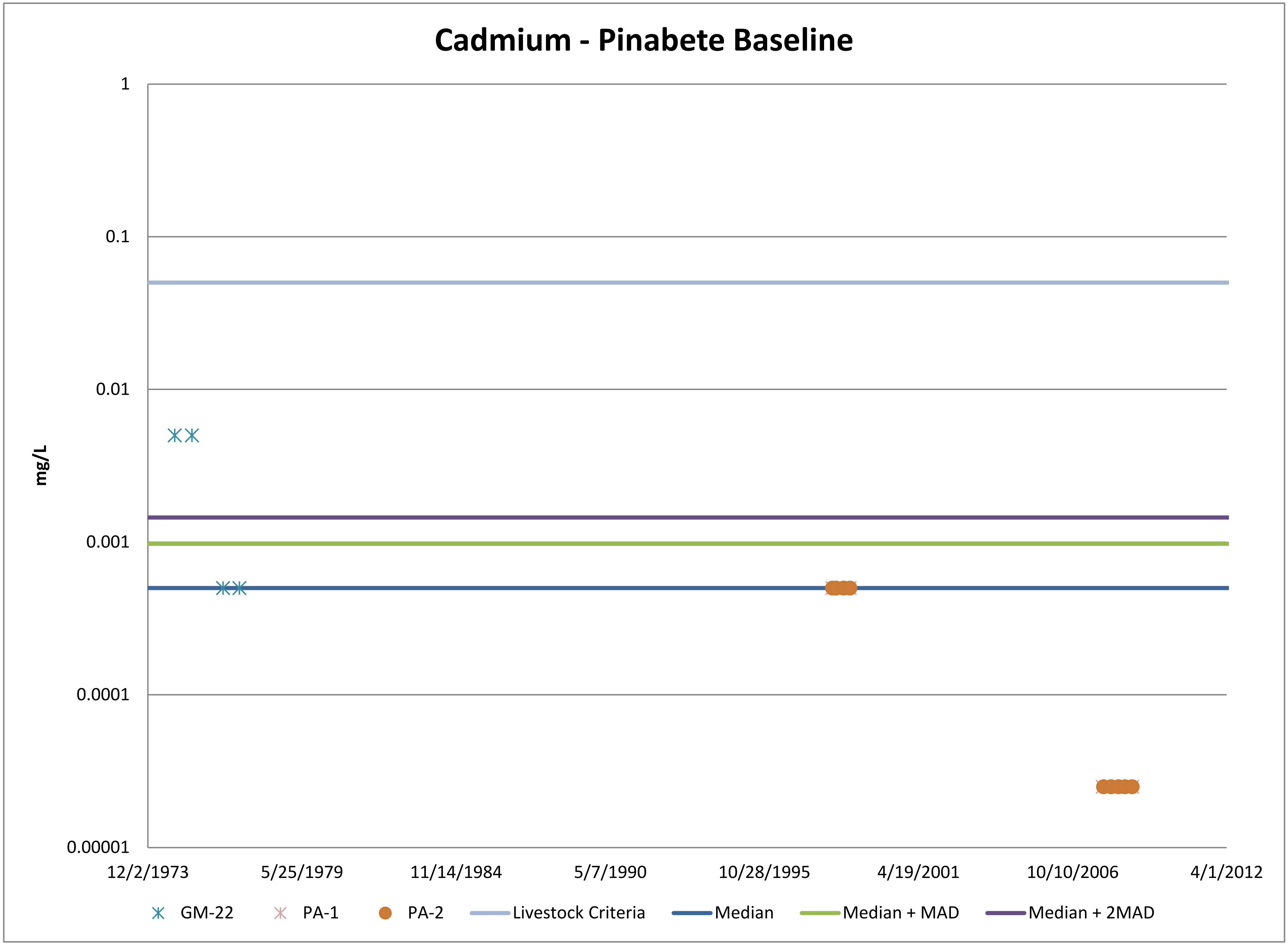

Conductivity - Cottonwood Baseline
mg/L
14000
12000
10000
8000
6000
4000
2000
0
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
GM-17
GM-16
QACW-1
QACW-2
QACW-2B
Median
Median + MAD
Median + 2MAD

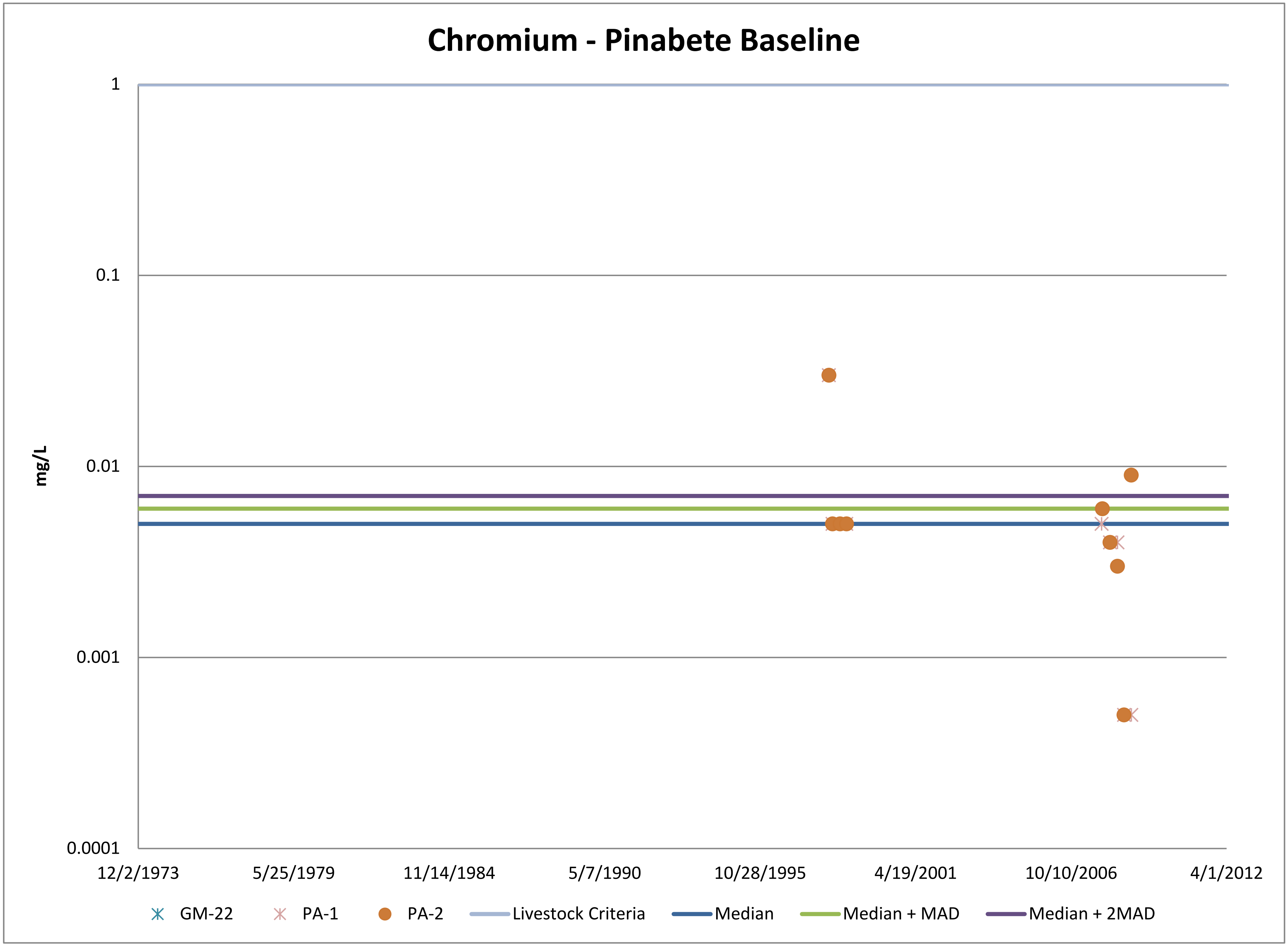

Iron - Cottonwood Baseline
100
10
1
0.1
0.01
mg/L
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
GM-17
GM-16
QACW-1
QACW-2
QACW-2B
Median
Median + MAD
Median + 2MAD


Manganese - Cottonwood Baseline
10
1
0.1
0.01
0.001
mg/L
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
GM-17
GM-16
QACW-1
QACW-2
QACW-2B
Median
Median + MAD
Median + 2MAD

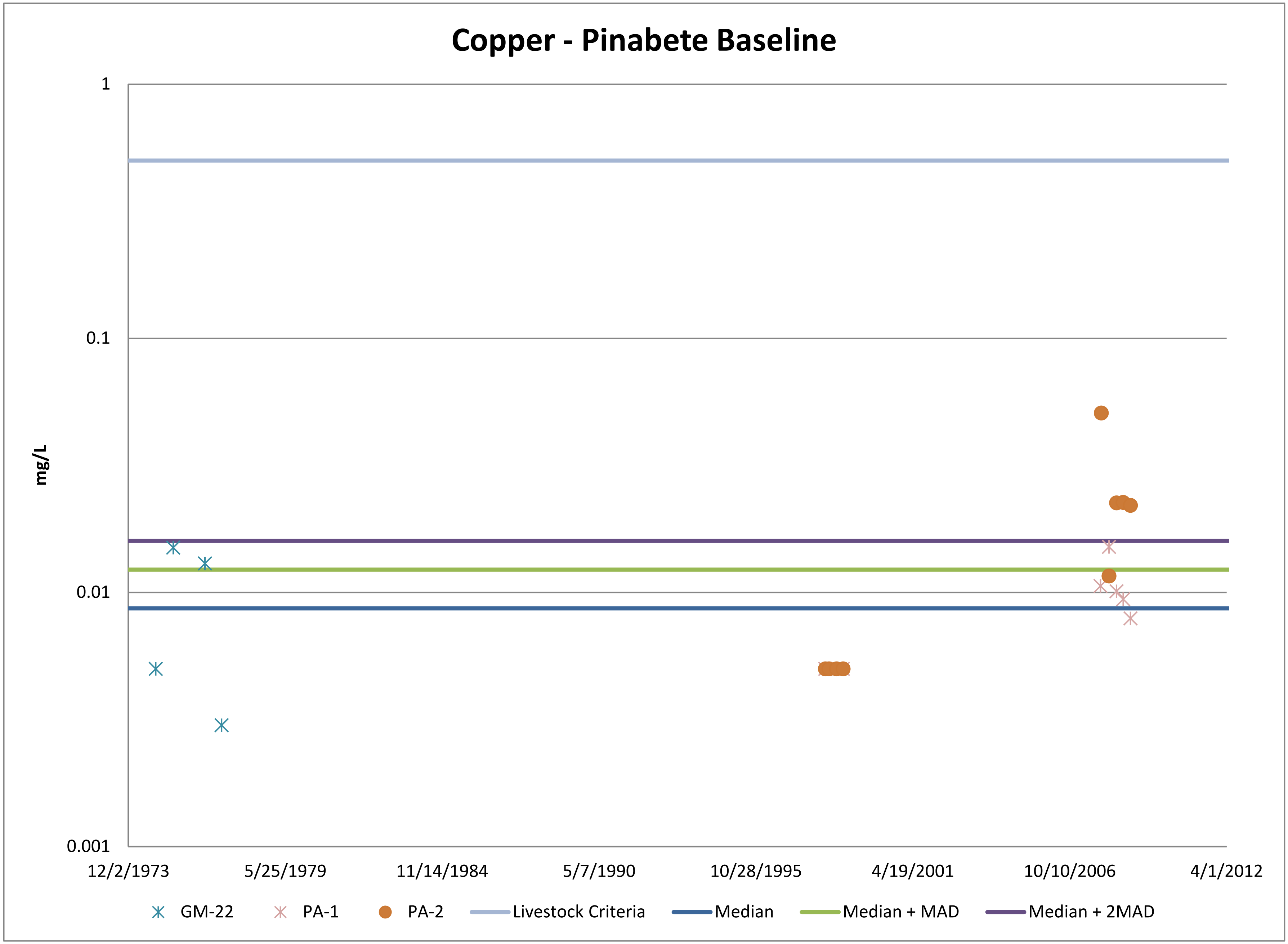

Arsenic - Pinabete Baseline
mg/L
1
0.1
0.01
0.001
0.0001
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-22
PA-1
PA-2
Livestock Criteria
Median
Median + MAD
Median + 2MAD

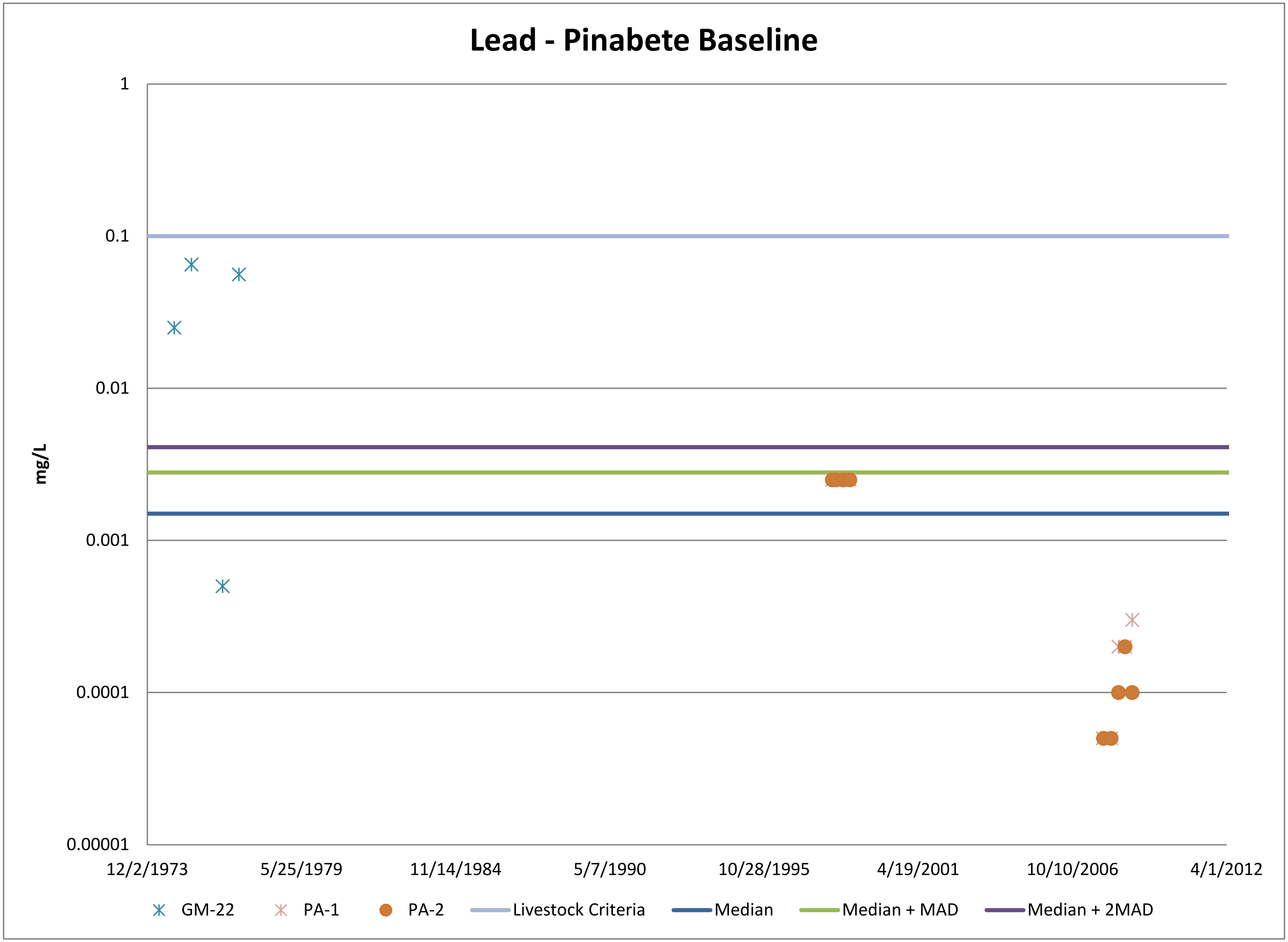

Boron - Pinabete Baseline
mg/L
10
1
0.1
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-22
PA-1
PA-2
Livestock Criteria
Median
Median + MAD
Median + 2MAD

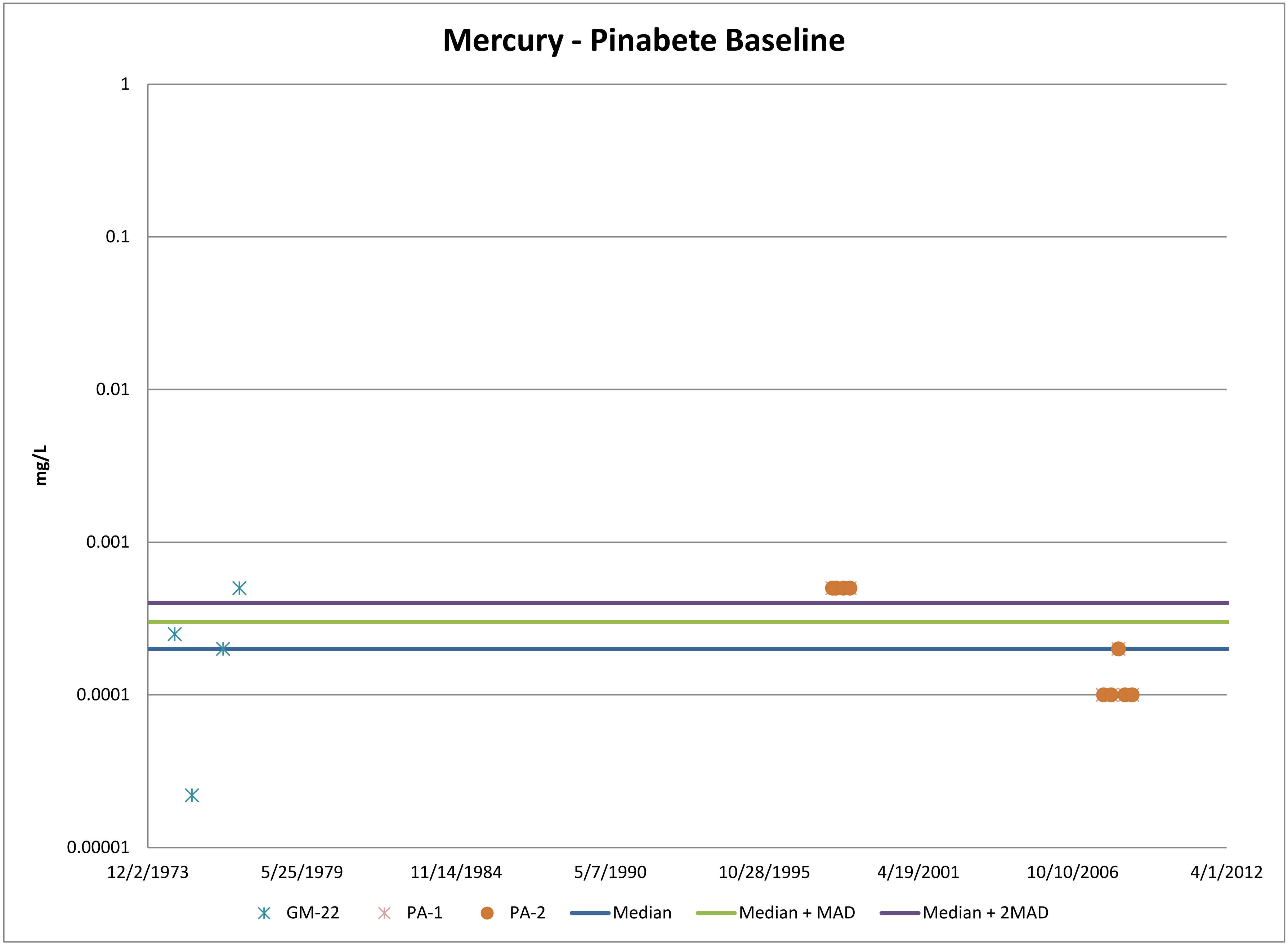

Cadmium - Pinabete Baseline
mg/L
1
0.1
0.01
0.001
0.0001
0.00001
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-22
PA-1
PA-2
Livestock Criteria
Median
Median + MAD
Median + 2MAD

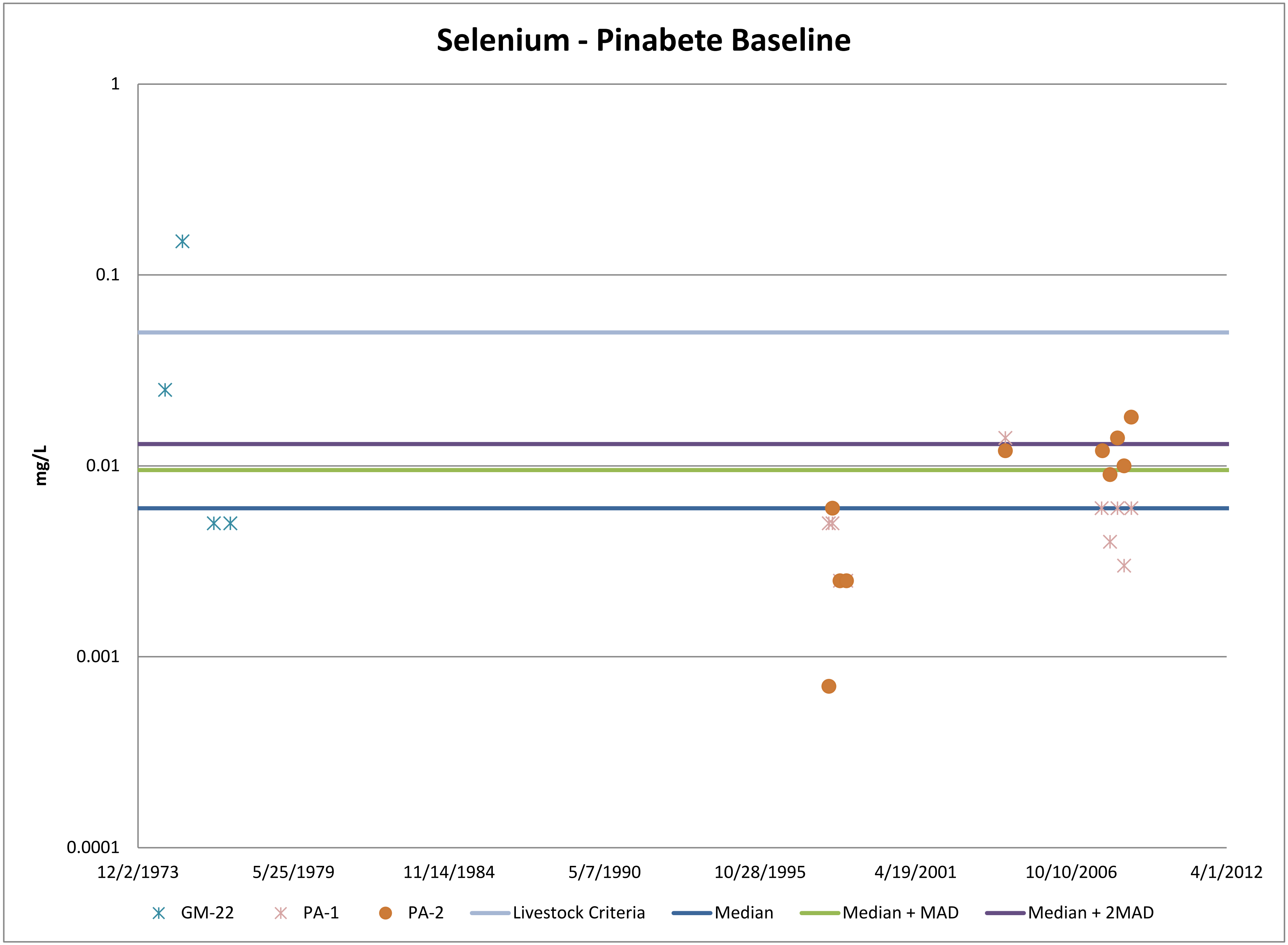

Chromium - Pinabete Baseline
mg/L
1
0.1
0.01
0.001
0.0001
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-22
PA-1
PA-2
Livestock Criteria
Median
Median + MAD
Median + 2MAD

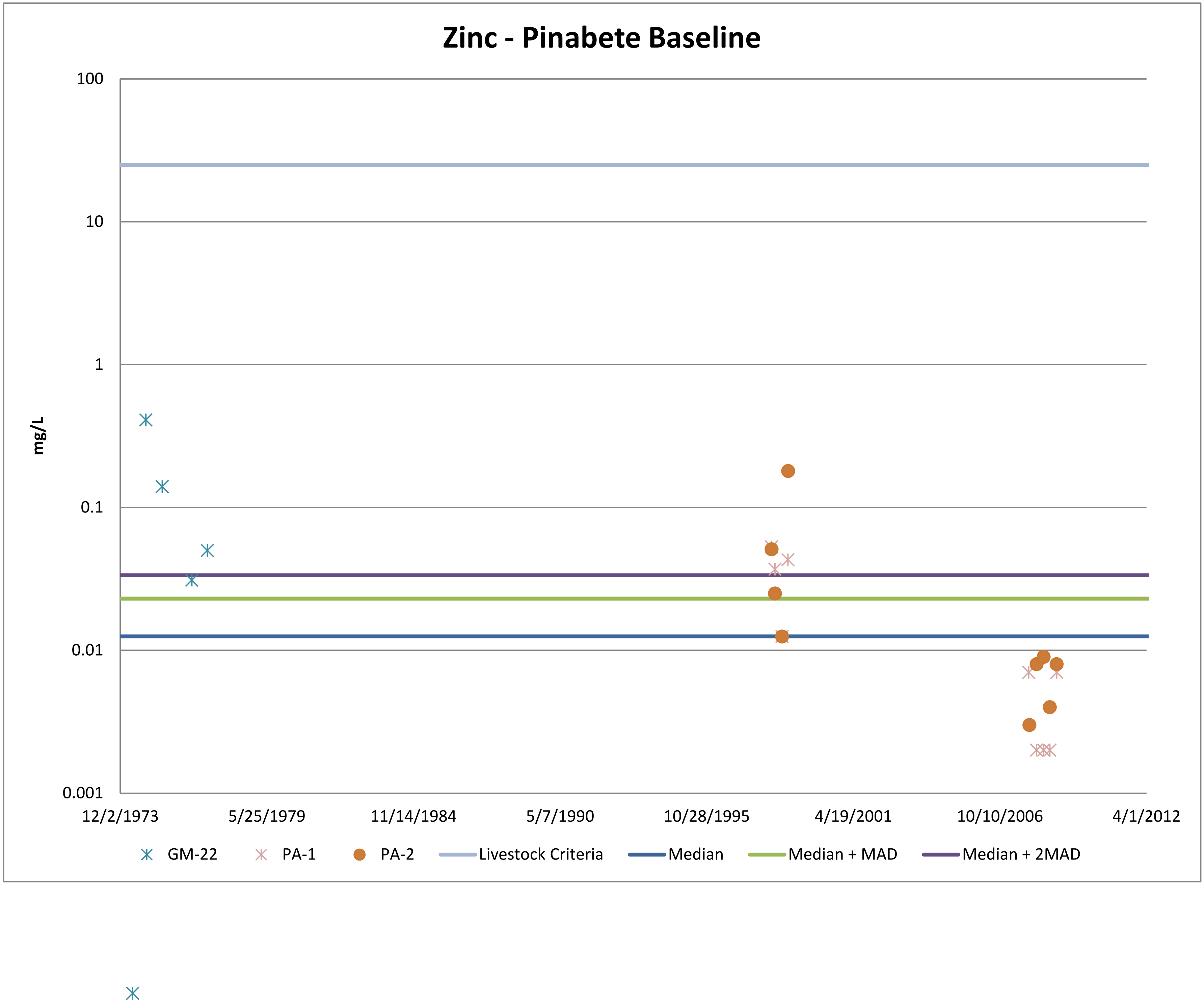
Appendix F - Groundwater Data Summary
Pinabete and No Name Alluvial Graphs

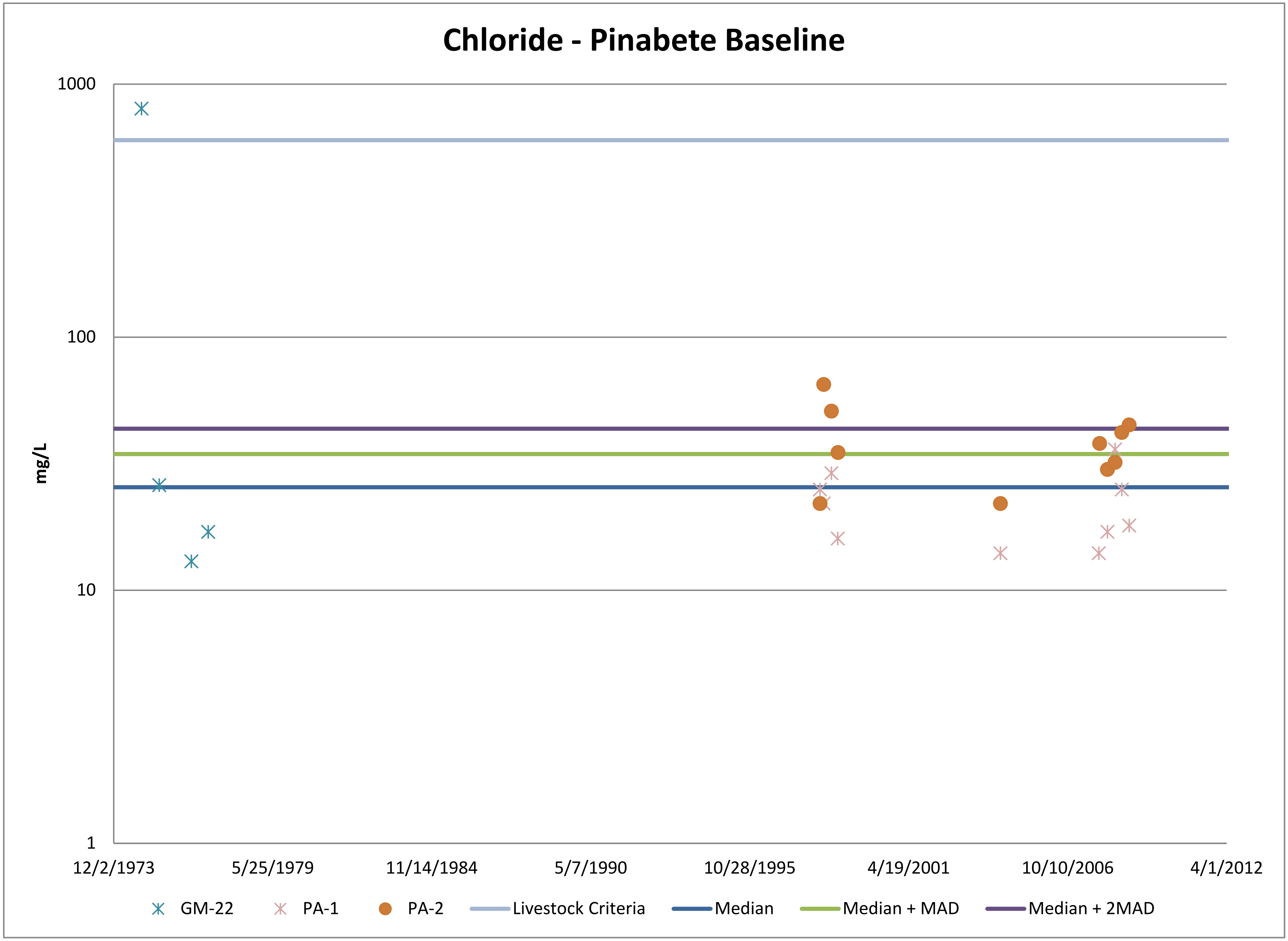


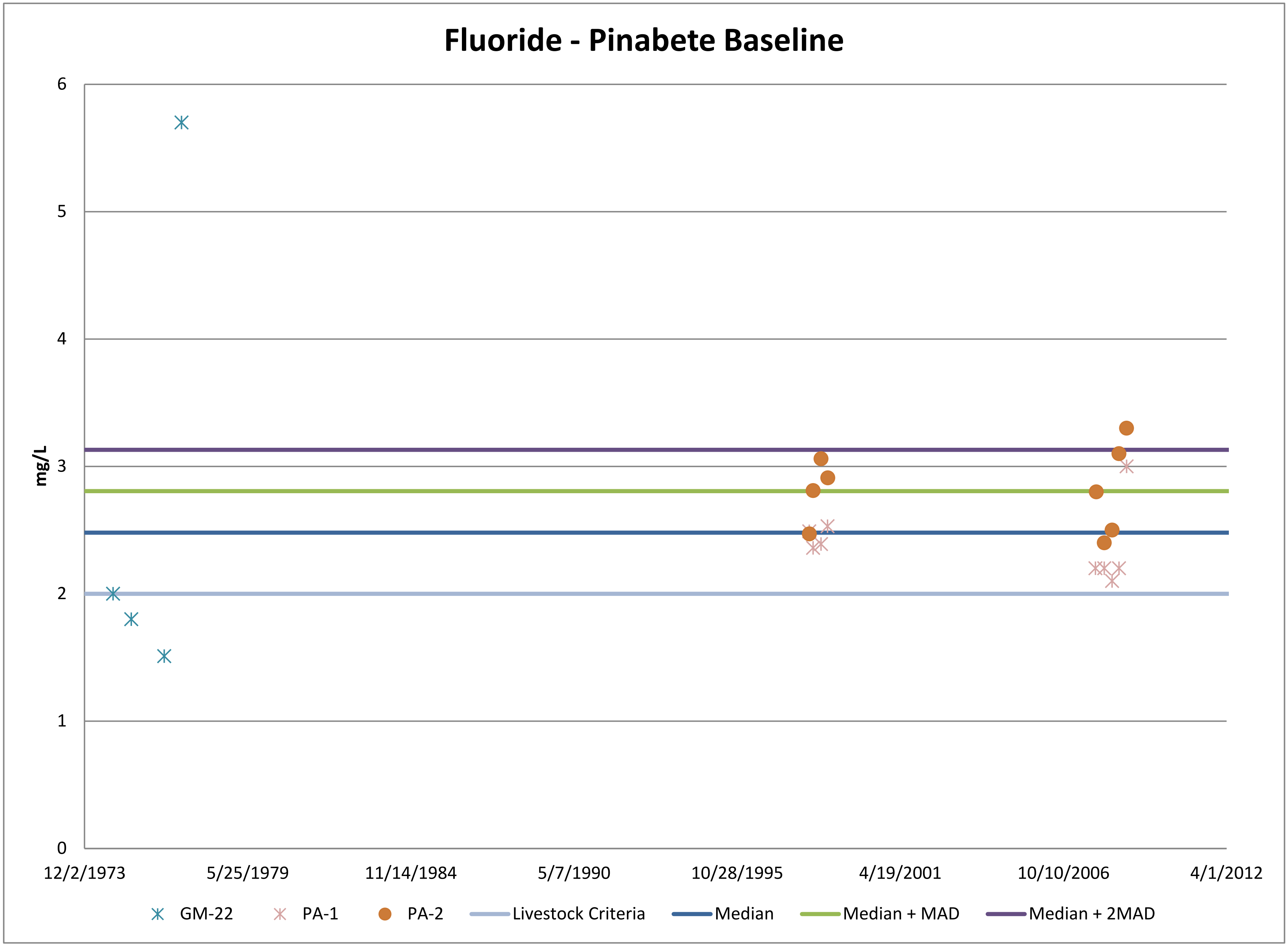

Lead - Pinabete Baseline
mg/L
1
0.1
0.01
0.001
0.0001
0.00001
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-22
PA-1
PA-2
Livestock Criteria
Median
Median + MAD
Median + 2MAD

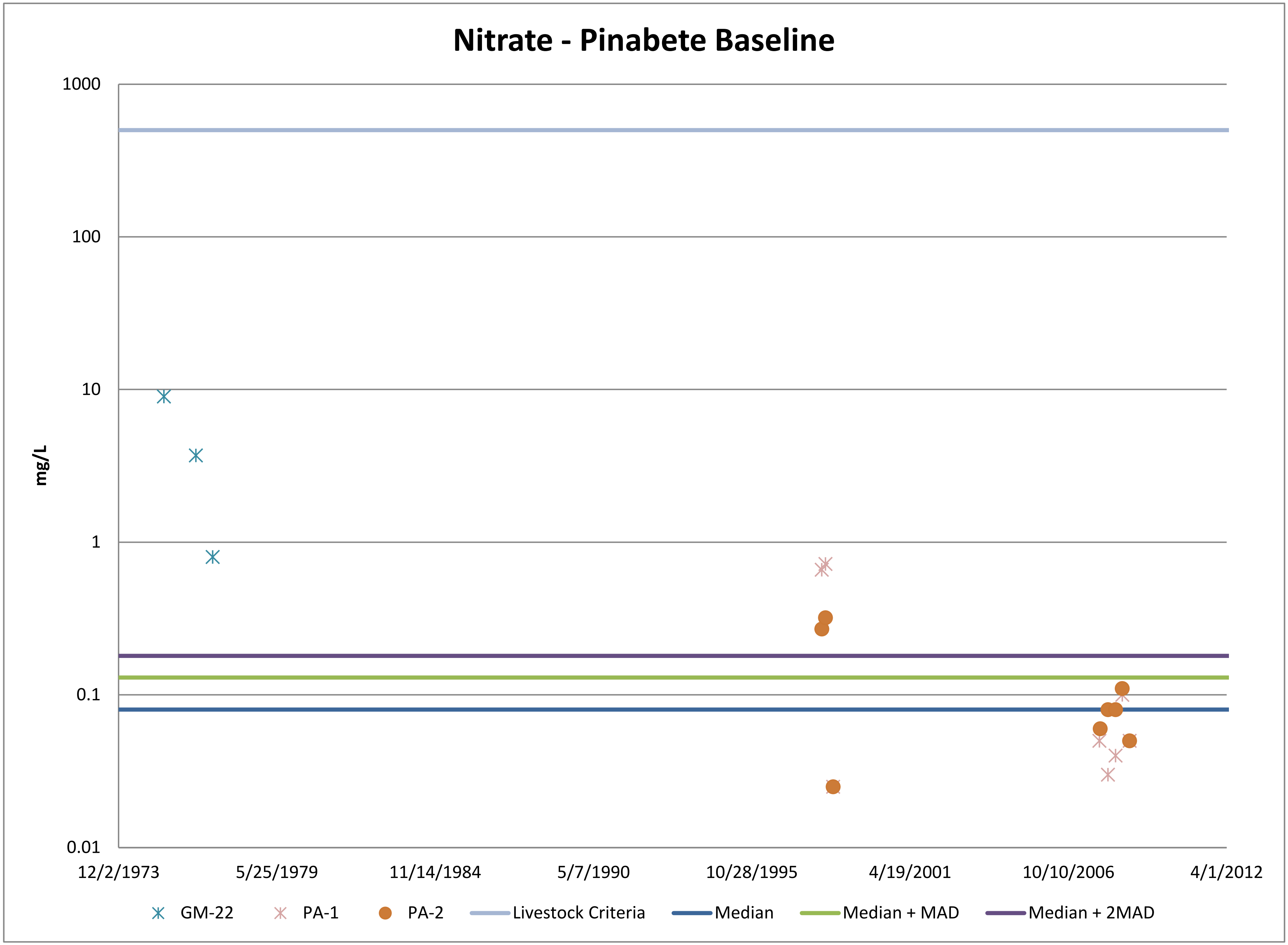

Mercury - Pinabete Baseline
mg/L
1
0.1
0.01
0.001
0.0001
0.00001
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-22
PA-1
PA-2
Median
Median + MAD
Median + 2MAD

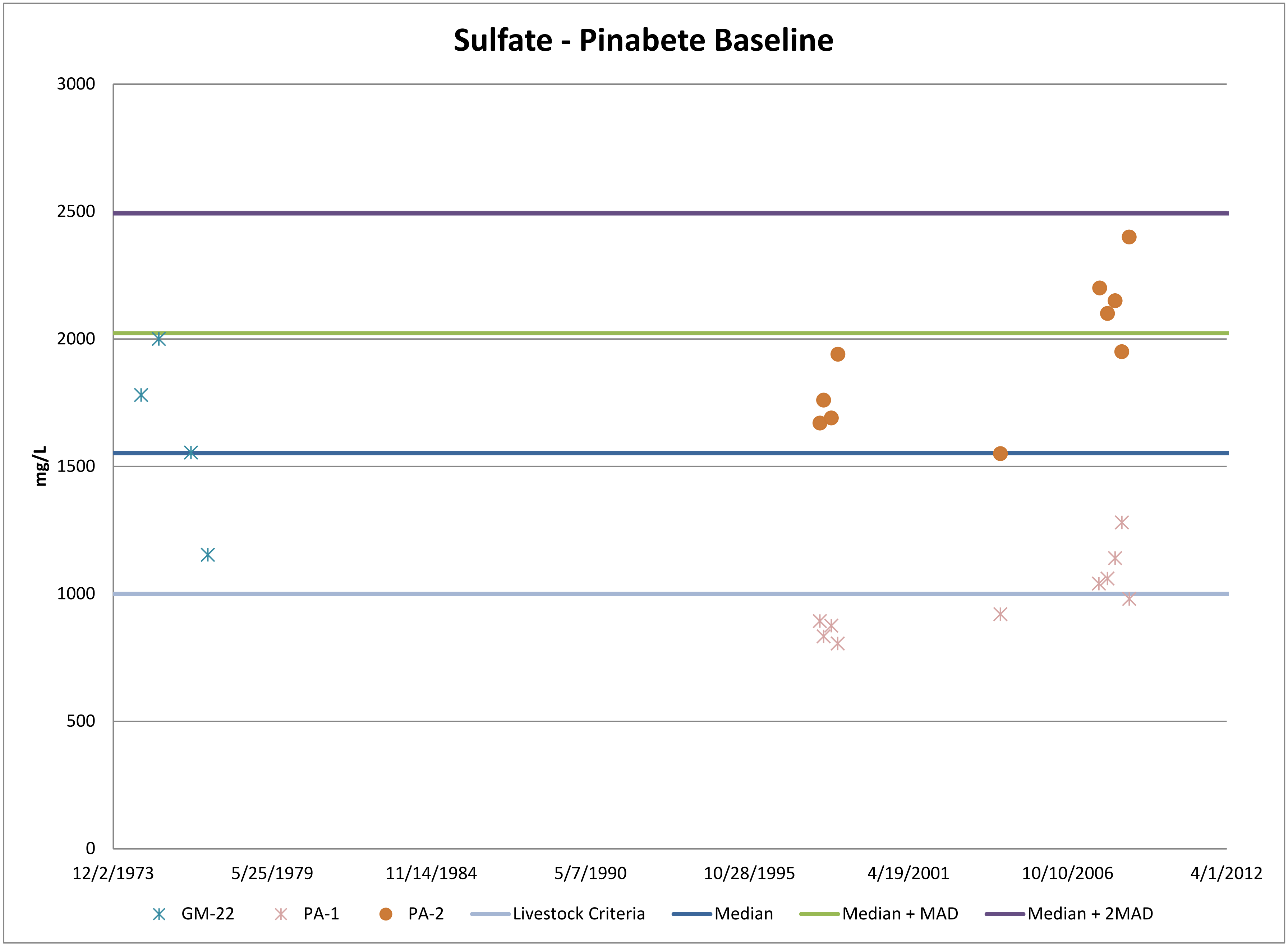

Selenium - Pinabete Baseline
mg/L
1
0.1
0.01
0.001
0.0001
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-22
PA-1
PA-2
Livestock Criteria
Median
Median + MAD
Median + 2MAD

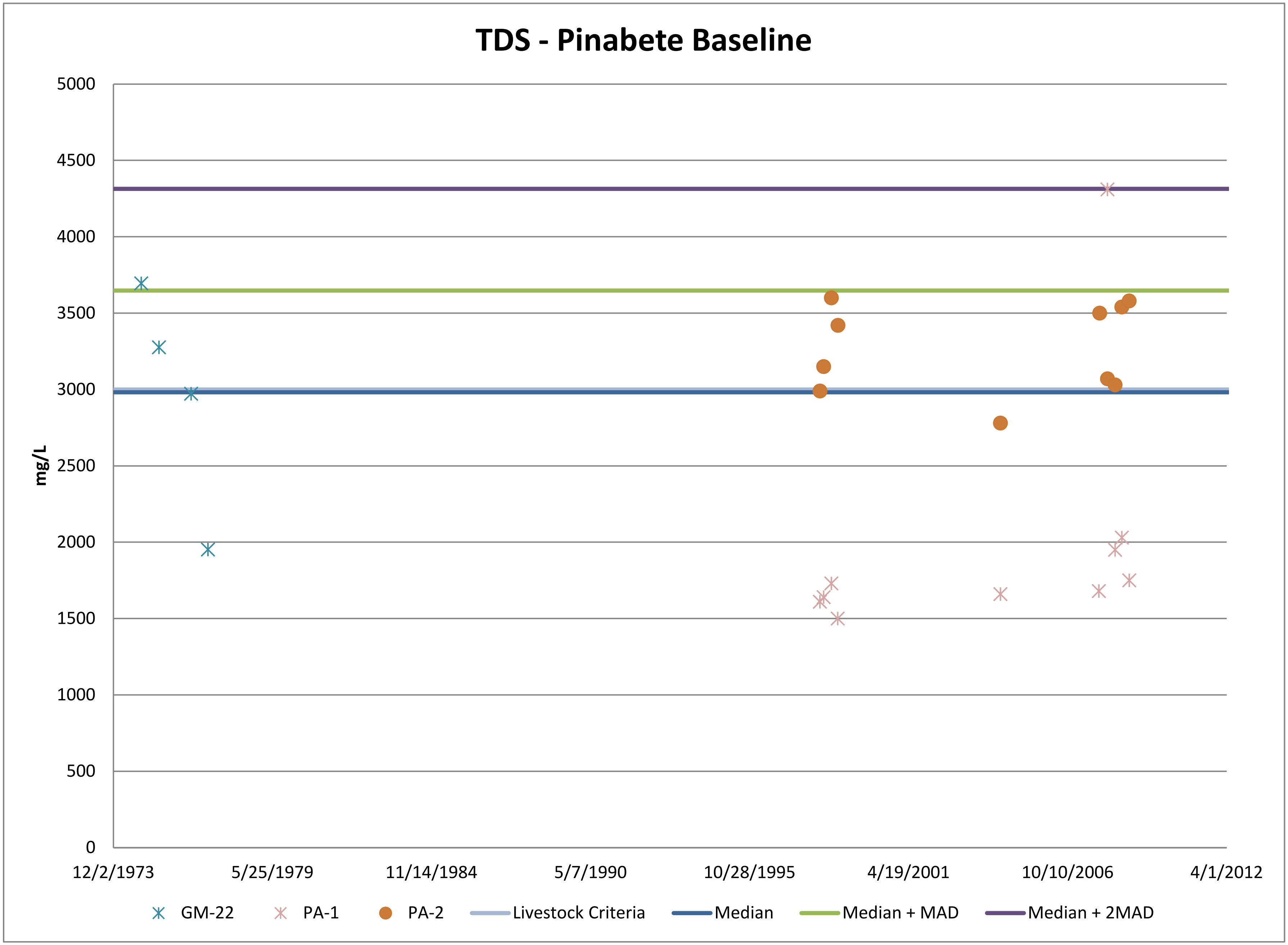

Zinc - Pinabete Baseline
100
10
1
0.1
0.01
0.001
mg/L
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-22
PA-1
PA-2
Livestock Criteria
Median
Median + MAD
Median + 2MAD

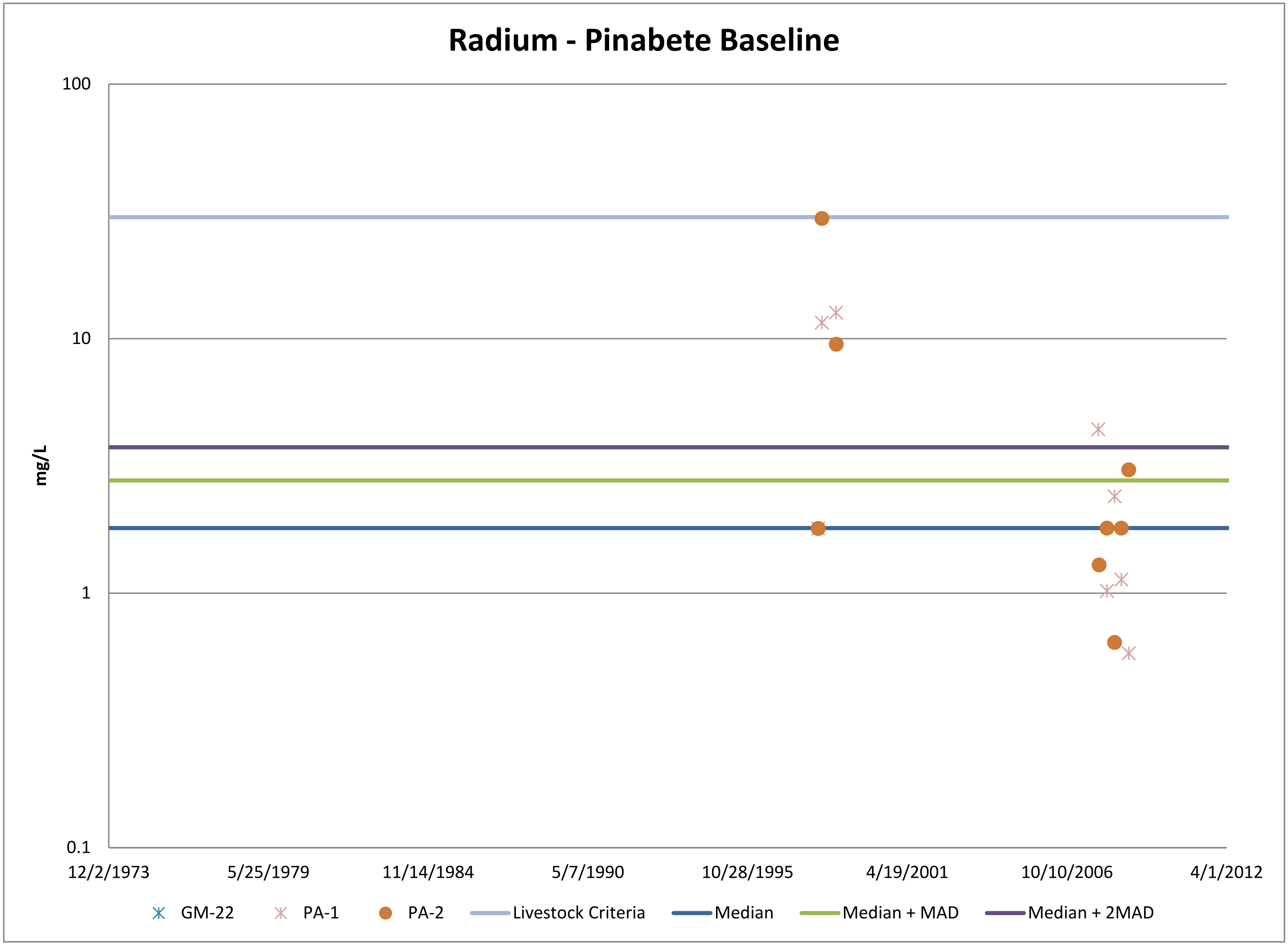

Chloride - Pinabete Baseline
mg/L
1000
100
10
1
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-22
PA-1
PA-2
Livestock Criteria
Median
Median + MAD
Median + 2MAD

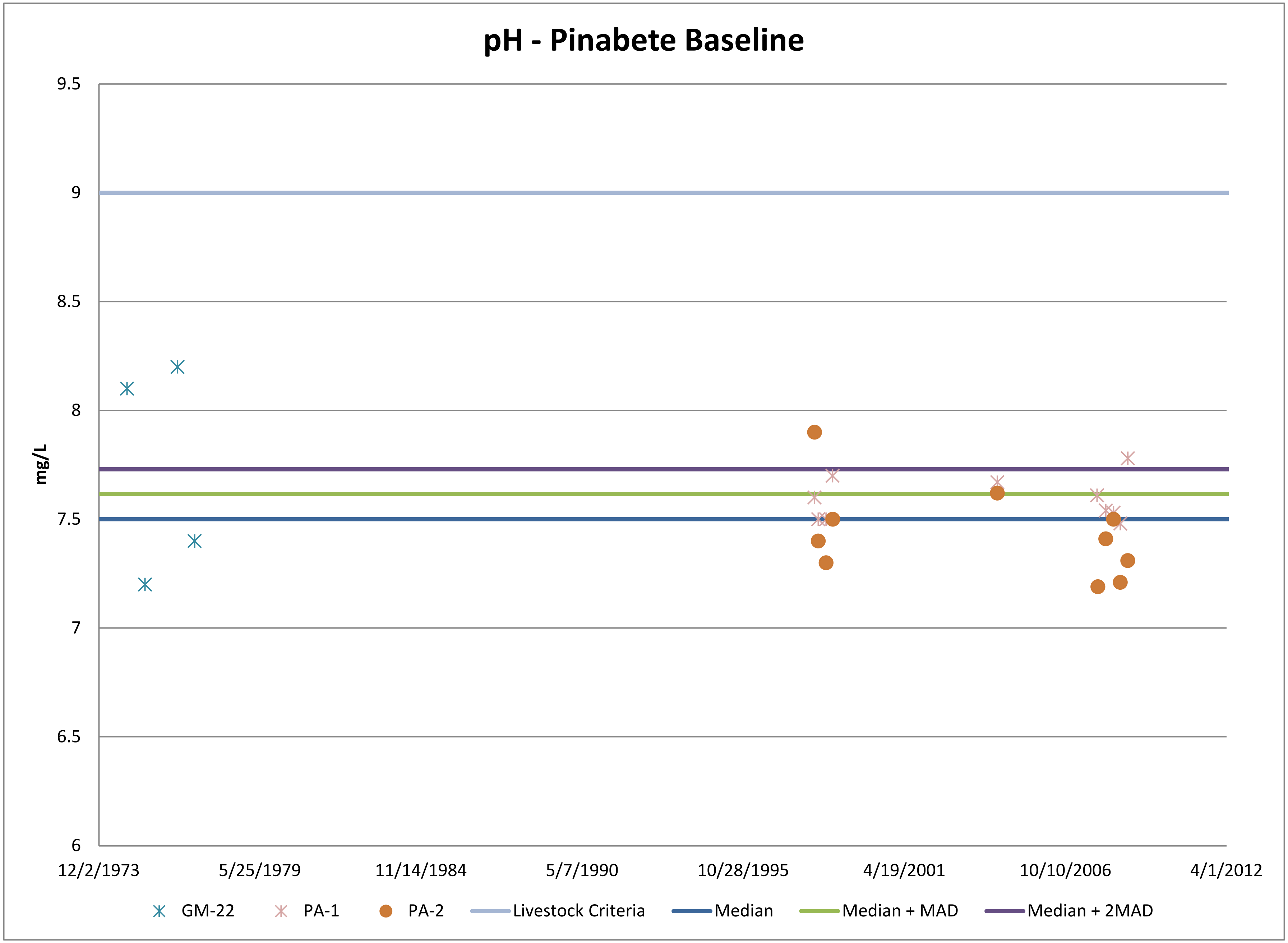

Fluoride - Pinabete Baseline
mg/L
0
1
2
3
4
5
6
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-22
PA-1
PA-2
Livestock Criteria
Median
Median + MAD
Median + 2MAD

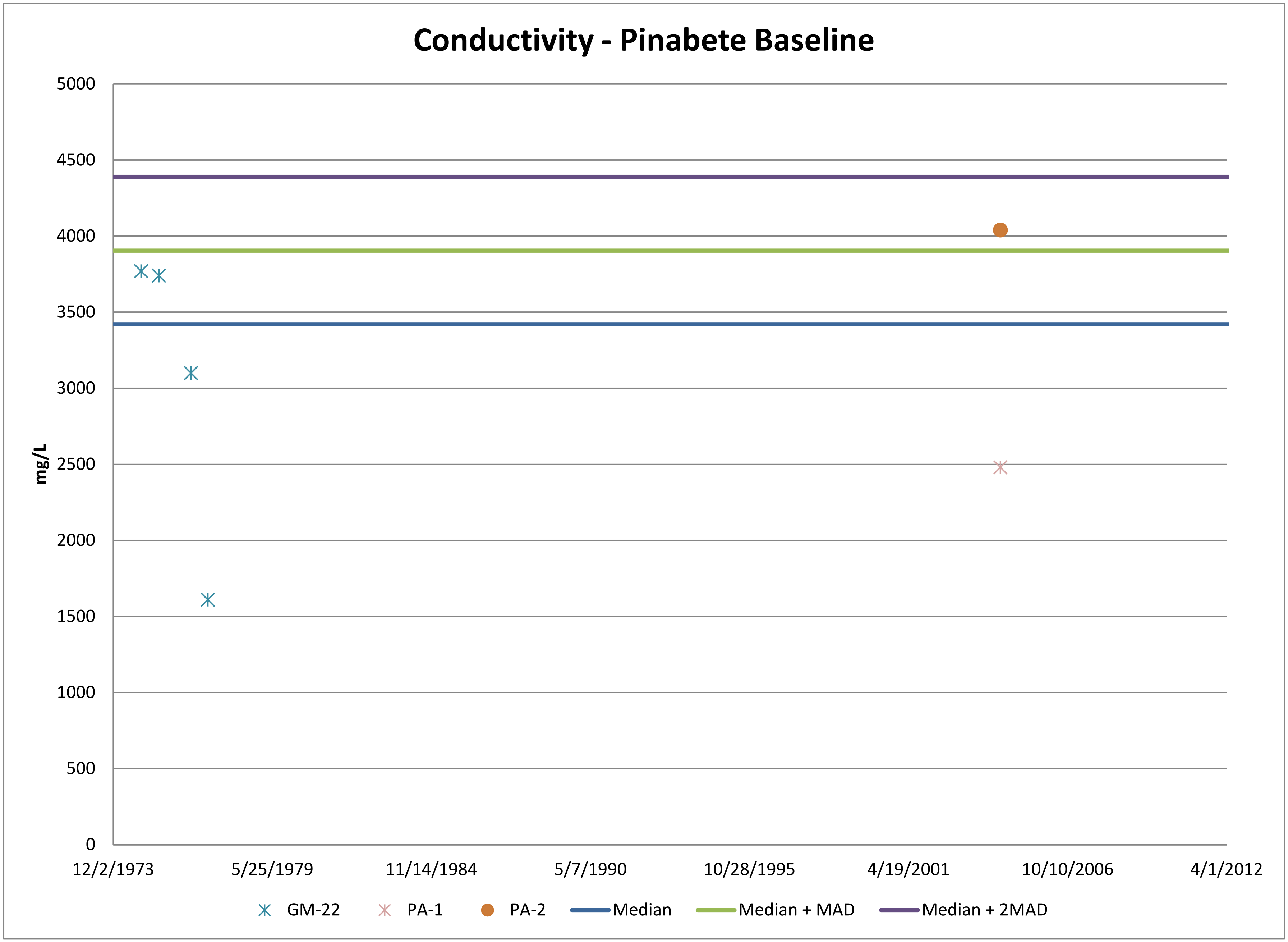

Nitrate - Pinabete Baseline
mg/L
1000
100
10
1
0.1
0.01
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-22
PA-1
PA-2
Livestock Criteria
Median
Median + MAD
Median + 2MAD

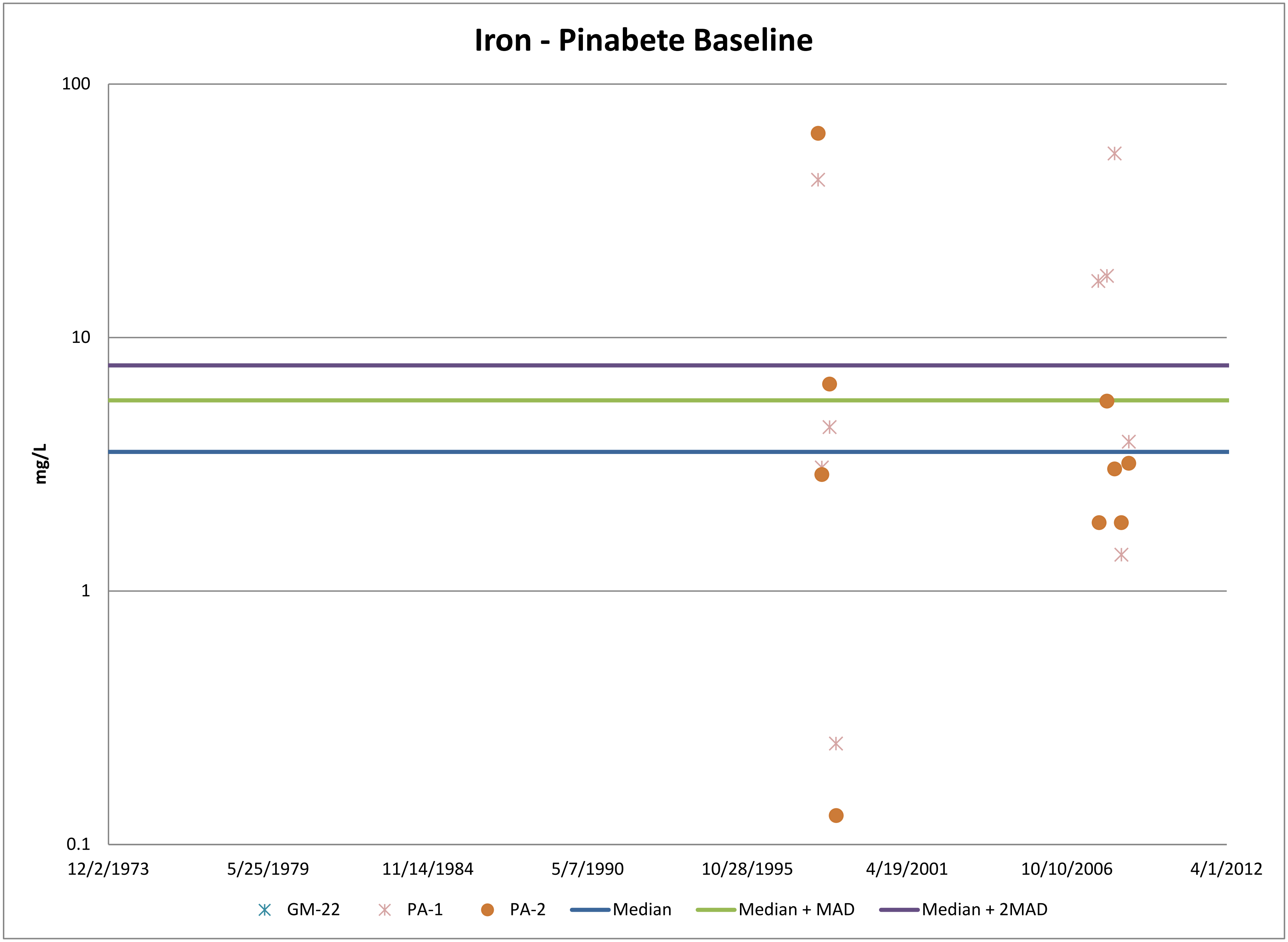

Sulfate - Pinabete Baseline
mg/L
3000
2500
2000
1500
1000
500
0
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-22
PA-1
PA-2
Livestock Criteria
Median
Median + MAD
Median + 2MAD

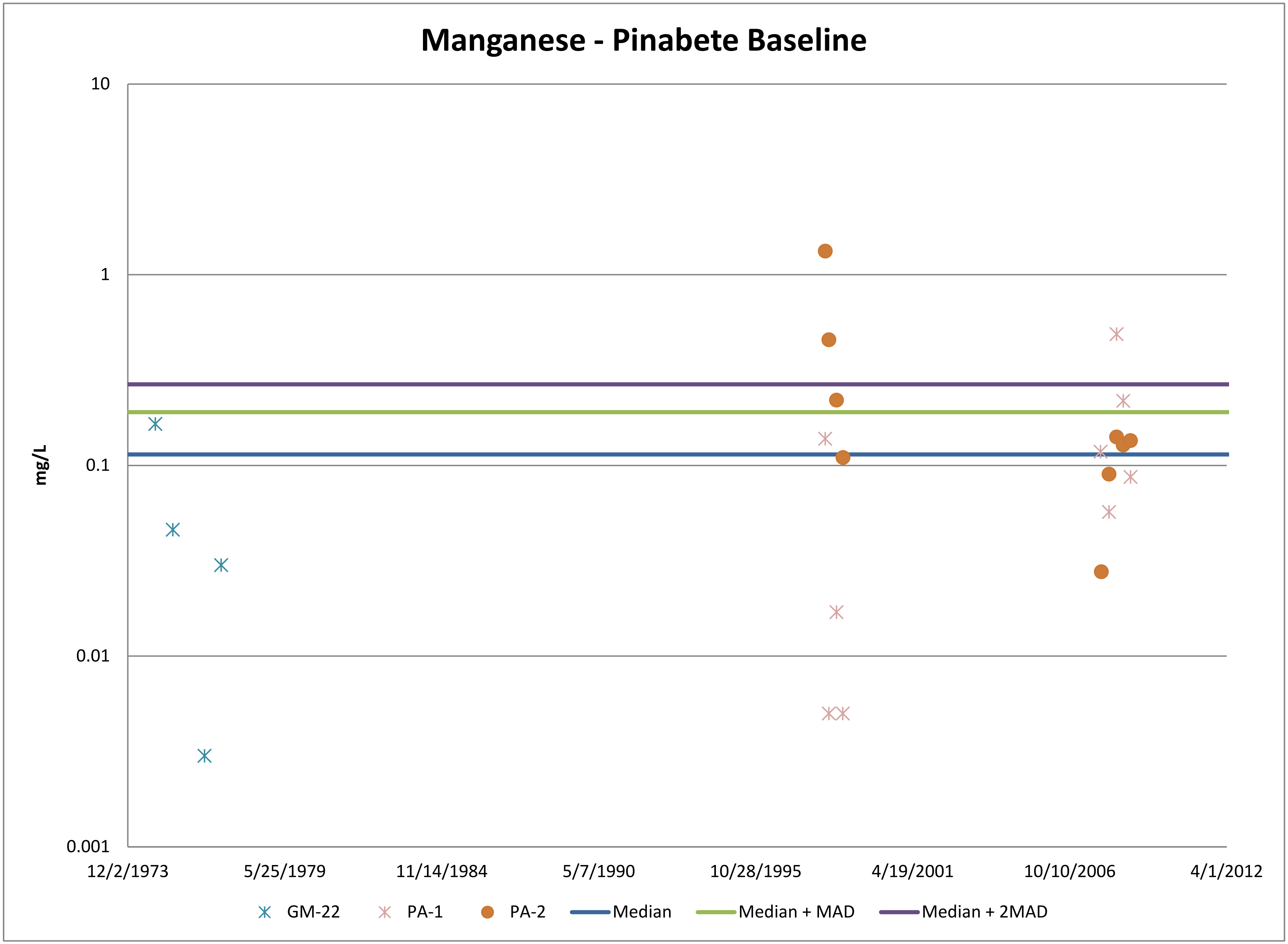

TDS - Pinabete Baseline
mg/L
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-22
PA-1
PA-2
Livestock Criteria
Median
Median + MAD
Median + 2MAD

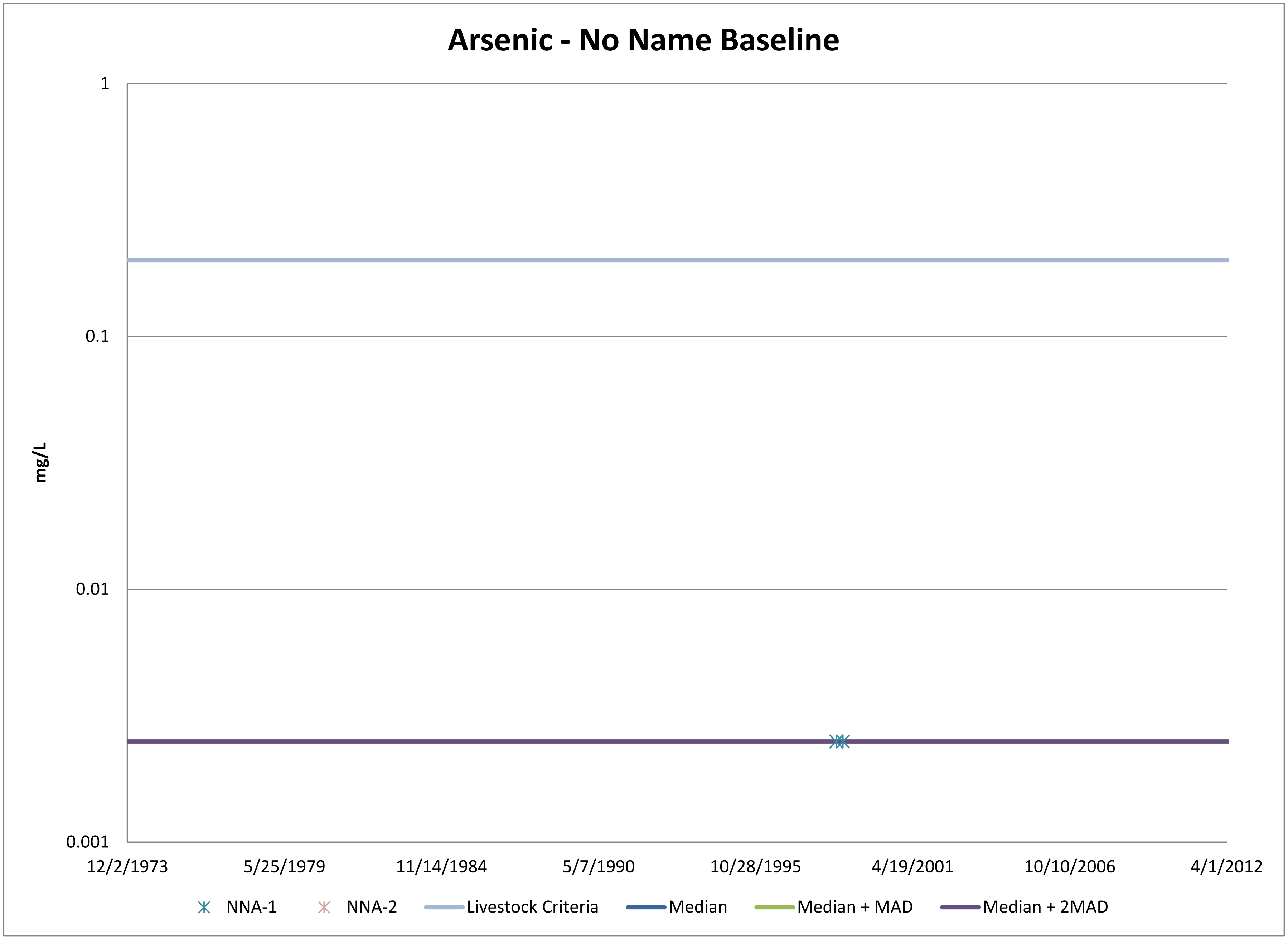

Radium - Pinabete Baseline
mg/L
100
10
1
0.1
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-22
PA-1
PA-2
Livestock Criteria
Median
Median + MAD
Median + 2MAD

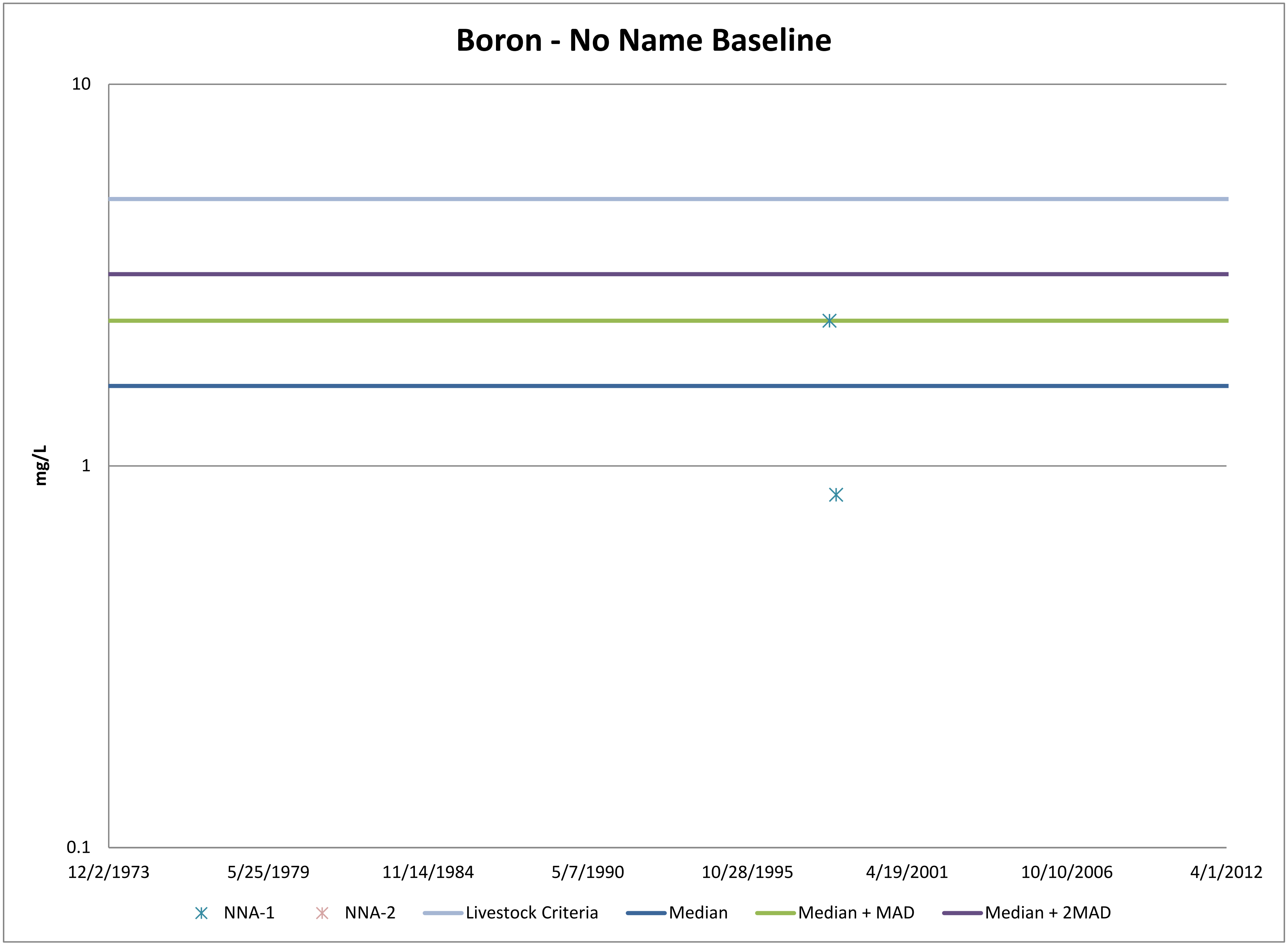

pH - Pinabete Baseline
mg/L
9.5
9
8.5
8
7.5
7
6.5
6
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-22
PA-1
PA-2
Livestock Criteria
Median
Median + MAD
Median + 2MAD

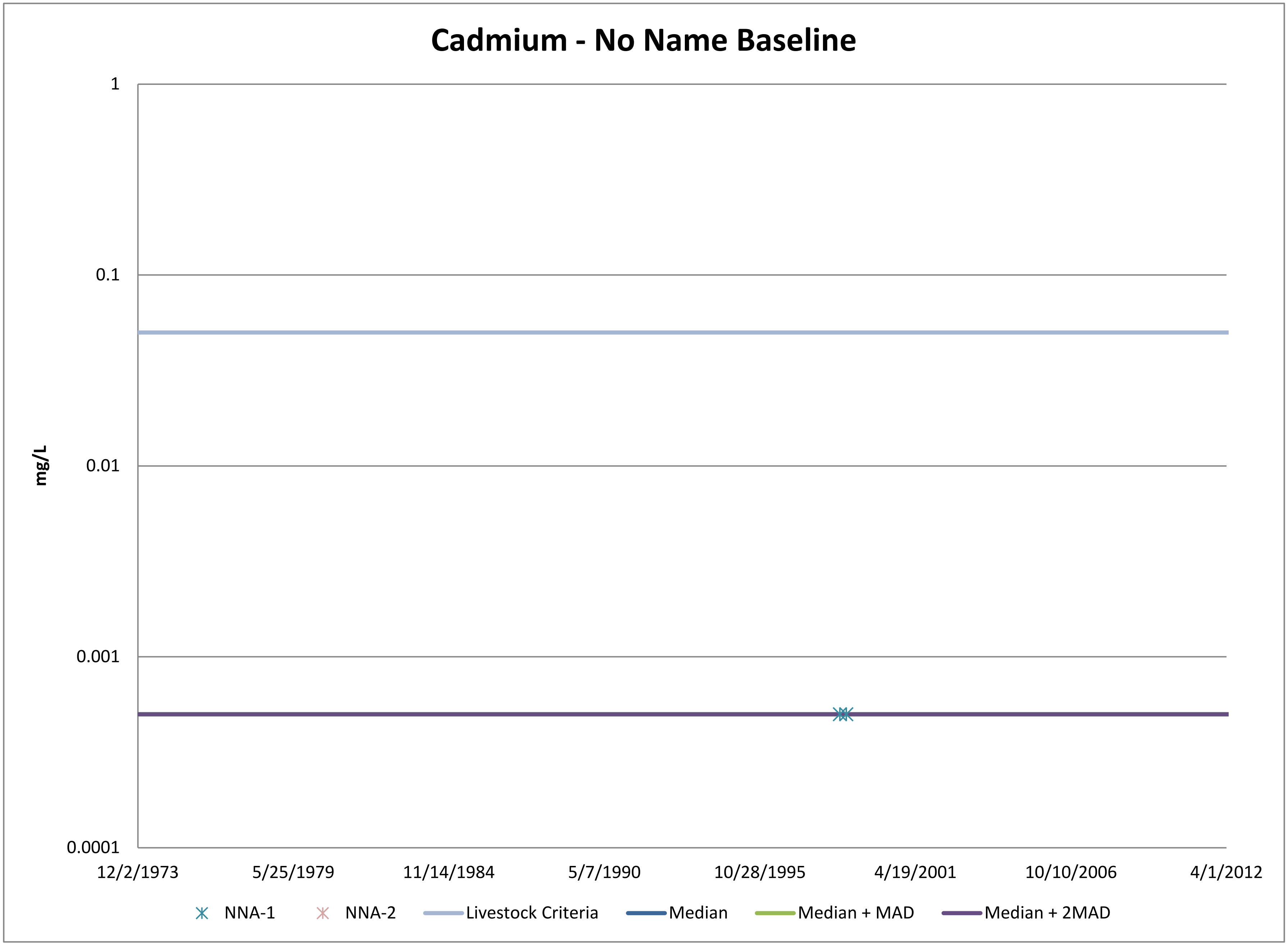

Conductivity - Pinabete Baseline
mg/L
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-22
PA-1
PA-2
Median
Median + MAD
Median + 2MAD

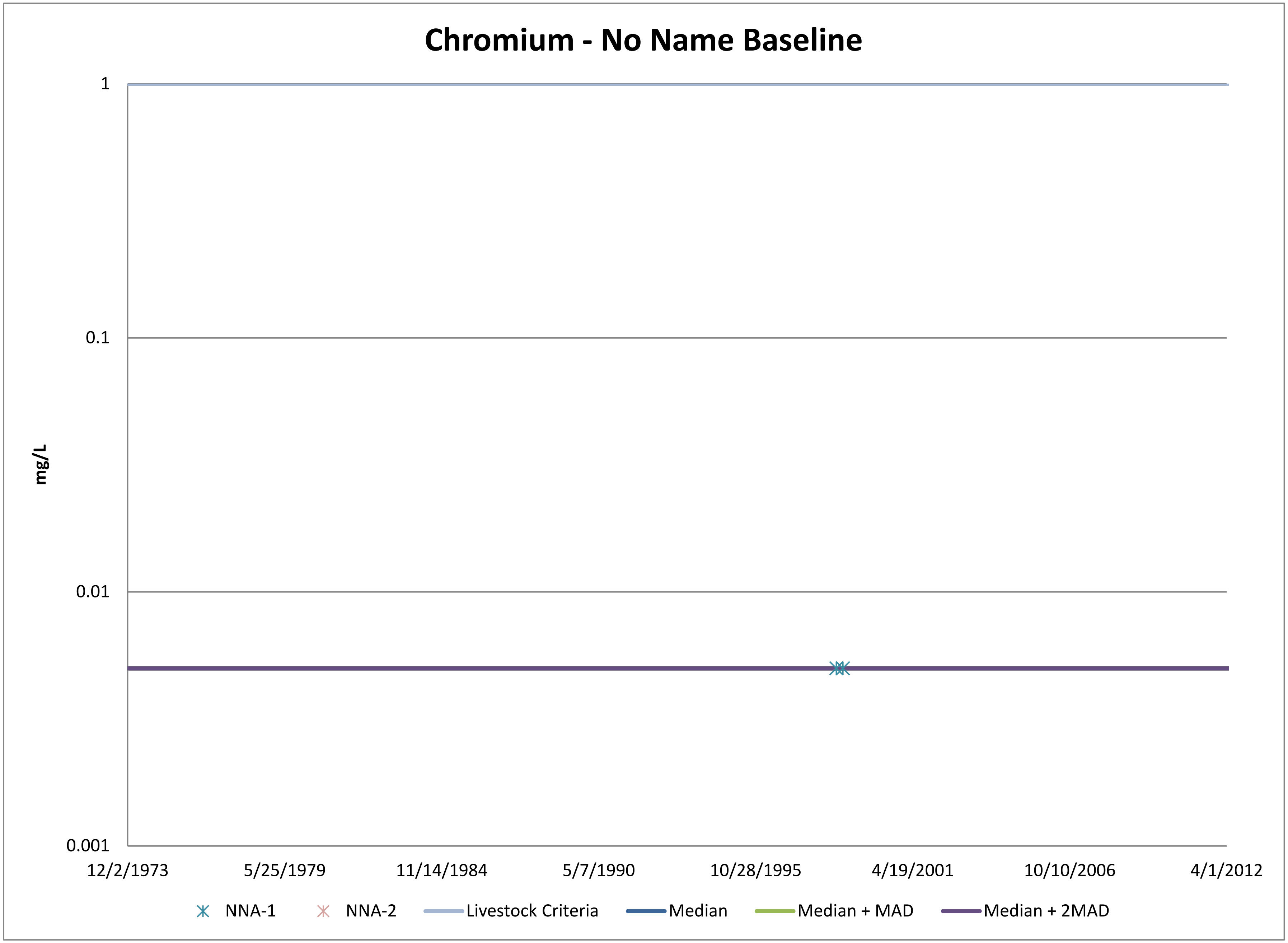

Iron - Pinabete Baseline
100
10
1
0.1
mg/L
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-22
PA-1
PA-2
Median
Median + MAD
Median + 2MAD

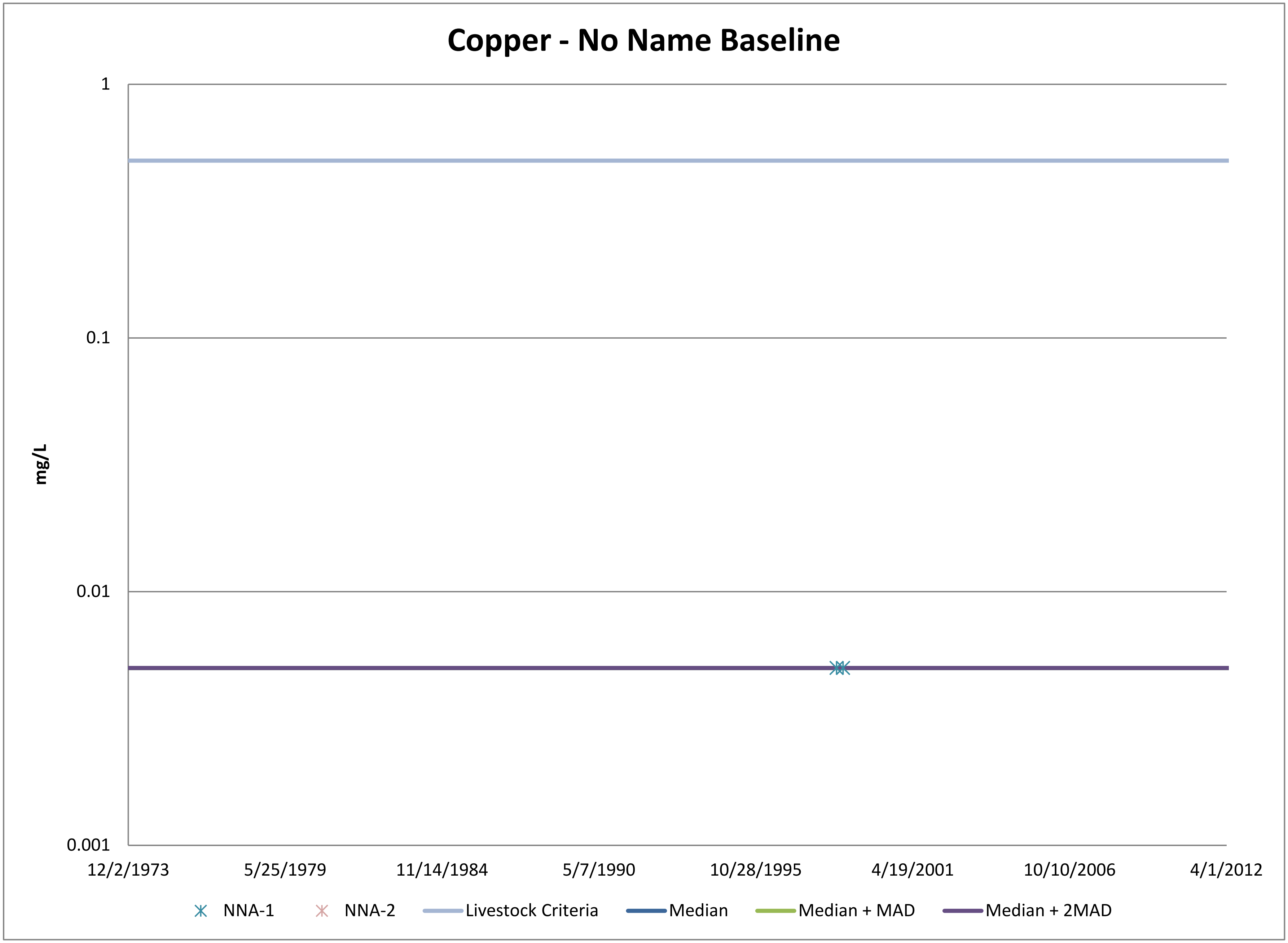

Manganese - Pinabete Baseline
mg/L
10
1
0.1
0.01
0.001
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-22
PA-1
PA-2
Median
Median + MAD
Median + 2MAD

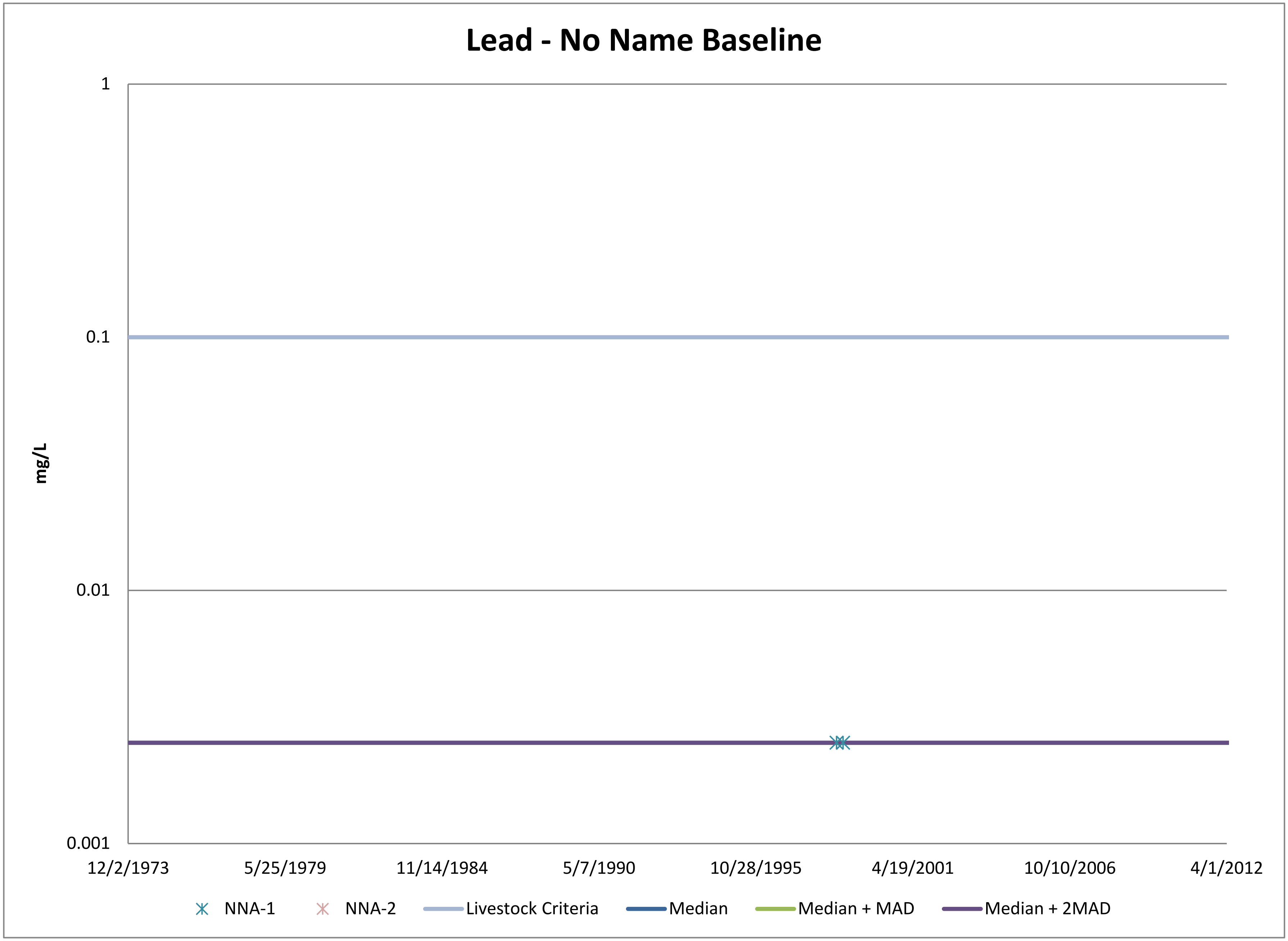

Arsenic - No Name Baseline
mg/L
1
0.1
0.01
0.001
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
NNA-1
NNA-2
Livestock Criteria
Median
Median + MAD
Median + 2MAD

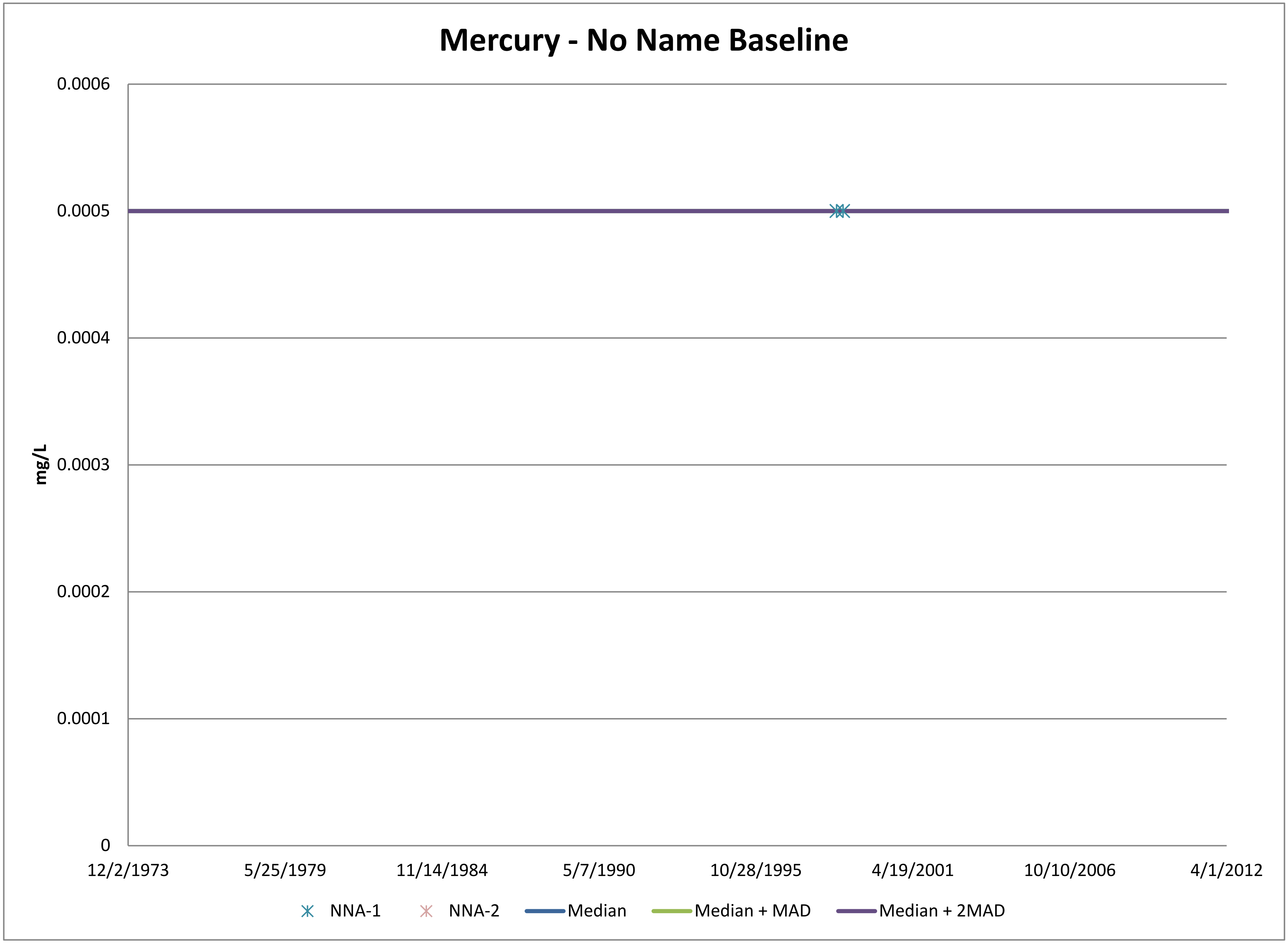

Boron - No Name Baseline
mg/L
10
1
0.1
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
NNA-1
NNA-2
Livestock Criteria
Median
Median + MAD
Median + 2MAD

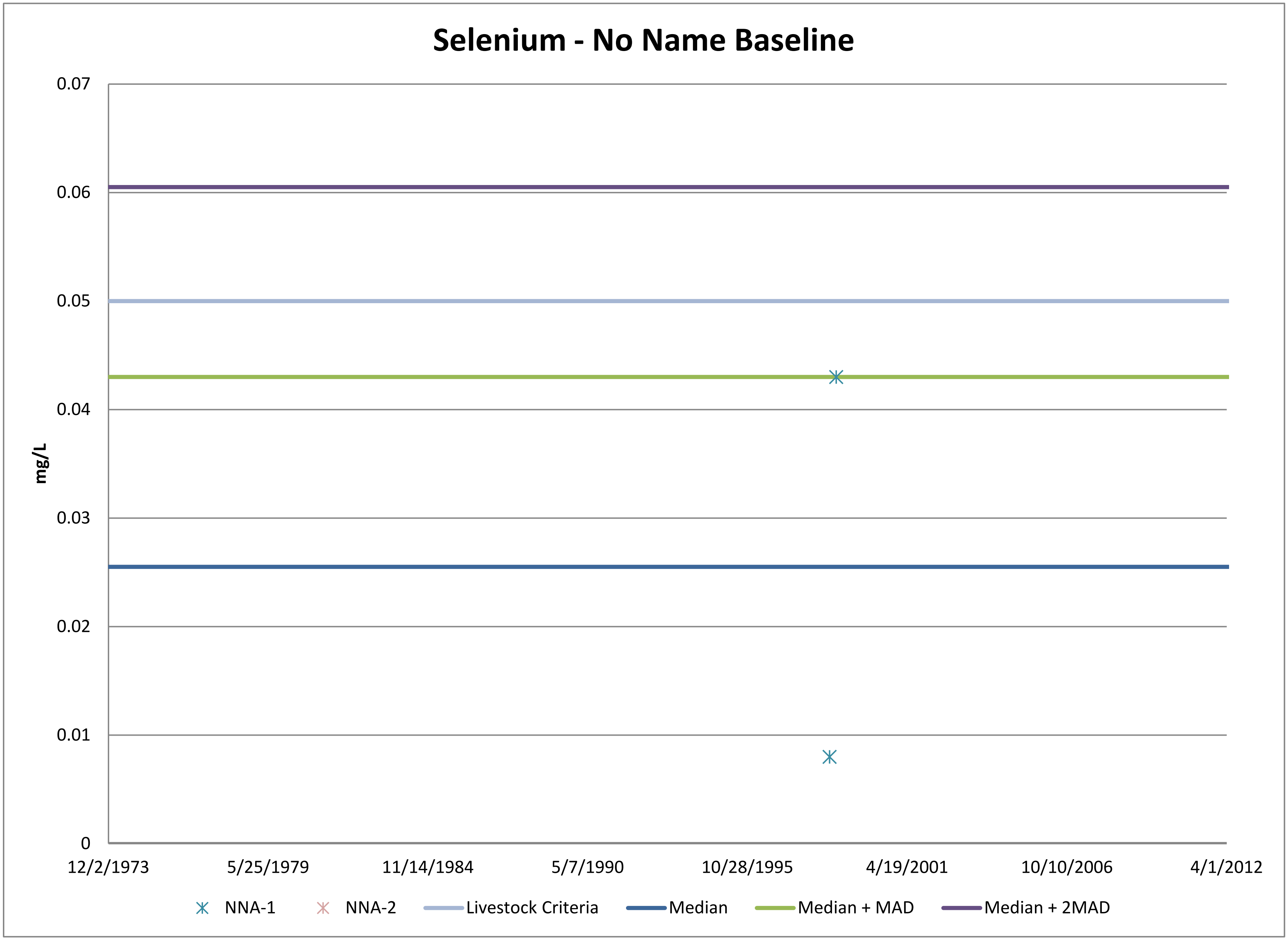

Cadmium - No Name Baseline
1
0.1
0.01
0.001
0.0001
mg/L
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
NNA-1
NNA-2
Livestock Criteria
Median
Median + MAD
Median + 2MAD

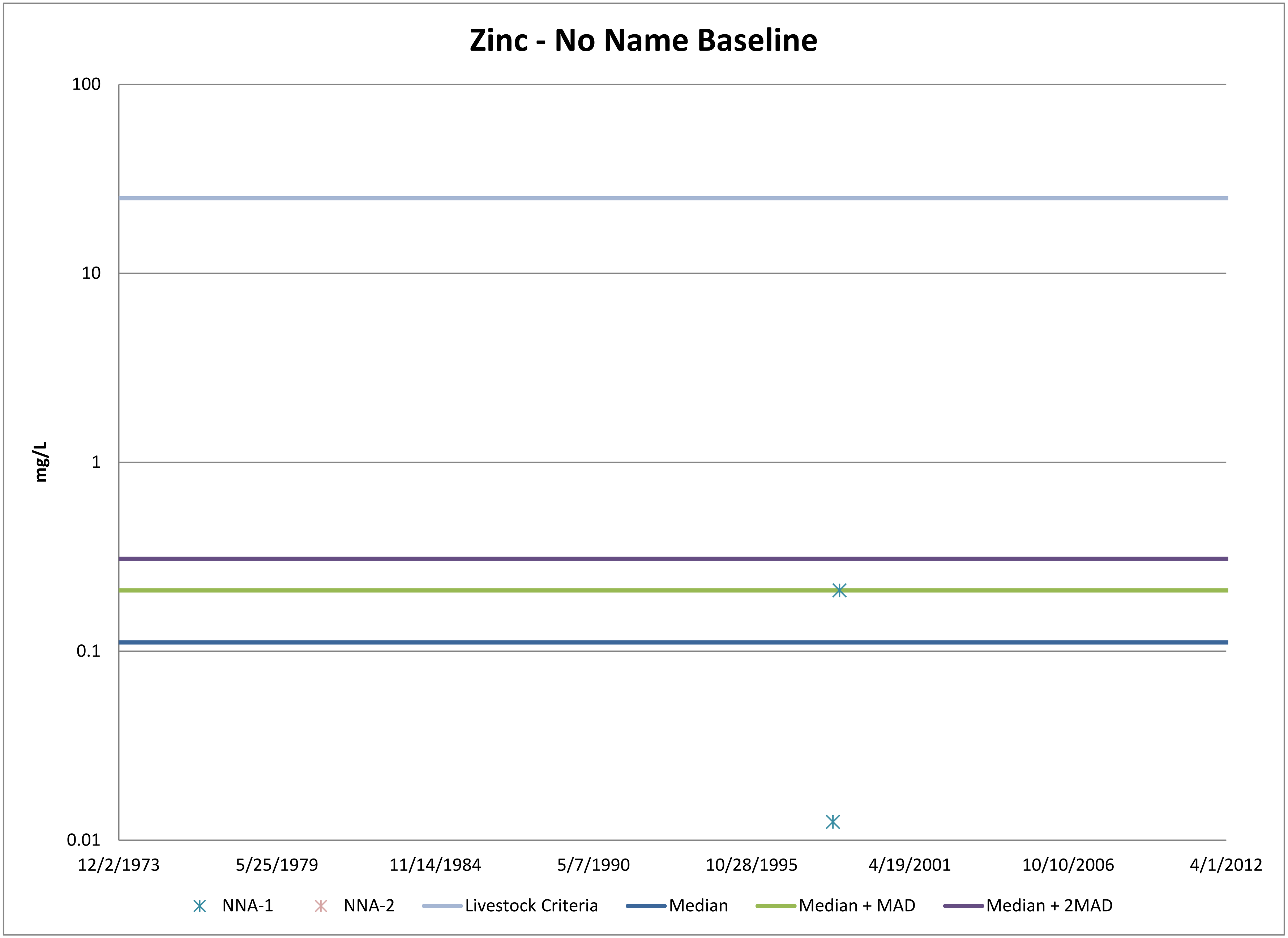

Chromium - No Name Baseline
mg/L
1
0.1
0.01
0.001
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
NNA-1
NNA-2
Livestock Criteria
Median
Median + MAD
Median + 2MAD

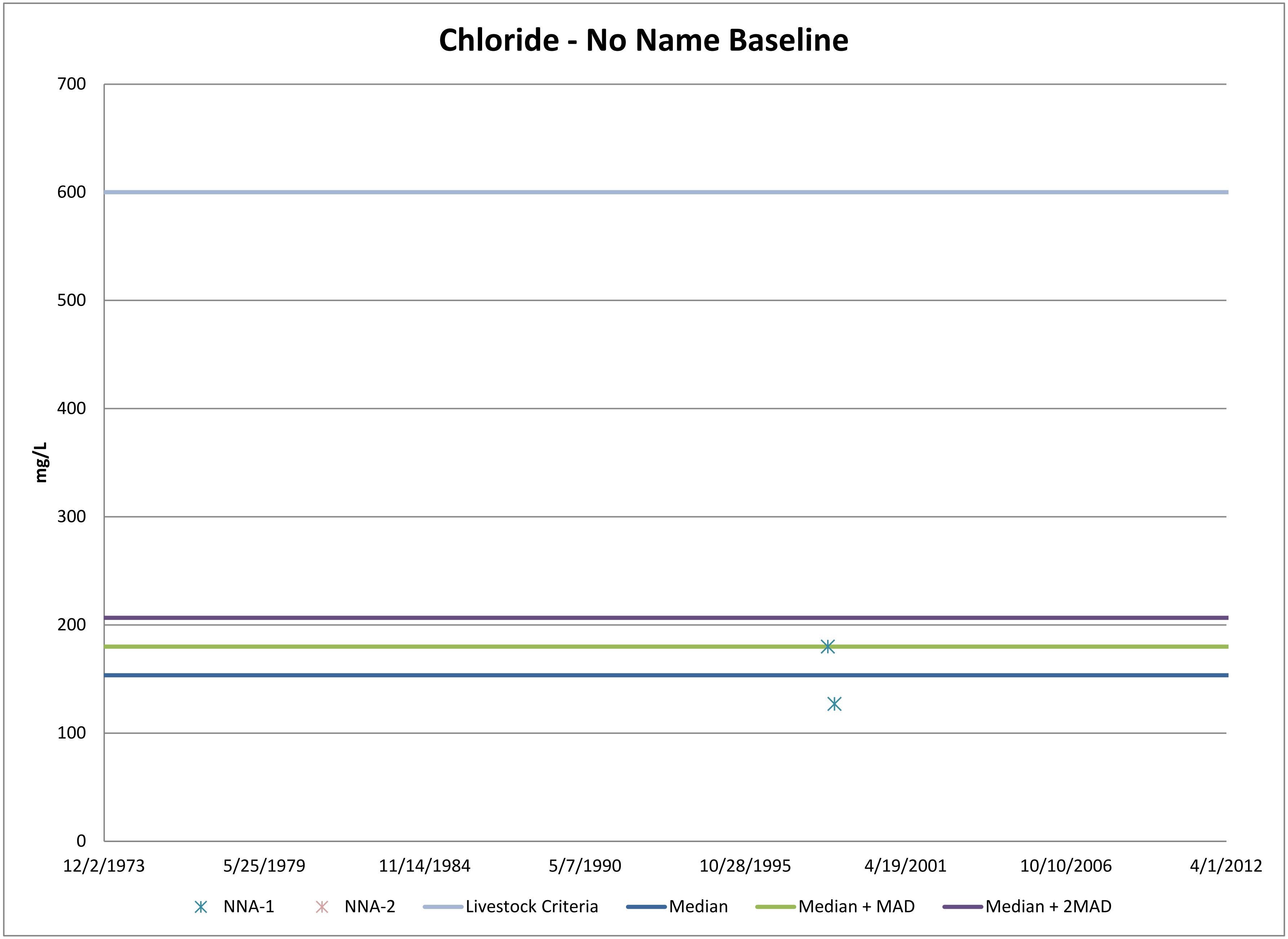

Copper - No Name Baseline
mg/L
1
0.1
0.01
0.001
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
NNA-1
NNA-2
Livestock Criteria
Median
Median + MAD
Median + 2MAD

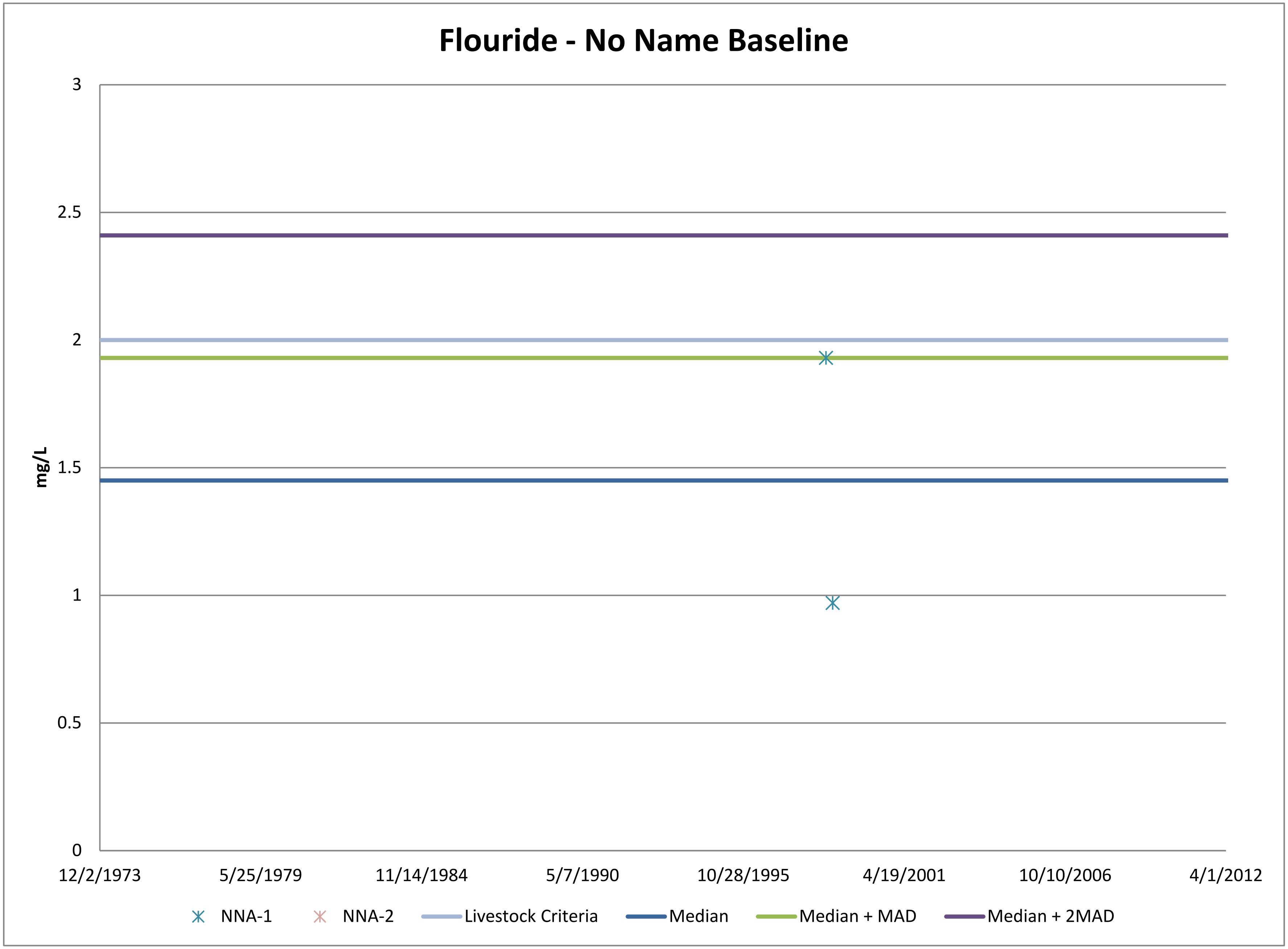

Lead - No Name Baseline
mg/L
1
0.1
0.01
0.001
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
NNA-1
NNA-2
Livestock Criteria
Median
Median + MAD
Median + 2MAD

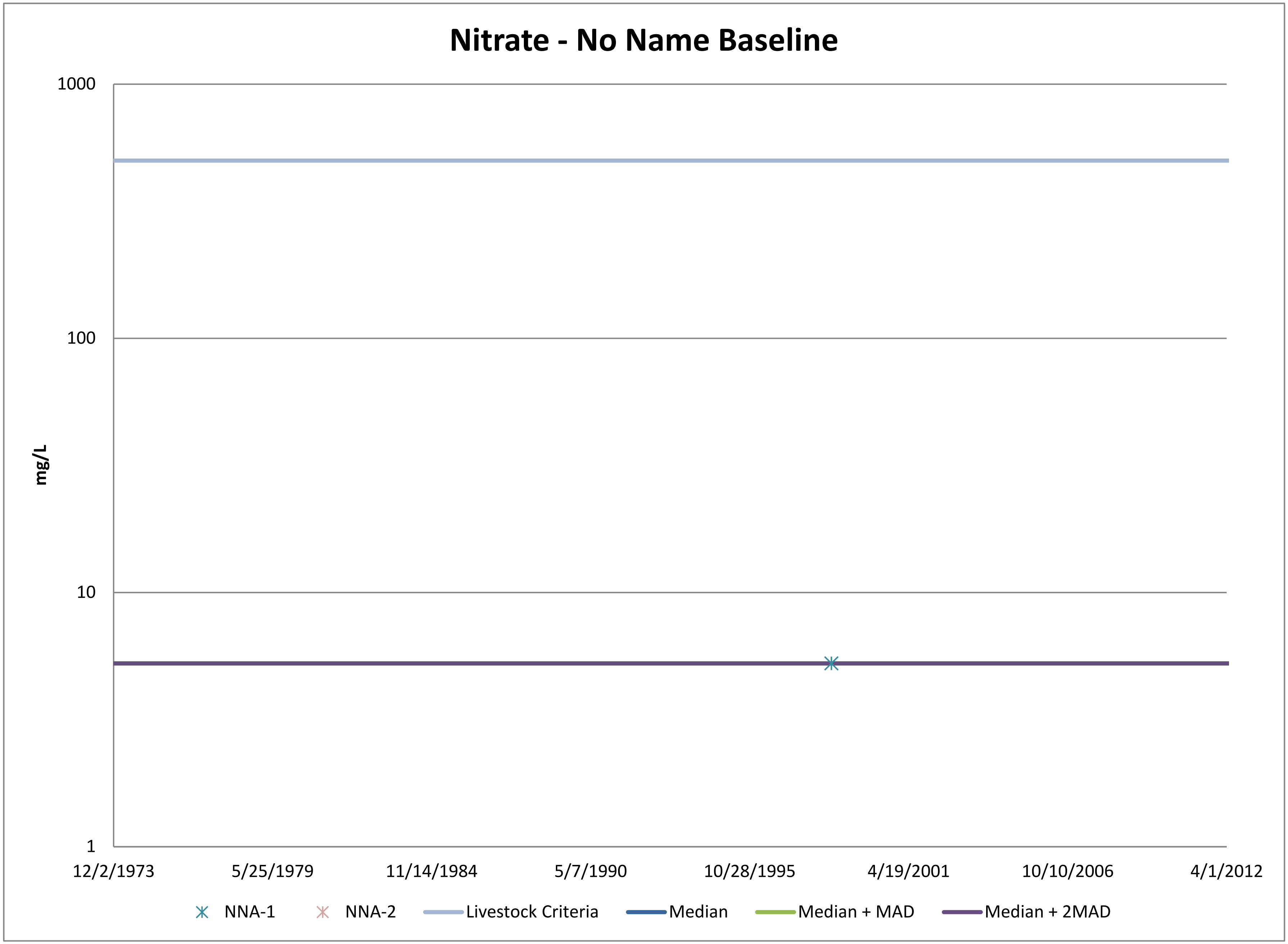

Mercury - No Name Baseline
mg/L
0.0006
0.0005
0.0004
0.0003
0.0002
0.0001
0
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
NNA-1
NNA-2
Median
Median + MAD
Median + 2MAD

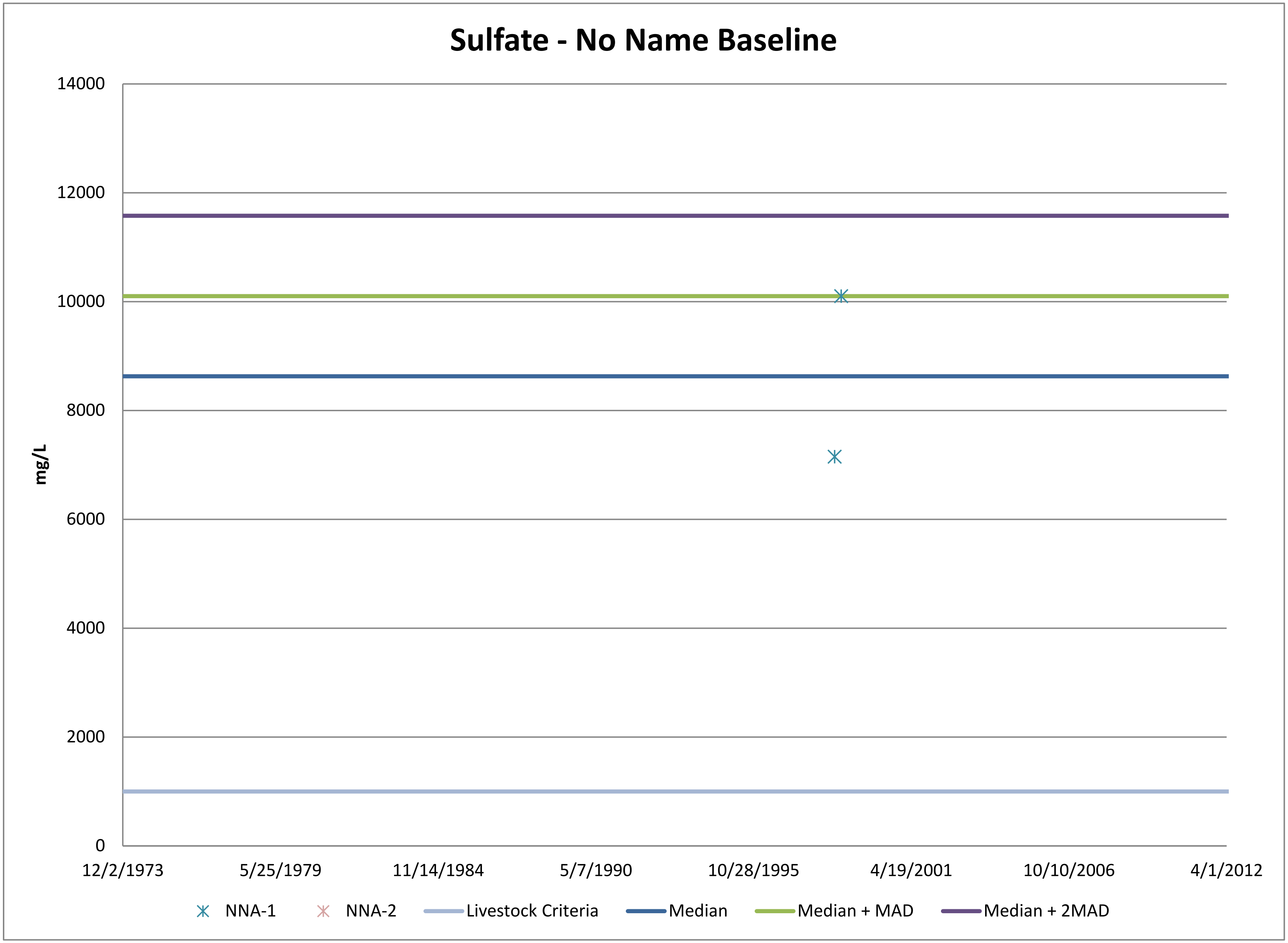

Selenium - No Name Baseline
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
mg/L
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
NNA-1
NNA-2
Livestock Criteria
Median
Median + MAD
Median + 2MAD

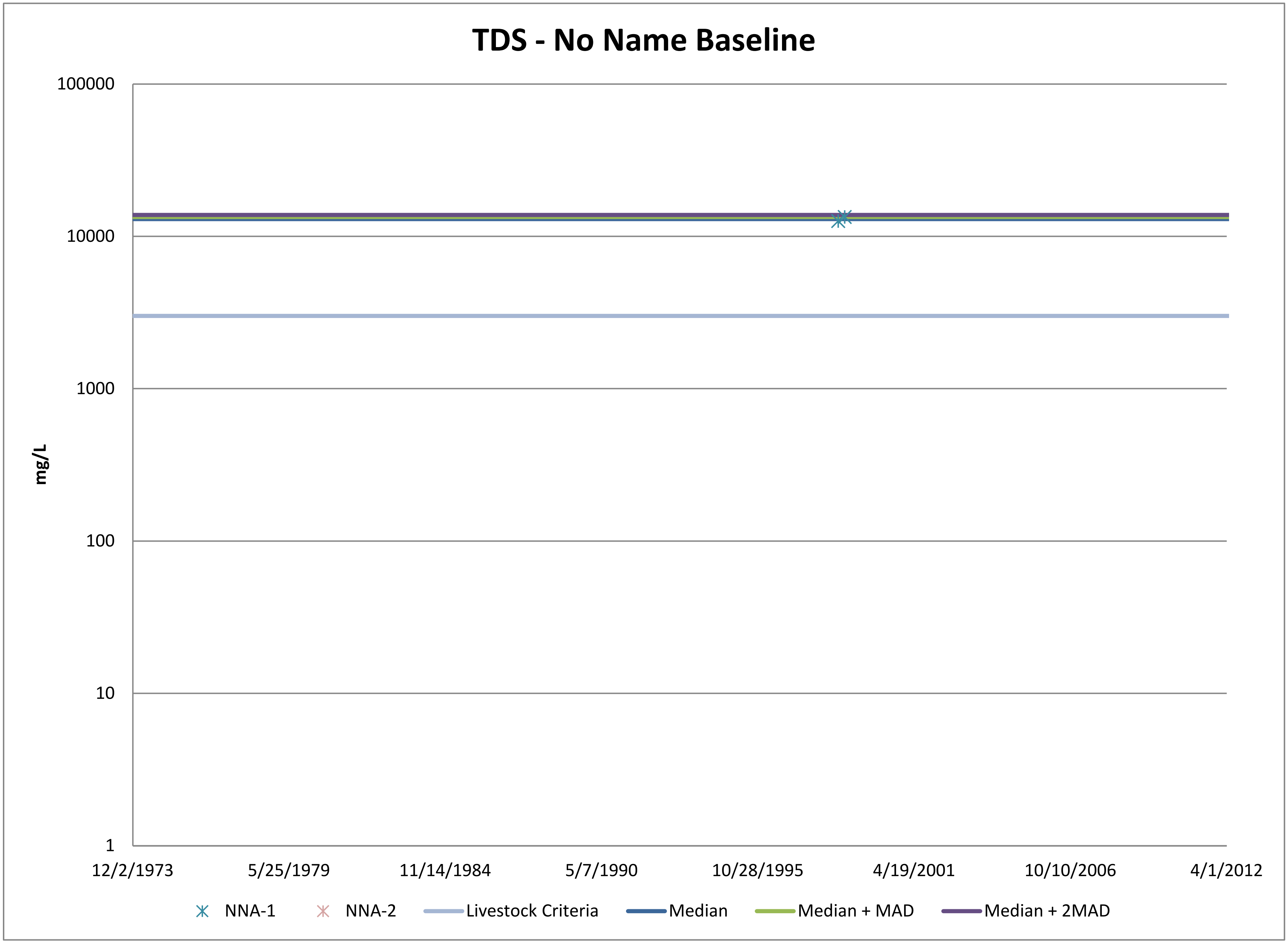

Zinc - No Name Baseline
mg/L
100
10
1
0.1
0.01
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
NNA-1
NNA-2
Livestock Criteria
Median
Median + MAD
Median + 2MAD

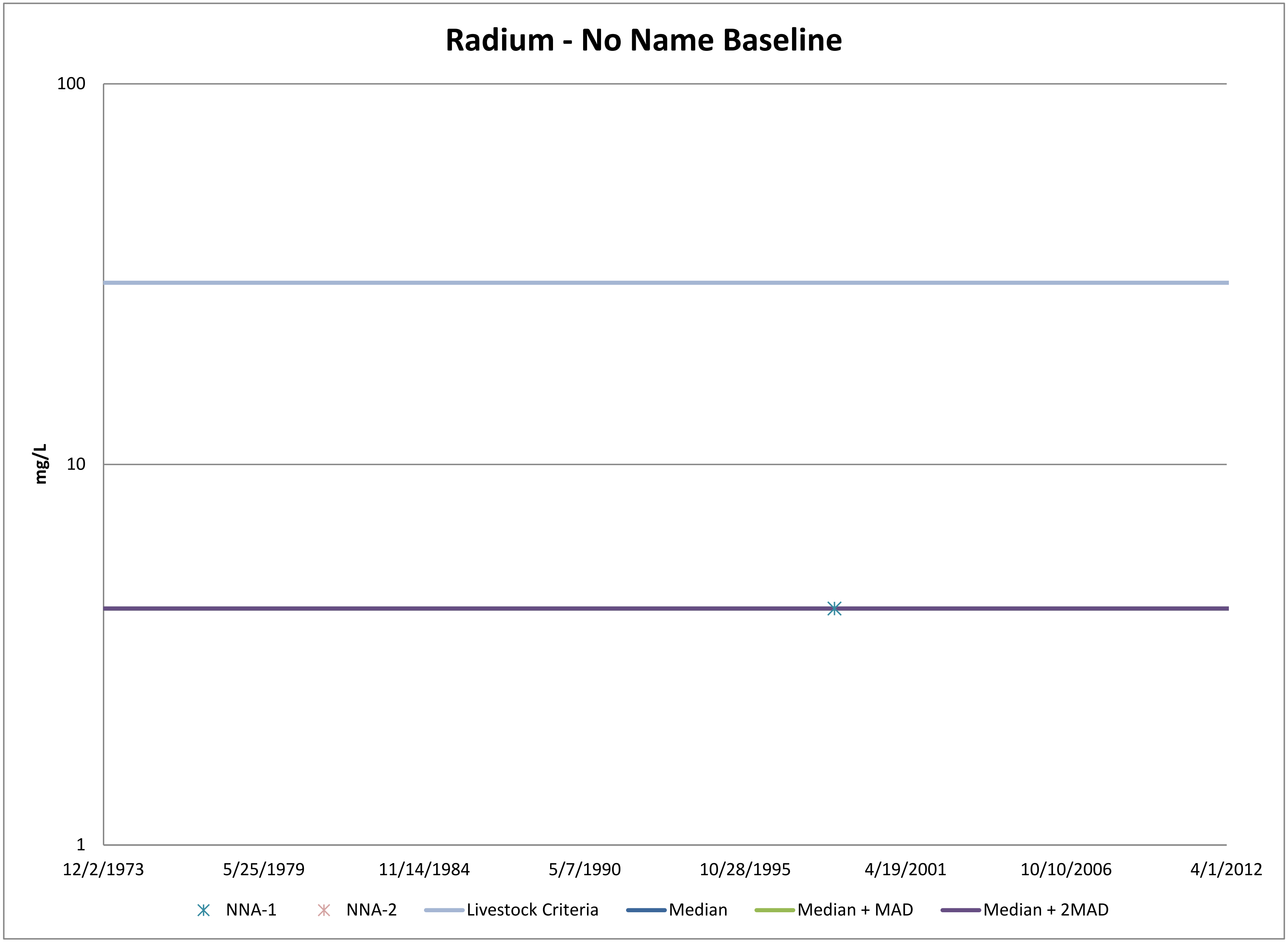

Chloride - No Name Baseline
mg/L
700
600
500
400
300
200
100
0
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
NNA-1
NNA-2
Livestock Criteria
Median
Median + MAD
Median + 2MAD

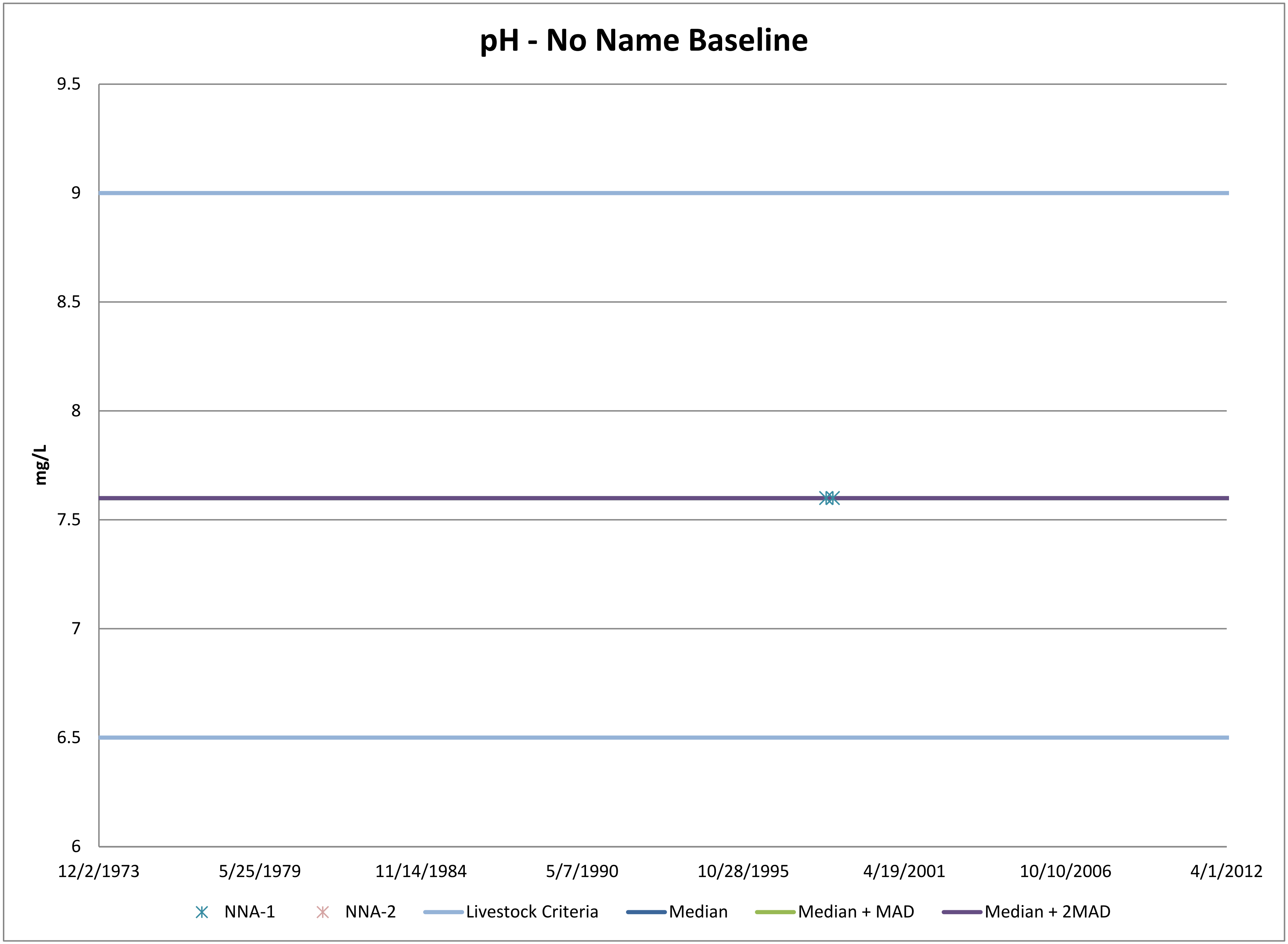

Flouride - No Name Baseline
mg/L
3
2.5
2
1.5
1
0.5
0
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
NNA-1
NNA-2
Livestock Criteria
Median
Median + MAD
Median + 2MAD

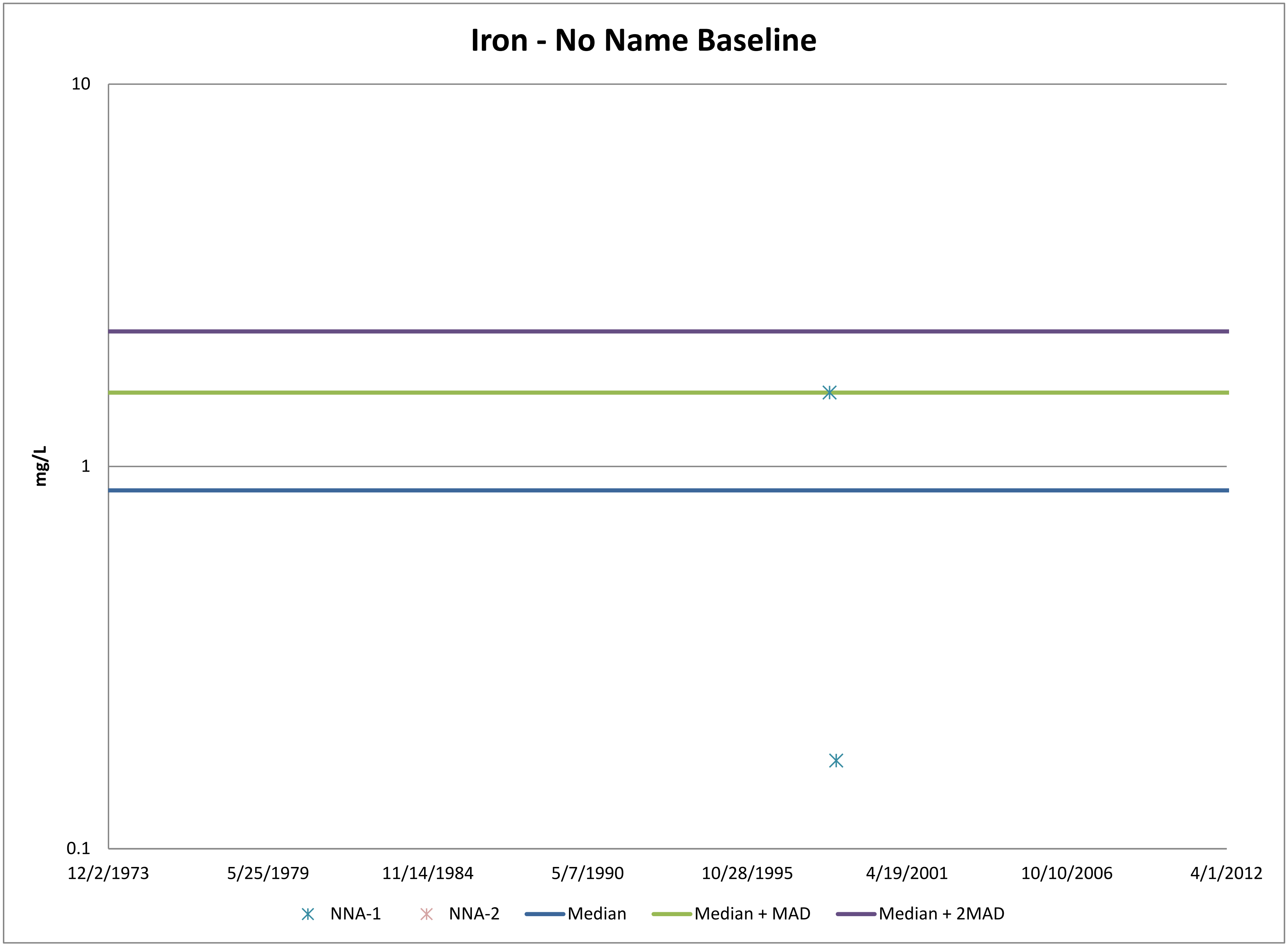

Nitrate - No Name Baseline
1000
100
10
1
mg/L
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
NNA-1
NNA-2
Livestock Criteria
Median
Median + MAD
Median + 2MAD

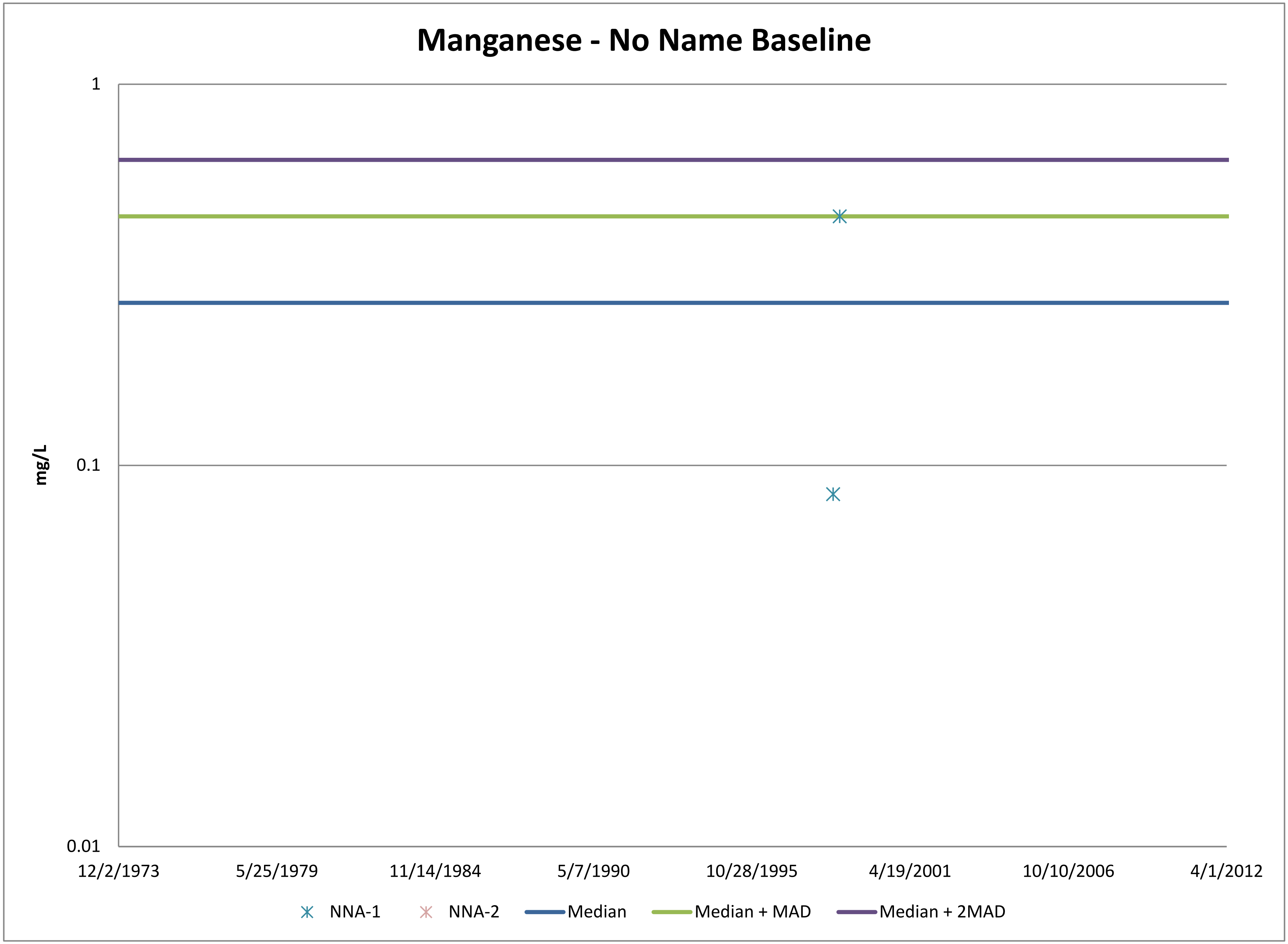

Sulfate - No Name Baseline
mg/L
14000
12000
10000
8000
6000
4000
2000
0
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
NNA-1
NNA-2
Livestock Criteria
Median
Median + MAD
Median + 2MAD

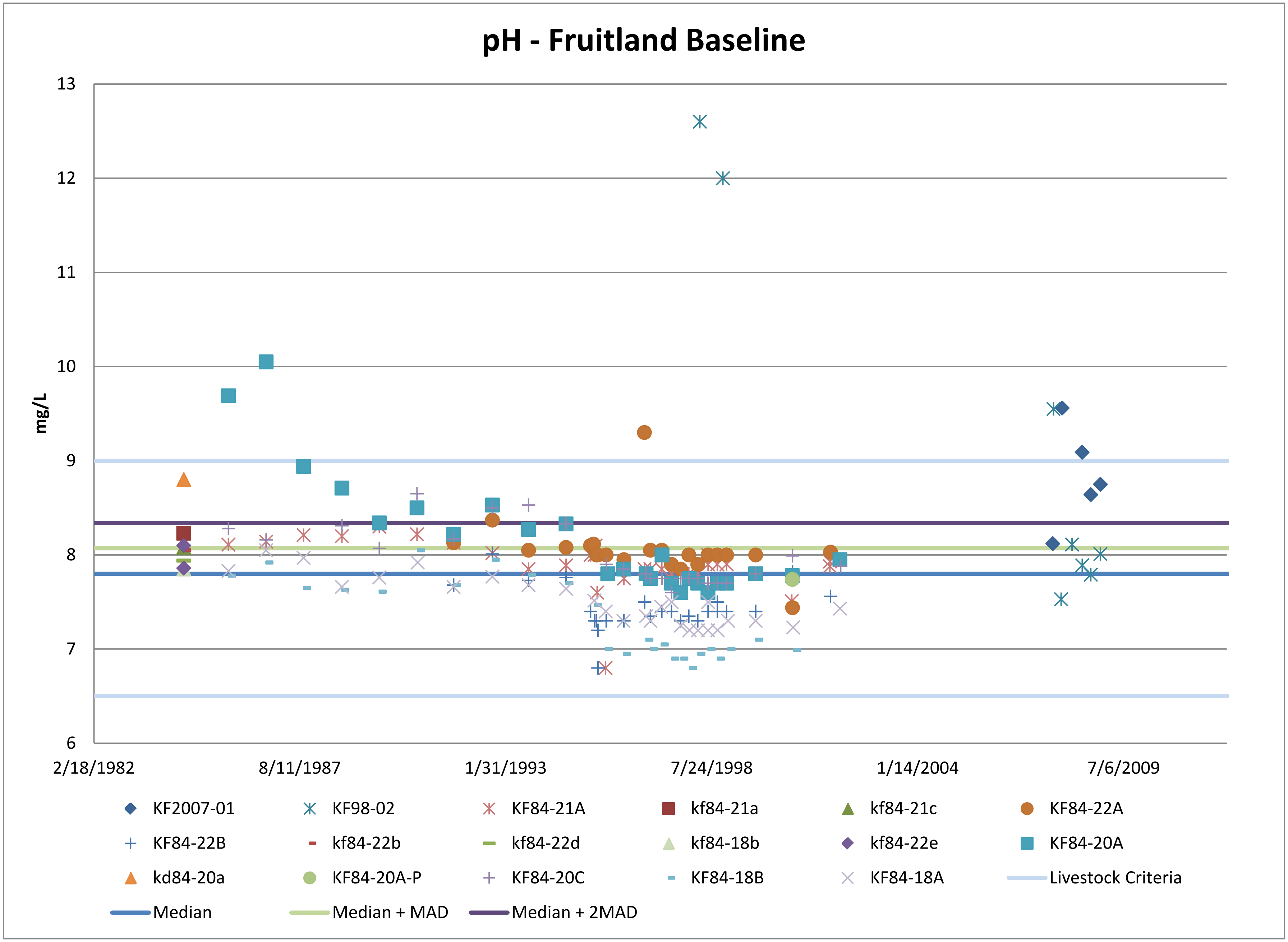

TDS - No Name Baseline
100000
10000
1000
100
10
1
mg/L
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
NNA-1
NNA-2
Livestock Criteria
Median
Median + MAD
Median + 2MAD

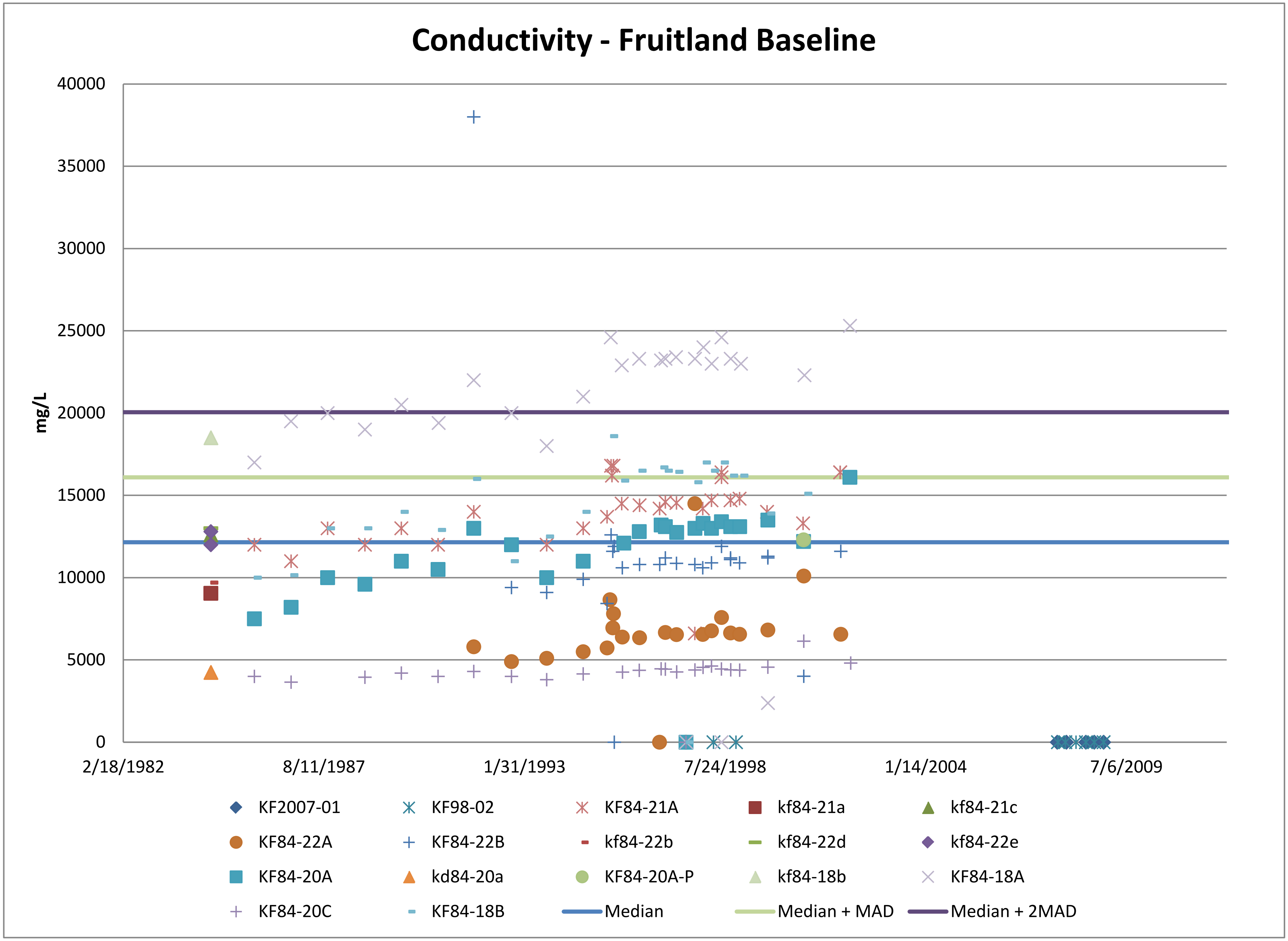

Radium - No Name Baseline
mg/L
100
10
1
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
NNA-1
NNA-2
Livestock Criteria
Median
Median + MAD
Median + 2MAD


pH - No Name Baseline
9.5
9
8.5
8
7.5
7
6.5
6
mg/L
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
NNA-1
NNA-2
Livestock Criteria
Median
Median + MAD
Median + 2MAD

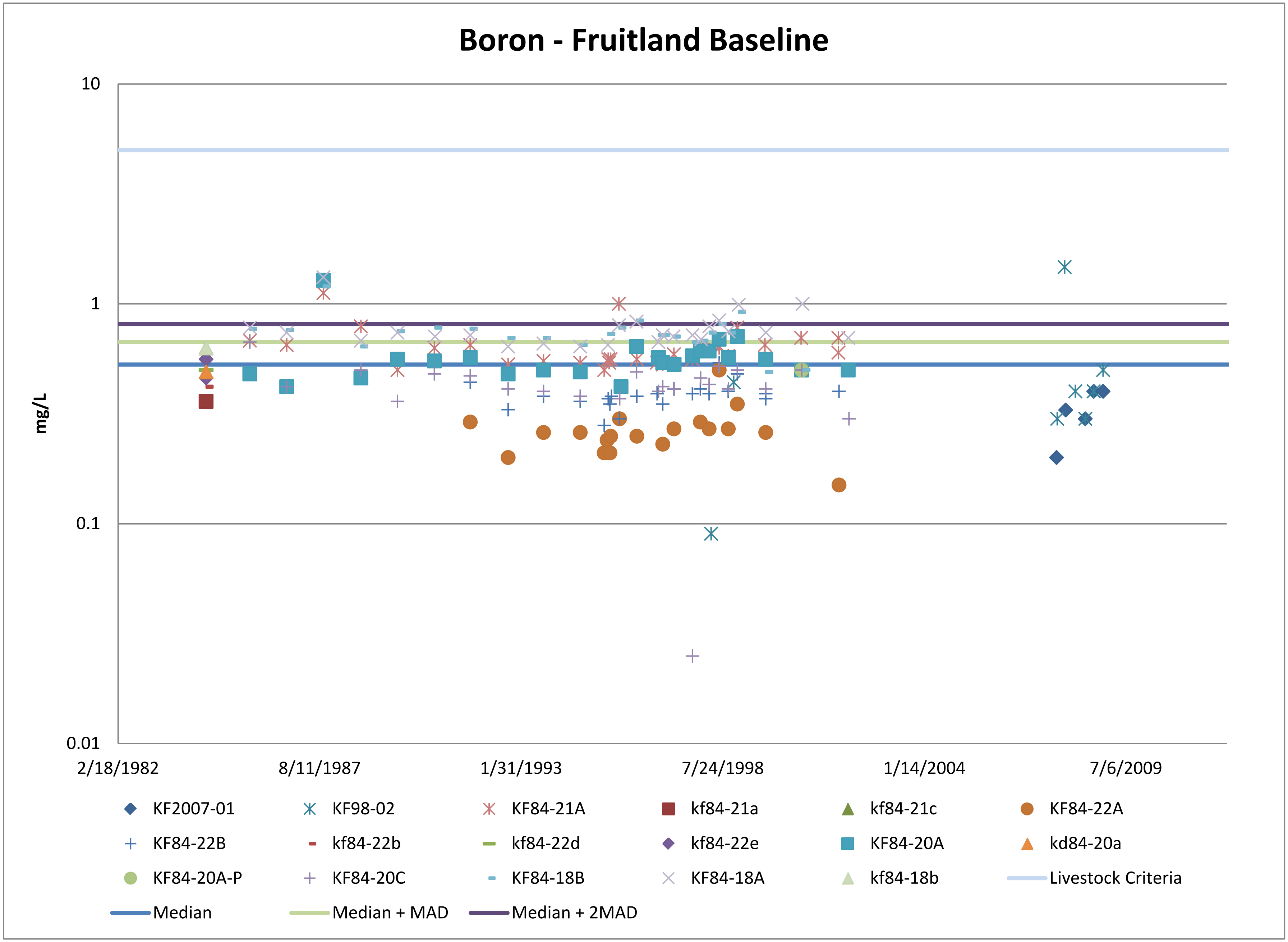

Iron - No Name Baseline
10
1
0.1
mg/L
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
NNA-1
NNA-2
Median
Median + MAD
Median + 2MAD

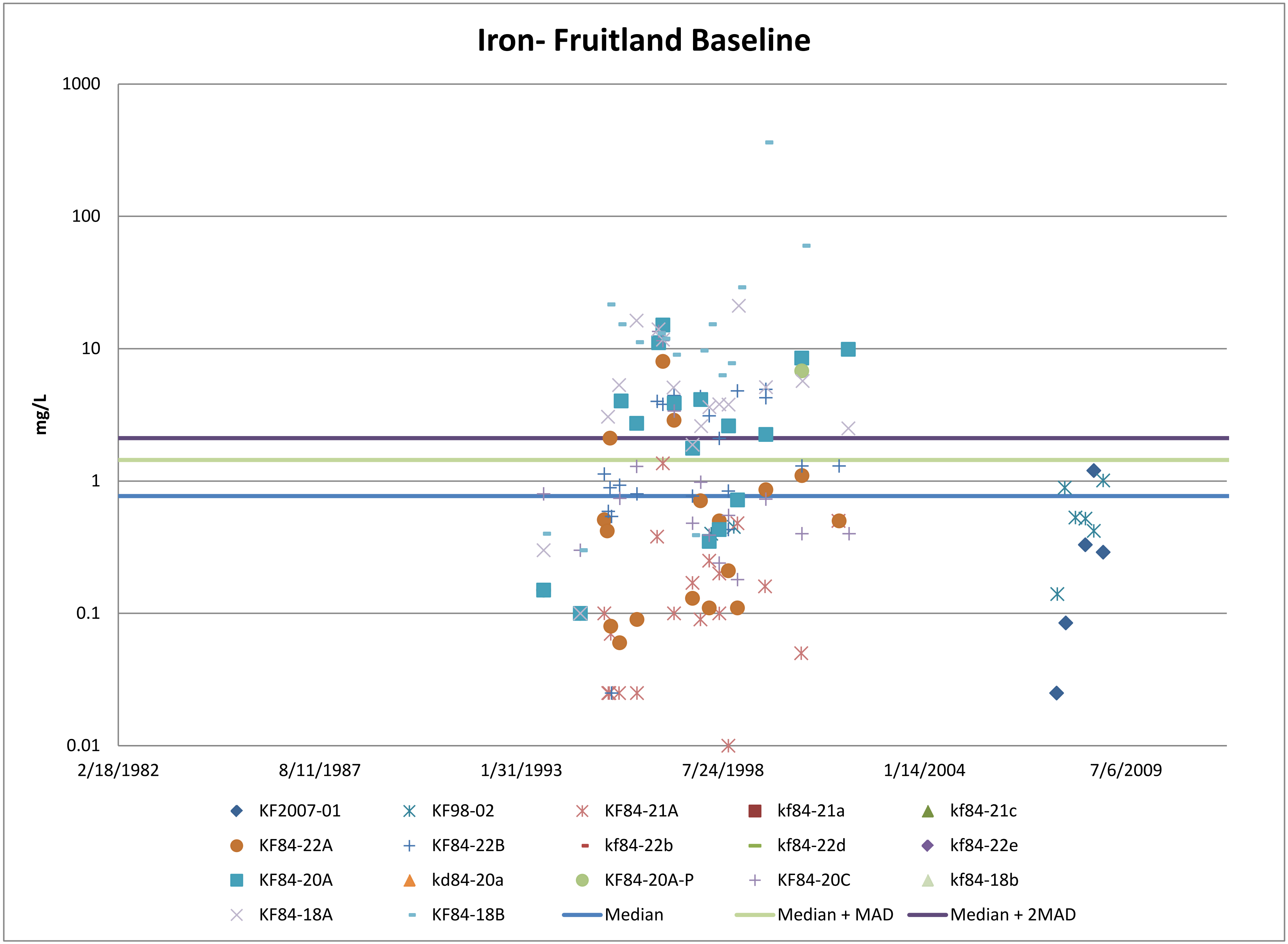

Manganese - No Name Baseline
1
0.1
0.01
mg/L
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
NNA-1
NNA-2
Median
Median + MAD
Median + 2MAD

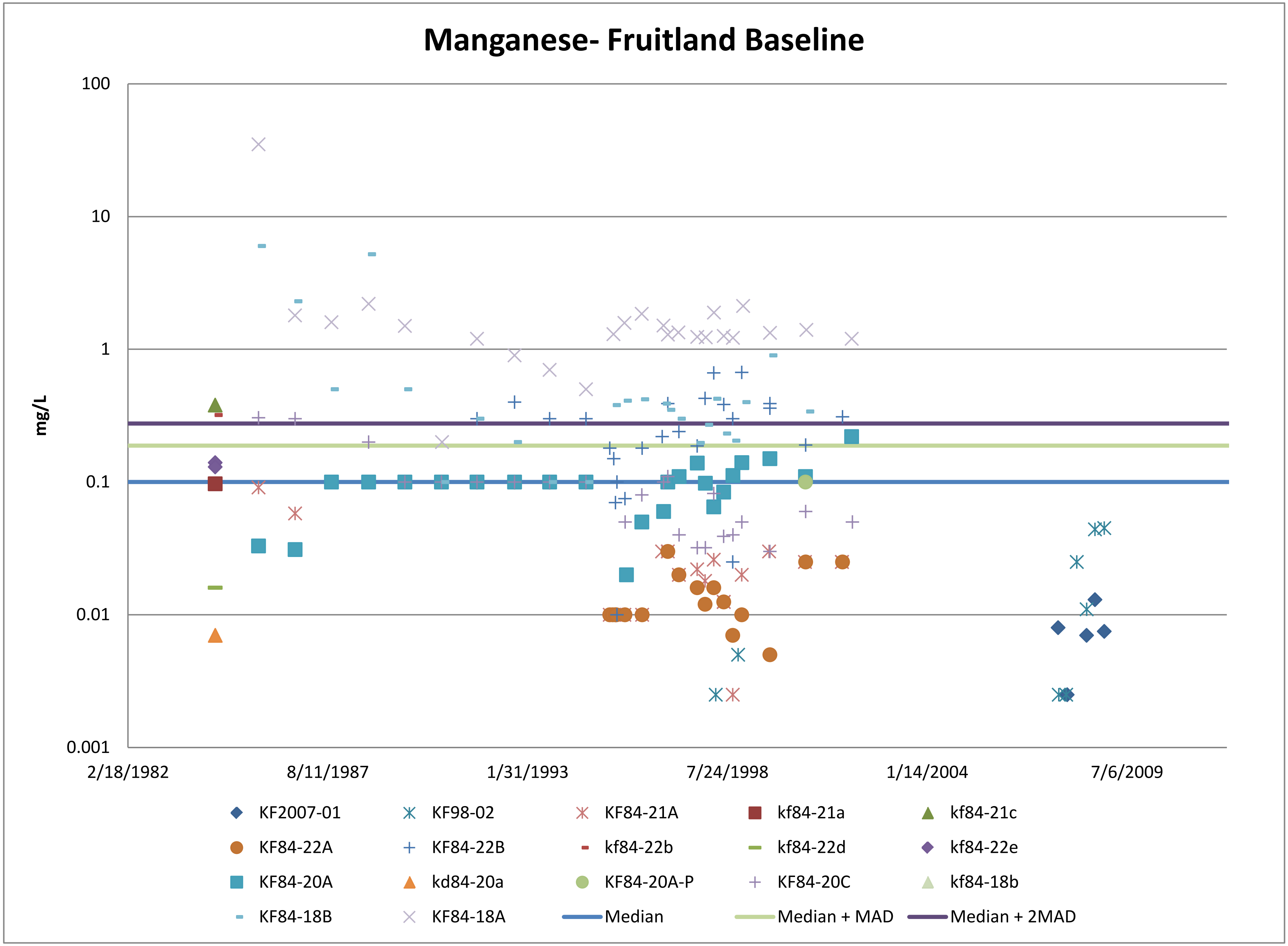

pH - Fruitland Baseline
mg/L
13
12
11
10
9
8
7
6
2/18/1982
8/11/1987
1/31/1993
7/24/1998
1/14/2004
7/6/2009
KF2007-01
KF98-02
KF84-21A
kf84-21a
kf84-21c
KF84-22A
KF84-22B
kf84-22b
kf84-22d
kf84-18b
kf84-22e
KF84-20A
kd84-20a
KF84-20A-P
KF84-20C
KF84-18B
KF84-18A
Livestock Criteria
Median
Median + MAD
Median + 2MAD

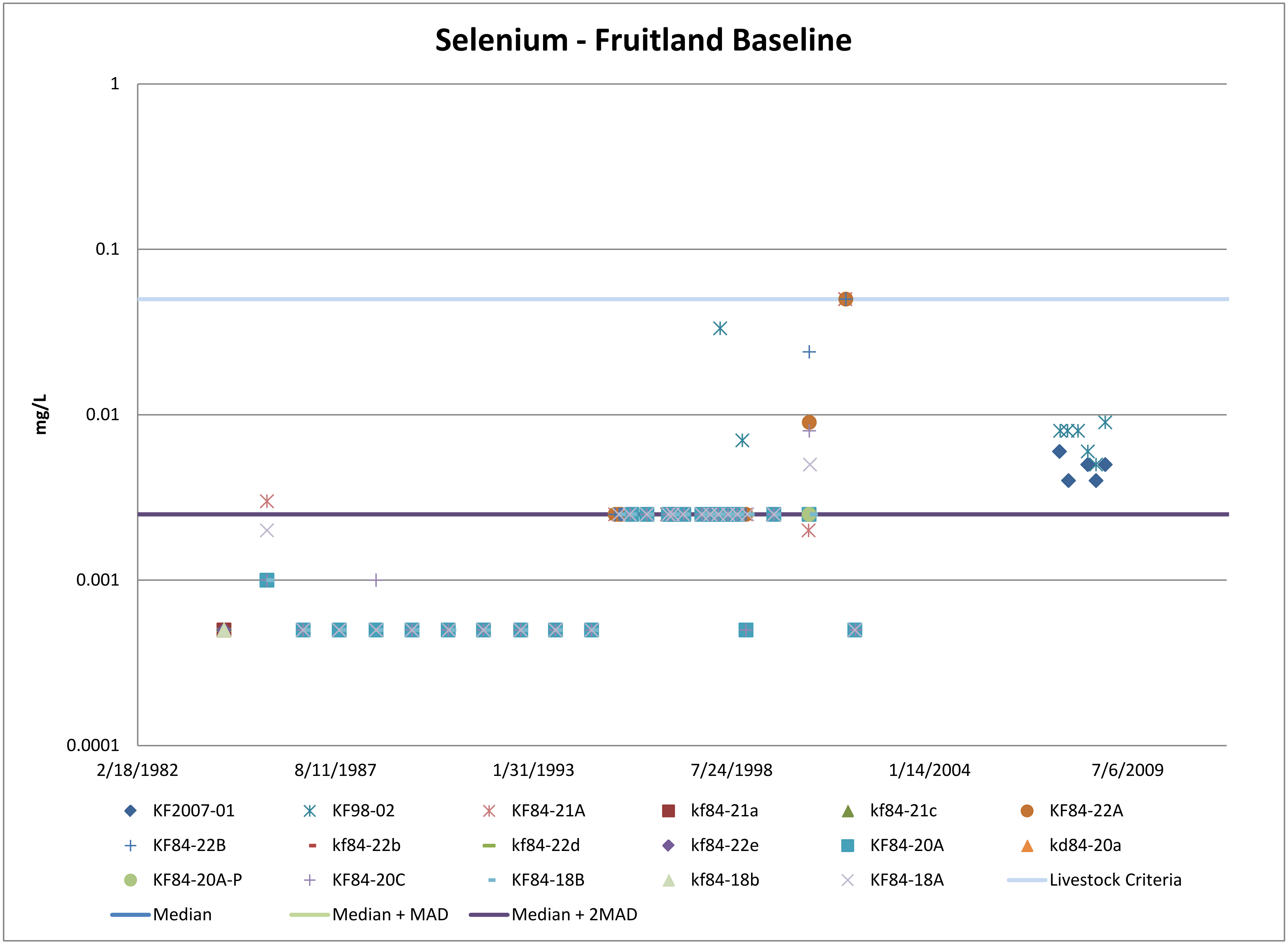

Conductivity - Fruitland Baseline
mg/L
40000
35000
30000
25000
20000
15000
10000
5000
0
2/18/1982
8/11/1987
1/31/1993
7/24/1998
1/14/2004
7/6/2009
KF2007-01
KF98-02
KF84-21A
kf84-21a
kf84-21c
KF84-22A
KF84-22B
kf84-22b
kf84-22d
kf84-22e
KF84-20A
kd84-20a
KF84-20A-P
kf84-18b
KF84-18A
KF84-20C
KF84-18B
Median
Median + MAD
Median + 2MAD

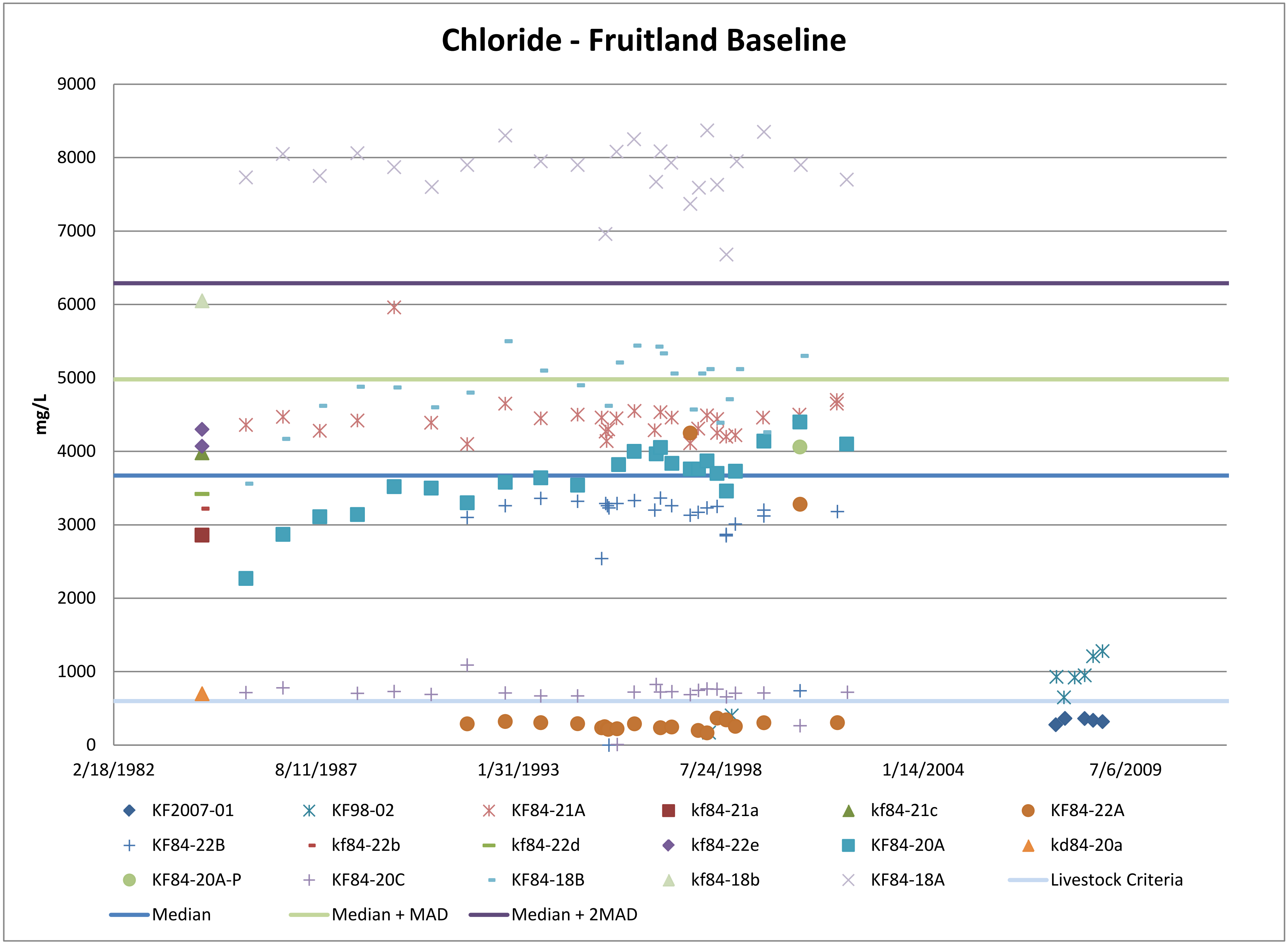
Appendix F - Groundwater Data Summary
Baseline Fruitland Graphs

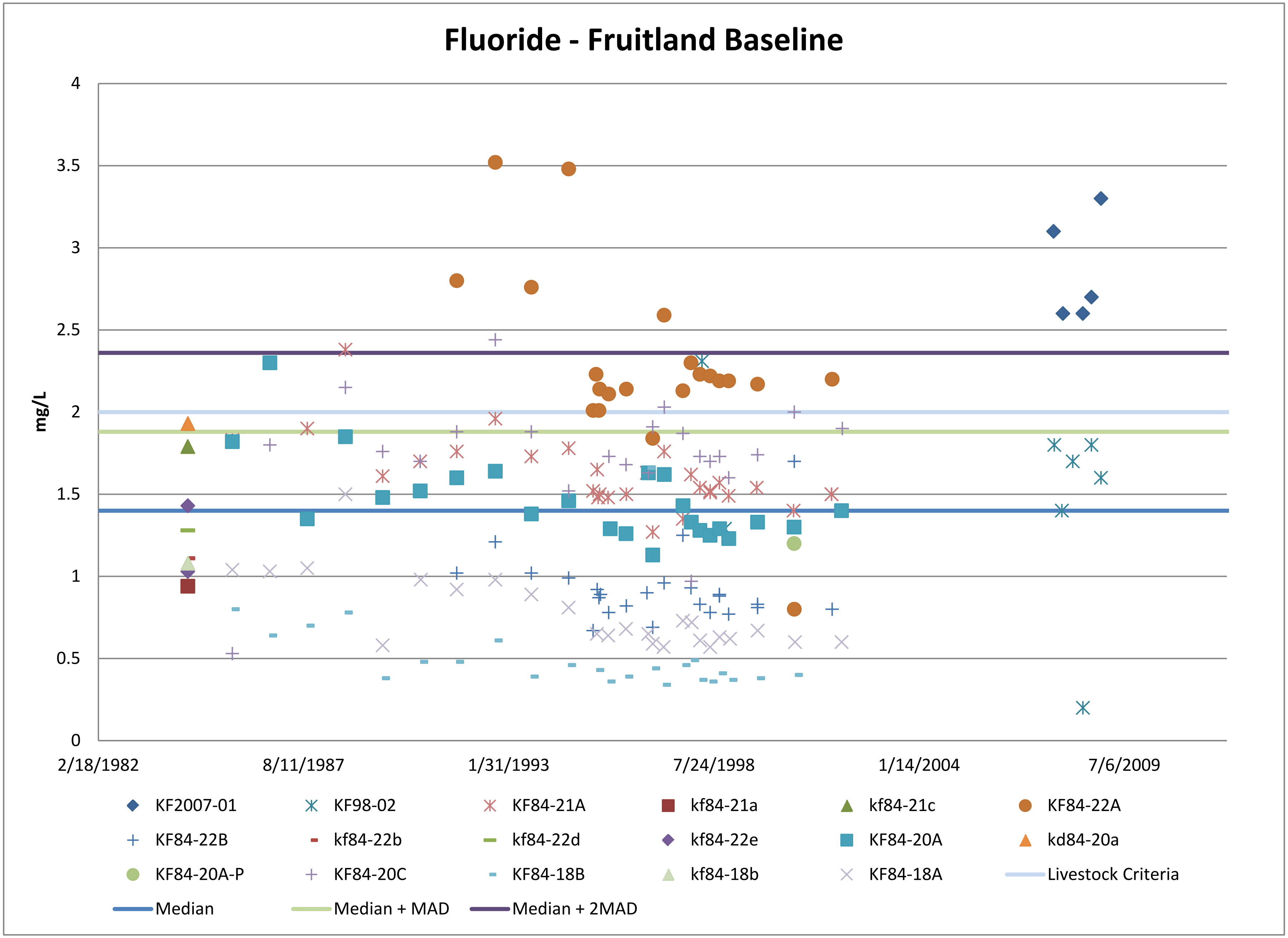


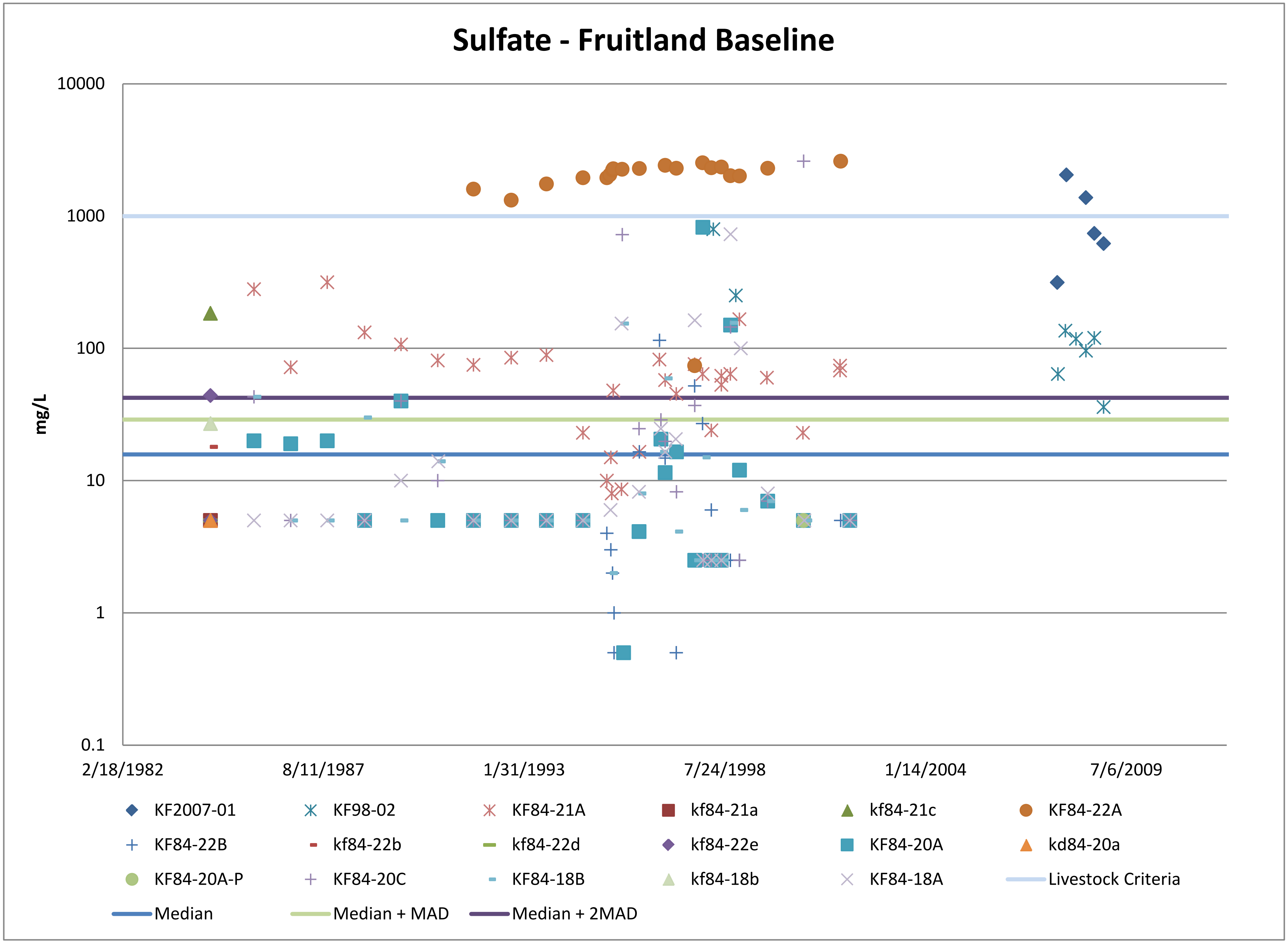

Iron- Fruitland Baseline
mg/L
1000
100
10
1
0.1
0.01
2/18/1982
8/11/1987
1/31/1993
7/24/1998
1/14/2004
7/6/2009
KF2007-01
KF98-02
KF84-21A
kf84-21a
kf84-21c
KF84-22A
KF84-22B
kf84-22b
kf84-22d
kf84-22e
KF84-20A
kd84-20a
KF84-20A-P
KF84-20C
kf84-18b
KF84-18A
KF84-18B
Median
Median + MAD
Median + 2MAD

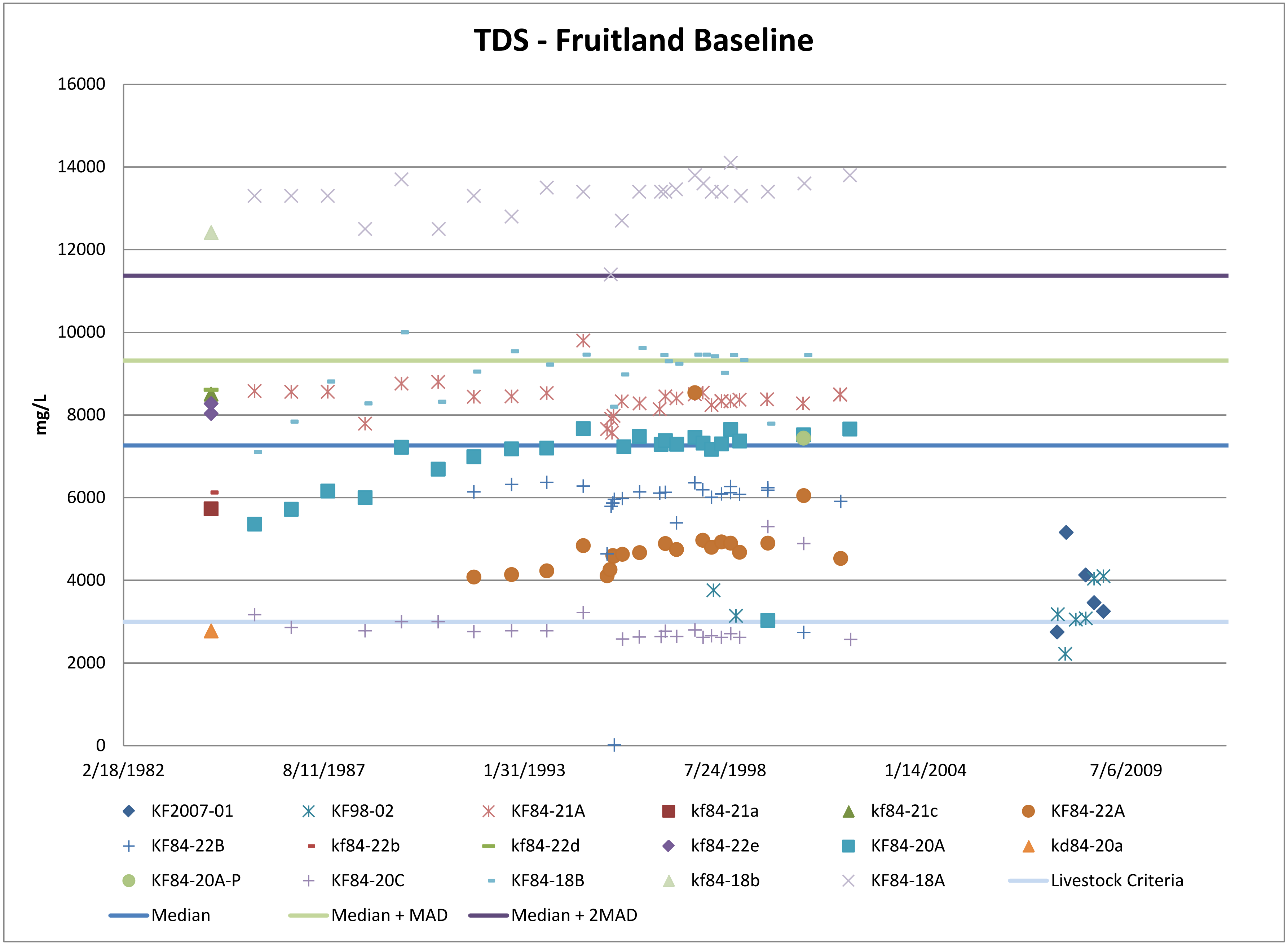

Manganese- Fruitland Baseline
mg/L
100
10
1
0.1
0.01
0.001
2/18/1982
8/11/1987
1/31/1993
7/24/1998
1/14/2004
7/6/2009
KF2007-01
KF98-02
KF84-21A
kf84-21a
kf84-21c
KF84-22A
KF84-22B
kf84-22b
kf84-22d
kf84-22e
KF84-20A
kd84-20a
KF84-20A-P
KF84-20C
kf84-18b
KF84-18B
KF84-18A
Median
Median + MAD
Median + 2MAD

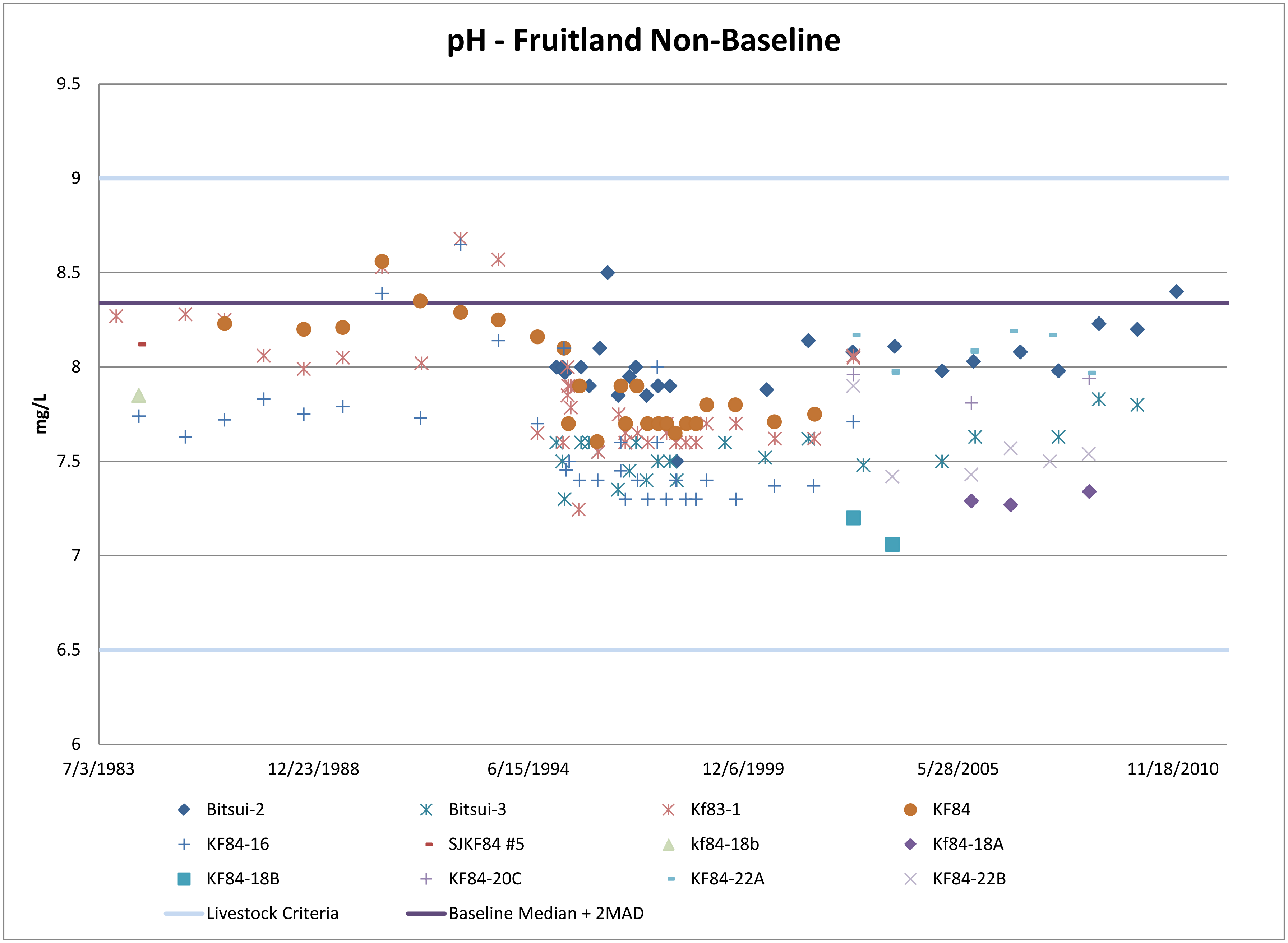

Selenium - Fruitland Baseline
mg/L
1
0.1
0.01
0.001
0.0001
2/18/1982
8/11/1987
1/31/1993
7/24/1998
1/14/2004
7/6/2009
KF2007-01
KF98-02
KF84-21A
kf84-21a
kf84-21c
KF84-22A
KF84-22B
kf84-22b
kf84-22d
kf84-22e
KF84-20A
kd84-20a
KF84-20A-P
KF84-20C
KF84-18B
kf84-18b
KF84-18A
Livestock Criteria
Median
Median + MAD
Median + 2MAD

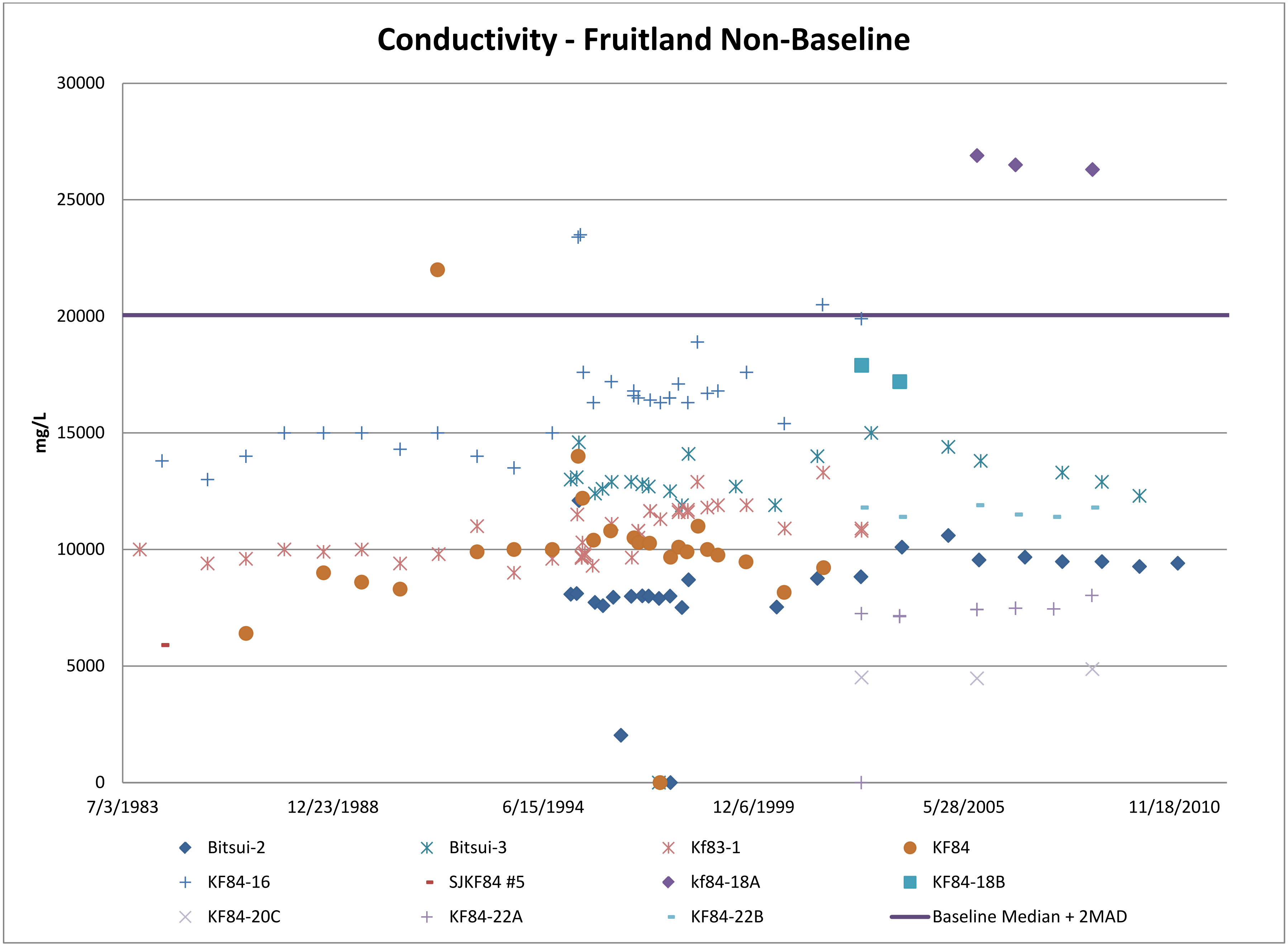

Chloride - Fruitland Baseline
mg/L
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
2/18/1982
8/11/1987
1/31/1993
7/24/1998
1/14/2004
7/6/2009
KF2007-01
KF98-02
KF84-21A
kf84-21a
kf84-21c
KF84-22A
KF84-22B
kf84-22b
kf84-22d
kf84-22e
KF84-20A
kd84-20a
KF84-20A-P
KF84-20C
KF84-18B
kf84-18b
KF84-18A
Livestock Criteria
Median
Median + MAD
Median + 2MAD

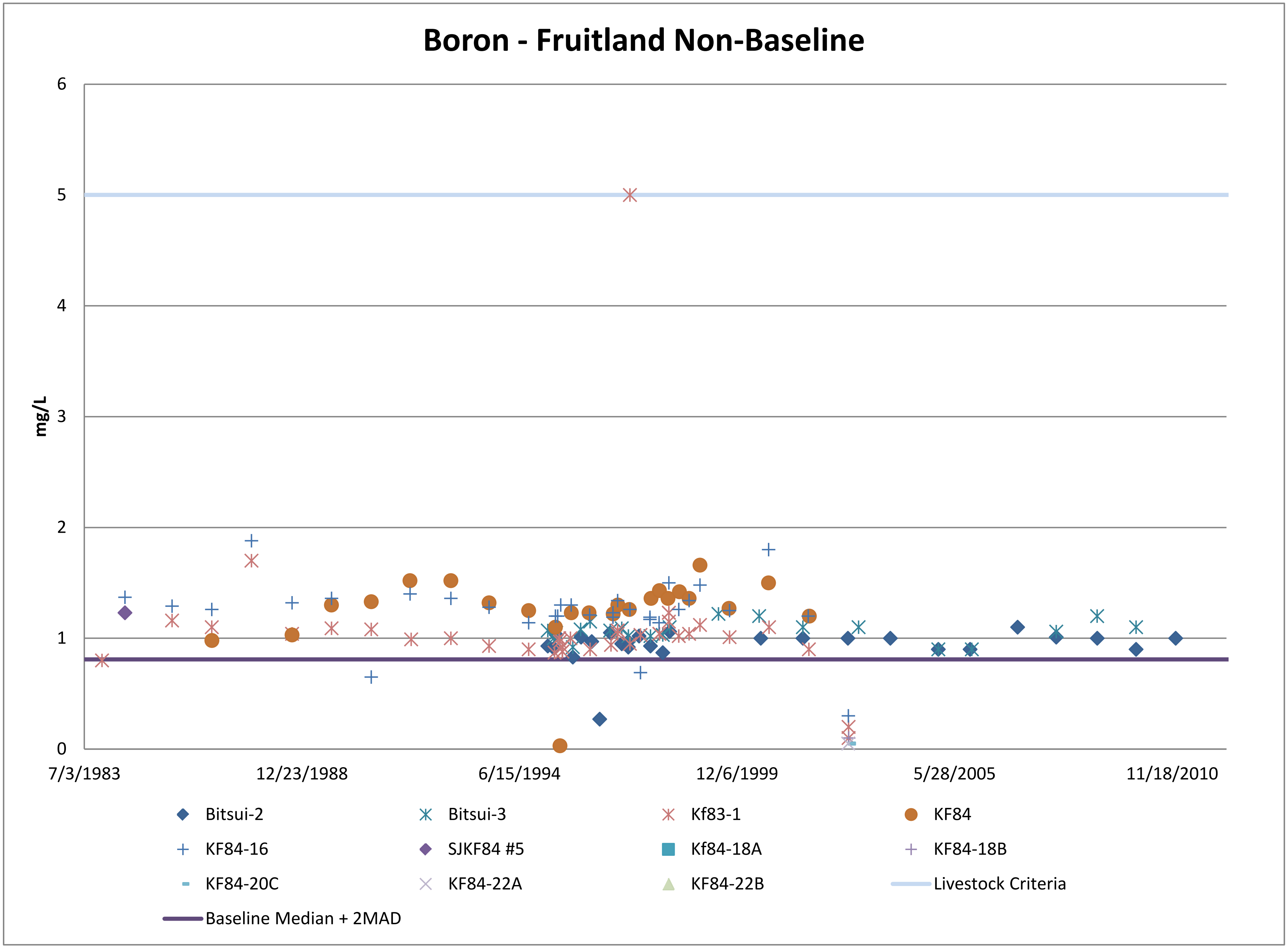

Fluoride - Fruitland Baseline
mg/L
4
3.5
3
2.5
2
1.5
1
0.5
0
2/18/1982
8/11/1987
1/31/1993
7/24/1998
1/14/2004
7/6/2009
KF2007-01
KF98-02
KF84-21A
kf84-21a
kf84-21c
KF84-22A
KF84-22B
kf84-22b
kf84-22d
kf84-22e
KF84-20A
kd84-20a
KF84-20A-P
KF84-20C
KF84-18B
kf84-18b
KF84-18A
Livestock Criteria
Median
Median + MAD
Median + 2MAD


Sulfate - Fruitland Baseline
mg/L
10000
1000
100
10
1
0.1
2/18/1982
8/11/1987
1/31/1993
7/24/1998
1/14/2004
7/6/2009
KF2007-01
KF98-02
KF84-21A
kf84-21a
kf84-21c
KF84-22A
KF84-22B
kf84-22b
kf84-22d
kf84-22e
KF84-20A
kd84-20a
KF84-20A-P
KF84-20C
KF84-18B
kf84-18b
KF84-18A
Livestock Criteria
Median
Median + MAD
Median + 2MAD


TDS - Fruitland Baseline
mg/L
16000
14000
12000
10000
8000
6000
4000
2000
0
2/18/1982
8/11/1987
1/31/1993
7/24/1998
1/14/2004
7/6/2009
KF2007-01
KF98-02
KF84-21A
kf84-21a
kf84-21c
KF84-22A
KF84-22B
kf84-22b
kf84-22d
kf84-22e
KF84-20A
kd84-20a
KF84-20A-P
KF84-20C
KF84-18B
kf84-18b
KF84-18A
Livestock Criteria
Median
Median + MAD
Median + 2MAD

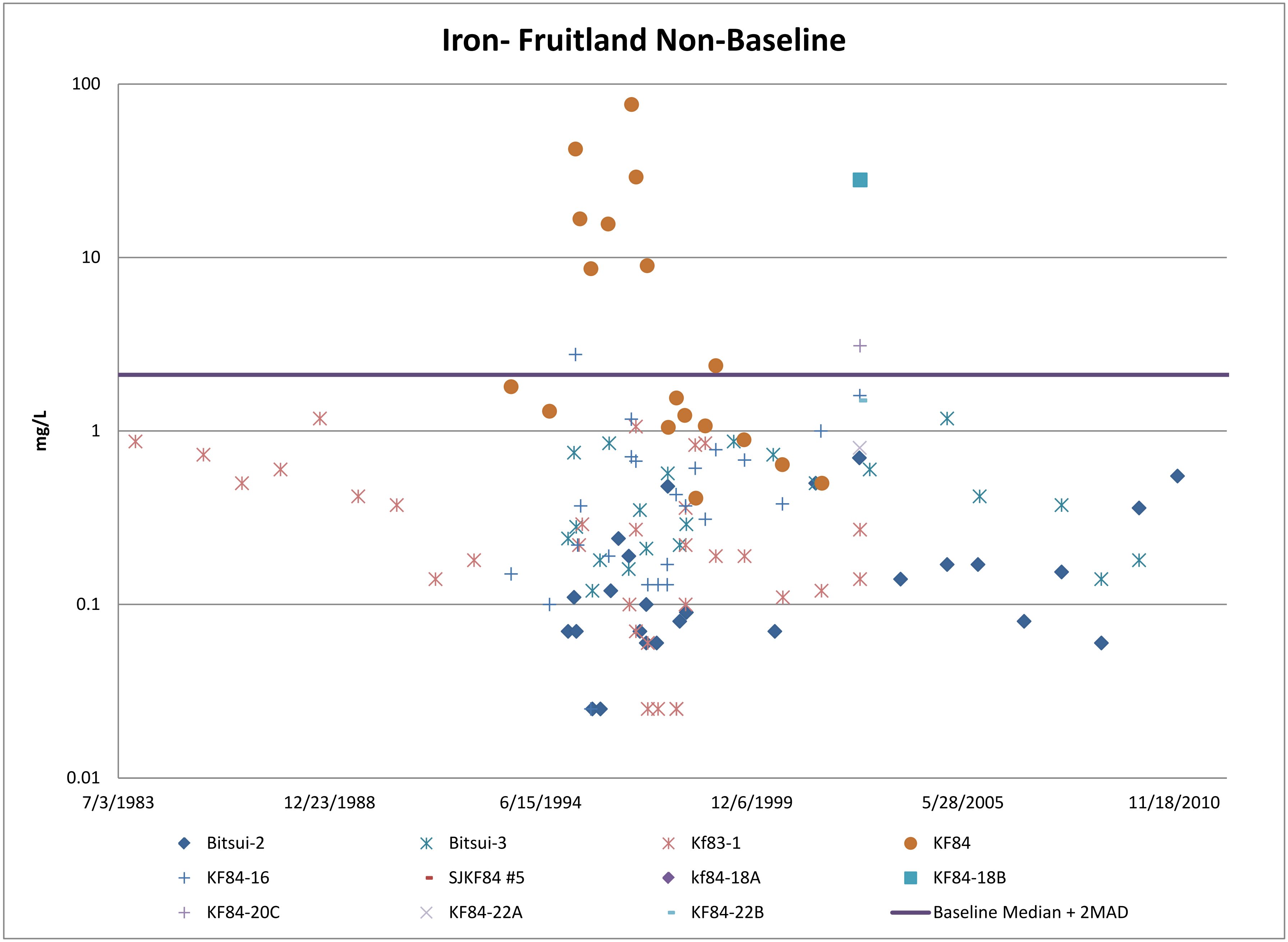

pH - Fruitland Non-Baseline
9.5
9
8.5
8
7.5
7
6.5
6
mg/L
7/3/1983
12/23/1988
6/15/1994
12/6/1999
5/28/2005
11/18/2010
Bitsui-2
Bitsui-3
Kf83-1
KF84
KF84-16
SJKF84 #5
kf84-18b
Kf84-18A
KF84-18B
KF84-20C
KF84-22A
KF84-22B
Livestock Criteria
Baseline Median + 2MAD

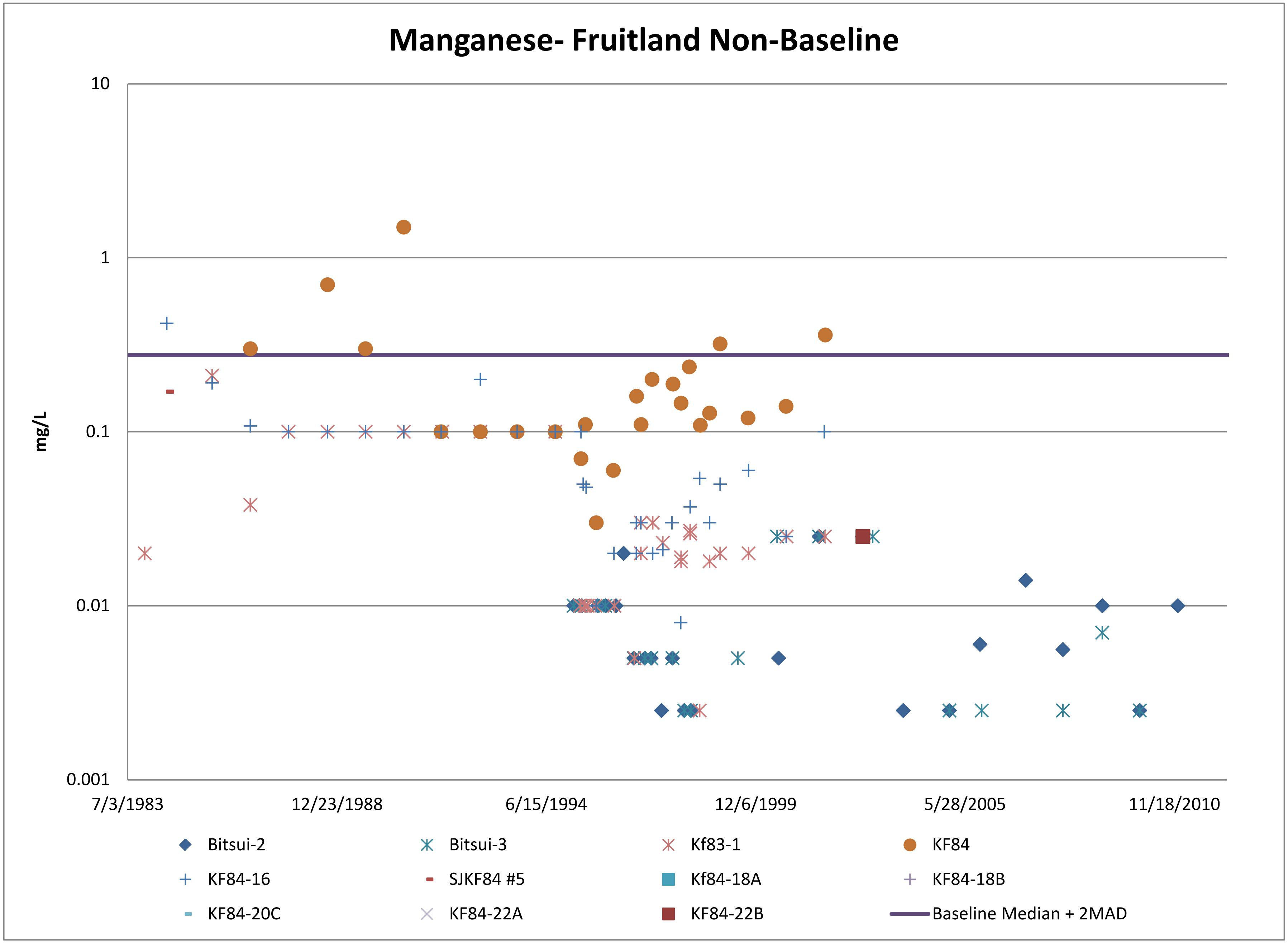

Conductivity - Fruitland Non-Baseline
mg/L
30000
25000
20000
15000
10000
5000
0
7/3/1983
12/23/1988
6/15/1994
12/6/1999
5/28/2005
11/18/2010
Bitsui-2
Bitsui-3
Kf83-1
KF84
KF84-16
SJKF84 #5
kf84-18A
KF84-18B
KF84-20C
KF84-22A
KF84-22B
Baseline Median + 2MAD

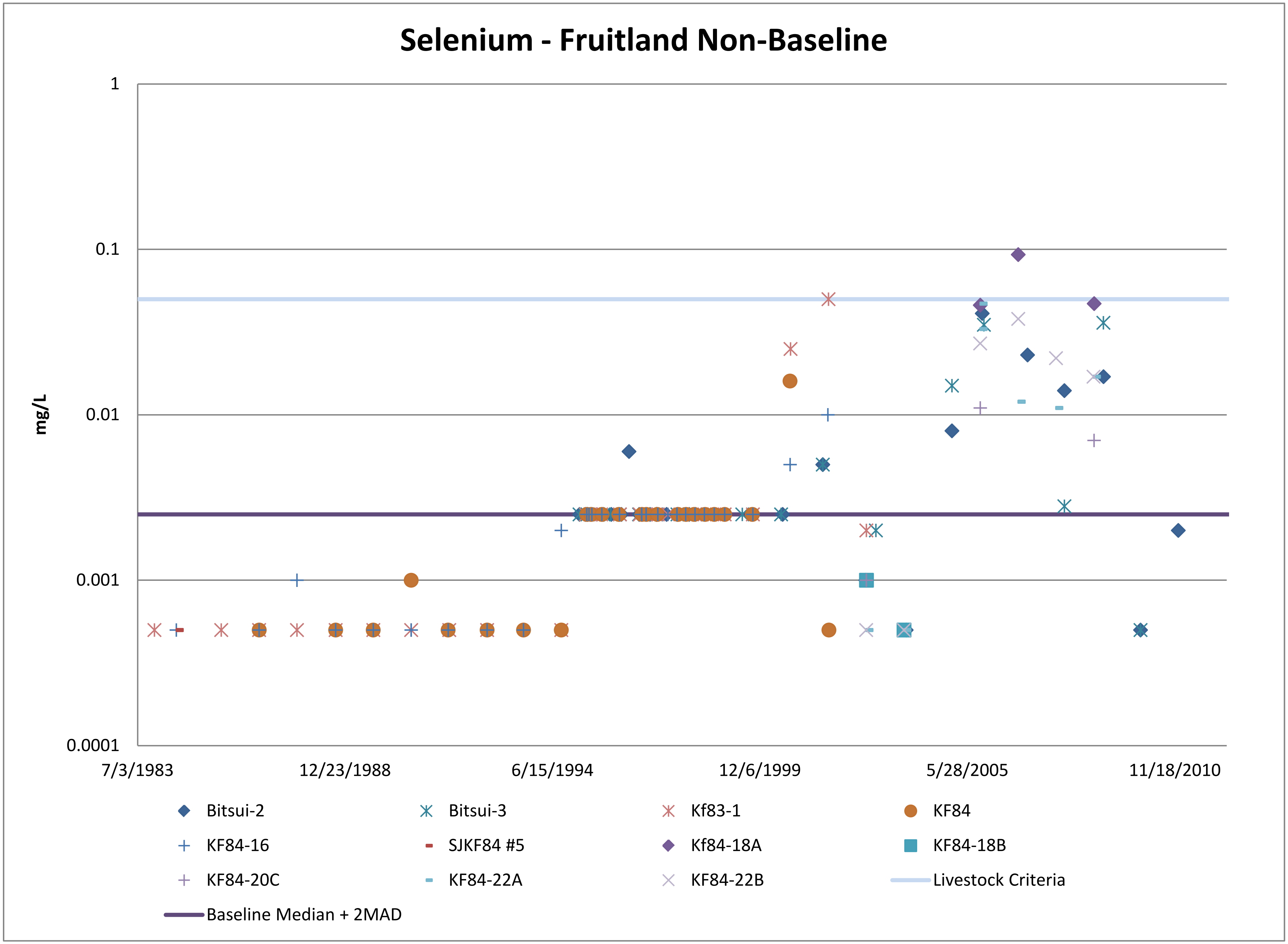

Boron - Fruitland Non-Baseline
mg/L
6
5
4
3
2
1
0
7/3/1983
12/23/1988
6/15/1994
12/6/1999
5/28/2005
11/18/2010
Bitsui-2
Bitsui-3
Kf83-1
KF84
KF84-16
SJKF84 #5
Kf84-18A
KF84-18B
KF84-20C
KF84-22A
KF84-22B
Livestock Criteria
Baseline Median + 2MAD

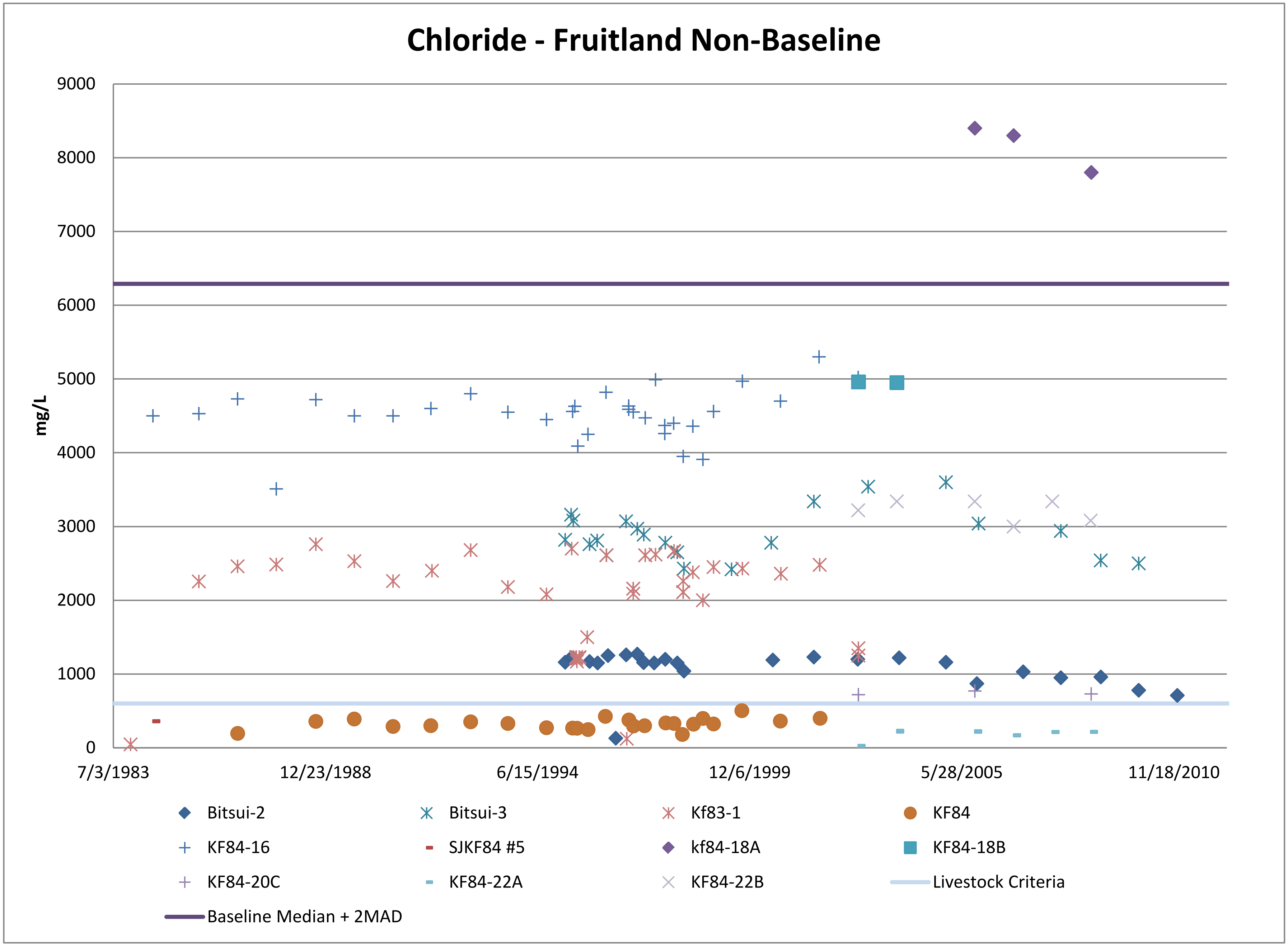
Appendix F - Groundwater Data Summary

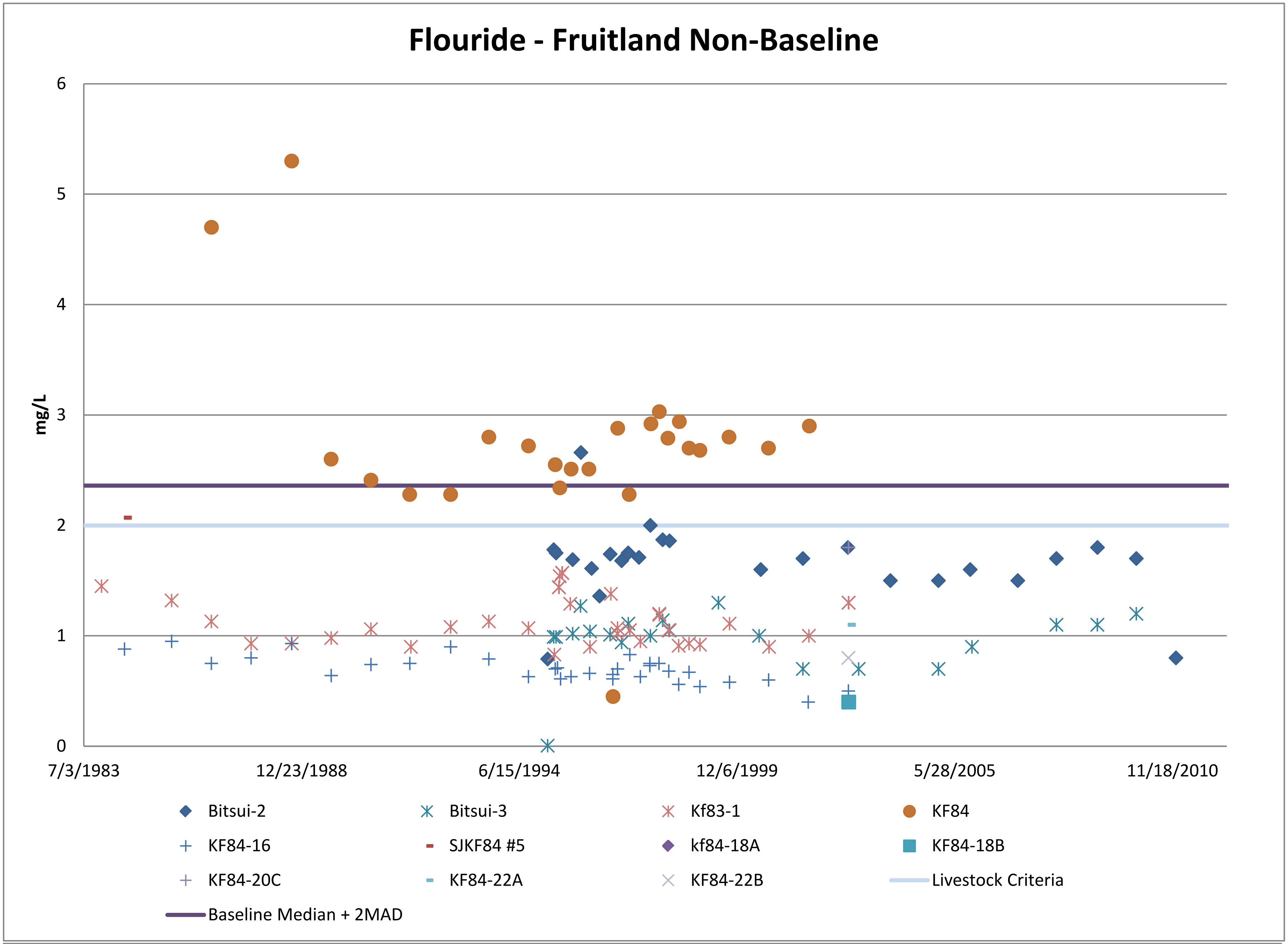
Non Baseline Fruitland Graphs

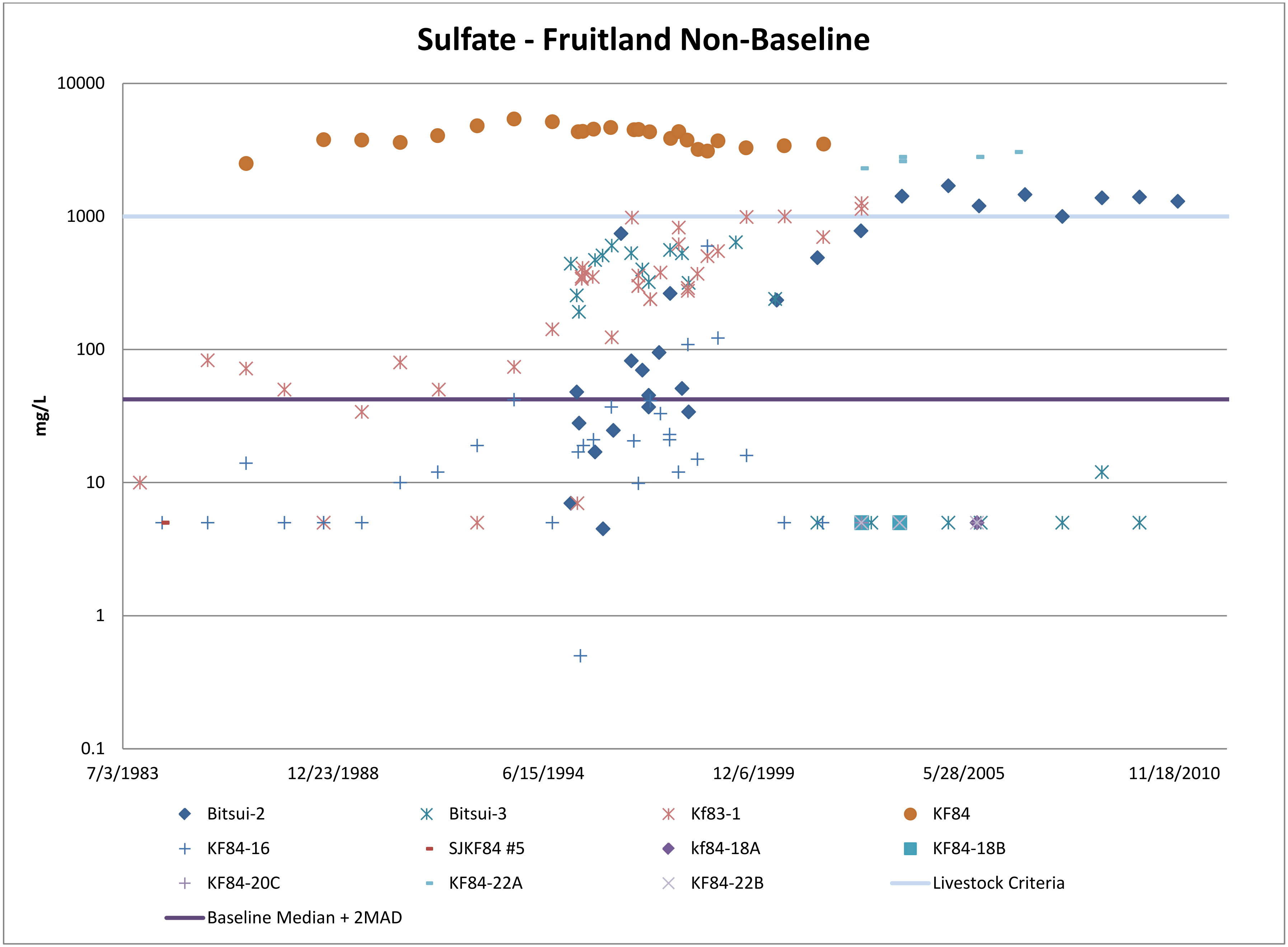


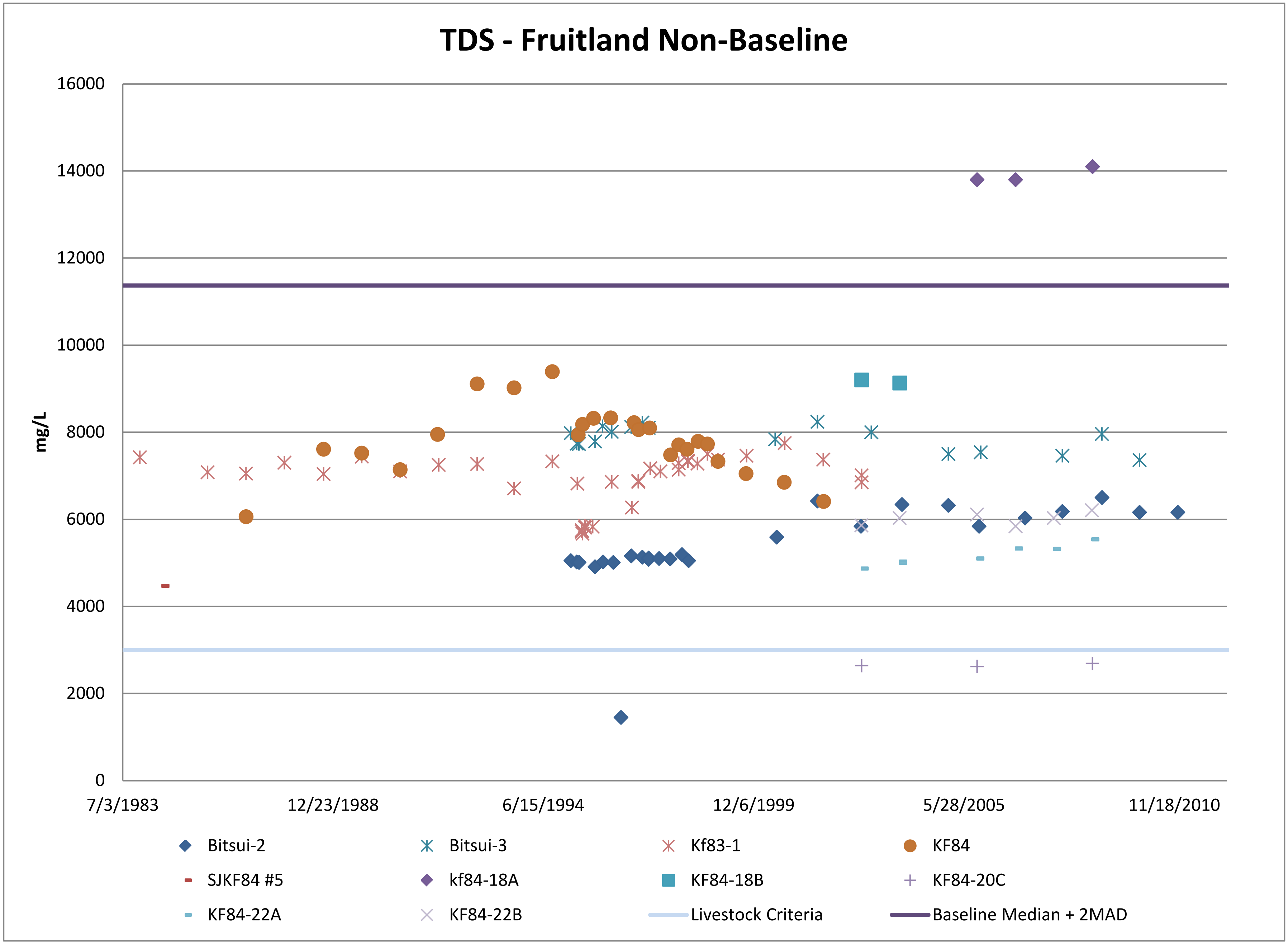

Manganese- Fruitland Non-Baseline
10
1
0.1
0.01
0.001
mg/L
7/3/1983
12/23/1988
6/15/1994
12/6/1999
5/28/2005
11/18/2010
Bitsui-2
Bitsui-3
Kf83-1
KF84
KF84-16
SJKF84 #5
Kf84-18A
KF84-18B
KF84-20C
KF84-22A
KF84-22B
Baseline Median + 2MAD

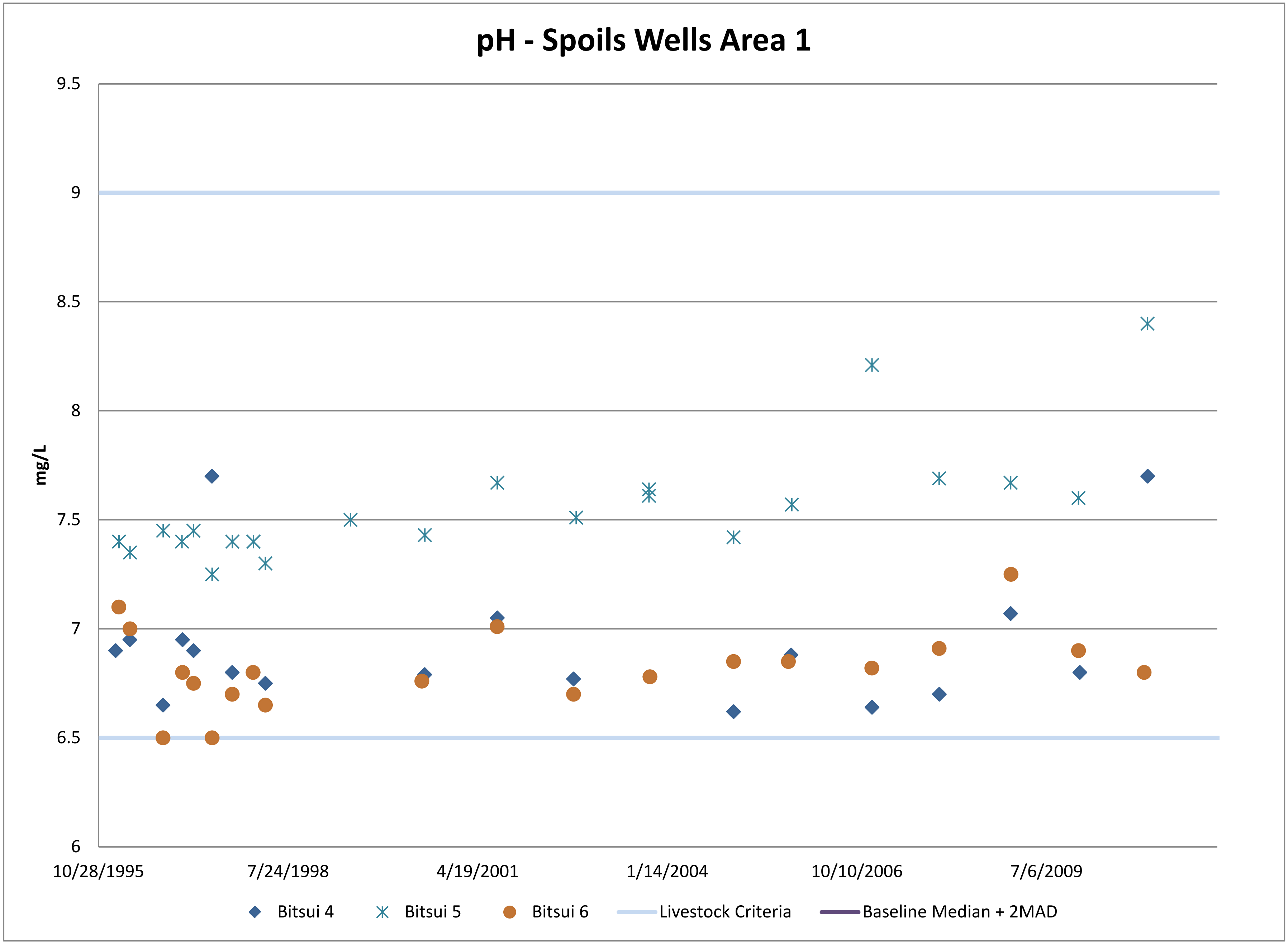

Selenium - Fruitland Non-Baseline
mg/L
1
0.1
0.01
0.001
0.0001
7/3/1983
12/23/1988
6/15/1994
12/6/1999
5/28/2005
11/18/2010
Bitsui-2
Bitsui-3
Kf83-1
KF84
KF84-16
SJKF84 #5
Kf84-18A
KF84-18B
KF84-20C
KF84-22A
KF84-22B
Livestock Criteria
Baseline Median + 2MAD

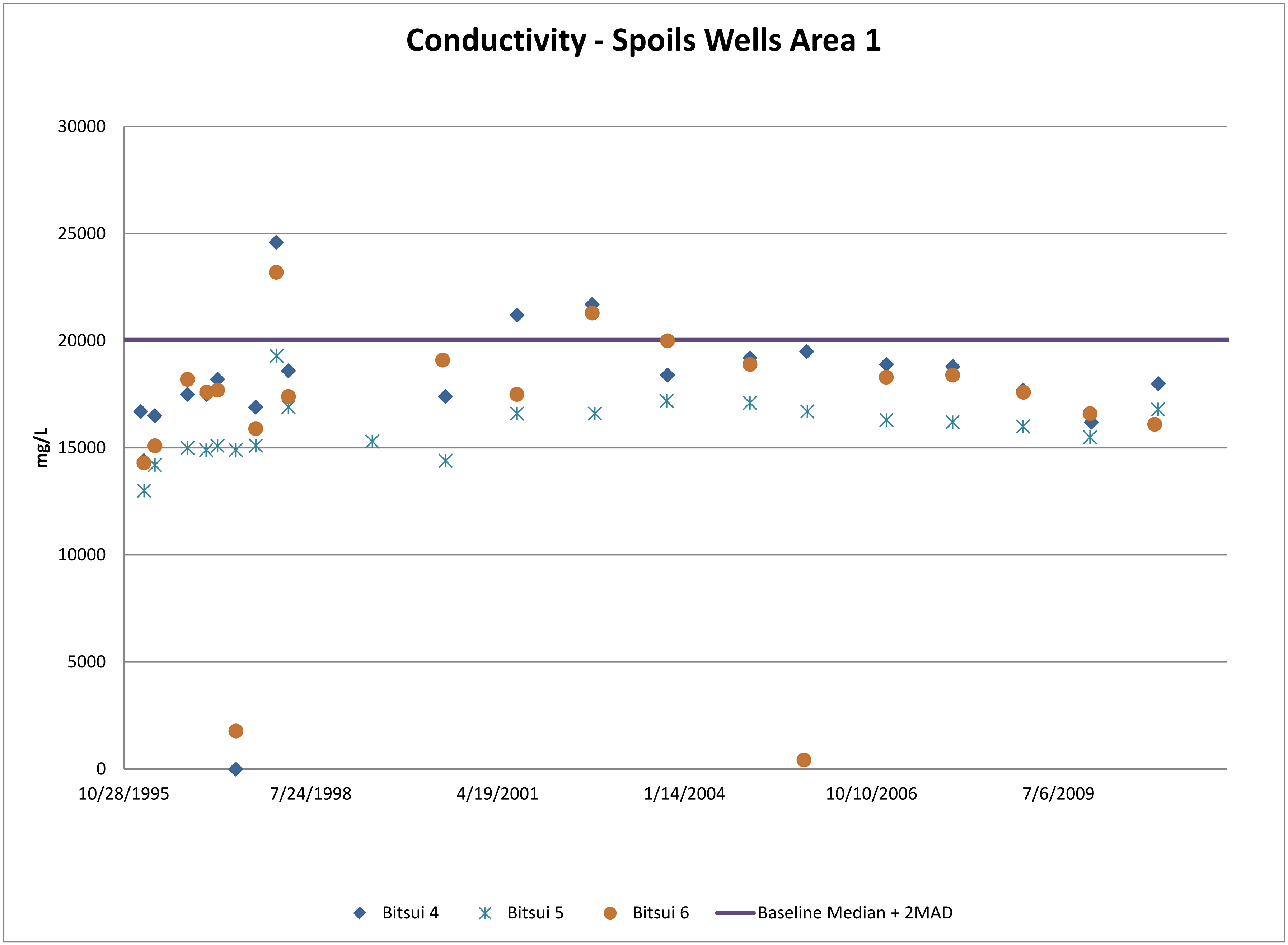

Chloride - Fruitland Non-Baseline
mg/L
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
7/3/1983
12/23/1988
6/15/1994
12/6/1999
5/28/2005
11/18/2010
Bitsui-2
Bitsui-3
Kf83-1
KF84
KF84-16
SJKF84 #5
kf84-18A
KF84-18B
KF84-20C
KF84-22A
KF84-22B
Livestock Criteria
Baseline Median + 2MAD

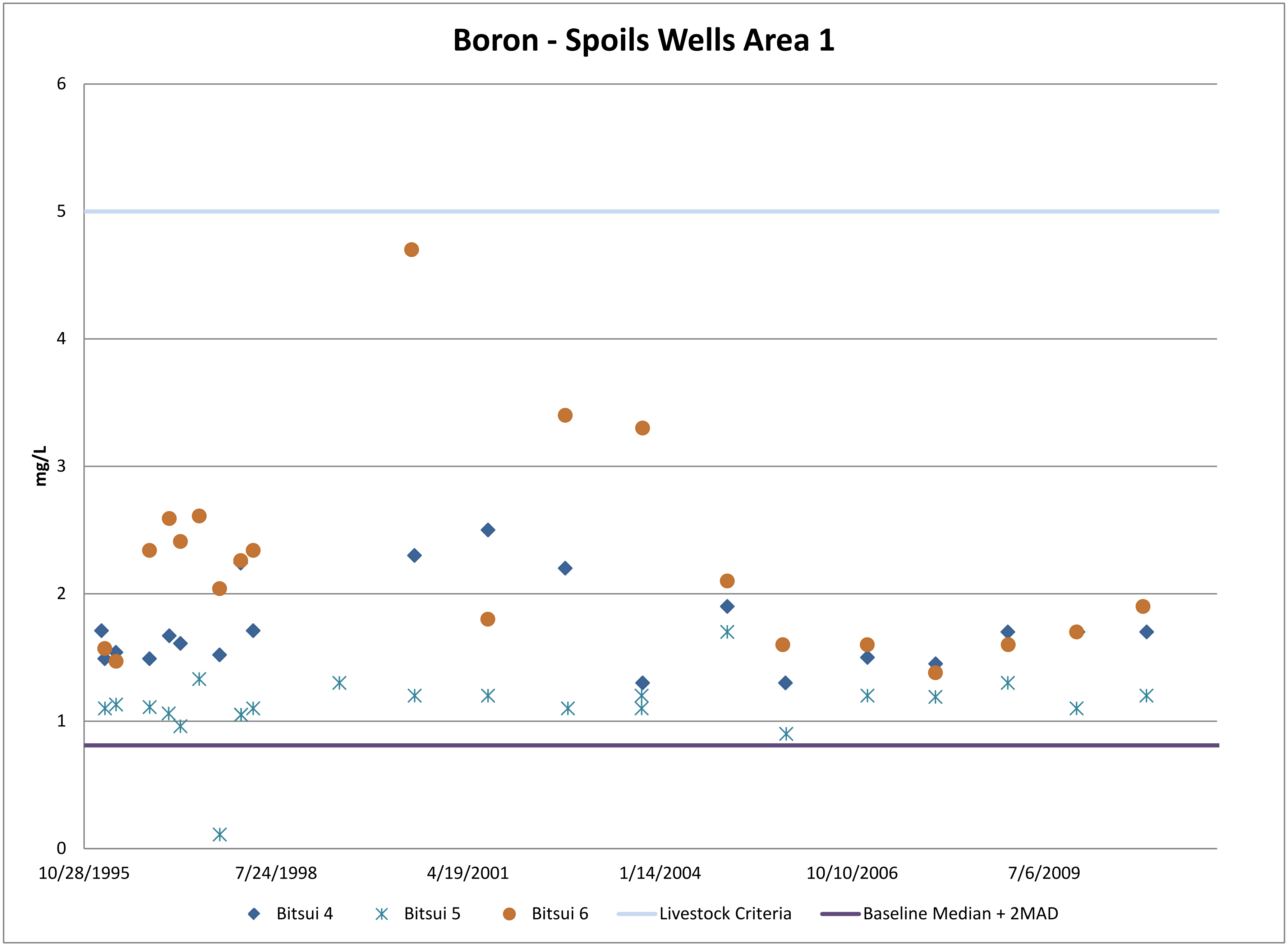

Flouride - Fruitland Non-Baseline
mg/L
6
5
4
3
2
1
0
7/3/1983
12/23/1988
6/15/1994
12/6/1999
5/28/2005
11/18/2010
Bitsui-2
Bitsui-3
Kf83-1
KF84
KF84-16
SJKF84 #5
kf84-18A
KF84-18B
KF84-20C
KF84-22A
KF84-22B
Livestock Criteria
Baseline Median + 2MAD

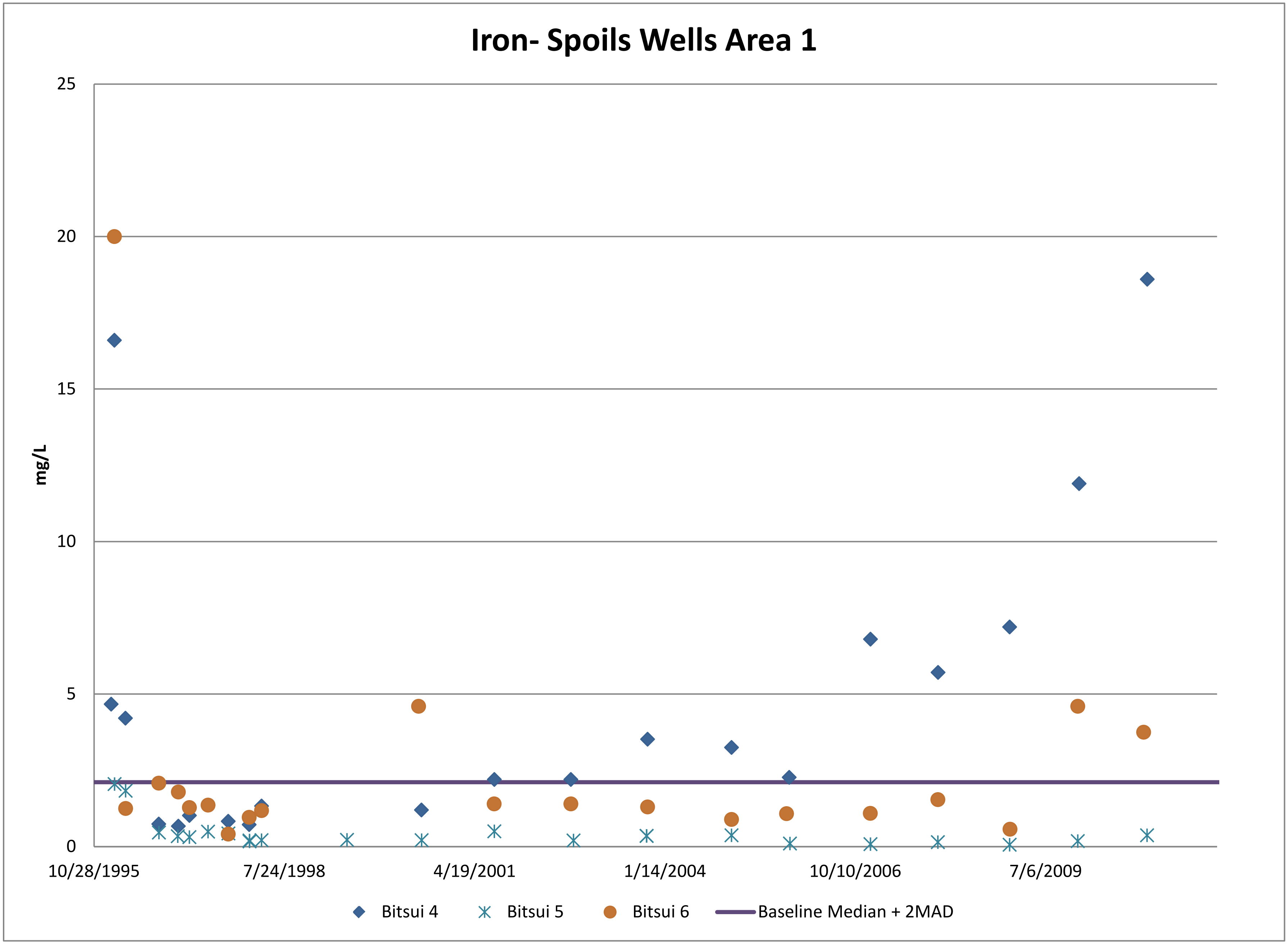

Sulfate - Fruitland Non-Baseline
mg/L
10000
1000
100
10
1
0.1
7/3/1983
12/23/1988
6/15/1994
12/6/1999
5/28/2005
11/18/2010
Bitsui-2
Bitsui-3
Kf83-1
KF84
KF84-16
SJKF84 #5
kf84-18A
KF84-18B
KF84-20C
KF84-22A
KF84-22B
Livestock Criteria
Baseline Median + 2MAD

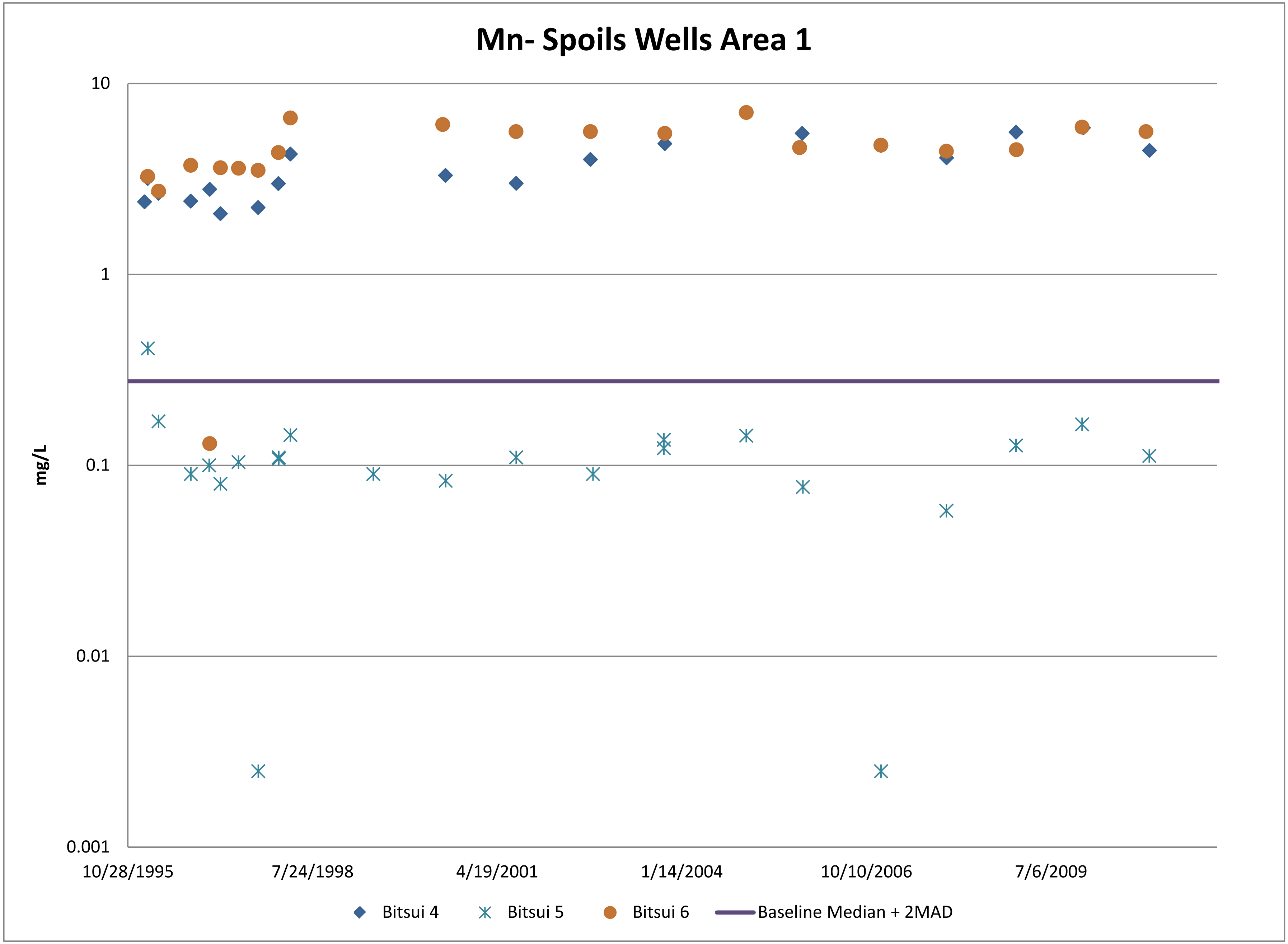

TDS - Fruitland Non-Baseline
mg/L
16000
14000
12000
10000
8000
6000
4000
2000
0
7/3/1983
12/23/1988
6/15/1994
12/6/1999
5/28/2005
11/18/2010
Bitsui-2
Bitsui-3
Kf83-1
KF84
SJKF84 #5
kf84-18A
KF84-18B
KF84-20C
KF84-22A
KF84-22B
Livestock Criteria
Baseline Median + 2MAD

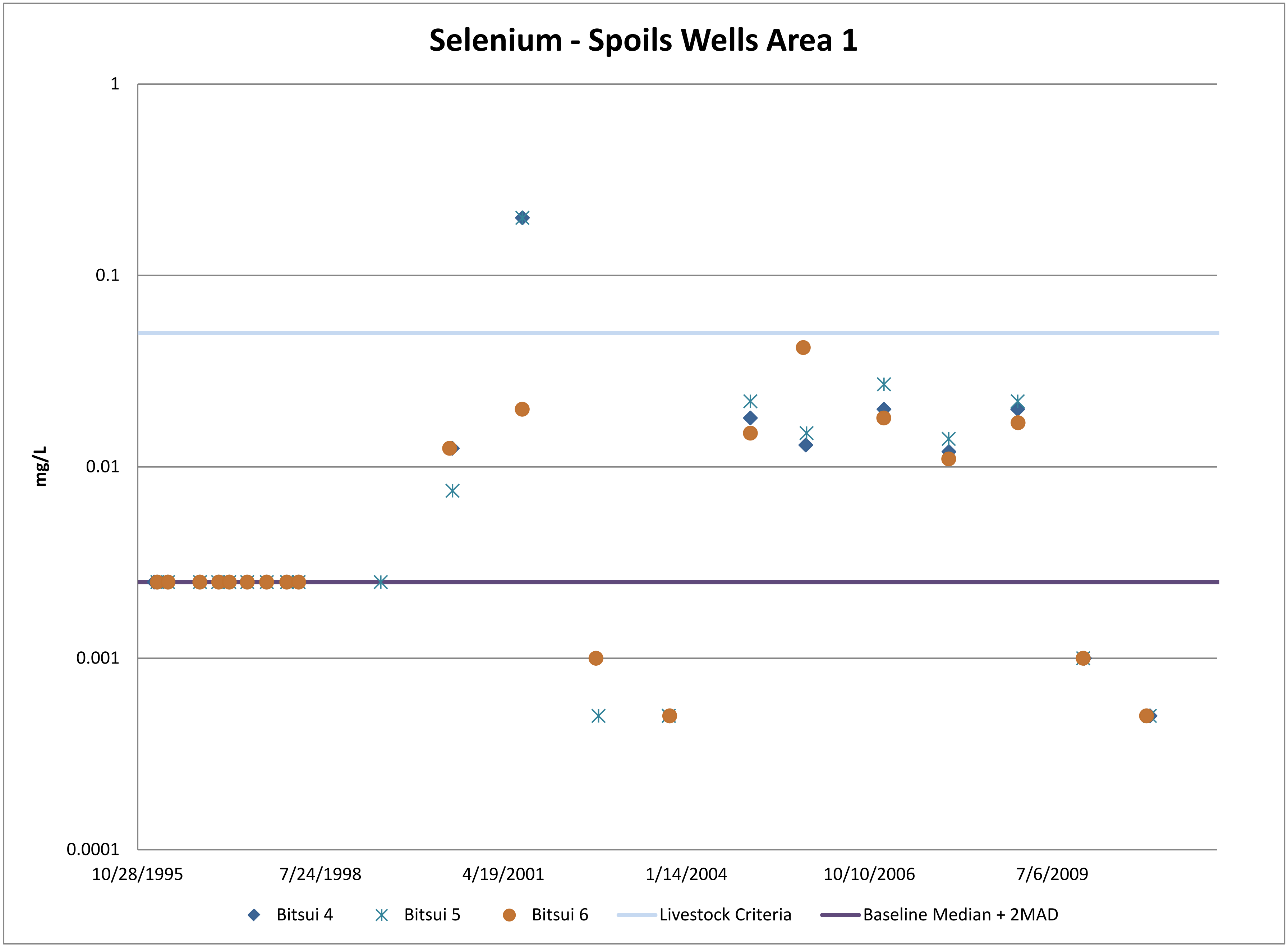

pH - Spoils Wells Area 1
9.5
9
8.5
8
7.5
7
6.5
6
mg/L
10/28/1995
7/24/1998
4/19/2001
1/14/2004
10/10/2006
7/6/2009
Bitsui 4
Bitsui 5
Bitsui 6
Livestock Criteria
Baseline Median + 2MAD

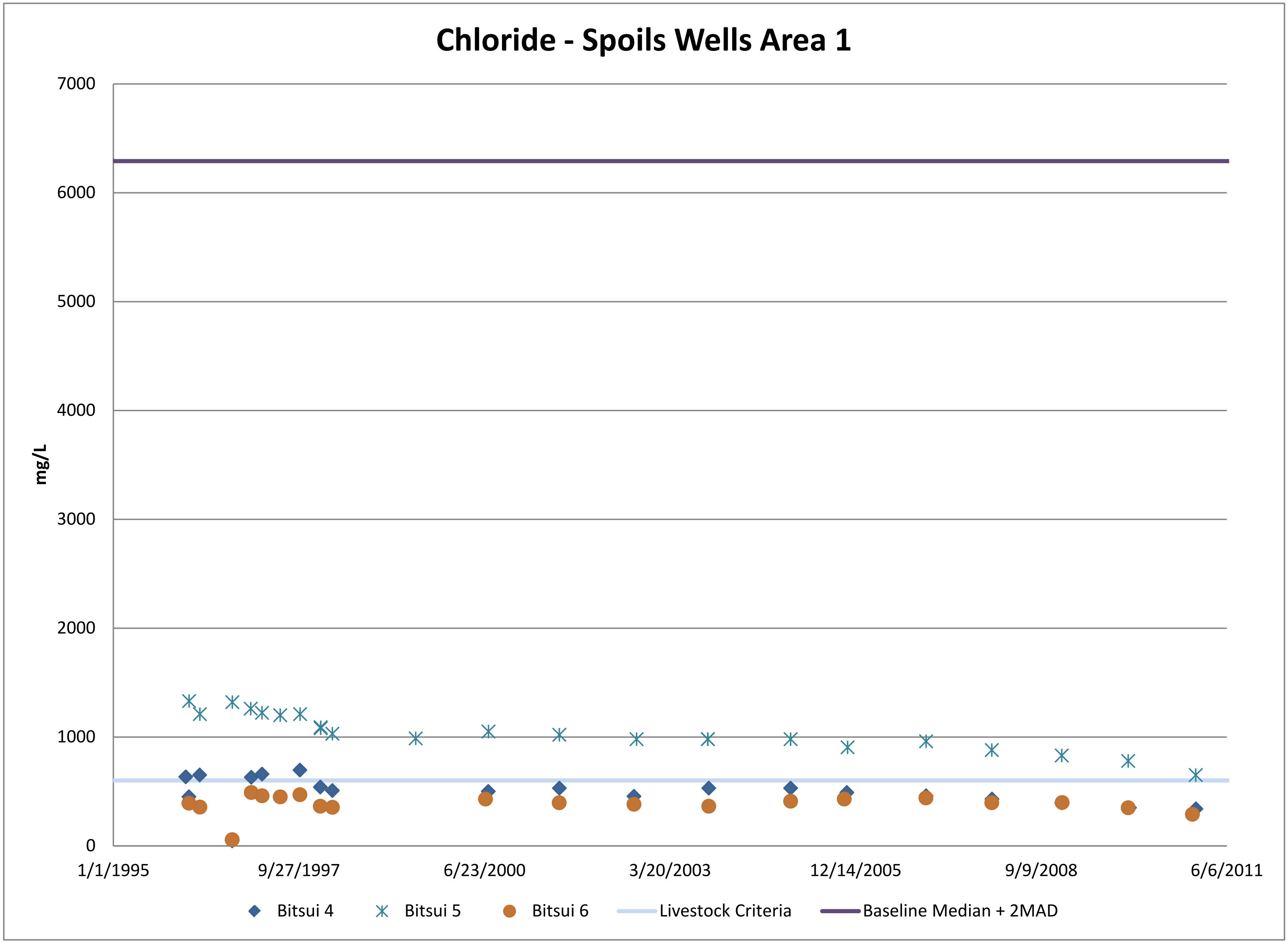

Conductivity - Spoils Wells Area 1
30000
25000
20000
15000
10000
5000
0
mg/L
10/28/1995
7/24/1998
4/19/2001
1/14/2004
10/10/2006
7/6/2009
Bitsui 4
Bitsui 5
Bitsui 6
Baseline Median + 2MAD

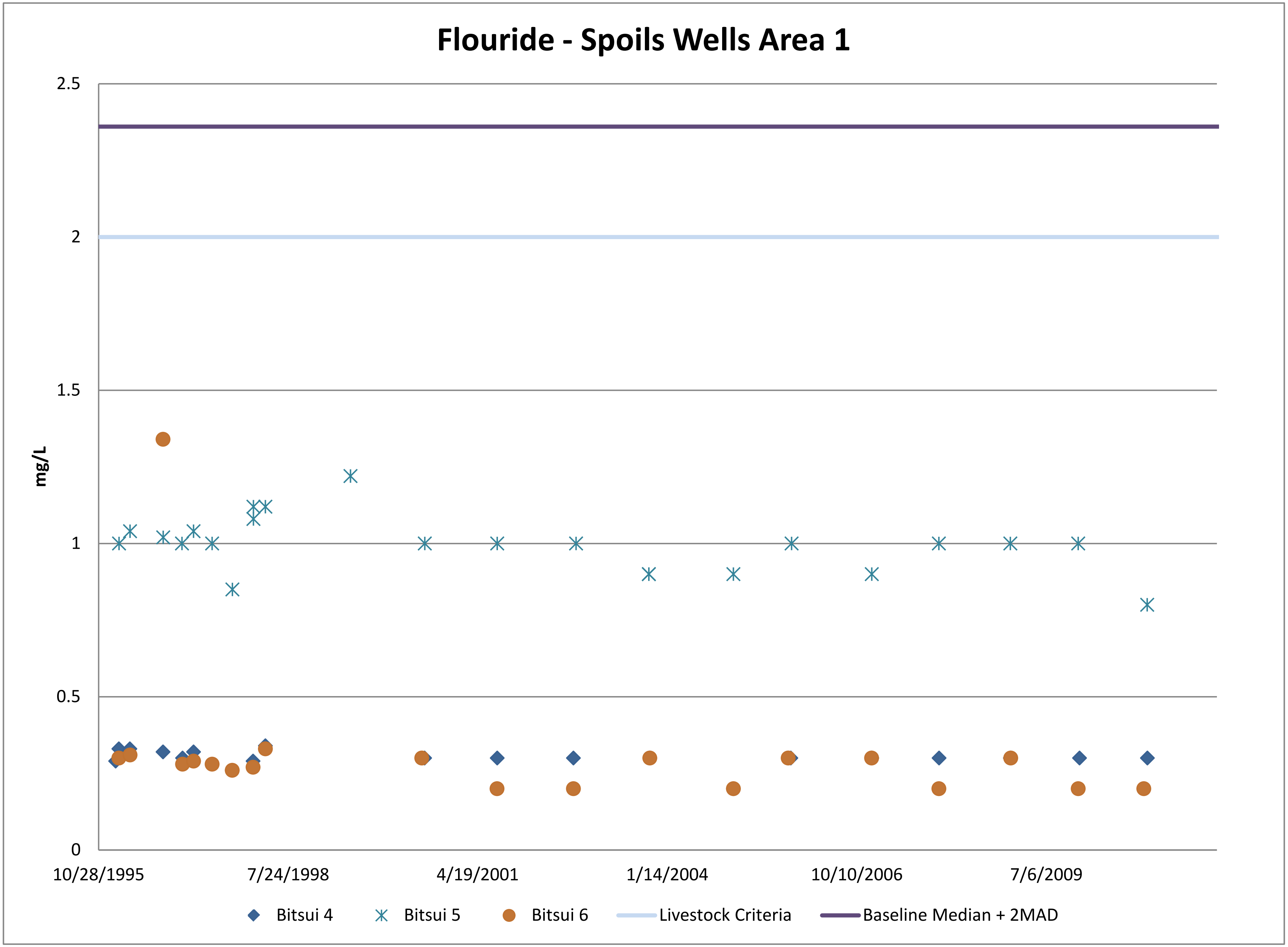

Boron - Spoils Wells Area 1
mg/L
6
5
4
3
2
1
0
10/28/1995
7/24/1998
4/19/2001
1/14/2004
10/10/2006
7/6/2009
Bitsui 4
Bitsui 5
Bitsui 6
Livestock Criteria
Baseline Median + 2MAD

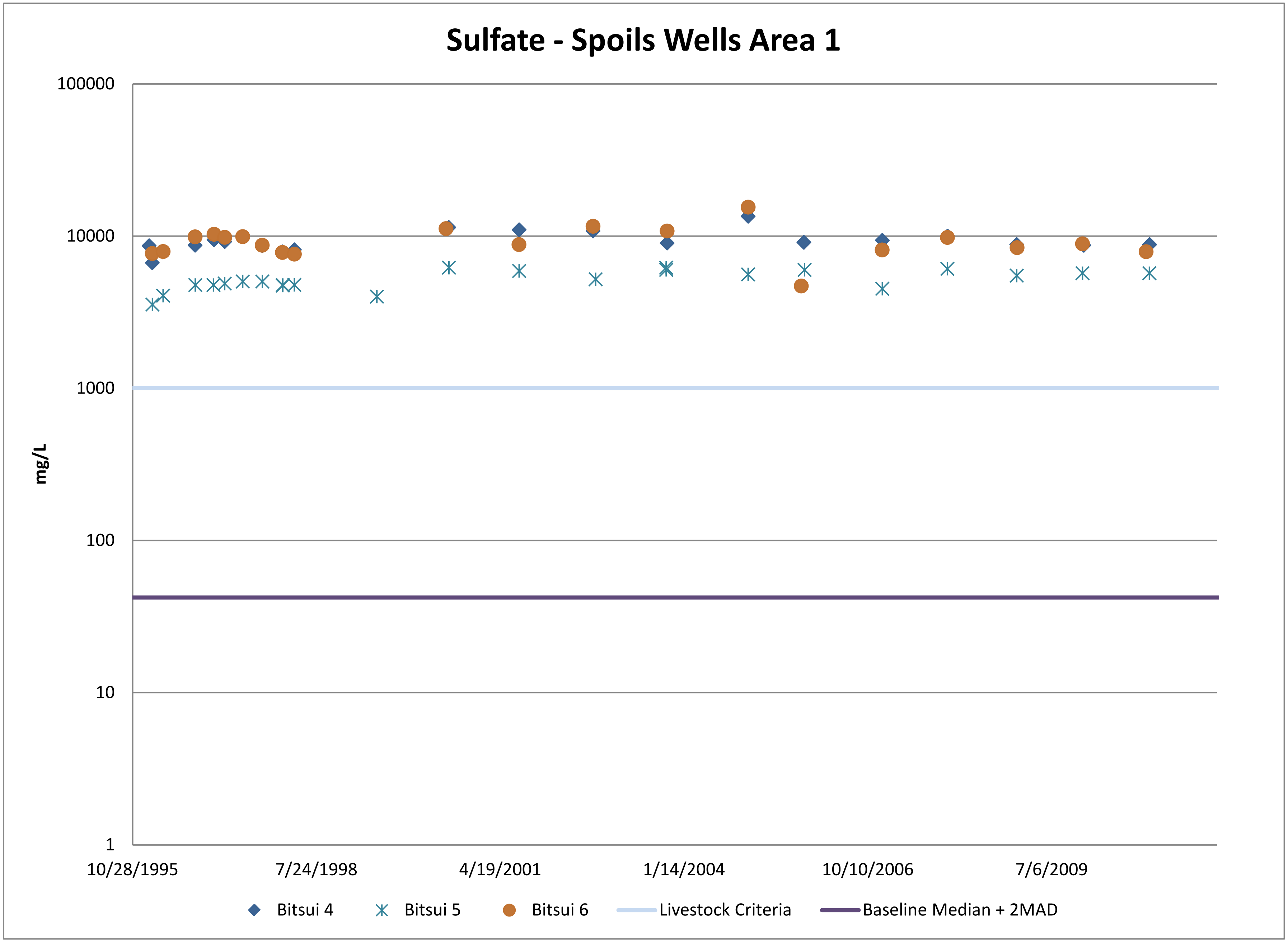

Iron- Spoils Wells Area 1
25
20
15
10
5
0
mg/L
10/28/1995
7/24/1998
4/19/2001
1/14/2004
10/10/2006
7/6/2009
Bitsui 4
Bitsui 5
Bitsui 6
Baseline Median + 2MAD

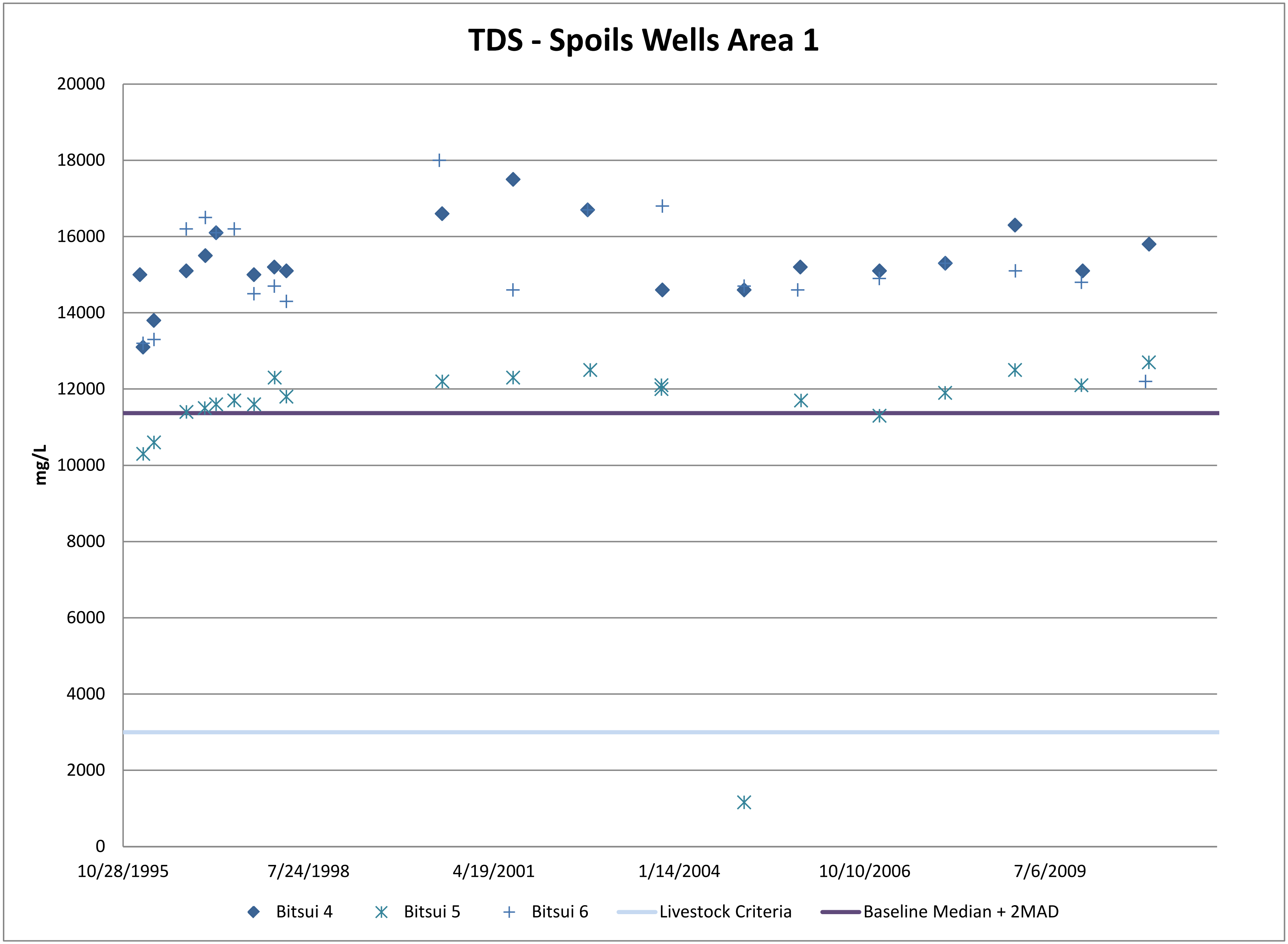

Mn- Spoils Wells Area 1
10
1
0.1
0.01
0.001
mg/L
10/28/1995
7/24/1998
4/19/2001
1/14/2004
10/10/2006
7/6/2009
Bitsui 4
Bitsui 5
Bitsui 6
Baseline Median + 2MAD

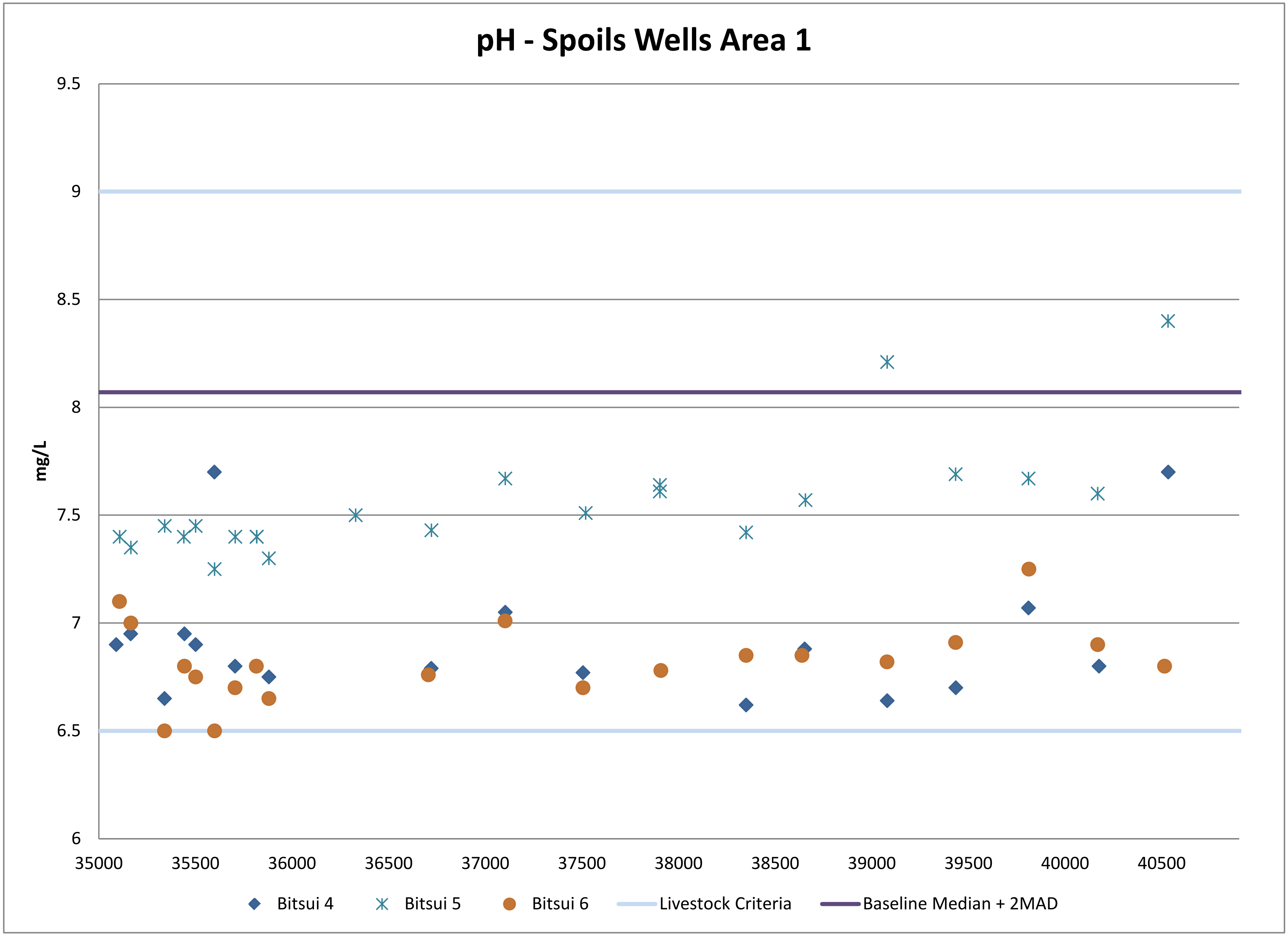

Selenium - Spoils Wells Area 1
mg/L
1
0.1
0.01
0.001
0.0001
10/28/1995
7/24/1998
4/19/2001
1/14/2004
10/10/2006
7/6/2009
Bitsui 4
Bitsui 5
Bitsui 6
Livestock Criteria
Baseline Median + 2MAD

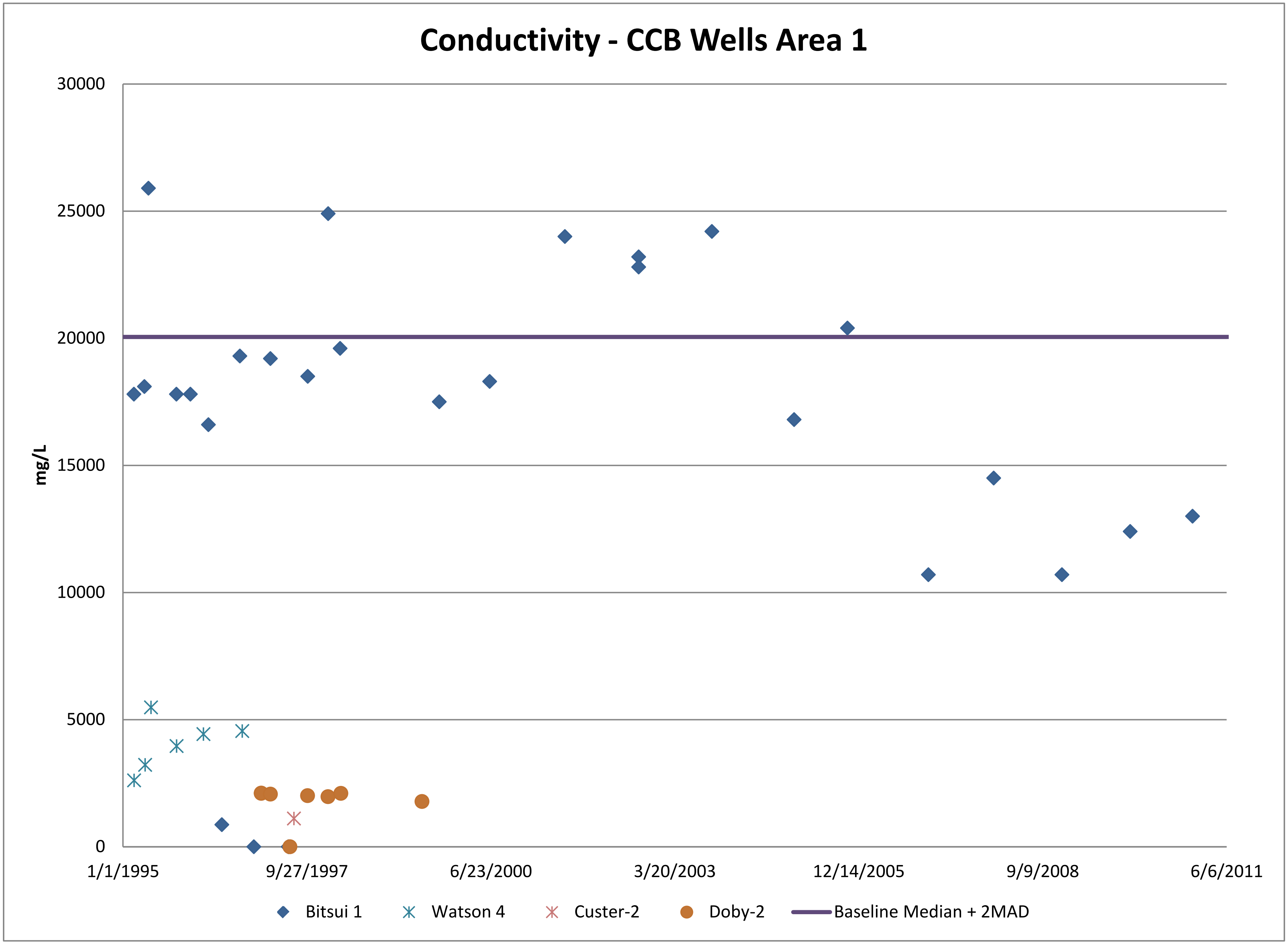

Chloride - Spoils Wells Area 1
mg/L
7000
6000
5000
4000
3000
2000
1000
0
1/1/1995
9/27/1997
6/23/2000
3/20/2003
12/14/2005
9/9/2008
6/6/2011
Bitsui 4
Bitsui 5
Bitsui 6
Livestock Criteria
Baseline Median + 2MAD

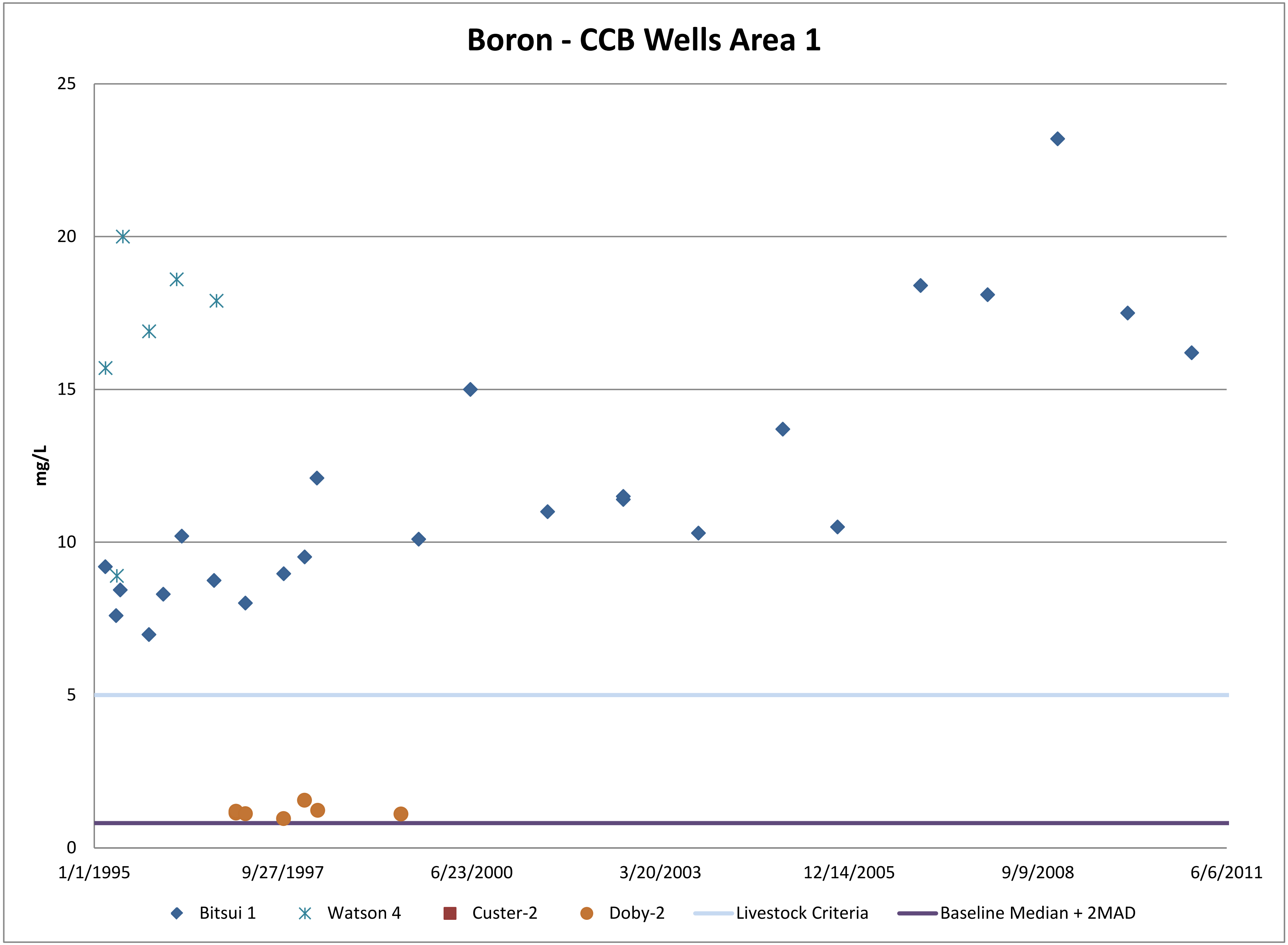

Flouride - Spoils Wells Area 1
mg/L
2.5
2
1.5
1
0.5
0
10/28/1995
7/24/1998
4/19/2001
1/14/2004
10/10/2006
7/6/2009
Bitsui 4
Bitsui 5
Bitsui 6
Livestock Criteria
Baseline Median + 2MAD

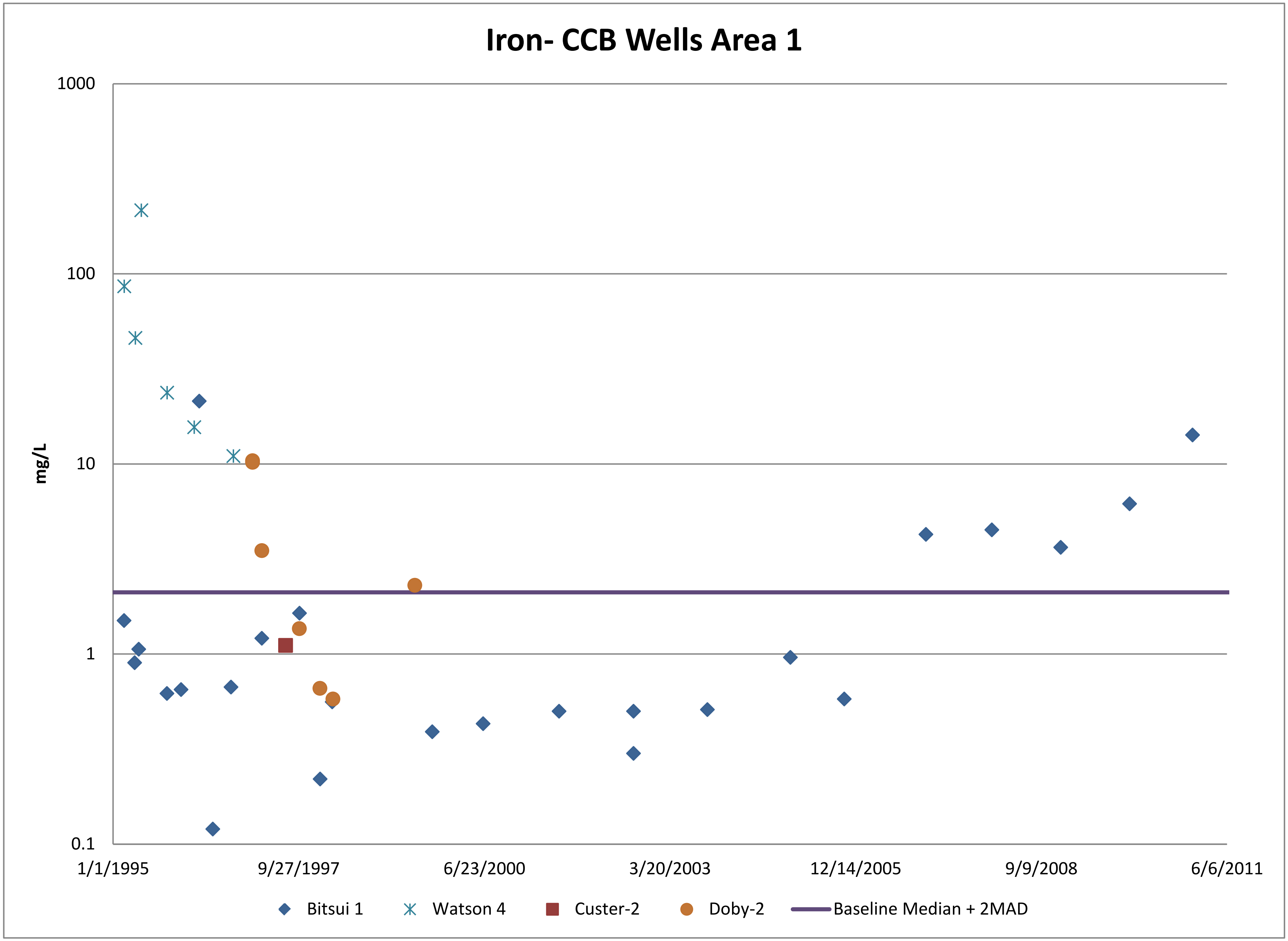

Sulfate - Spoils Wells Area 1
100000
10000
1000
100
10
1
mg/L
10/28/1995
7/24/1998
4/19/2001
1/14/2004
10/10/2006
7/6/2009
Bitsui 4
Bitsui 5
Bitsui 6
Livestock Criteria
Baseline Median + 2MAD

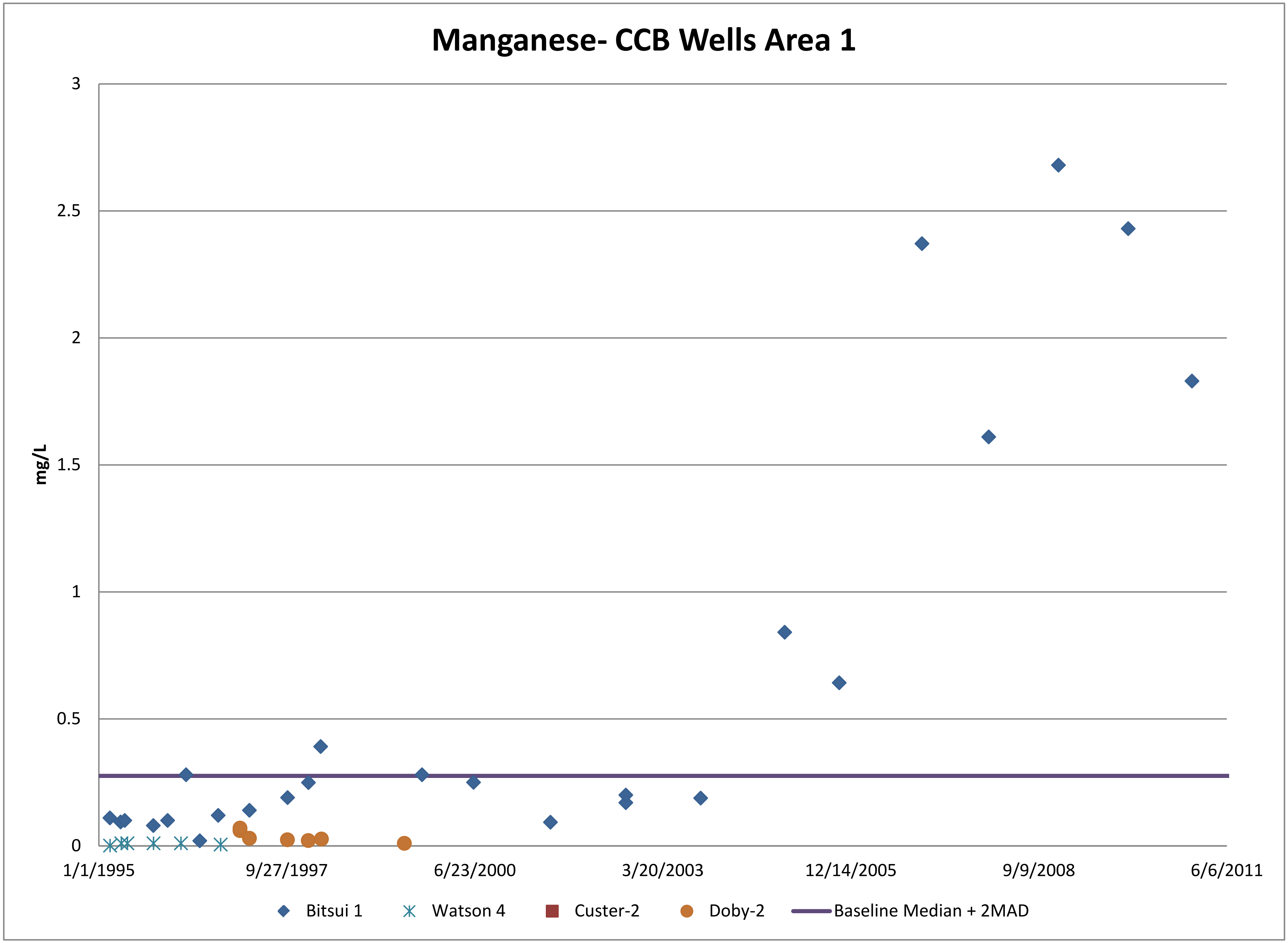

TDS - Spoils Wells Area 1
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
mg/L
10/28/1995
7/24/1998
4/19/2001
1/14/2004
10/10/2006
7/6/2009
Bitsui 4
Bitsui 5
Bitsui 6
Livestock Criteria
Baseline Median + 2MAD

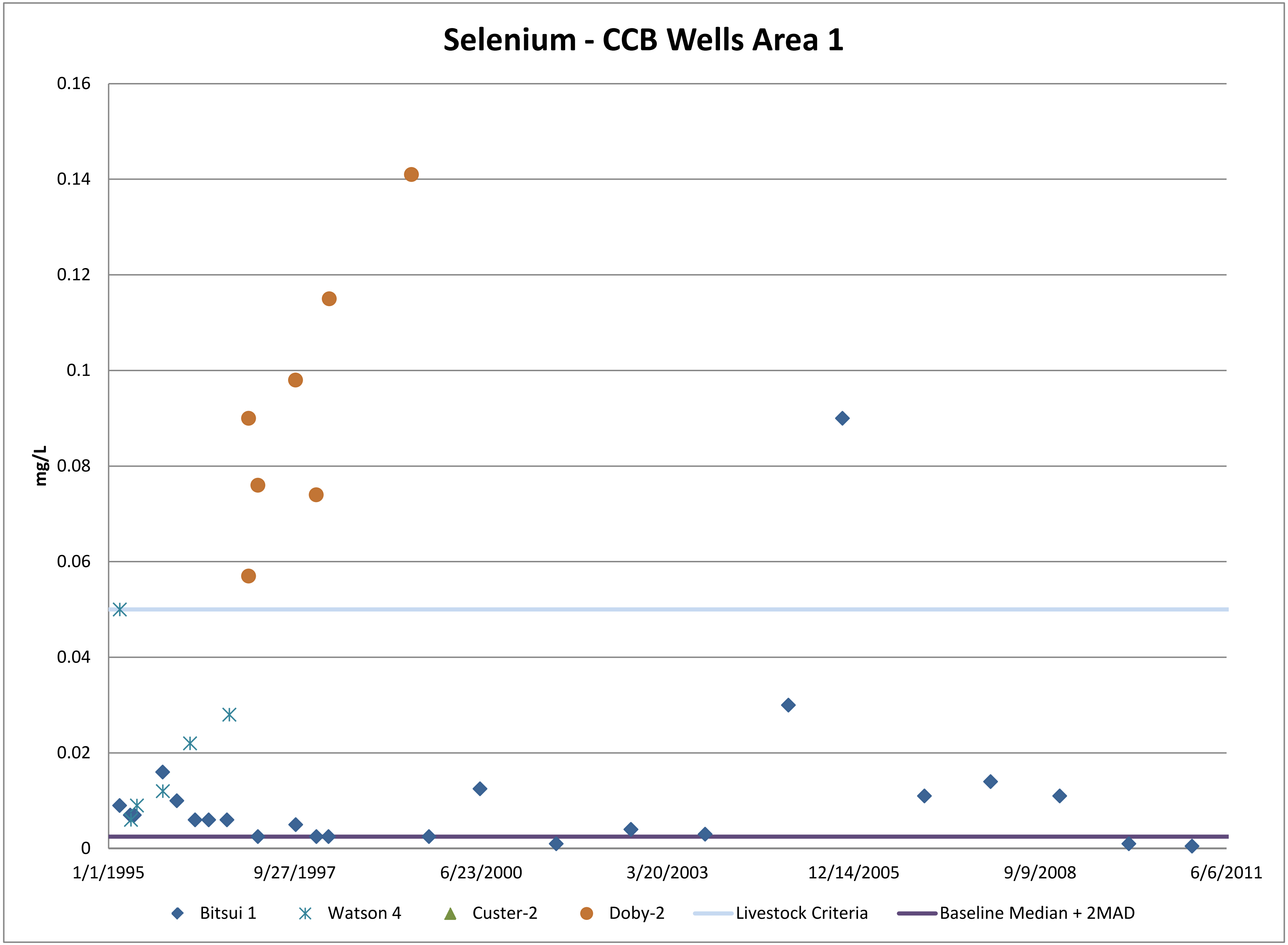

pH - Spoils Wells Area 1
mg/L
9.5
9
8.5
8
7.5
7
6.5
6
35000
35500
36000
36500
37000
37500
38000
38500
39000
39500
40000
40500
Bitsui 4
Bitsui 5
Bitsui 6
Livestock Criteria
Baseline Median + 2MAD

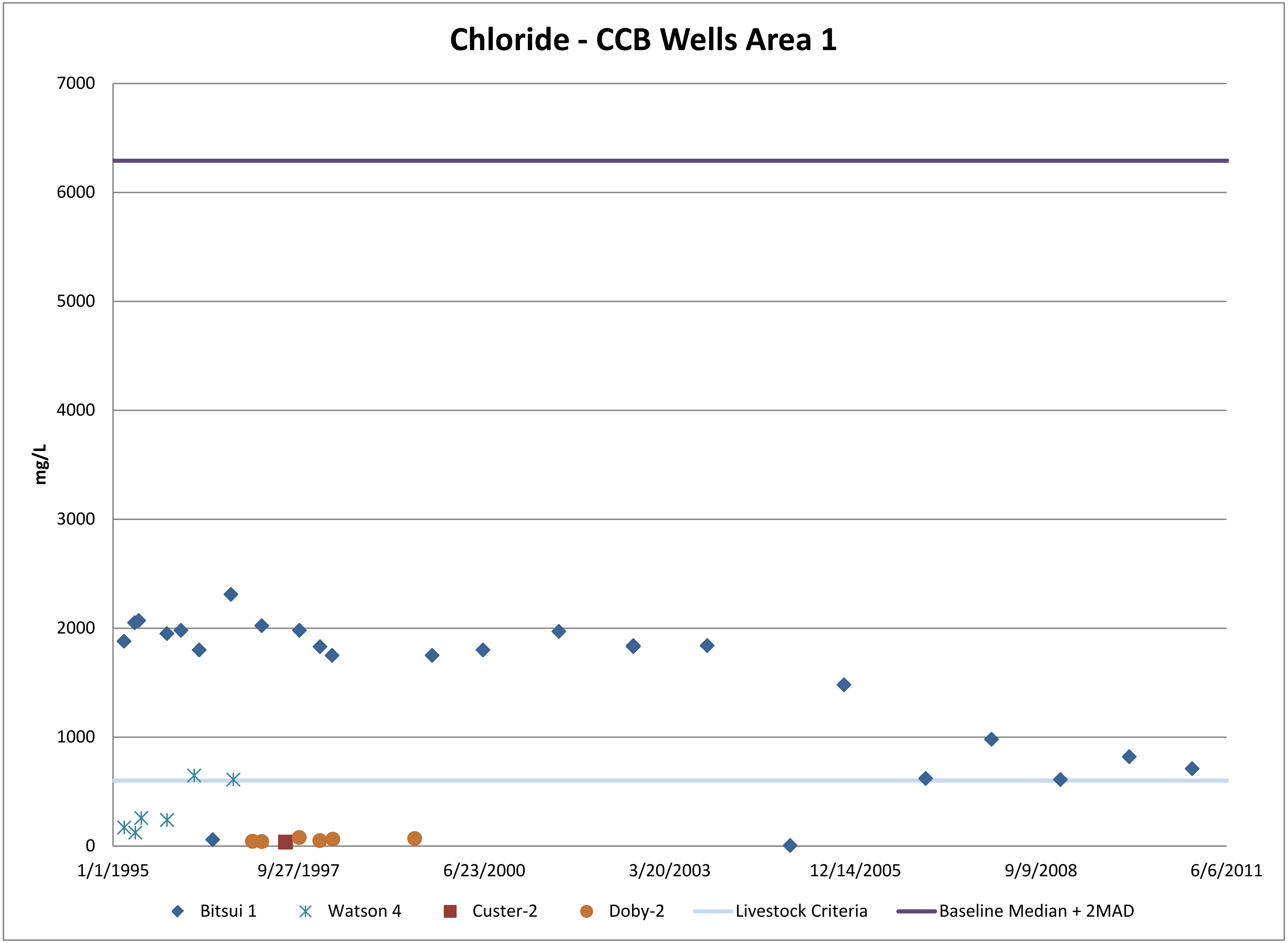

Conductivity - CCB Wells Area 1
mg/L
30000
25000
20000
15000
10000
5000
0
1/1/1995
9/27/1997
6/23/2000
3/20/2003
12/14/2005
9/9/2008
6/6/2011
Bitsui 1
Watson 4
Custer-2
Doby-2
Baseline Median + 2MAD

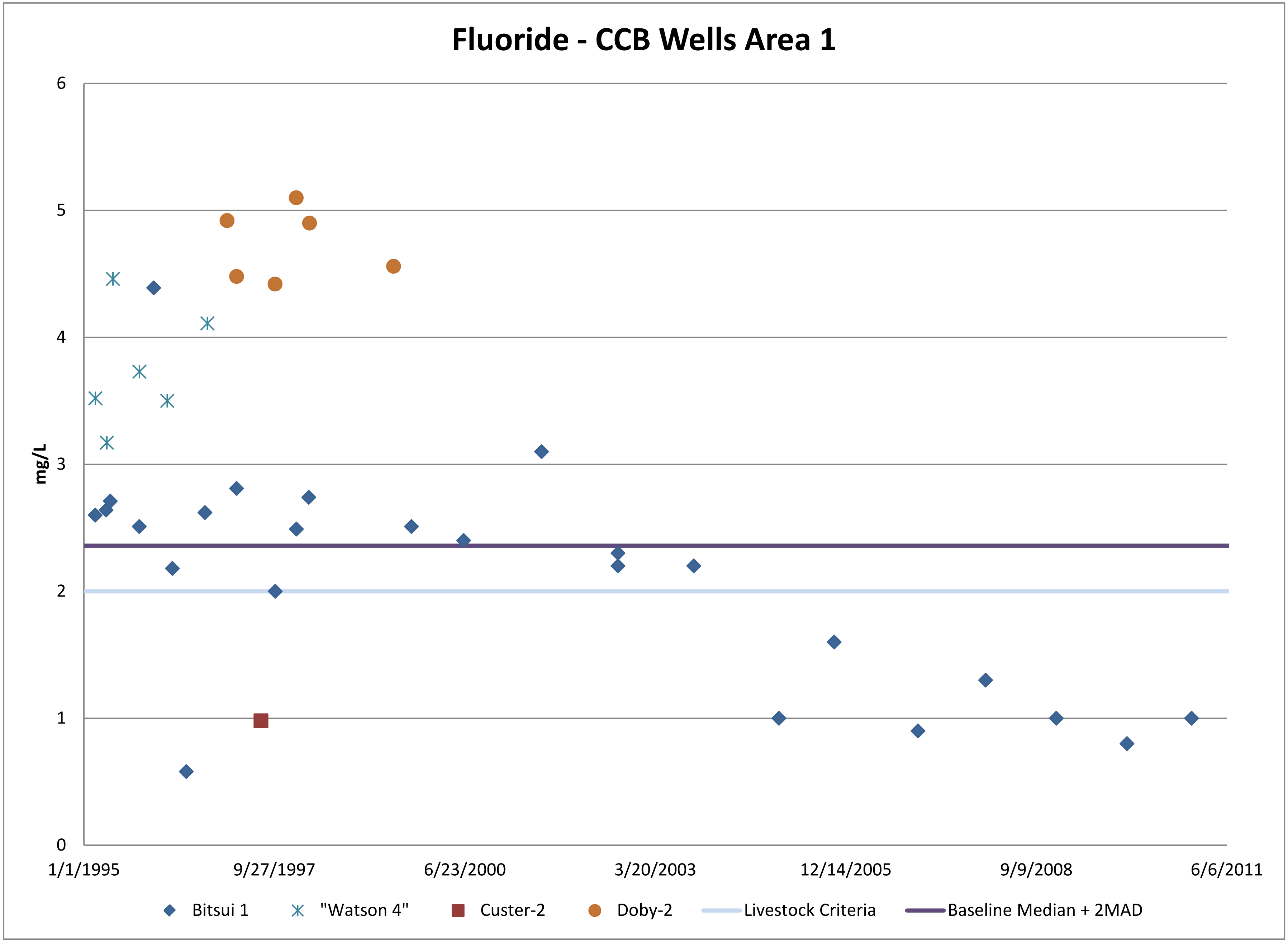

Boron - CCB Wells Area 1
mg/L
25
20
15
10
5
0
1/1/1995
9/27/1997
6/23/2000
3/20/2003
12/14/2005
9/9/2008
6/6/2011
Bitsui 1
Watson 4
Custer-2
Doby-2
Livestock Criteria
Baseline Median + 2MAD

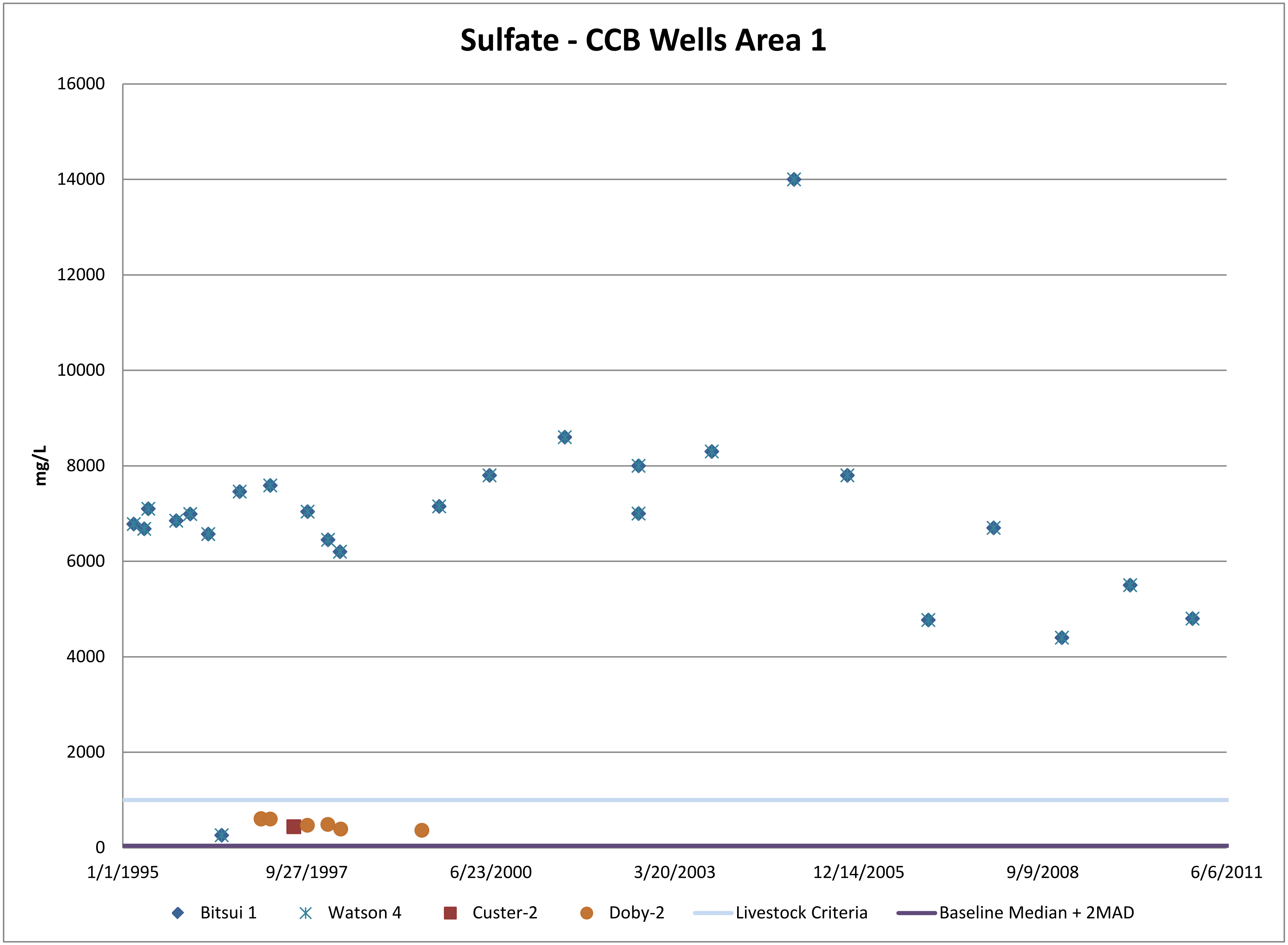

Iron- CCB Wells Area 1
mg/L
1000
100
10
1
0.1
1/1/1995
9/27/1997
6/23/2000
3/20/2003
12/14/2005
9/9/2008
6/6/2011
Bitsui 1
Watson 4
Custer-2
Doby-2
Baseline Median + 2MAD

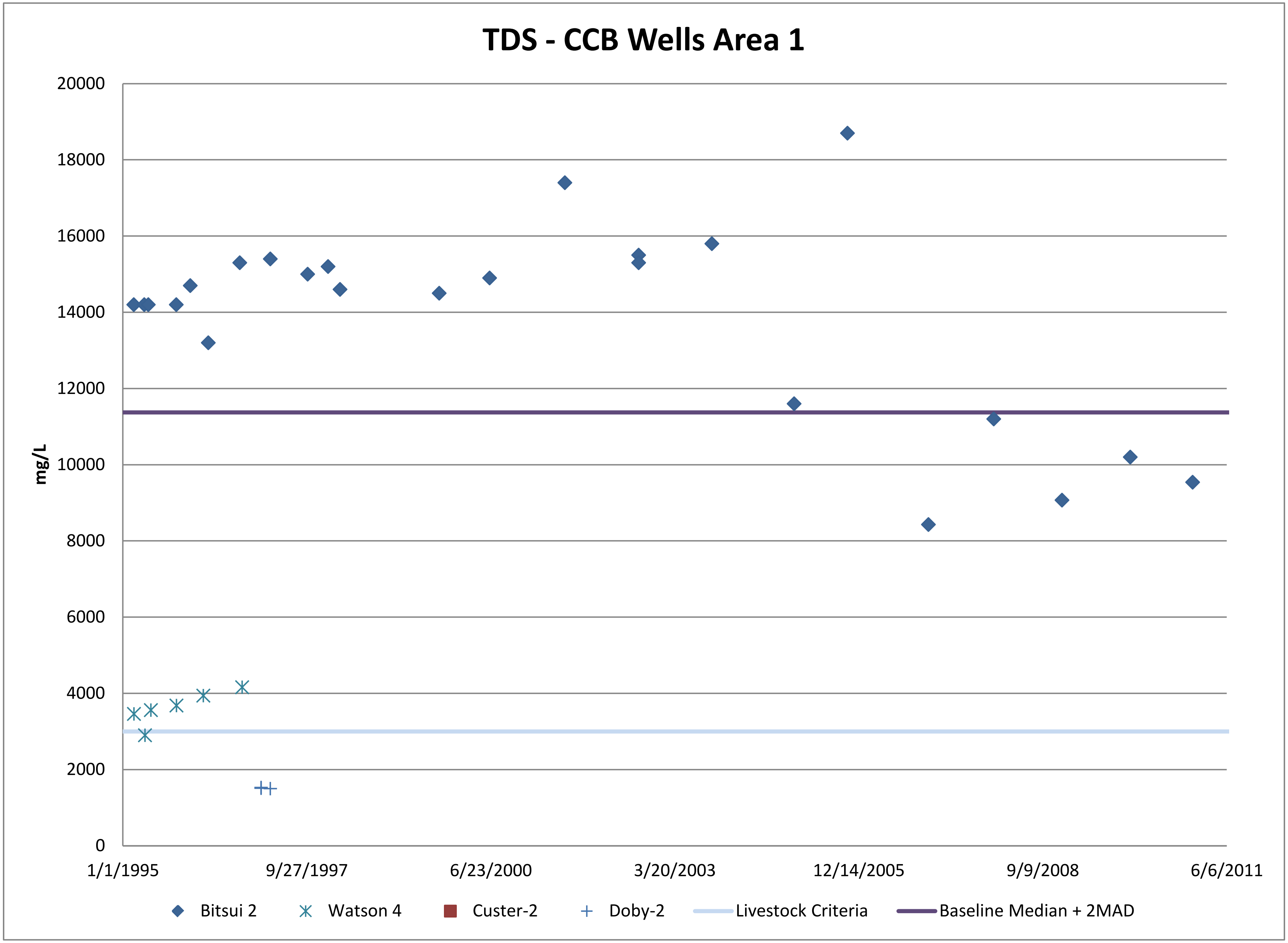

Manganese- CCB Wells Area 1
mg/L
3
2.5
2
1.5
1
0.5
0
1/1/1995
9/27/1997
6/23/2000
3/20/2003
12/14/2005
9/9/2008
6/6/2011
Bitsui 1
Watson 4
Custer-2
Doby-2
Baseline Median + 2MAD

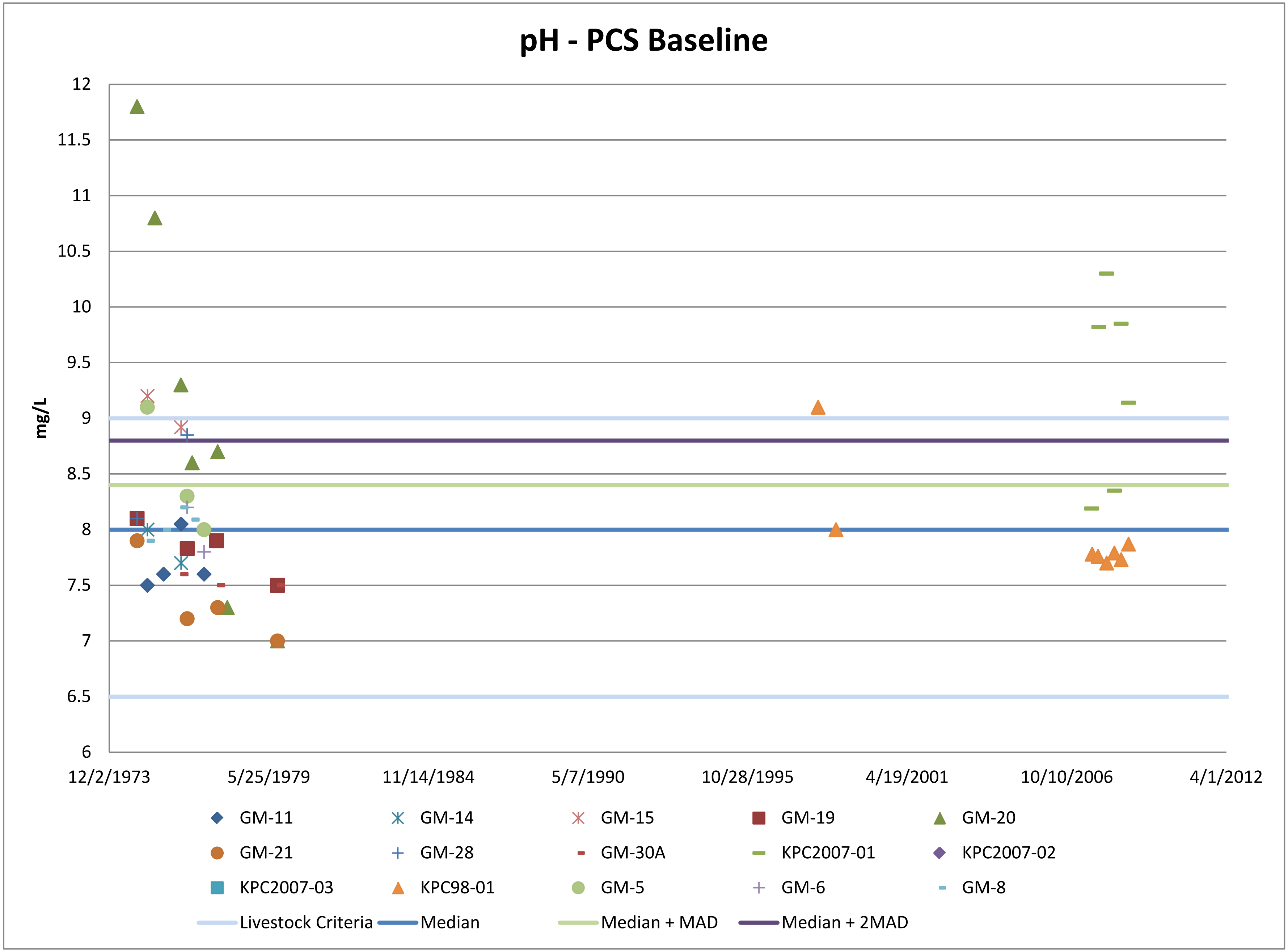

Selenium - CCB Wells Area 1
mg/L
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
1/1/1995
9/27/1997
6/23/2000
3/20/2003
12/14/2005
9/9/2008
6/6/2011
Bitsui 1
Watson 4
Custer-2
Doby-2
Livestock Criteria
Baseline Median + 2MAD


Chloride - CCB Wells Area 1
mg/L
7000
6000
5000
4000
3000
2000
1000
0
1/1/1995
9/27/1997
6/23/2000
3/20/2003
12/14/2005
9/9/2008
6/6/2011
Bitsui 1
Watson 4
Custer-2
Doby-2
Livestock Criteria
Baseline Median + 2MAD


Fluoride - CCB Wells Area 1
mg/L
0
1
2
3
4
5
6
1/1/1995
9/27/1997
6/23/2000
3/20/2003
12/14/2005
9/9/2008
6/6/2011
Bitsui 1
"Watson 4"
Custer-2
Doby-2
Livestock Criteria
Baseline Median + 2MAD

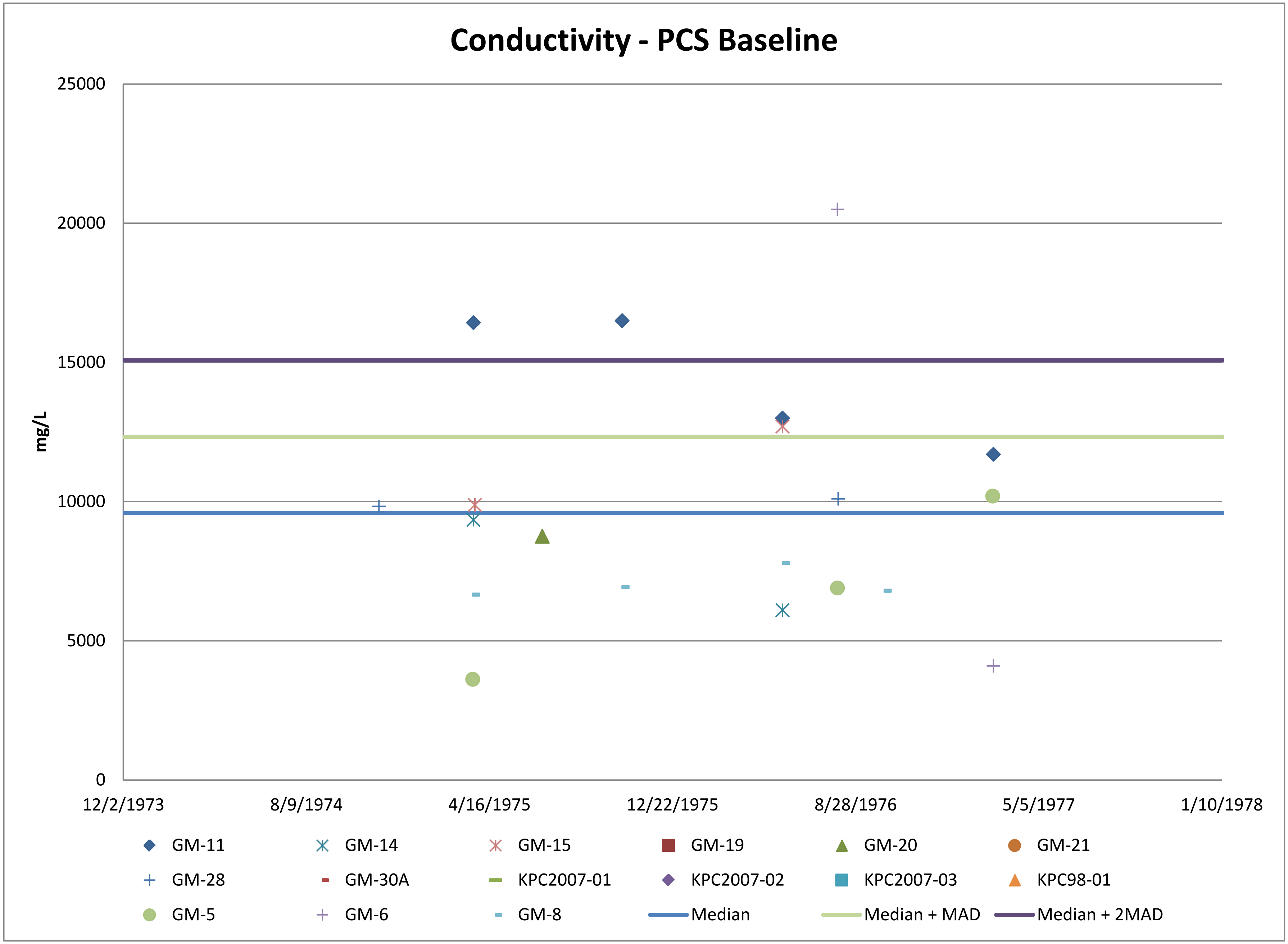

Sulfate - CCB Wells Area 1
mg/L
16000
14000
12000
10000
8000
6000
4000
2000
0
1/1/1995
9/27/1997
6/23/2000
3/20/2003
12/14/2005
9/9/2008
6/6/2011
Bitsui 1
Watson 4
Custer-2
Doby-2
Livestock Criteria
Baseline Median + 2MAD

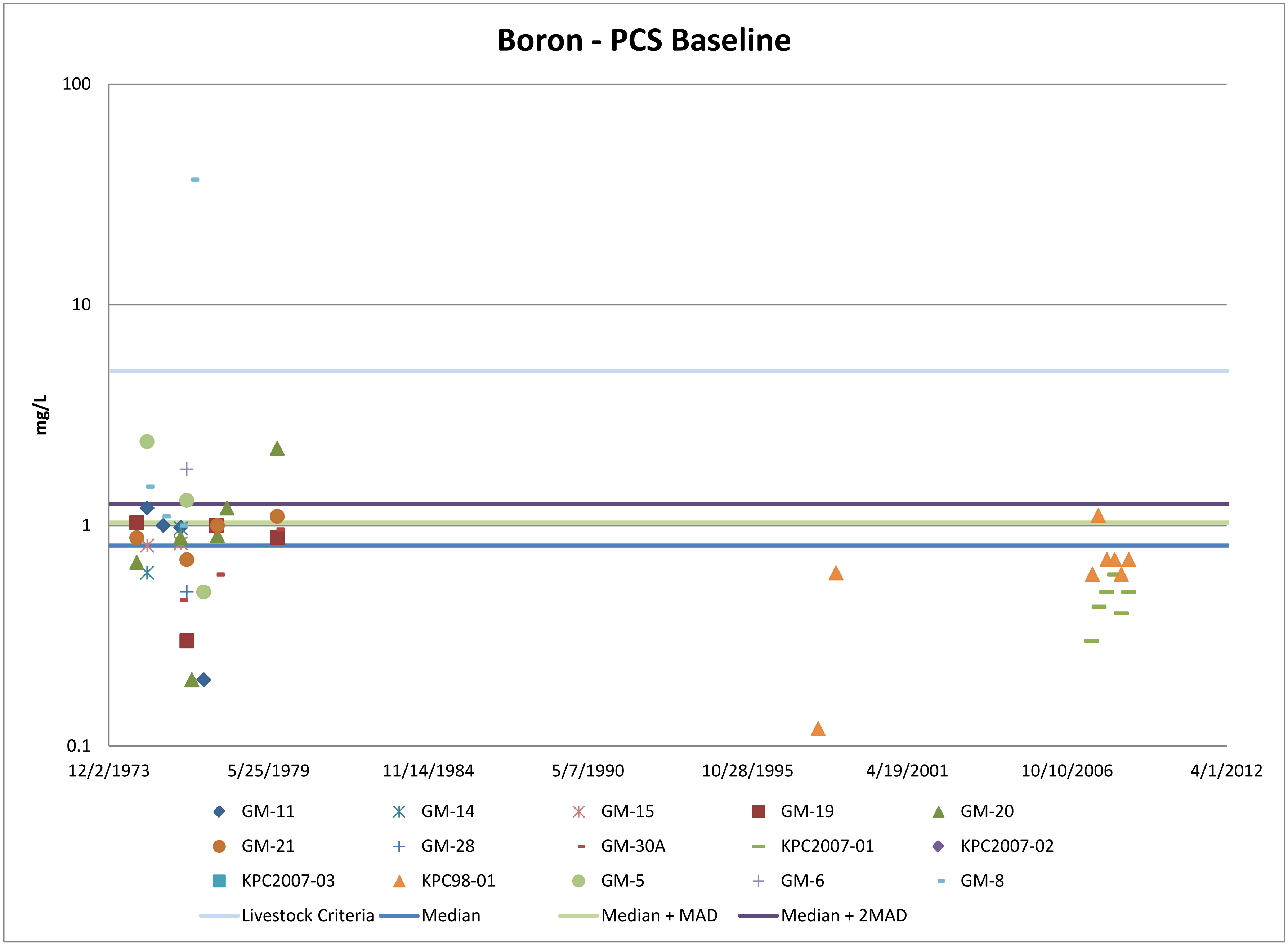

TDS - CCB Wells Area 1
mg/L
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
1/1/1995
9/27/1997
6/23/2000
3/20/2003
12/14/2005
9/9/2008
6/6/2011
Bitsui 2
Watson 4
Custer-2
Doby-2
Livestock Criteria
Baseline Median + 2MAD

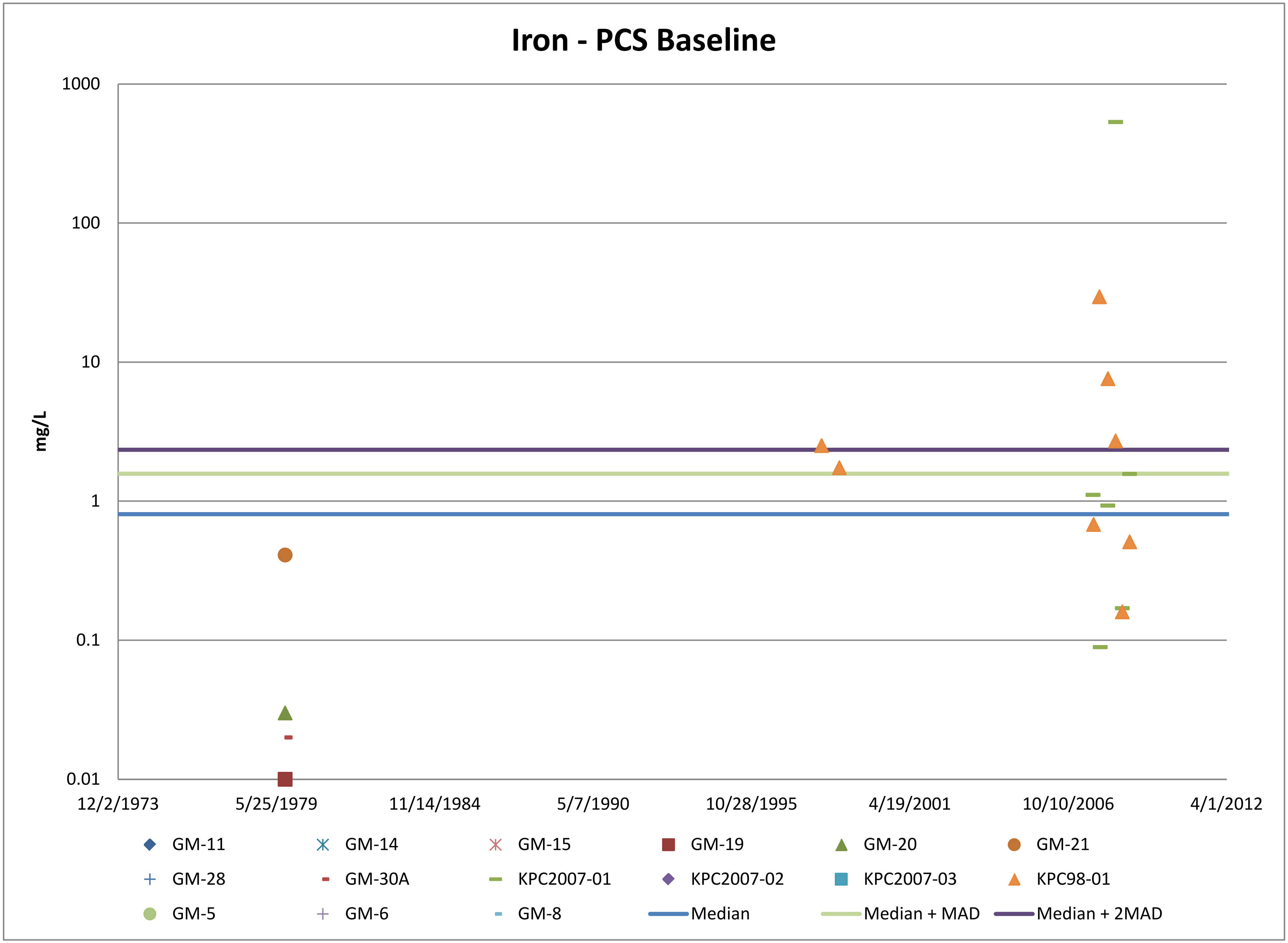

pH - PCS Baseline
mg/L
12
11.5
11
10.5
10
9.5
9
8.5
8
7.5
7
6.5
6
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-11
GM-14
GM-15
GM-19
GM-20
GM-21
GM-28
GM-30A
KPC2007-01
KPC2007-02
KPC2007-03
KPC98-01
GM-5
GM-6
GM-8
Livestock Criteria
Median
Median + MAD
Median + 2MAD

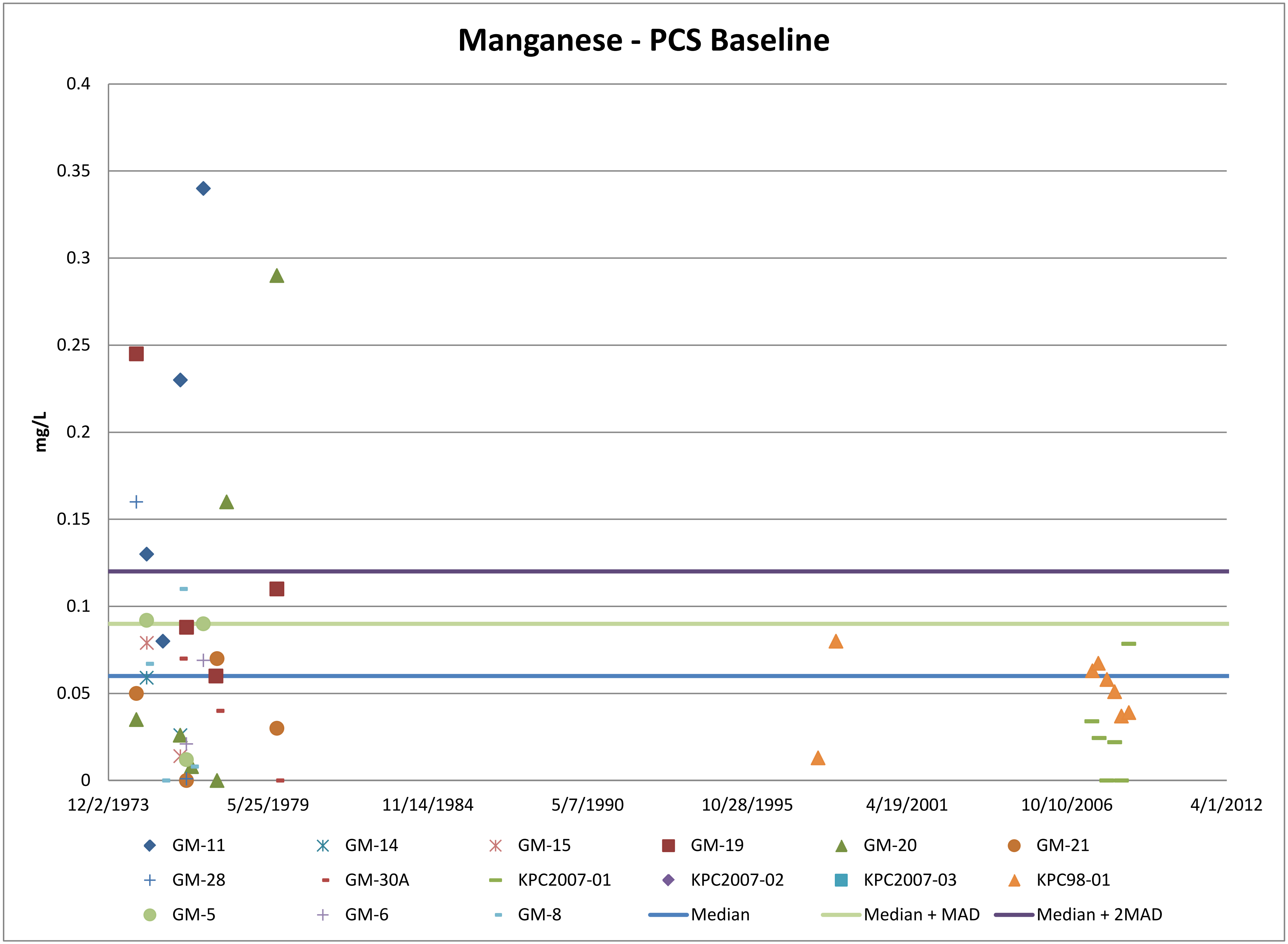
Appendix F - Groundwater Data Summary

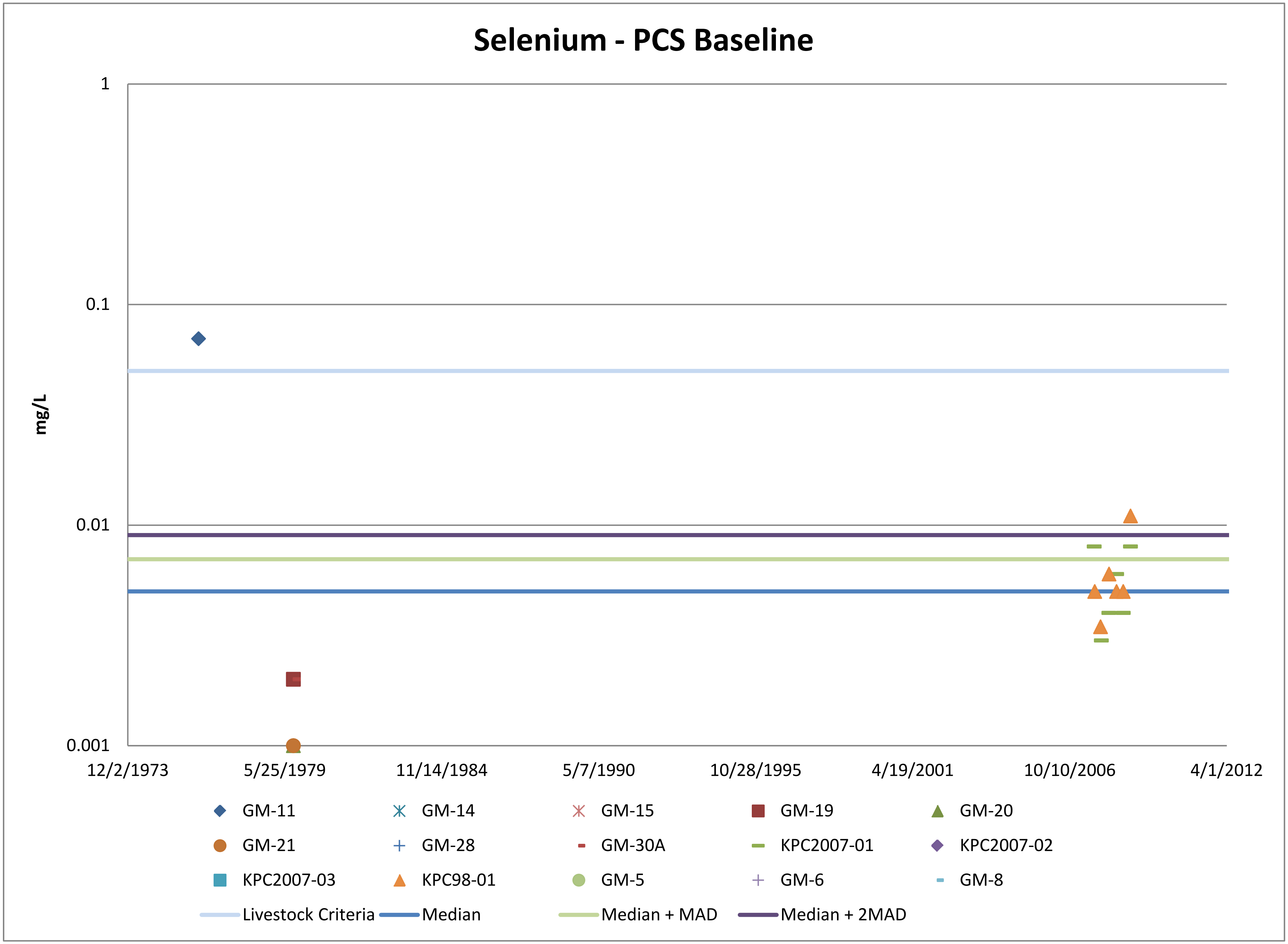
Baseline PCS Well Graphs




Boron - PCS Baseline
100
10
1
0.1
mg/L
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-11
GM-14
GM-15
GM-19
GM-20
GM-21
GM-28
GM-30A
KPC2007-01
KPC2007-02
KPC2007-03
KPC98-01
GM-5
GM-6
GM-8
Livestock Criteria
Median
Median + MAD
Median + 2MAD


Iron - PCS Baseline
mg/L
1000
100
10
1
0.1
0.01
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-11
GM-14
GM-15
GM-19
GM-20
GM-21
GM-28
GM-30A
KPC2007-01
KPC2007-02
KPC2007-03
KPC98-01
GM-5
GM-6
GM-8
Median
Median + MAD
Median + 2MAD


Manganese - PCS Baseline
mg/L
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-11
GM-14
GM-15
GM-19
GM-20
GM-21
GM-28
GM-30A
KPC2007-01
KPC2007-02
KPC2007-03
KPC98-01
GM-5
GM-6
GM-8
Median
Median + MAD
Median + 2MAD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mg/L
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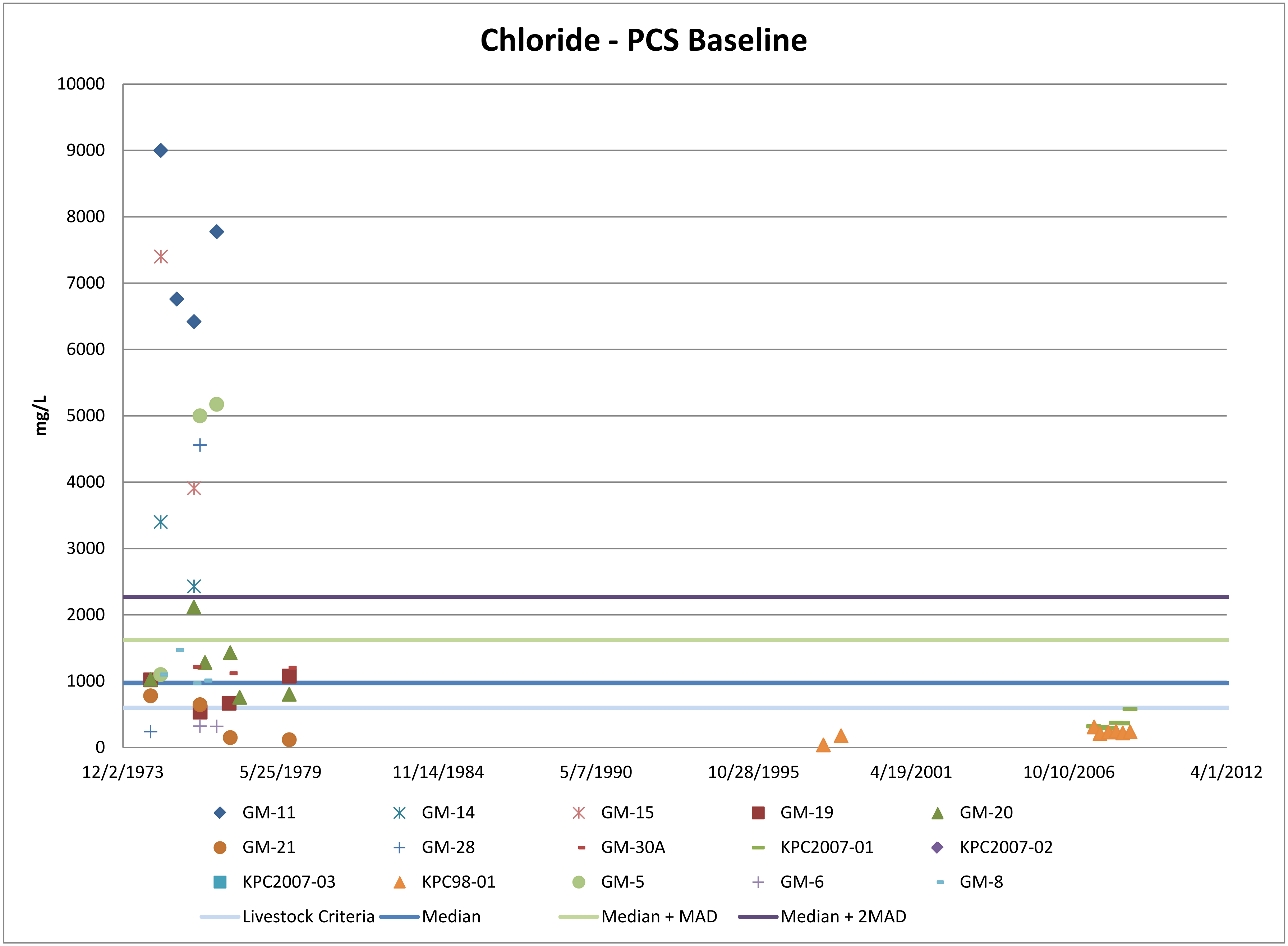
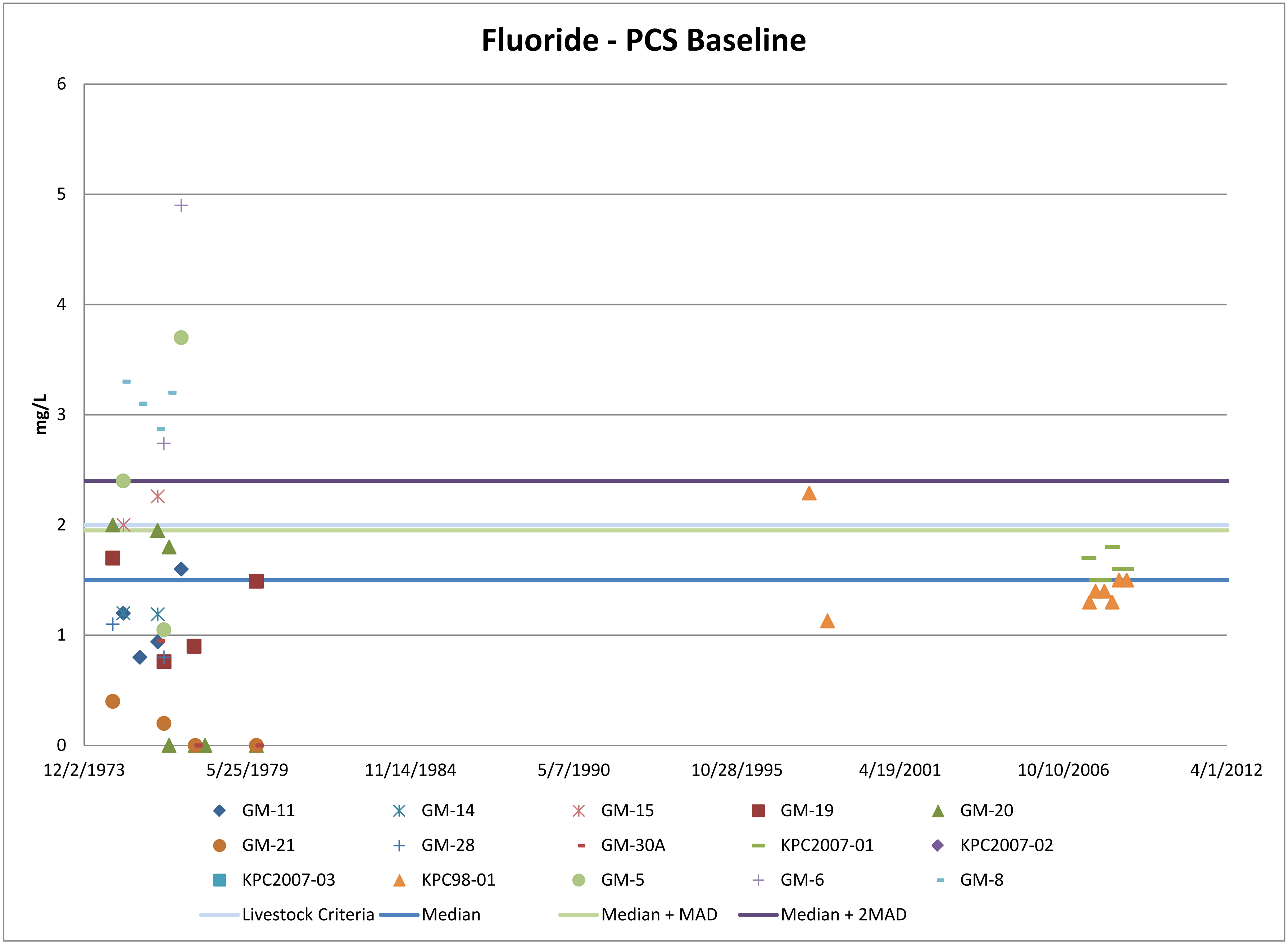
0.1
0.01
0.001
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-11
GM-14
GM-15
GM-19
GM-20
GM-21
GM-28
GM-30A
KPC2007-01
KPC2007-02
KPC2007-03
KPC98-01
GM-5
GM-6
GM-8
Livestock Criteria
Median
Median + MAD
Median + 2MAD

Appendix F - Groundwater Data Summary

Baseline PCS Well Graphs




Fluoride - PCS Baseline
mg/L
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5
4
3
2
1
0
12/2/1973
5/25/1979
11/14/1984
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10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-11
GM-14
GM-15
GM-19
GM-20
GM-21
GM-28
GM-30A
KPC2007-01
KPC2007-02
KPC2007-03
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GM-5
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Livestock Criteria
Median
Median + MAD
Median + 2MAD

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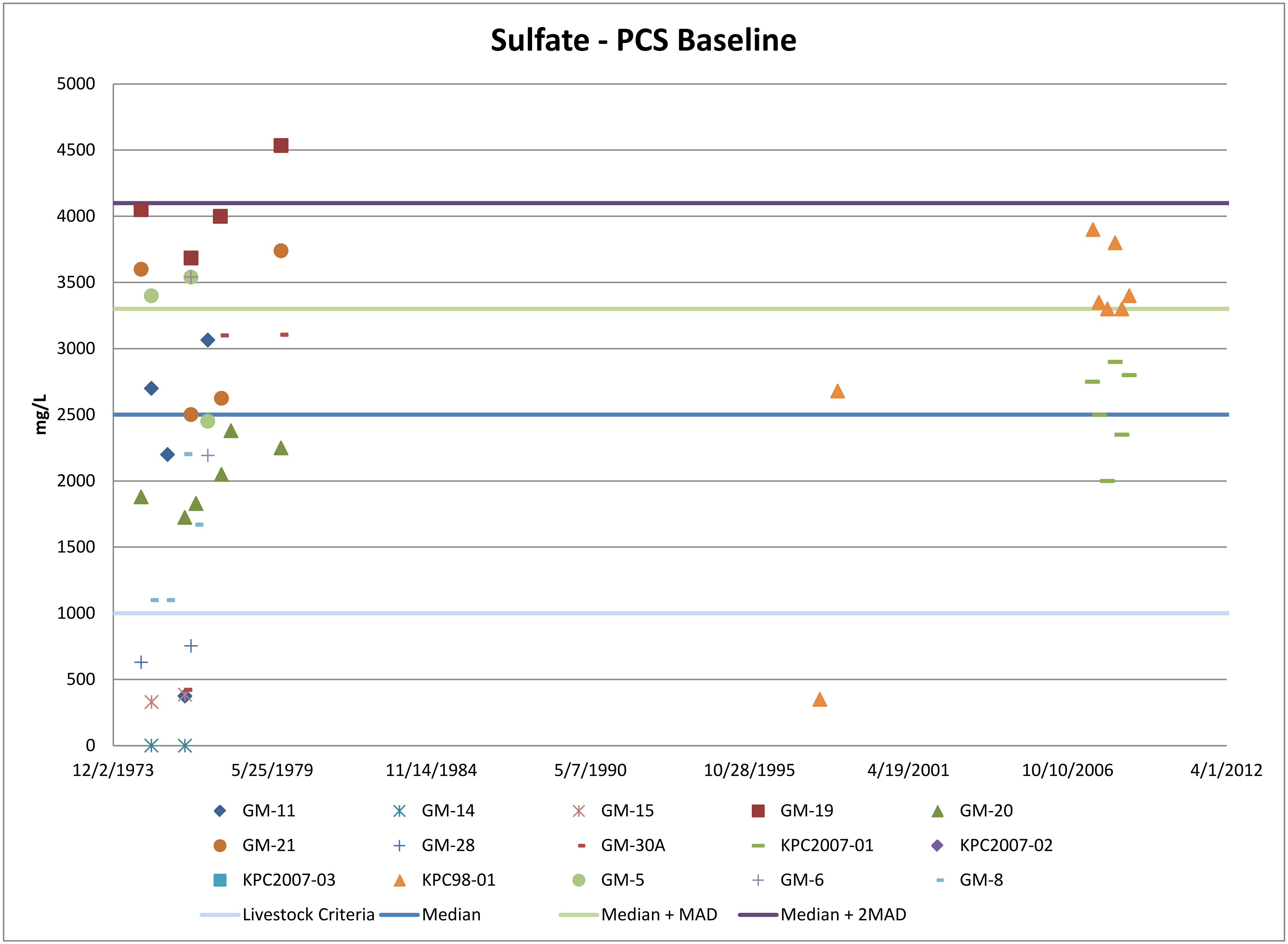

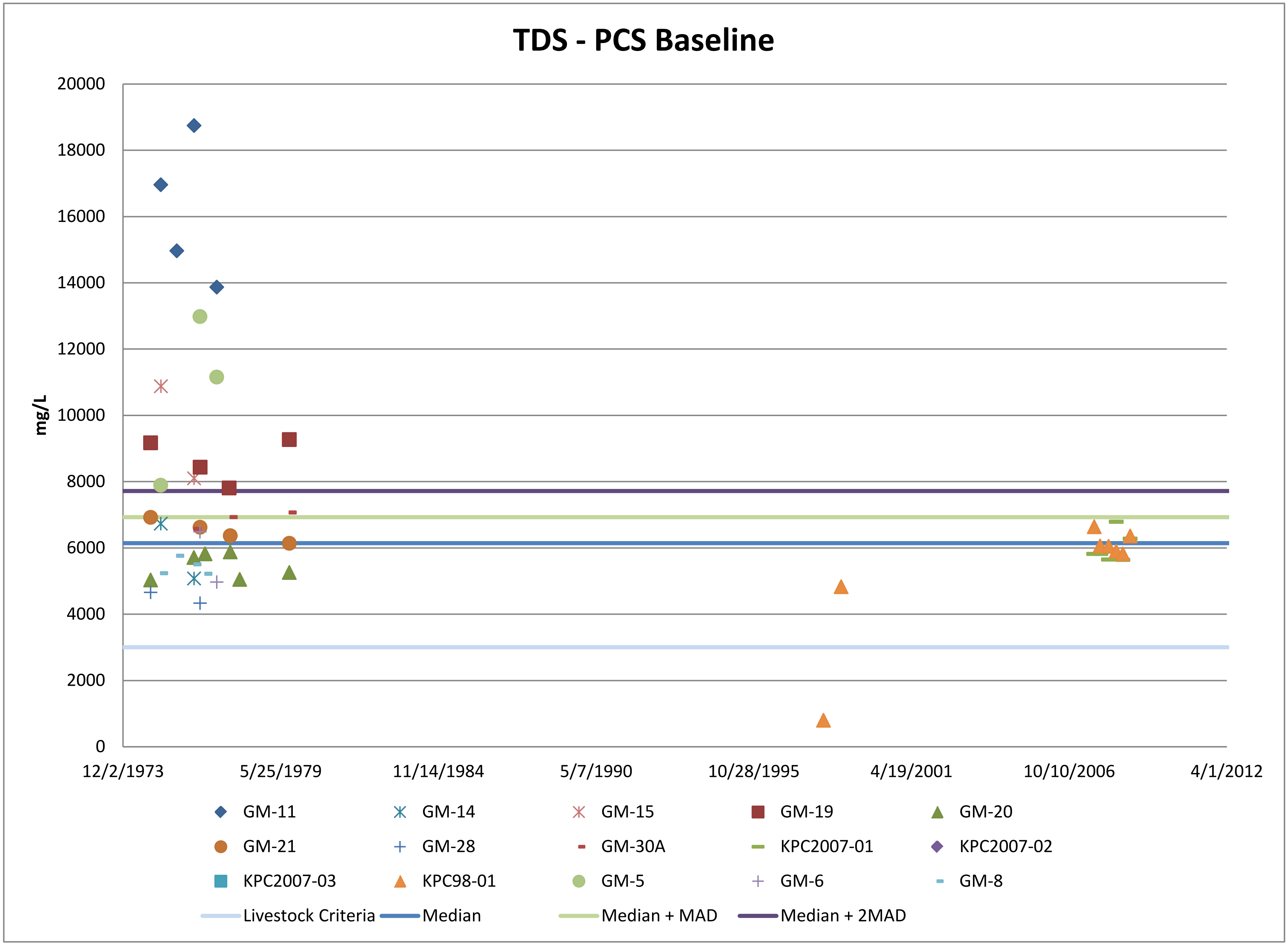
TDS - PCS Baseline
mg/L
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18000
16000
14000
12000
10000
8000
6000
4000
2000
0
12/2/1973
5/25/1979
11/14/1984
5/7/1990
10/28/1995
4/19/2001
10/10/2006
4/1/2012
GM-11
GM-14
GM-15
GM-19
GM-20
GM-21
GM-28
GM-30A
KPC2007-01
KPC2007-02
KPC2007-03
KPC98-01
GM-5
GM-6
GM-8
Livestock Criteria
Median
Median + MAD
Median + 2MAD

Appendix G:

Coal Combustion Byproduct Assessment

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Background

Under the Navajo Mine's fuel supply contract with Arizona Public Service, the Navajo Mine accepted CCBs from the Four Corners Power Plant units 4 and 5 for disposal in final pits and ramps from 1971 to 2008. CCBs disposed of at Navajo Mine included: fly ash, scrubber sludge, and bottom ash. CCBs from the Four Corners Power Plant were placed in mined-out pits and ramps of the Navajo Mine to help achieve approximate original contours (AOC) (NTEC, 2013).

Fly ash and bottom ash are generated by the combustion of coal at the Four Corners Power Plant. The fly ash is collected in emission control baghouses. Fabric bags in the baghouses act as a filter removing the fly ash from the flue gas stream of units 4 and 5. Ash too large to be carried by the flue gas to the baghouse falls to the bottom of the boiler during the combustion process and is removed as bottom ash. Scrubber sludge is the byproduct of removing SO_2 from the flue gas. The SO_2 reacts with lime to form calcium sulfite and calcium sulfate. The major chemical constituents of CCBs disposed of at the Navajo Mine include: Silicon Dioxide ($Si0_2$), Aluminum Oxide ($Al0_3$) and Calcium Sulfite ($CaS0_3$).

Coal fly ash is made up of 3 different types of materials: un-reactive and stable solids ($Si0_2$, $Al2O_3$, Fe_2O_3, etc.), semi-soluble solids (borates, sulfates, carbonates, etc.), and solids that react with water (CaO, MgO, Na_2O, etc.). The insoluble constituents of fly ash are composed of spherical, glassy mixtures of metal-oxides and sometimes other compounds. The chemistry of the coal determines whether the coal ash is basic or acidic, and this in turn affects leaching properties of the ash once it is in contact with water (Vories 2001). Coal ash typically exhibits a point of zero charge, PZC_{pH}, of around 4.6, and sorption/leaching properties within a given ash are greatly controlled by the pH of the mixture once it is slaked. With regards to alkaline or Class C coal ash, the main constituents of concern in terms of leaching are boron, arsenic, and possibly selenium (Manoharan 2007). Although arsenic is fairly susceptible to attenuation in the subsurface, boron can be quite chemically stable while being transported over large geographic areas.

Disposal History and Techniques

The Navajo Mine and the San Juan Mine formerly used CCBs from adjacent generating stations as a backfill material to achieve AOC. Approximately 4 million tons of ash was placed in mined out pits and ramps at the two mines annually. Disposal of CCBs in this manner at the Navajo Mine was seen as the best long-term solution for CCB disposal in the absence of other beneficial uses for the ash. Placement of ash was governed by a detailed ash disposal plan developed and approved for the Navajo Mine. It described performance standards for the use of ash as mine backfill.

The performance standards required physically characterizing the ash, covering the ash with spoil, not burying ash beneath large drainages, and performing reclamation on the affected areas. The precautionary measures were designed to prevent the ash from being exposed on the ground and to prevent plant roots and surface water from directly coming into contact with the buried ash. Due to the arid environment of Northwest New Mexico and the absence of any significant groundwater, ash placement was in dry pits and ramps.

The AOC surrounding all ash disposal areas was designed to have positive drainage away from the ash and avoid any puddling, sheet flow, or other collection of water above or adjacent to disposal areas. This design specification has kept most of the permanent program and interim ash disposal areas unsaturated, which can be verified from the monitoring well data. In addition to this, all post-mining drainages that intersected an ash disposal area were modified to flow across the ash disposal area at approximately right angles to the long axis of the disposal site to minimize potential infiltration of surface waters into the ash. This design specification limits the amount of contact time that running water has with the ash-reclaimed areas.

Navajo Mine monitors a suite of wells in a historic, Pre-Law CCB disposal area (Bitsui and Watson Pits) that has become water-saturated due to NAPI activity adjacent to the area. It is important to note that disposal of CCB in this area occurred not only prior to SMCRA but prior to NAPI activities. A map displaying the outline of the Bitsui ash disposal area and relevant wells is seen in Figure 1. The influence of NAPI activity in the area has raised groundwater tables and increased surface water movement contributing to the saturation level of the buried CCBs.

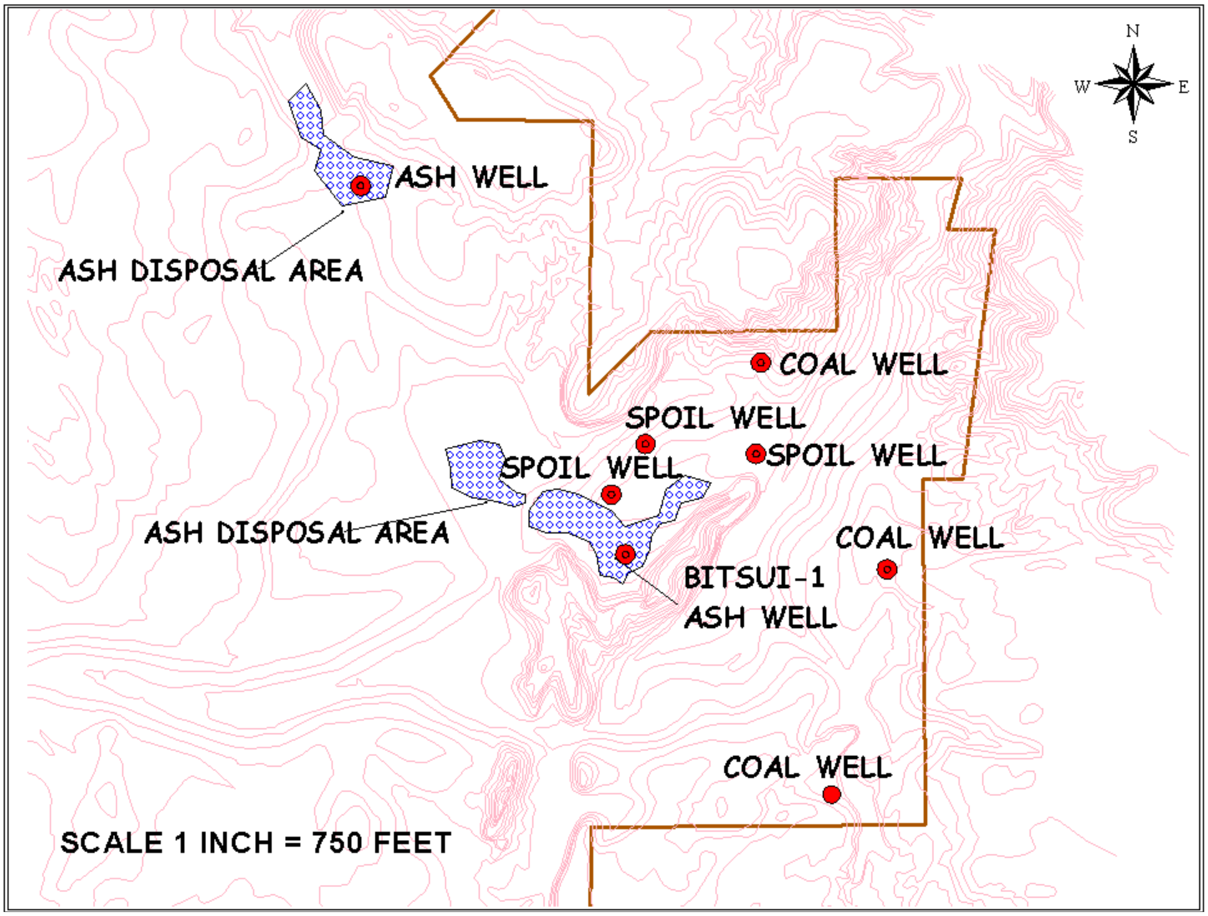

Figure 1: Bitsui Ash Disposal Area Delineation and Monitoring Wells

Ash was covered by a minimum of 10 feet of spoil material, plus any required topdressing and the required topsoil thickness. The spoil material has a low hydraulic conductivity of 10^{-6} cm/sec (four samples ranged from 1.66 x 10^{-6} to 5.4 x 10^{-6} cm/sec), which has helped to minimize vertical infiltration of surface water. During the process of reclamation, active ash disposal areas were regularly overlain with spoil material to cover the surface and minimize fugitive dust as the ash was backfilled into the pits (NTEC, 2013).

The geological conditions surrounding the Navajo Mine pits where the ash was disposed create favorable condition for ash disposal in pits. After mining was completed in the ash disposal areas, the pit floor was directly on top of a low-conductivity (10^{-7}cm/sec, comparable to many commercial grade liners) shale/mudstone stratigraphic unit which is part of the lower shale members of the Fruitland Formation. This layer restricts vertical transport of CCB leachate-laden water into the underlying PCS unit. The surrounding spoil disposed in the pits along with the CCBs is a mixture of sandstones, mudstones, coal processing waste, and shale.

Hydrologic Effects

Pre-mine water level data from the coal seams record that the seams were dry (unsaturated) in the majority of the coal lease, particularly Barber, Pinto, and Doby pits, except for a few localized areas in Area III (Lowe/Dixon pits). Hydraulic conductivity within the coal seams in the Navajo Mine, determined from aquifer tests reaches a maximum of 2.68 X 10^{-5} cm/sec in some places (NTEC, 2013). It could potentially take quite a long time for ash disposal areas to become saturated in some places because of the slow groundwater velocities in the lease area and because of the small effective porosity of the coal seams through which transport occurs.

Regular irrigation of NAPI agricultural fields immediately east of the Bitsui mine pit area contribute to development of saturated conditions in portions of backfilled and reclaimed Bitsui pits. Shallow groundwater has accumulated in aeolian sand units south and east of the Bitsui area and is perched on top of the low permeability shale and mudstone units of the Fruitland Formation. The saturation measured in the reclaimed area results in part from excess irrigation water migrating down gradient from the agricultural fields and toward the backfilled pit and also from the gradient created by Morgan Lake (0.01 ft/ft). Regional shallow groundwater gradients (Keller-Bliesner 1997) in the sand unit indicate that the groundwater contained in the aeolian sand will discharge to Bitsui Wash.

The Bitsui area was mined during 1964-1965 and backfilled in the mid-1970s. Some of the backfill in this area consisted of ash from the Four Corners Generating Station. NAPI activity began in the late 1970s. The Navajo Mine monitoring program has been recording groundwater levels and quality in the Bitsui area since 1995. A total of seven monitoring wells were placed in both spoil and ash disposal areas, and in the No. 8 coal seam within the immediate Bitsui area as seen in Figure 1. Additionally, water level and chemistry data was collected from the No. 8 coal seam well KF84-16 that is 1,400 feet to the east of the Bitsui area. Monitoring of static water level in the No. 8 seam coal in the Bitsui area began in 1985 in wells KF83-1 and KF84-16. Over an 11-year period from 1985 to 1996, water levels in the No. 8 coal seam rose 11 feet in well KF83-1 to the southeast and 6 feet in well KF84-16, further to the east. Water levels in both wells appear to have reached an equilibrium stage with relatively little change since 1996. Monitoring of these two particular wells has since ceased.

No. 8 coal seam wells Bitsui-2 and Bitsui-3 are located in the former highwall adjacent to the mined out area and have been monitored since 1995. Water levels from these two wells record a pattern of initial recharge followed by a period of steady state that is similar to wells KF-84-16 and KF83-1. The cumulative effect of the return flows from irrigation has produced perennial surface water flows in Bitsui Wash and a large perennial pond upslope of the mined out area. These perennial sources of water located at a higher elevation than the former Bitsui pit would have sufficient volume of flow, given enough time, to migrate down slope and saturate the Bitsui mined out area. The likely sequence is that soon after NAPI began irrigating, return flows began accumulating in the mined out areas until a steady state condition developed. Due to the low groundwater velocities in the area and the large distance (about two miles) from Morgan Lake, it probably has contributed significantly less to the affected saturation levels in the Bitsui pit.

Leachate Studies

The CCBs from the Four Corners Power Plant were analyzed along with coal spoil from the Navajo Mine to determine chemical constituents. Column leaching tests were performed on the CCBs to measure how much a number of key constituents were susceptible to leaching. Chromium, boron, molybdenum, potassium, magnesium, calcium, and sodium were determined to be key species for evaluation (Lamkin 1981). These elements were selected because they were found to approach or exceed the drinking water standards in the RCRA leachates or because they were seen as being representative of the behavior of the major species. The specific method used in this study was the Extraction Procedure (EP) method, which was congruent with RCRA requirements at the time the study was published. Furthermore, the attenuation capacity of the overburden was examined to ascertain the amounts of leachate that could be effectively removed by being filtered through it. The results from this study and a chemical analysis of the spoil and CCBs are presented in Table 1 and Table 2.

Table 1: Leachate Analysis of CCBs (Lamkin 1981)

Chemical of Concern	Total Solid Phase Concentration in CCBs (mg/kg)	Leachable Concentration from CCBs (mg/kg)	Attenuation Capacity of Overburden (mg/kg)
Potassium	6000	34	10
Magnesium	2500	1	0
Calcium	24000	1570	1260
Sodium	16000	270	0
Chromium	30	0.22	0.49
Molybdenum		2.6	0
Boron	220	52	0

In the mid 1980s, an additional study was conducted on the Navajo Mine to determine whether leaching of spoil material and CCBs could potentially have any effects on the environment. Mixtures of spoil and CCBs were leached in the batch leaching process with natural waters from the site. The batch leaching procedures accelerated the leaching process and determined in a shorter time period what the long-term contact between native groundwater, CCBs, and spoil would produce in terms of water chemistry. The data collected from this study was evaluated to determine the net geochemical impact expected as a result of the CCB disposal at the mine site. Additionally, the attenuation properties of various solid materials was evaluated. This study was a follow up to the initial one that characterized the ash composition.

Concentrations in the surface water leachate for boron and selenium increased when leached through fly ash (NTEC, 2013). However, the levels of boron declined slightly when leached through a mixture of ash and spoil, and the increased selenium concentrations were similar to the selenium concentrations in leachate produced by spoil alone. The iron concentration in both surface and groundwater decreased following leaching through spoil, CCBs, or a mixture of the two.

Overall, the conclusions from the study were that the leachate nearly always had higher TDS than the initial groundwater. One exception to this was in the case of leachate produced from a particular mixture of ash and spoil that had lower TDS and lower trace metal concentrations than natural groundwater from coal seams #4-6, though this instance isn't representative of prevalent conditions in the reclaimed areas. Many different attenuation processes such as high cation exchange capacity (CEC) of the spoil, formation of polymeric iron hydroxide complexes, and sorption to CCBs and spoil were suggested.

Table 2: Concentration of Chemical Constituents in CCBs and Spoil (Lamkin 1981)

Element	Concentration (mg/kg)	
	CCBs	Spoil
Aluminum	120000	7400
Arsenic	32	6
Barium	700	42
Beryllium	<0.1	
Boron	220	8
Cadmium	<1.6	0.9
Calcium	24000	17000
Chromium	30	3
Cobalt	21	7
Copper	61	6
Iron	23000	13000
Lead	55	32
Magnesium	2500	3100
Manganese	160	200
Mercury	0.033	0.2
Molybdenum	<0.40	<6
Nickel	<0.60	9
Potassium	6000	1400
Selenium	4	<2
Silicon	260000	
Silver	<0.40	<0.2
Sodium	1.60%	2700
Strontium	320	
Titanium	5100	
Uranium	<6.0	
Vanadium	97	
Zinc	150	63

Potential Offsite Migration

Based on the potentiometric surface for the No. 8 coal, the discharge locations for the re-saturated mine spoil within Area I are projected to be: the subcrop of the No. 8 coal and the Fruitland Formation beneath the alluvium of San Juan River Valley to the northeast of Area I and down-dip in the No. 8 coal Seam toward the drawdown influences of nearby coal bed methane wells (NTEC, 2013).

The subcrop of the No. 8 coal seam beneath the alluvium in the San Juan River Valley occurs at elevations below the water levels in the coal seam to the south. The approximate location for the coal subcrop is depicted in Figure 2. The extent of the San Juan River alluvium along the Fruitland Formation subcrop is also mapped out in this figure. This subcrop location along the alluvium of the San Juan River is thought to be the primary discharge location for groundwater in the No. 8 coal seam and in the undifferentiated Fruitland Formation.

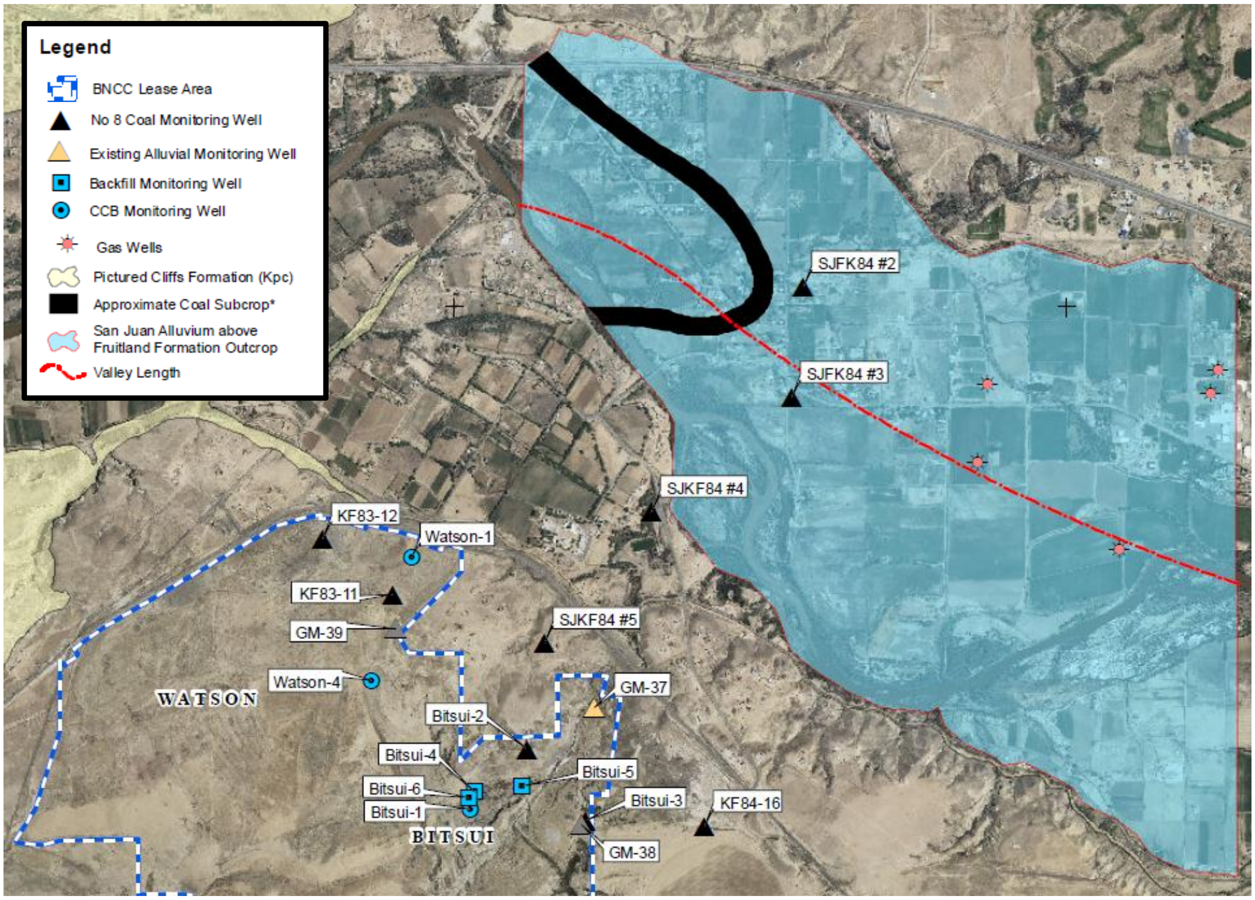

Figure 2: Fruitland coal subcrop and San Juan Alluvium

A hydraulic conductivity of 0.08 feet per day from this table is considered a reasonably conservative estimate for the No. 8 coal based on the test results for wells SJKF84 #3, SJKF84 #4 and SJKF84 #5 located in the coal down gradient of the Bitsui Pit. The porosity of coal seams is primarily associated with cleating and small scale fracturing of the coal. Porosity estimates ranging from 0.02 to 0.007 were obtained for the Fruitland Formation coals from tests conducted for the Western Cretaceous Coal Seam Project (Mavor 1992). An estimate of coal porosity of 0.01 was used for modeling. This estimate also appears to match the rate of transport from the Bitsui Pit to well Bitsui-2 and has been used in the model calibration and simulations.

An elevation difference of 63 feet is calculated for the water elevation of 5,164 feet measured in the Bitsui Pit and the water elevation of 5,101 feet estimated in the alluvium at the coal subcrop. The horizontal distance between the Bitsui Pit and the coal subcrop is approximately 7,300 feet resulting in an average hydraulic gradient between the Bitsui Pit and the groundwater at the coal subcrop of 0.0086 ft/ft.

Based on the porosity and hydraulic conductivity for the coal, the groundwater velocity is estimated to be 0.069 feet per day, and it would take 290 years for water from the mine pit to flow the 7,300 foot distance through the coal from the Bitsui Pit to the coal subcrop under the San Juan River alluvial aquifer. The groundwater velocity in the undifferentiated Fruitland Formation is expected to be at least 5 times lower based on an estimated effective porosity of 5% and because of the low hydraulic conductivity estimates based on the extent of shale and claystone within the unit and the observations from mining and exploration drilling.

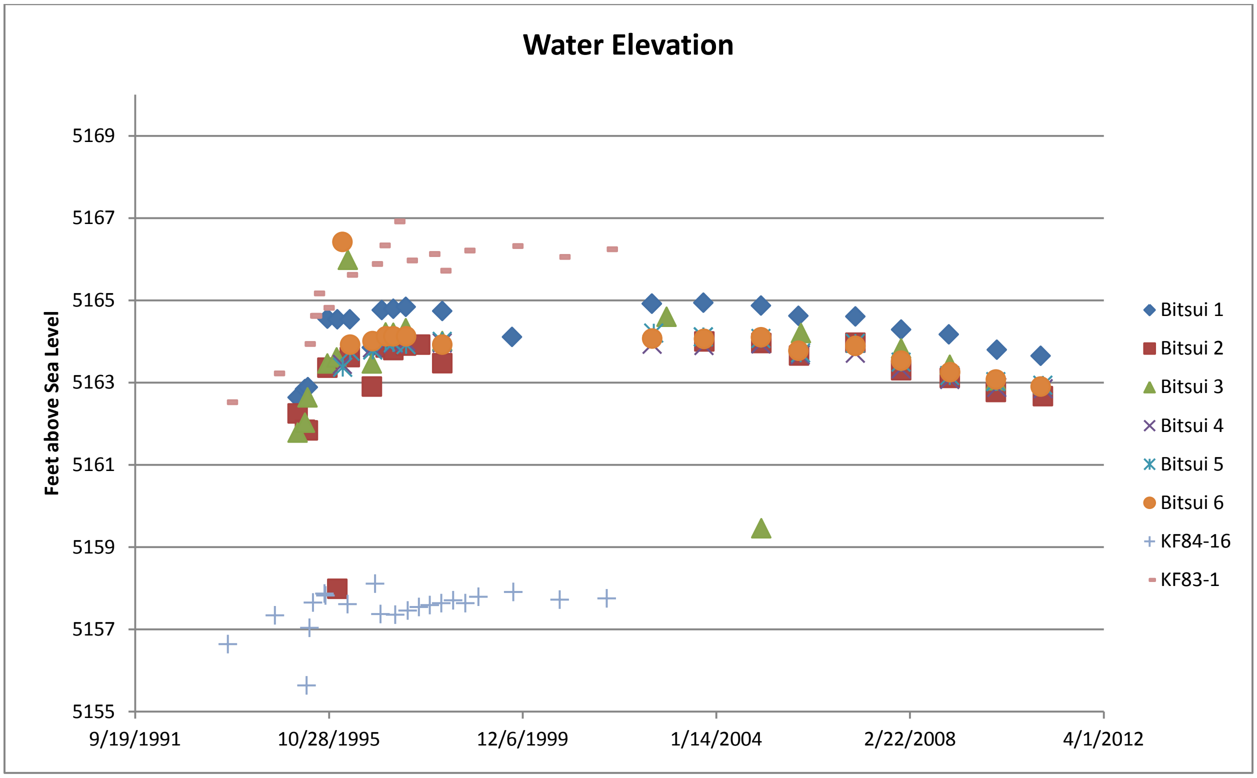

Figure 3: Water Table elevation of Select Wells in the Bitsui Pit Pre-Law Area

Groundwater Modeling

An advection-dispersion model simulation was applied to evaluate the characteristics of groundwater movement and leachate attenuation in the Area 1 Bitsui Pit. Specifically, the model considered the transport of boron, modeled as a conservative geochemical tracer, from the upgradient Bitsui CCB disposal area to the downstream Bitsui 6 spoil well. The distance between the maximum extent of the CCB disposal and the downgradient well is an approximate horizontal distance of 3 feet, or 10 meters (NTEC, 2013). Approximate concentrations of boron and other parameters of interest within this CCB disposal area are inferred by data recorded at the Bitsui 6 ash-disposal well. The groundwater gradients in the Bitsui area trend towards the northwest where discharge ultimately occurs in outcrops of the Fruitland Formation next to the San Juan River. In an effort to reduce the uncertainty and the number of variables, boron was chosen since other chemical species may degrade and attenuate considerably over time and distance.

Advection-dispersion models assume that a center of mass is traveling through the subsurface at the same speed as the average groundwater velocity (Fetter 2001). As the plume moves through the subsurface over time, dispersion effects cause it to exhibit a Gaussian normal-distribution concentration gradient, similar to a bell shaped curve. Dispersion is a function of the tortuosity in the subsurface, but in this model it was calculated based on an empirical formula. If the initial time in which transport began is known, as well as the distance the plume traveled, the groundwater velocity (pore water velocity) and hence the dispersion coefficient can be calculated iteratively.

Certain assumptions went into making the model. One primary assumption is that the aquifer is homogeneous. Additionally, since the area was reclaimed about 1975, and because extensive NAPI activity in the area didn't occur until 1980, the chemical transport is assumed to start in 1985. The assumption is based on the estimated time for the pit to become saturated, for the boron to start leaching out of the CCBs, and for the plume to start moving at any appreciable rate. The nature of the loading that created the plume is assumed to be impulse, or slug loading because it was found to support the data more accurately than a continuous load. Model parameters are shown in Table 3.

Depending on the distance assumption, the plume migrated from the source to the receiving well (Bistui 6), and different groundwater velocities can be calculated from the model. The results of the model were evaluated using two distances from the assumed point source to the downgradient well. In one case 33 feet was used since it is the distance between the maximum extent of the CCB disposal and Bitsui 6 well, and 172 feet was also used because it is the distance between Bitsui-1 (CCB well in Bitsui pit ash disposal) and Bitsui-6 (closest downgradient spoil well in the Bitsui pit). Based on the assumption that the distance between the source and downgradient well is 33 feet, a groundwater velocity of 0.6 meters/year, or about 10^{-6} cm/second, was calculated after calibrating the model to fit the breakthrough curve in the downgradient well, as shown in Figure 4. If one assumes that the distance between the source and the downgradient well is 172 feet a groundwater velocity of 3.285 meters/year, or 10^{-5} cm/second, is calculated. Because of the slow velocities involved in the groundwater transport, it is estimated to take 85 to 450 years for leachate to even reach the coal seams at the edge of the CCB and spoil disposal area of Bitsui Pit given the current conditions.

The results of the model indicate transport through the areas reclaimed with fly ash is considerably slower compared to transport through the coal seams. The model fit the data with a coefficient of determination (R squared) value of 0.96, suggesting good agreement with the data. However, there is always uncertainty concerning groundwater modeling given the simplifying assumptions. An alternative assessment approach assumes a continuous load rather than an impulse load from the ash disposal area, with down-gradient migration and attenuation in the spoil. Although this is an alternative possibility, the evidence in the literature concerning boron attenuation concludes that it remains fairly stable as it moves through the subsurface (Heebink 2001) (Manoharan 2007). In addition to this, based on the ash characterization studies, the amount of boron present within the ash is limited and most likely would have been released immediately following water-saturation as an impulse load.

The model was calculated using the following equation (Fetter 2001):

$$C = \frac{Co}{2}[erfc\left(\frac{L - vxt}{2\sqrt{Dlt}}\right) + \exp\left(\frac{vxL}{Dl}\right) erfc\left(\frac{L + vxt}{2\sqrt{Dlt}}\right)]$$

Where;

C=concentration at a specific x coordinate and time

Co=the initial source concentration

Dl=*aLvx* =longitudinal dispersion coefficient ($\frac{Length^2}{Time}$)

L=flow path length

aL=0.83(log$L$)$^{2.414}$ = the apparent longitudinal dynamic dispersivity (length)

vx=average ground water velocity ($\frac{Length}{Time}$)

t=time since movement began

Table 3: Advection Dispersion Model Input and Output Parameters

Year	1990	1992	1994	1996	1998	2000	2002	2004	2006	2008	2010
C (g/m^3)	0.016	0.221	0.874	1.959	3.246	4.510	4.783	3.786	2.930	2.226	1.667
Co (g/m^3)	9	9	9	9	9	9	9	9	9	9	9
L (m)	10.06	10.06	10.06	10.06	10.06	10.06	10.06	10.06	10.06	10.06	10.06
vx (m/d)	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Dl (m^2/d)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
t (d)	1825	2555	3285	4015	4745	5475	6205	6935	7665	8395	9125
aL (m)	0.835	0.835	0.835	0.835	0.835	0.835	0.835	0.835	0.835	0.835	0.835

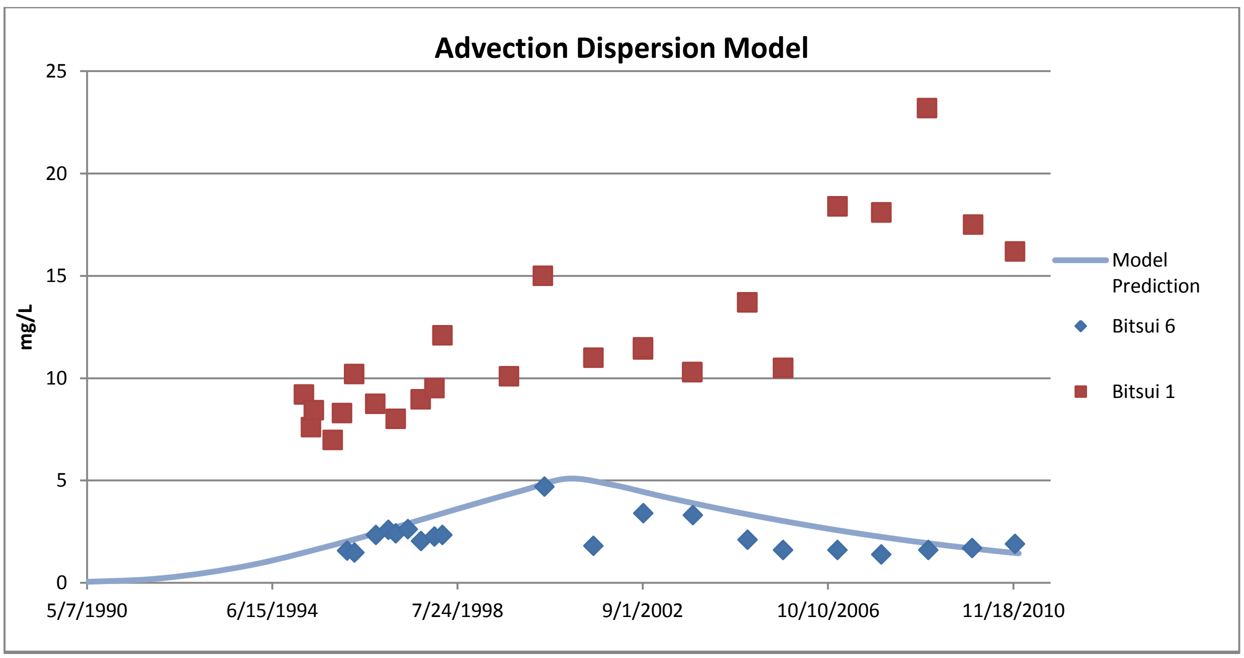

Figure 4: Advection-Dispersion Modeling of a Boron Breakthrough Curve

Conclusions

There were varying hydraulic gradients during the timeframe that was modeled. This is important to consider because hydraulic gradient is the driving force for determining groundwater velocity, particularly in unconfined conditions (Fetter 2001). The gradients varied from extremes of 0.02 ft/ft in 1996 to 0.005 ft/ft in 2008, as is seen in Figure 3. The gradients could have also been greater at the beginning of the transport sequence while the reclaimed area was becoming saturated from NAPI water; however, there is no data available for analysis. The groundwater velocity calculated from the model represents a steady state condition in the reclaimed area where there is minimal driving force for groundwater movement.

The reclamation of the CCB disposal areas at Navajo Mine has been sufficient in part because of the natural conditions prevalent in the area and also due to placement considerations during disposal and reclamation. The data evaluated indicate negligible impacts have resulted from the CCB disposal. It is also not anticipated that any significant future effects will ensue from the CCB disposal at the Navajo Mine because of the very slow groundwater movement and the likely attenuation of contaminants of concern as they migrate through the subsurface. Therefore, OSMRE concludes that potential impacts from CCB disposal at the Navajo Mine are negligible.

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BHP Billiton Mine Management Company

Technical Memorandum

Date	February 26, 2015
To	Mychal Yellowman (OSMRE)
CC	Paul Clark (OSMRE); Kent Applegate (MMCo); Daphne Place-Hoskie (MMCo)
From	Ed Epp
Our Ref	**Navajo Mine NM-0003F SMCRA Required Water Quality Monitoring Enhancements Technical Memorandum**

This technical memorandum (TM) documents the activities conducted in fulfilment of water quality monitoring enhancements required by the U.S. Federal Office of Surface Mining, Reclamation, and Enforcement (OSMRE) as part of its approval of the Navajo Mine Pre-2016 Permit (Appendix 1). Specifically the TM describes:

1. Surface water station and ground water monitoring well installation progress since 2012.
2. Analysis of water quality data collected from these sites since installation.
3. Ongoing work to fulfil monitoring requirements.

1 Executed Water Quality Monitoring Enhancements:

1.1 Bedrock Monitoring Wells

BHP Billiton Mine Management Company (MMCo) reinstated monitoring at three (3) bedrock monitoring wells at Area 1 (Figure 1). Water quality monitoring is done quarterly at monitoring well Bitsui-2. The well is completed in the #8 Coal Seam. Water level measurements are collected quarterly at monitoring wells KF84-16, and KF83-1. These two wells are also completed in the #8 Coal Seam.

The three (3) groundwater monitoring wells (KF84-20A, B, and C) that monitored the #7, #4, and #3 Coal Seams, respectively, at the Lowe Pit were mined through in 2012. MMCo replaced these with three new monitoring wells in 2012 (KF3-12-1, KF4-12-1, and KF7-12-1) to the east of the final highwall of Lowe Pit in an area with no planned future disturbance (Figure 2) (Appendix 2).

MMCo originally intended to install one well each in the #8 and #3 Coal Seams along the north edge of the Gilmore Pit, in Area 4 North. However, because the #8 Coal Seam is “thin, discontinuous, and split into as many as four child seams” in the area proscribed by OSMRE for the #8 well, OSMRE approved an alternate plan to install a second monitoring well in the #3 Coal Seam (Appendix 2 and 5). These wells are KF3-12-2 and KF3-12-3 (Figure 3).

Table 1 summarizes the new bedrock wells, target formations and their locations at the Navajo Mine.

Figure 1. Ground and surface water monitoring in Area 1 of the Navajo Mine.

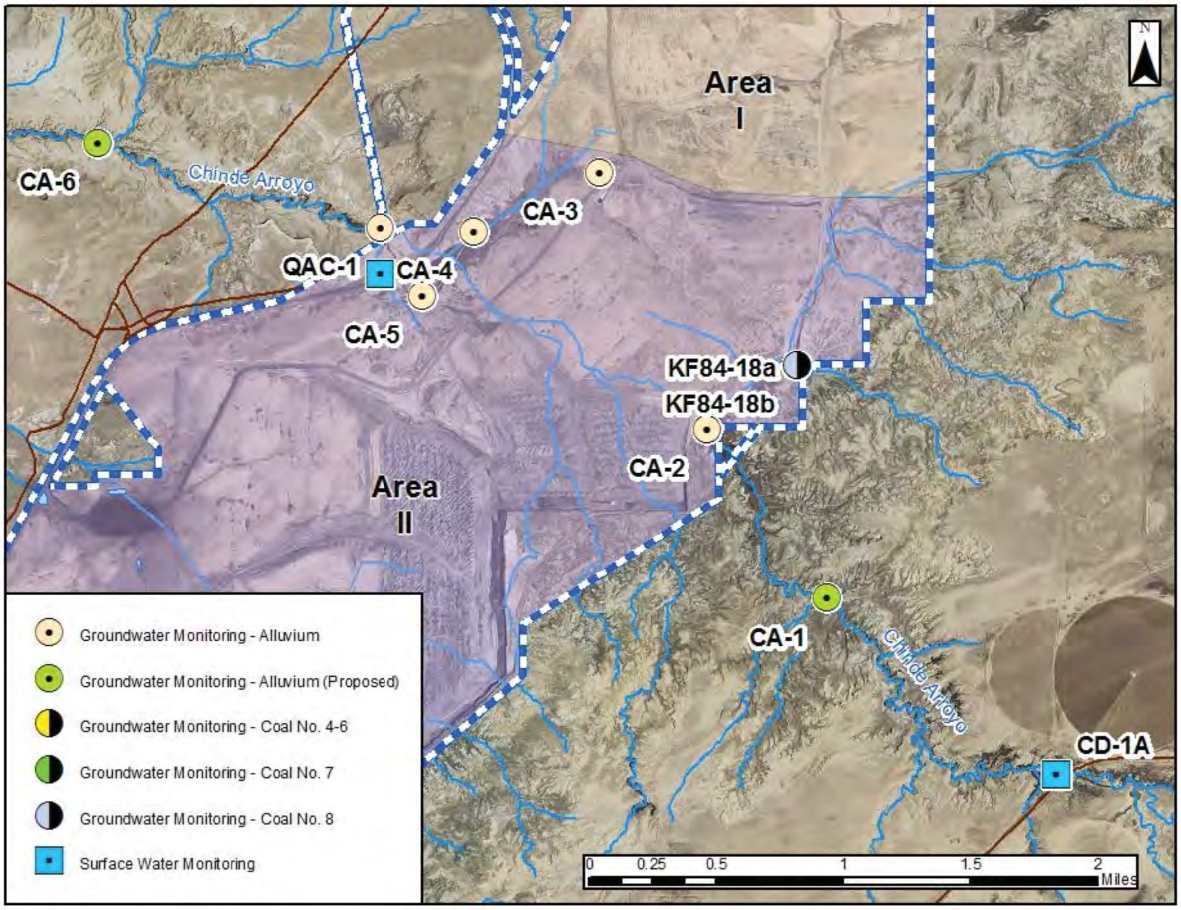

Figure 2. Ground and surface water monitoring in the vicinity of Chinde Arroyo at the Navajo Mine.

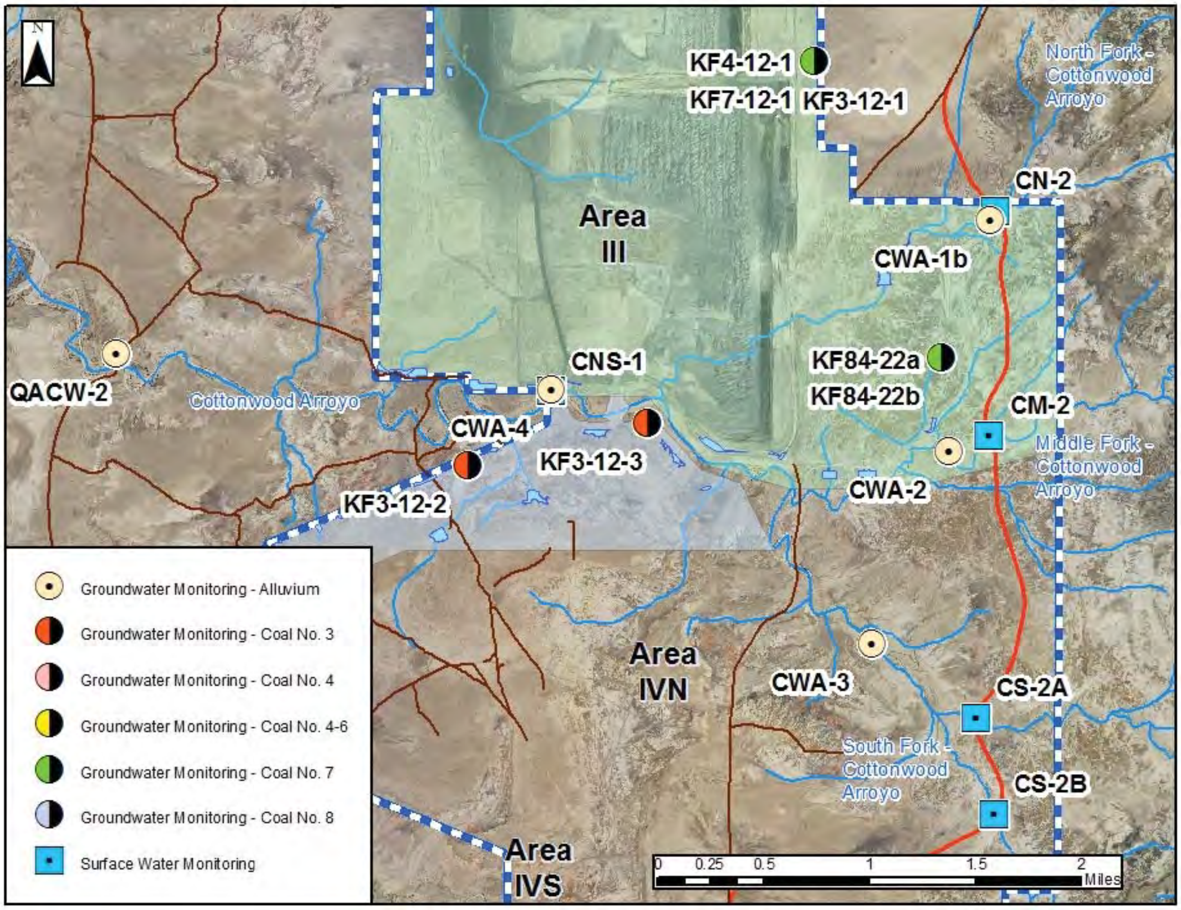

Figure 3. Ground and surface water monitoring in the vicinity of Cottonwood Arroyo at the Navajo Mine.

Table 1. Groundwater Monitoring Wells Installed at Navajo Mine Since Approval of the Pre-2016 Permit Application.

Major Unit	Well Number	Location	Sampling Frequency	Status, Year Installed
Fruitland Coal Seam #8	KF84-22A	East of Dixon Pit	Annual	Active, 1984
	Bitsui-2	Bitsui Pit	Quarterly	Active, 1994
	KF84-16	Bitsui Pit	Quarterly	Active, 1984
	KF83-1	East of Bitsui Bit	Quarterly	Active, 1983
Fruitland Coal Seam #7	KF7-12-1	East of Lowe Pit	Annual	Active, 2012
	KF84-22B	East of Dixon Pit	Annual	Active, 1984
Fruitland Coal Seam #4-6	KF84-18A	East of Yazzie Pit	Annual	Active, 1984
	KF4-12-1	East of Lowe Pit	Annual	Active, 2012
Fruitland Coal Seam #3	KF3-12-1	East of Lowe Pit	Annual	Active, 2012
	KF3-12-2	North of Gilmore Pit	Annual	Active, 2012
	KF3-12-3	North of Gilmore Pit	Annual	Active, 2012

1.2. Alluvial Groundwater Wells

MMCo installed seven (7) alluvial groundwater monitoring wells in 2012 (Appendix 2) (Table 2). One (1) alluvial monitoring well, CA-2, was installed in 2013 (Appendix 3). Well CWA-1a was damaged by a flood event on the Cottonwood Arroyo during the fall of 2012. The well was subsequently abandoned and was replaced by well CWA-1b (Appendix 4) in 2013. All abandonments and installations were supervised and documented in the field by a representative of Norwest Corporation (see Figures 2 and 3 for alluvial well locations). Two (2) wells have not been installed. See Section 3 for discussion of progress to install Chinde Alluvium monitoring wells CA-1 and CA-6.

Table 2. Alluvial Wells Installed at Navajo Mine Since Approval of the Pre-2016 Permit Application.

Well Designation	General Location	Monitoring Type	Sampling Frequency	Status, Year Installed
CA-1	Chinde Arroyo – Downgradient of NAPI	Hand augur pre-packed well	NA	Proposed
CA-2	Chinde Arroyo – Wetland east of mining influence	Monitoring Well	Quarterly	Active, 2013
CA-3	Chinde Arroyo – Wetland on lease	Monitoring Well	Quarterly	Active, 2012
CA-4	Chinde Arroyo – Wetland on lease	Monitoring Well	Quarterly	Active, 2012
CA-5	Chinde Arroyo – Wetland on lease	Monitoring Well	Quarterly	Active, 2012
CA-6	Chinde Arroyo – Downgradient of mine lease	Monitoring Well	NA	Proposed
CWA-1a	Cottonwood Arroyo, upgradient of mining	Monitoring Well	NA	Damaged, Abandoned
CWA-1b	Cottonwood Arroyo – North Fork, upgradient of mining	Monitoring Well	Quarterly	Active, 2013
CWA-2	Cottonwood Arroyo – Middle Fork, upgradient of mining	Monitoring Well	Quarterly	Active, 2012
CWA-3	Arroyo – South Fork, upgradient of mining	Monitoring Well	Quarterly	Active, 2012
CWA-4	Cottonwood Arroyo – Downgradient of mining	Monitoring Well	Quarterly	Active, 2012

1.3 Surface Water Monitoring Stations

MMCo installed passive water quality monitoring stations upstream and downstream of mining in the Cottonwood Arroyo. The stations consist of one (1) crest gauge and a minimum of two (2) single stage sediment samplers (Figures 4 and 5). The sediment samplers are constructed of 4-inch PVC pipe and contain 1-liter sample bottles. The bottles have an intake and a vent tube attached. The stations begin to capture water samples when flow reaches the apex of the intake tube. Once the bottle is full, the sampler can no longer capture water. Once flow in the arroyo ceases, and the arroyo is safe to enter, the samples are removed from the 4-inch PVC tubes. The maximum height of flow is recorded from the staff gauge. Cleaning and maintenance of the station is done, if necessary, and the samples are shipped to an analytical laboratory.

The locations, monitoring frequency, and equipment installation details for surface water stations are summarized in Table 3. One station is located downstream of each of four (4) major culverts beneath the Burnham Road within the Cottonwood Arroyo. One station (CN-2) is on the North Fork, while a second station (CM-2) is located on the Middle Fork of Cottonwood Arroyo. The South Fork of Cottonwood Arroyo consists of two smaller (sub)-forks that merge just downstream of the Burnham Road. Station CS-2A is located on the northern of these sub-forks and CS-2B is located on the southern sub-fork (Figure 2). A fifth flow meter is located on the Cottonwood Arroyo, downstream of mining at the historical location CNS-1.

Teledyne ISCO 2110 Ultrasonic Flow Modules were installed at Cottonwood surface water monitoring stations CN-2, CM-2, CS-2A, CS-2B, and CNS-1. These flow meters were installed in 4-foot diameter culverts, set vertically into the ground, to protect the instruments (Figure 6). The sondes hang from the roofs of the Burnham Road culverts, which afford relatively constant cross sections. The data from the flow meters can be converted to cross sectional area of flow and the runoff volumes can then be calculated.

Initial data collected by these flow meters in April, 2014 indicated that the detection range of the sondes installed was insufficient to reach the floors of the culverts. Further discussion on corrective actions can be found in Section 3.

A Teledyne ISCO 2110 Ultrasonic flow meter will be installed at CD-2A on the Chinde Arroyo at the downstream end of the Big Fill culvert. Installation of an ultrasonic sonde is planned at the upstream station (CD-1A). Further discussion on CD-1A can be found in Section 3.

The upstream (CD-1A) and downstream (CD-2A) Chinde Wash stations are inspected on a quarterly schedule. In accordance with Navajo Mine Permit NM-0003F, water samples are collected when flowing conditions are observed during quarterly inspections. Flow meters are being installed at CD-2A and one is planned at CD-1A (see section 3.2).

Table 3. Surface Water Stations Installed at Navajo Mine Since Approval of the Pre-2016 Permit Application.

Station ID	Drainage	Location	Sampling	Instrumentation
CD-1A	Chinde	Upstream	Quarterly Grab Sample	None installed (see section 3.2)
CD-2A	Chinde	Downstream	Quarterly Grab Sample, Flow Gauge	Construction in progress
CN-2	North Fork Cottonwood	Upstream	Passive Sampler, Flow Gauge	6' Ultrasonic sonde installed. Need 10' Ultra-sonic sonde
CM-2	Middle Fork Cottonwood	Upstream	Passive Sampler, Flow Gauge	6' Ultrasonic sonde installed. Need 10' Ultra-sonic sonde
CS-2A	South Fork Cottonwood	Upstream	Passive Sampler, Flow Gauge	6' Ultrasonic sonde installed. Need 10' Ultra-sonic sonde
CS-2B	South Fork Cottonwood	Upstream	Passive Sampler, Flow Gauge	6' Ultrasonic sonde installed. Need 10' Ultra-sonic sonde
CNS-1	Cottonwood	Downstream	Passive Sampler, Flow Gauge	6' Ultrasonic sonde installed. Need 10' Ultra-sonic sonde

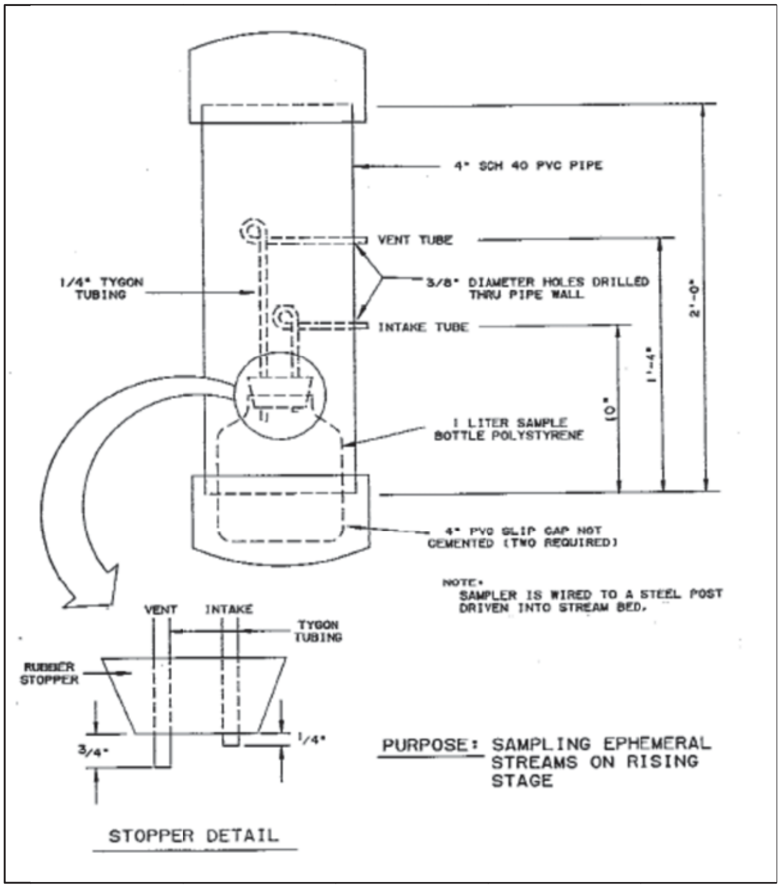

Figure 4. Schematic of Single Stage Sampler.

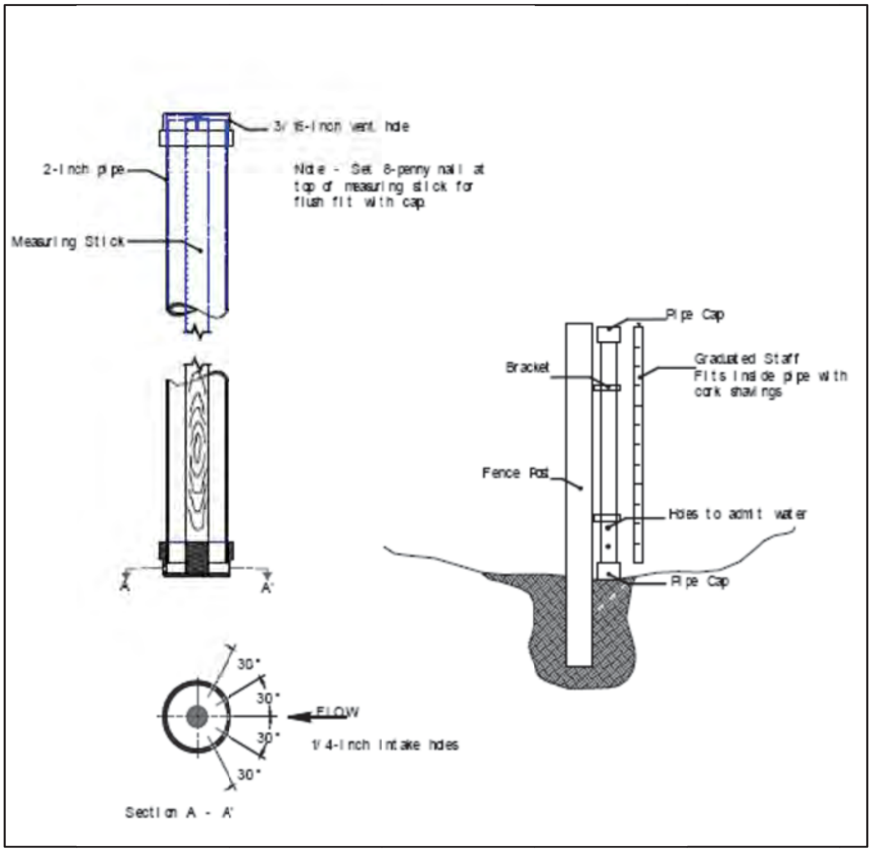

Figure 5. Schematic of Crest Gauge.

Figure 6. Example of 4-foot diameter culvert station used to house flow meter equipment.

2 Analysis of water quality data collected from these sites since installation.

MMCo contracted with Norwest Corporation to produce an analysis of data collected from the surface water stations and groundwater monitoring wells installed since 2012. The report is included as Appendix 6 Hydrology Report for OSMRE CHIA Update. The format of the report is identical to the Navajo Mine Hydrology Report that is submitted twice each permit term to OSMRE. The monitoring data has been updated through September of 2014, and emphasis of analysis is on data collected between 2012 and September, 2014. Historical analysis is included for comparative purposes.

3 Ongoing work to fulfil monitoring requirements.

3.1 Groundwater Monitoring

MMCo submitted application for water use permits to the Navajo Nation Water Code Administration on September 24, 2012, to install alluvial monitoring wells CA-1 upstream and CA-6 downstream of the Navajo Mine lease. MMCo subsequently contracted for the performance of biological and archaeological surveys and received conditional approval for construction from Navajo Nation Fish and Wildlife on January 30, 2013 and a cultural resources compliance form from the Navajo Nation Historic Preservation Department on January 29, 2013. MMCo received approval from Navajo Nation Water Code Administration to drill both CA-1 and CA-6 on April 15, 2013, for duration of 1 year, expiring on April 15, 2014. MMCo will need to renew this drilling permit. MMCo also received the permit for water use from both CA-1 and CA-6 on April 15, 2013 for the duration of 5 years, expiring on April 15, 2018.

In early 2013, MMCo consulted with Navajo Nation Environmental Protection Agency (NNEPA) and Bureau of Indian Affairs (BIA) for the off-lease monitoring wells and was instructed that a Right of Way (ROW) for the proposed monitoring well sites should be obtained. In March 2013, MMCo submitted a ROW application package to the BIA and the Navajo Nation for review and approval. In October 2013, MMCo was informed by Bureau of Indian Affairs (BIA) Reality Office that a Categorical Exclusion (CatEx) would be necessary to grant approval for access to the wells. A CatEx was prepared by Ecosphere Environmental Inc. and submitted later that month (October 24, 2013) to BIA Division of Environmental, Cultural and Safety Management. MMCo was then informed by the Navajo Nation Land Office that ROW applications require an Environmental Assessment (EA). Additionally, MMCo was informed that the ROW was not required for permitting the monitoring wells and instead a Revocable Use Permit (RUP) would be required. Numerous correspondences and consultations were conducted - in person, by phone, letter, and email to determine the correct course of action for the permitting process through the remainder of 2013 and into 2014.

MMCo conducted an in-person meeting in June 2014 with BIA Reality Office and the Navajo Nation Land Department to get a final determination on the permitting process to gain access to the sites of the proposed monitoring wells. At this meeting the BIA and Navajo Nation parties concluded that the RUP would, in fact, be the appropriate process to undertake to gain access to CA-1 and CA-6. MMCo re-submitted the application package as an RUP, in person, in November 2014. However, at this time, the RUP application package is still under review with Navajo Nation with continued uncertainty whether it will proceed as an RUP or go back to an ROW. Once the departments arrive at an agreement, a final permit can be issued, and the wells will be installed.

3.2 Surface Water Monitoring

MMCo installed five (5) ISCO Ultrasonic flow samplers at surface water monitoring stations on the Cottonwood Arroyo in early winter 2013. The data from the first flows, recorded in April 2014, indicated that the flow sensors were only collecting data at peak flow and not low flow. A conversation with the manufacturer’s representative indicated that MMCo had purchased sondes with a six foot sonic emission and detection range. The height of the culverts requires a sonde with a ten foot range. MMCo is in the process of purchasing new sondes to install in the Cottonwood stations.

MMCo maintains a RUP for surface water sampling at CD-1A. At this location, a large culvert passes under Navajo Highway 3005. MMCo estimates that this RUP was last utilized for installation of flow measurement equipment at the Chinde culvert sometime around 1999. MMCo is investigating whether the RUP allows it to install flow monitoring equipment beside the culvert, in a small parking area on the west side of the road, or at the crest of the culvert. Upon final determination, either a 4-foot culvert station will be installed adjacent to the Chinde Arroyo (Figure 1), or a metal box will be welded to the top of the highway culvert, to house the flow monitoring equipment. Further permitting with the Navajo Nation may also be necessary.

Appendices

Appendix 1: Section 5.2.1.1 Monitoring Program Updates, from the 2012 Cumulative Hydrologic Impact Assessment of the BHP Billiton Navajo Coal Company [sic] Navajo Mine

Appendix 2: Norwest Corporation - Technical Memorandum: Completion and Development of 2012 Navajo Mine Groundwater Monitoring Wells

Appendix 3: Norwest Corporation - Technical Memo: Navajo Mine Monitoring Well CA-2 Installation

Appendix 4: Norwest Corporation - Technical Memo: Navajo Mine Monitoring Well CWA-1A Replacement with CWA-1B

Appendix 5: Letter_120626_Groundwater Well Drilling and Surface Water Monitoring Site Status

Appendix 6: Ground and Surface Water Quality Monitoring Results and Analysis

Appendix 1: Section 5.2.1.1 Monitoring Program Updates, from the 2012 Cumulative HydrologicImpact Assessment of the BHP Billiton Navajo Coal Company [sic] Navajo Mine cation/anion balance for quality assurance. Additional monitoring parameters, are only used if the reference criteria are exceeded, and are found in the Navajo Mine PAP, Chapter 6, Section 6.6.13.2 and footnote 1 of Table 6.5 Additional monitoring parameters include iron, manganese, nitrate, and boron. Table 6.5 lists the reference criteria. OSMRE finds that the groundwater monitoring program has supplied sufficient information to support the required evaluation for material damage potential in this CHIA.

5.2.1.1 Monitoring Program Updates

Monitoring programs are periodically updated to enhance the available data sets for predictive analysis. OSMRE recently approved enhancements to the hydrologic monitoring program proposed by BNCC. Monitoring program enhancements are outlined below (BNCC 2012):

Surface Water:

1. Chinde Wash
    a. One continuous flow gauge will be installed upstream, off lease in the proximity of agricultural fields.
    b. One continuous flow gauge will be installed on-lease, downstream of the "big fill"
2. Cottonwood Arroyo
    a. Four upstream flow gauges will be installed (one each) along the North Fork, Middle Fork and two branches of the South Fork
        i. Above mentioned upstream gauges will be installed at the outfall of culverts along the proposed Burnham Road re-route
    b. One downstream flow gauge will be installed on an already existing cable structure across the channel; periodic channel surveys will confirm accurate channel cross section
    c. All stations will consist of flow meters to sample flow quantity and water samplers for water quality analysis
3. Implementation Schedule
    a. Chinde gauges upon approval of off-lease monitoring
    b. Cottonwood upstream gauges dependent on permit approval and construction schedule of Burnham Road re-route; proposed for June 2012 (North Fork) and October 2012 (Middle and South Fork)
    c. Cottonwood downstream monitoring scheduled for completion in May 2012

Groundwater:

1. Bitsui Area – used on part to evaluate the Area I groundwater model
    a. Existing well Bitsui-2 will be used for #8 seam groundwater level monitoring and for groundwater sampling.
    b. Existing wells KF84-16 and KF83-1 will be used for monitoring #8 seam groundwater levels.
2. Chinde Wash Area
    a. One off-lease, upstream pre-packed well (CA-1) will be installed via hand augur
    b. CA-2 will be installed near the lease boundary as a well to monitor water quality of Chinde Arroyo up gradient of mining activities.
    c. One off-lease, downstream pre-packed well (CA-6) may be installed via hand augur; this will be replaced by a drilled well once final approvals have been acquired
    d. Three piezometers (CA-3, CA-4, CA-5) will be installed in the "big fill" wetland area
    e. All Chinde wells and piezometers will be monitored quarterly for a period of two years, followed by an assessment of continued monitoring frequency.
3. Cottonwood Arroyo Area
    a. A new alluvial well (proposed CWA-4) will be installed to replace the hand-dug, dry well QACW-2B along the main Cottonwood Arroyo just south of Dixon.

b. A new alluvial well (proposed CWA-1) will be installed to replace the abandoned well GM-17 along the North Fork of the Cottonwood Arroyo just inside the lease boundary.
c. Two new alluvial wells (proposed CWA-2 and CWA-3) will be installed along the Main Fork and South Fork, respectively, of the Cottonwood Arroyo near the lease boundary.
d. Two new Fruitland wells (proposed KF-1 #3 and KF-1 #8) will be installed on the northwest side of Area IV North near the lease boundary. These will be used to evaluate Area IV north groundwater model predictions of drawdown, recharge and TDS transport. Monitoring of the No. 3 and No. 8 coal seam should provide information about potential impacts prior to influences on the alluvial water system, which will be protective of downstream alluvial users on the Cottonwood and Chaco.

4. Groundwater Reference Criteria
    a. Criteria will be recalculated using the entire set of baseline data from *10/17/2011*
    b. Reference criteria will be established for QACW-2
    c. QACW-2B is a dry, unsuitable hand-dug well and will be replaced by well CWA-4; new reference criteria will be developed for well CWA-4
    d. GM-17 well will be replaced by proposed well CWA-1; local variation in natural soil properties precludes comparing these two wells as being chemically equivalent so new reference criteria will be developed for CWA-1
    e. Reference criteria are based on the median + 2 median absolute deviations for the baseline monitoring data through year 2001; detection values are calculated as the product of 0.5 and the detection limit
    f. Reference Criteria have been established for well QACW-2 as requested; detection values were calculated as the product of 0.5 and the detection limit.
5. Implementation Schedule
    a. All replacement wells, with the exception of CA-6, are scheduled to be installed during April and May of 2012
    b. Chinde downstream drilled well CA-6 will be installed when necessary approvals are acquired
    c. Well development is scheduled to be completed during June, 2012
    d. The monitoring plan revision to the permit is planned for submittal in August, 2012

Modifications to the Chinde alluvial monitoring are particularly important in light of the potential mining related impacts to this system discussed in section 5.3.7.1.2.2. The objective of these new monitoring locations is to characterize and monitor hydrogeologic conditions of the Chinde Alluvium as follows:

The first monitoring location would be a drive point well that would be installed down-gradient of the NAPI fields and up-gradient of the wetland east of the mine lease. The purpose of this monitoring location would be to assess the groundwater quality immediately down-gradient of NAPI.

- The second monitoring location would be a well installed adjacent to the wetland east and up-gradient of the mining activities. The purpose of this well would be to monitor water quality immediately up-gradient of mining activities.
- The third monitoring location would be a well installed in the Chinde Wash down-gradient of existing well QAC-1. The purpose of this well would be to monitor water quality down-gradient of the mine. Since this monitoring location is located off-lease it is anticipated that installation will be delayed due to the approvals that must be obtained. BNCC is proposing that a drive point be installed prior to well installation to expedite the collection of data. Once the necessary approvals are acquired for the monitoring location, the drive point will be removed and replaced with a monitoring well.
- The remaining three new monitoring locations would be installed in the wetland immediately up-gradient of the Big Fill. The purpose of these is to monitor potential impacts of the wetland on

alluvial water quality, and to monitor groundwater elevations and enable groundwater flow direction to be determined.

BNCC proposes to sample these six new monitoring locations for a period of two years, after which BNCC will discuss with OSMRE the efficacy of continued monitoring of the new monitoring wells. These proposed additions are outlined in Table 6 and approximate locations are shown in Figure 22.

Table 6: Proposed Chinde Alluvium Monitoring (BNCC 2012)

<table>
<tr><th>Target Unit</th><th>Well Designation</th><th>General Location</th><th>Monitoring Type</th><th>Screen Interval</th><th>Sampling Frequency</th></tr>
<tr><td>Top of competent bedrock</td><td>CA-1</td><td>Chinde Wash – downgradient of NAPI</td><td>Drive Point</td><td>Dependent on refusal</td><td rowspan="6">Quarterly</td></tr>
<tr><td rowspan="5">Alluvium</td><td>CA-2</td><td>Chinde Wash – adjacent to wetland east of mine lease</td><td rowspan="4">Monitoring Well</td><td rowspan="4">Varies – 5' above the water table plus thickness of aquifer</td></tr>
<tr><td>CA-3*</td><td rowspan="3">Chinde Wash – wetland on lease</td></tr>
<tr><td>CA-4*</td></tr>
<tr><td>CA-5*</td></tr>
<tr><td>CA-6</td><td>Chinde Wash – downgradient of mine lease</td><td>Drivepoint/ Monitoring well</td><td>Dependent on refusal/ Varies – 5' above the water table plus thickness of aquifer</td></tr>
</table>

*Water level measurements only

5.3 Impact Assessment

The assessment presented in Chapter 5 of this document considers available quantity and quality information related to surface water and groundwater potentially affected by BNCC operations. The assessment approach used for each resource is outlined in Table 7. Impact assessment relied upon analysis of monitoring data, several models, relevant published and unpublished reports and papers, experience from past mining and reclamation operations at Navajo Mine and other mines located along the western rim of the San Juan Watershed, as well as observations made by BNCC and OSMRE staff during the day-to-day operations and regulation of the mine. Impacts are designated as negligible, minor, moderate or major as defined in Table 7. Table 7 also outlines current minimize techniques and updates to the BNCC monitoring program.

Appendix 2: Norwest Corporation - Technical Memorandum: Completion and Development of 2012 Navajo Mine Groundwater Monitoring Wells

NORWEST CORPORATION

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DENVER, CO 80246
TEL: (303) 782-0164 FAX: (303) 782-2560

TECHNICAL MEMORANDUM

To	Jeff Mattern, BHP Billiton New Mexico Coal	**Ref #**	350-15-TM-DRAFT
CC	Art O'Hayre	**Date**	August 17, 2012
From	Landon Beck and Orion Cannon		
Subject	Completion and Development of 2012 Navajo Mine Groundwater Monitoring Wells		

This technical memorandum documents field activities conducted for the completion and development of groundwater monitoring wells at the Navajo Mine during the spring of 2012. The following supervision and documentation activities were performed by Norwest Corporation:

- Detailed notes of all field activities
- Supervised drilling of soil borings
- Selected well screen intervals from drilling logs
- Supervised monitoring well installation and development
- Prepared figures, data tables, bore logs, and well installation reports (attached).

Two separate phases of well installation and associated sampling work were performed at the Navajo Mine in the spring of 2012. These were:

1. Drilling, logging of core samples, and installation of 1.5 inch PVC alluvial monitoring wells with pre-packed well screens.
2. Drilling, logging of core samples, and installation of 2 and 4 inch PVC coal seam monitoring wells.

Figure 1 shows where these monitoring wells were installed at the Navajo Mine. A summary of each investigative drilling and well installation works performed are presented in the remainder of the memorandum.

Monitoring and Observation Well Installation

Field Activity Period

Activity	Start	Complete
Survey and stake planned well locations	March 2012	March 2012
Install 8 wells using Geoprobe	10 March '12	22 March '12
Install 5 wells using a Sonic drill rig	10 April '12	13 May '12
Develop monitoring wells	5 June '12	7 June '12

TECHNICAL MEMORANDUM

Methodology

Survey:

- The proposed well installation locations were staked by BHP-Billiton prior to commencement of the drilling and well installation program.
- The locations of the 1.5 inch monitoring wells drilled with the Geoprobe 6610DT track-mounted drill rig (simply referred to as the Geoprobe drill rig from here on) were surveyed by BHP-Billiton after completion of the first drilling program. The locations of the larger, 2 and 4 inch wells installed with a sonic rotary rig have also been surveyed.
- The locations of the monitoring wells are shown on **Figure 1**.

Well Installation (Geoprobe Drill Rig):

- A relatively small and maneuverable Geoprobe drill rig (**Figure 2**) was used to drill, collect core samples, and install monitoring wells during the first of two phases of the monitoring well installation program. A total of 8 wells were installed with the Geoprobe drill rig.
- Monitoring wells were constructed using 1.5 inch diameter PVC risers and pre-packed screen sections. The pre-packed screen sections are made of standard 1.5 inch PVC slotted screen pipe that are wrapped with stainless steel mesh. Filter sand is neatly packed between the stainless steel mesh and the 1.5 inch PVC slotted screen pipe.
- **Attachment 1** shows well construction details and lithology that was encountered during drilling of each of these 8 wells.
- Monitoring wells were completed to design specifications, including surface completions. **Figure 5** shows typical surface completion details for monitoring wells.
- Monitoring well details including total depth and depth to water are summarized in **Table 1**.
- Two-inch diameter AMS sample tubes were used with a core barrel to take soil samples. Core sample tubes were split open to be photographed.
- Field Lithology Log forms were used to record descriptions of soil/rock materials and water-bearing zones by depth interval. Unconsolidated soil materials were qualitatively classified using the Unified Soil Classification system, e.g., SP, poorly graded sand. Color of soil and bedrock materials was visually identified using a Munsell color classification system chart, e.g., dark yellowish brown (10YR4/2). These descriptions have been transferred into the monitoring well installation reports; however the original field notes and hand-written field lithology logs have been scanned and included as **Attachments 2 and 3,** respectively.

Well Installation (Sonic Rotary Drill Rig):

TECHNICAL MEMORANDUM

- A total of 5 monitoring wells were installed using a Sonic drilling method, a double-cased system using an inner core barrel and a larger override casing. Monitoring wells were constructed from either 2 or 4 inch diameter PVC risers and screen sections. **Figure 3** shows a sonic drill rig.
- Sample core, as shown in **Figure 5**, was extruded to be photographed and logged as shown.
- Detailed field notes of activities at each location, including photograph subjects were recorded in an all-weather field book and scanned copies are included as **Attachment 2**.
- Field Lithology Log forms were used to record descriptions of soil/rock materials and water-bearing zones by depth interval in the same way as described in the Geoprobe Drill Rig section above. These forms are included as **Attachment 3**.
- Depths to water measurements were collected, when there was water in the well, using a reel-type tape.
- Field Well Installation Report forms were used to record well installation details.
- **Attachment 1** shows well construction details and lithology that was encountered during drilling for each of the 5 wells installed using a sonic rig.

Well Development

- A total of 9 wells were either developed or bailed dry; 3 wells were dry and were not developed. The five coal seam monitoring wells were each drilled into dry bedrock formation. Because of difficult drilling conditions, water was used while drilling these wells. Due to the relatively low permeability of bedrock at the well completion intervals, stagnant potable drilling water was still present at the time of development approximately 3 weeks later. The water inside these three wells was bailed out as best as possible.
- Details of the well development are included as **Table 2**.
- The four wells installed in the lower Chinde wetlands were not developed by Norwest / Boart-Longyear and are therefore documented in this memorandum. They were developed by another contractor that specializes in wetlands work.
- Detailed field notes of activities at each location, including photograph subjects were recorded in an all-weather field book.
- Depths to water measurements were taken using a standard water level indicator tape.
- Development methods generally included bailing to purge settled and suspended solids followed by pumping to purge fine suspended solids until produced water was clear and purge parameters stabilized.
- A minimum of three casing volumes of water was purged from wells with yields sufficient for pumping. Low-yield wells were developed as best as possible under minimal well recovery conditions using a bailer. Very low-yield wells with minimal saturated thickness and slow recovery rates were typically bailed dry three times with adequate time to recharge in-between.

TABLES

TABLE 1
SOIL BORING AND WELL COMPLETION SUMMARY

Soil Bore	Location	Depth to First Water-Producing Zone (fgs)[1]	Type of Water-Producing Zone	Depth to Bedrock (fgs)	Total Depth Drilled (fgs)	Water Level When Drilled (fgs)	Land Surface Elevation (fmsl)	Bore Completion Date	Notes
CA-3	Lower Chinde Wetlands	6.5	Unconsolidated clayey sand & gravelly sand	19.3	20	not measured	5260.6	3/17/2012	Drill rig broke down.
CA-4	Lower Chinde Wetlands	10.5	Unconsolidated sandy clay & clayey sand	27.6	30	not measured	5236.8	3/16/2012	
CA-5	Lower Chinde Wetlands	19	Unconsolidated sandy gravel & silty sand	54.1	55	not measured	5252.1	3/14/2012	
CAE-7	Lower Chinde Wetlands	5	Highly weathered sandstone	1.8	12	not measured	5252.1	3/16/2012	No sandpack. Hole caved in to a depth of 2' during well installation.
CWA-1a	Cottonwood Arroyo, North Fork	8	Unconsolidated sand	11.5	14	not measured	5351.0	3/12/2012	
CWA-2a	Cottonwood Arroyo, North Fork	NA	NA	9.9	13.5	dry	5316.3	3/11/2012	
CWA-3c	Cottonwood Arroyo, South Fork	9	Unconsolidated sandy gravel	9	14.4	not measured	5307.9	3/11/2012	
CWA-4	Cottonwood Arroyo	23	Unconsolidated sandy gravel & clayey sand	27	29.5	not measured	5257.0	3/10/2012	
KF3-12-1	Lowe Highwall, #3B Seam	NA	NA	5	227.5	dry	5398.4	4/25/2012	
KF3-12-2	Area IV North, #3 Seam	NA	NA	0	92.5	dry	5365.6	5/11/2012	
KF3-12-3	Area IV North, #3 Seam	NA	NA	0.5	41	dry	5295.5	5/12/2012	
KF4-12-1	Lowe Highwall, #4 Seam	NA	NA	4	207.5	dry	5398.4	5/9/2012	
KF7-12-1	Lowe Highwall, #7 Seam	NA	NA	0	183.5	dry	5398.6	5/9/2012	

Footnotes:
1 fgs = feet below ground surface
2 fmsl=feet above mean sea level

TABLE 2
MONITORING AND OBSERVATION WELL DEVELOPMENT SUMMARY

Well	Type of Water-Producing Zone	Development Method	Installed Well Depth (fgs) 1	Water Level Pre-Development (fgs)	Water Column (feet)	PVC Casing/ Screen Diameter (inches)	Three Casing Volume (gallons)	Volume Purged (gallons)	Final Pumping Rate (gpm)	Well Development Date	Notes
CA-3	Unconsolidated gravelly sand	Not developed by Norwest	19.7	Not measured	Not measured	1.5	--	--	NA	NA	Wells in the Lower Chinde wetlands not developed by Norwest/Boart-Longyear
CA-4	Unconsolidated silty sand and clayey sand	Not developed by Norwest	27.7	Not measured	Not measured	1.5	--	--	NA	NA	Wells in the Lower Chinde wetlands not developed by Norwest/Boart-Longyear
CA-5	Unconsolidated gravelly sand	Not developed by Norwest	53.3	Not measured	Not measured	1.5	--	--	NA	NA	Wells in the Lower Chinde wetlands not developed by Norwest/Boart-Longyear
CAE-7	Highly weathered sandstone	Not developed by Norwest	9.0	Not measured	Not measured	1.5	--	--	NA	NA	Wells in the Lower Chinde wetlands not developed by Norwest/Boart-Longyear
CWA-1a	Unconsolidated poorly graded fine sand	Bail	11.2	10.5	0.7	1.5	0.4	4	NA	6/9/2012	Minimal saturated thickness and slow recharge. Bailed dry multiple times.
CWA-2a	Unconsolidated poorly graded fine sand	NA, dry	10.2	Dry	0.0	1.5	0.0	NA	NA	NA	
CWA-3c	Unconsolidated fine sand and sandy gravel	NA, dry	10.2	Dry	0.0	1.5	0.0	NA	NA	NA	
CWA-4	Unconsolidated gravelly sand	Bail	26.8	25	1.8	1.5	0.9	5	NA	6/9/2012	Minimal saturated thickness and slow recharge. Bailed dry multiple times.
KF3-12-1	Coal	Bail out drilling water	225.1	Not measured	Not measured	4	--	Bail until dry	NA	6/5/2012	
KF3-12-2	Coal	Bail out drilling water	88.9	Not measured	Not measured	2	--	Bail until dry	NA	6/6/2012	
KF3-12-3	Coal	NA, dry	35.9	Dry	0.0	2	0.0	NA	NA	NA	
KF4-12-1	Coal	Bail out drilling water	205.4	Not measured	Not measured	2	--	Bail until dry	NA	6/5/2012	
KF7-12-1	Coal	Bail out drilling water	178.9	Not measured	Not measured	2	--	Bail until dry	NA	6/5/2012	
BITSUI-2	unknown	Bail and pump	123.0	60	63.0	2	32.1	80	2.00	6/6/2012	An existing well previously drilled.
KF83-1	unknown	Bail and pump	Not measured	Not measured	Not measured	4	--	150	2.00	6/6/2012	An existing well previously drilled.
KF84-16	unknown	Bail and pump	294.0	110	184.0	2	93.8	120	NA	6/7/2012	An existing well previously drilled.

Footnotes:
1 fgs = feet below ground surface
2 ftoc = feet below top of PVC casing; toc is measuring point for all depth measurements
3 fmsl = feet above mean sea level

FIGURES

N

Miles

0 0.25 0.5 1

1:48,000

Projection: State Plane
Datum: NAD 1927
Zone: New Mexico West
Units: feet

LEGEND

Monitoring Wells

- 1.5 inch PVC
- 2 OR 4 inch PVC
- Navajo Mine Permit Boundary
- Pinabete Permit Boundary

Figure 1

BHP NAVAJO COAL COMPANY

bhpbilliton

Navajo Mine

2012 Monitoring Well Locations

PREPARED BY: MDK	DRAWN BY: MDK	PAPER SIZE: 11"x17"
APPROVED BY: APO	DATE: 6/27/2012	

Figure 3
Boart-Longyear Drillers and Geoprobe 6610DT Drill Rig

Figure 4
Sonic Rotary Rig and Support Rig

Figure 4
Completed Well with Protective Well Cover and Bollards

Figure 5
Sonic Rotary Rig Extruded Samples

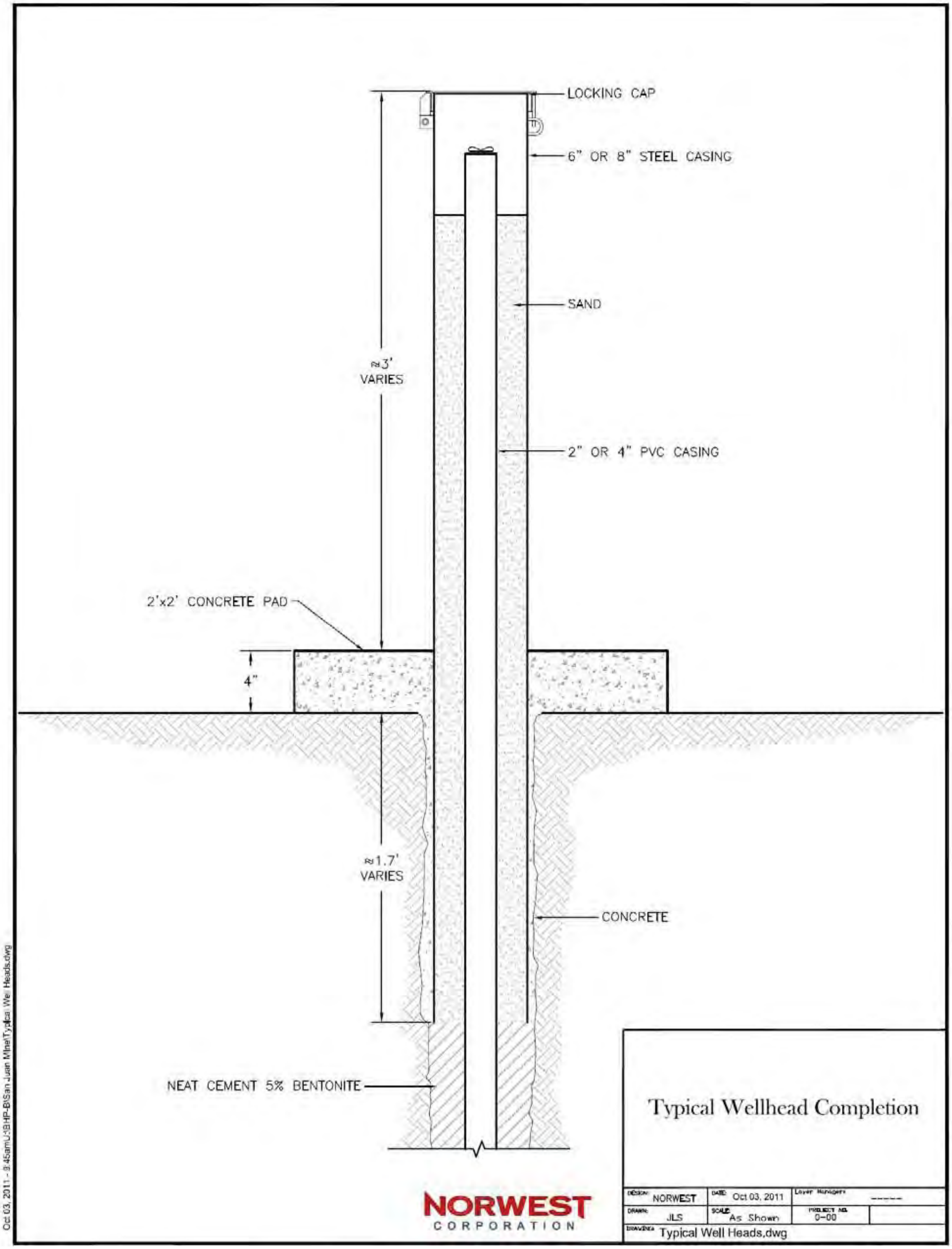


Figure 6
Typical Well Head Completion Diagram

WELL INSTALLATION REPORTS

WELL INSTALLATION REPORT

WELL ID:	CA-3	PAD ELEVATION:	5263.5 ft
SITE:	Navajo Mine	NORTHING (NAD 27):	N 2,054,287.6
COUNTY:	San Juan	EASTING (NAD 27):	E 314,735.7
STATE:	New Mexico		

COMPLETION INFORMATION

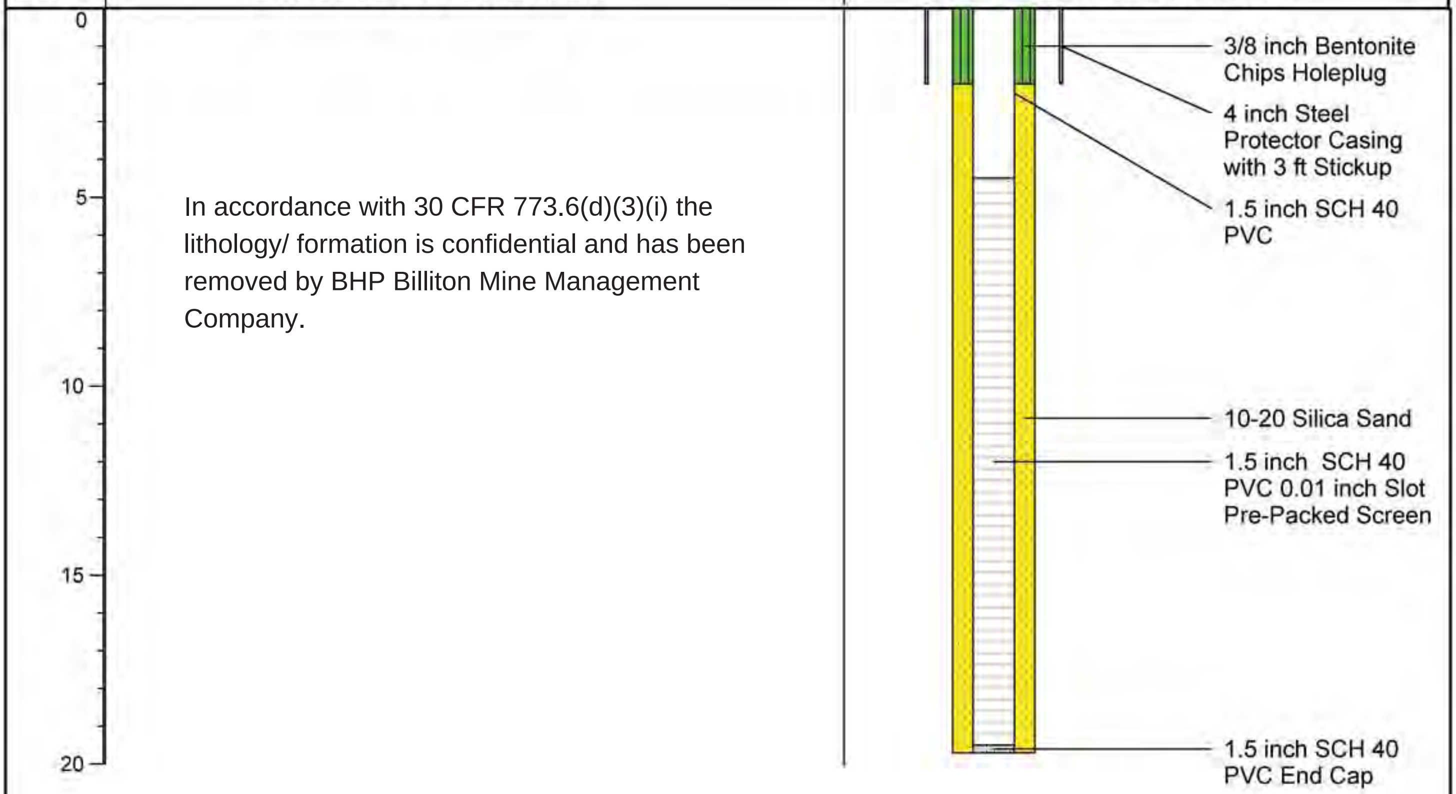
COMPLETION TYPE: Monitoring Well
COMPLETION ZONES: 4.5 - 19.5 ft bgs
COMPLETION DEPTH: 19.7 ft bgs
COMPLETION DATE: 3/17/12
DEVELOPMENT DATE: ---

DRILLING INFORMATION

DRILLING CO.: Boart-Longyear
GEOLOGIST: O. Cannon
METHOD OF DRILLING: Direct Push
HOLE DIAMETER: 3 in.

DEPTH	LITHOLOGY / FORMATION	WELL CONSTRUCTION

In accordance with 30 CFR 773.6(d)(3)(i) the lithology/ formation is confidential and has been removed by BHP Billiton Mine Management Company.



NORWEST CORPORATION

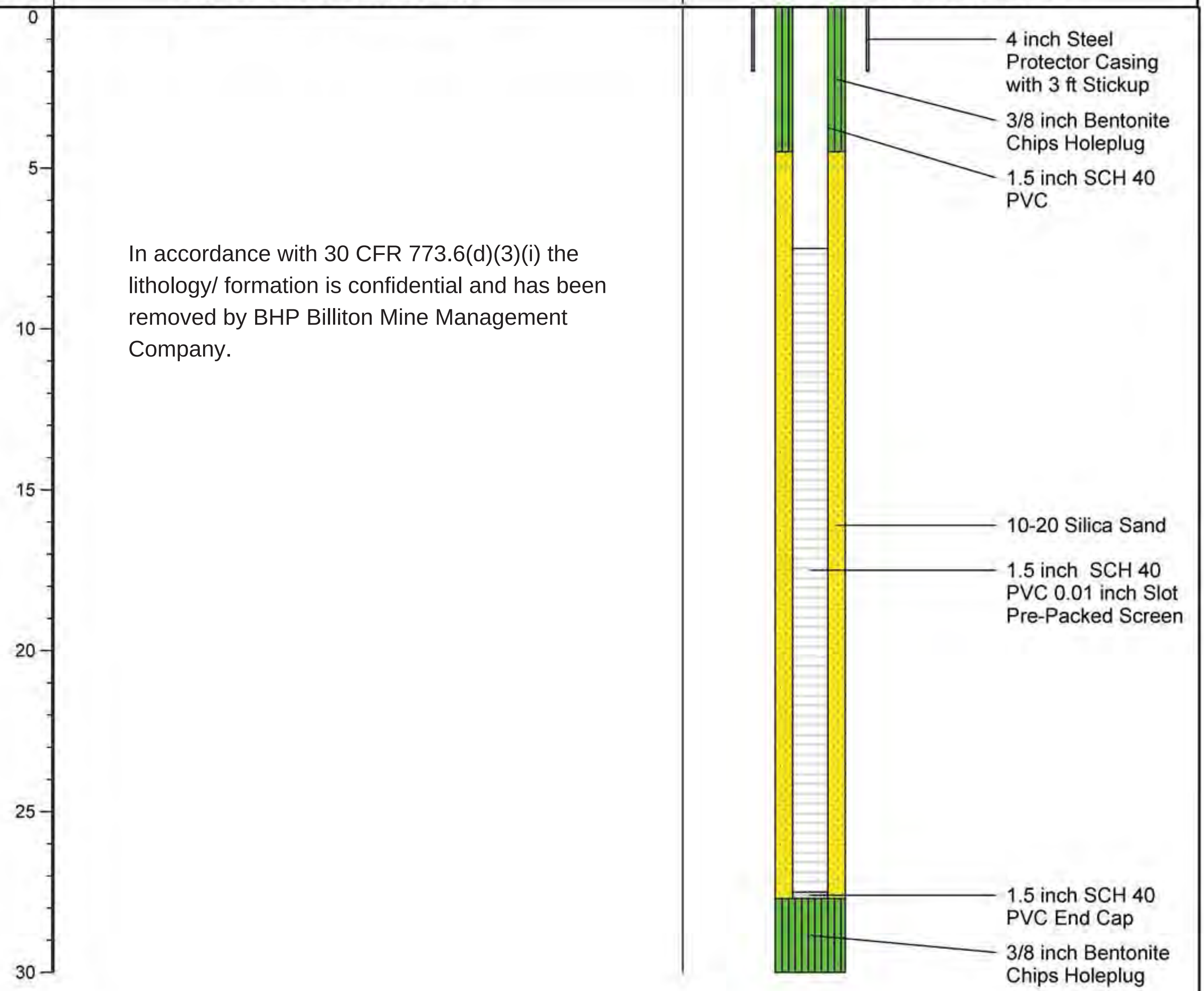
WELL INSTALLATION REPORT

WELL ID:	CA-4	PAD ELEVATION:	5239.1 ft
SITE:	Navajo Mine	NORTHING (NAD 27):	N 2,053,048.7
COUNTY:	San Juan	EASTING (NAD 27):	E 314,735.7
STATE:	New Mexico		

COMPLETION INFORMATION		DRILLING INFORMATION	
COMPLETION TYPE:	Monitoring Well	DRILLING CO.:	Boart-Longyear
COMPLETION ZONES:	7.5 - 27.5 ft bgs	GEOLOGIST:	O. Cannon
COMPLETION DEPTH:	27.7 ft bgs	METHOD OF DRILLING:	Direct Push
COMPLETION DATE:	3/16/12	HOLE DIAMETER:	3 in.
DEVELOPMENT DATE:	---		

DEPTH | LITHOLOGY / FORMATION | WELL CONSTRUCTION

In accordance with 30 CFR 773.6(d)(3)(i) the lithology/ formation is confidential and has been removed by BHP Billiton Mine Management Company.



NORWEST CORPORATION

WELL INSTALLATION REPORT

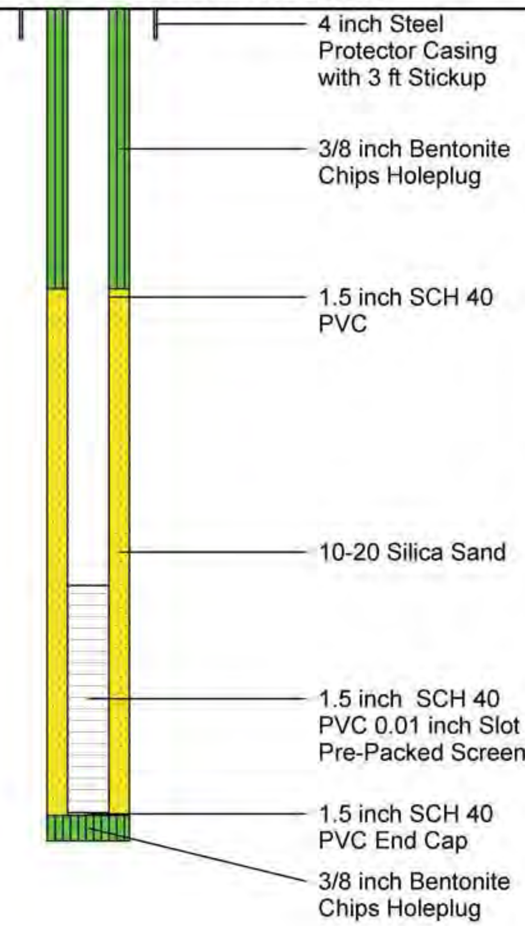
WELL ID:	CA-5	PAD ELEVATION:	5235.9 ft
SITE:	Navajo Mine	NORTHING (NAD 27):	N 2,051,710.4
COUNTY:	San Juan	EASTING (NAD 27):	E 311,049.7
STATE:	New Mexico		

COMPLETION INFORMATION		DRILLING INFORMATION	
COMPLETION TYPE:	Monitoring Well	DRILLING CO.:	Boart-Longyear
COMPLETION ZONES:	38 - 53 ft bgs	GEOLOGIST:	O. Cannon
COMPLETION DEPTH:	55 ft bgs	METHOD OF DRILLING:	Direct Push
COMPLETION DATE:	3/13/12	HOLE DIAMETER:	3 in.
DEVELOPMENT DATE:	---		

DEPTH	LITHOLOGY / FORMATION	WELL CONSTRUCTION

0 5 10 15 20 25 30 35 40 45 50 55

In accordance with 30 CFR 773.6(d)(3)(i) the lithology/ formation is confidential and has been removed by BHP Billiton Mine Management Company.



NORWEST CORPORATION

WELL INSTALLATION REPORT

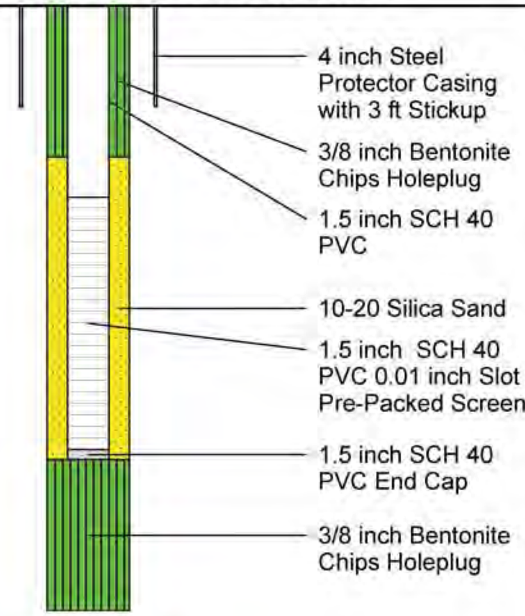
WELL ID:	CAE-7	PAD ELEVATION:	5254.9 ft
SITE:	Navajo Mine	NORTHING (NAD 27):	N 2,054,271.6
COUNTY:	San Juan	EASTING (NAD 27):	E 313,637.7
STATE:	New Mexico		

COMPLETION INFORMATION		DRILLING INFORMATION	
COMPLETION TYPE:	Monitoring Well	DRILLING CO.:	Boart-Longyear
COMPLETION ZONES:	3.8 - 8.8 ft bgs	GEOLOGIST:	O. Cannon
COMPLETION DEPTH:	12 ft bgs	METHOD OF DRILLING:	Direct Push
COMPLETION DATE:	3/16/12	HOLE DIAMETER:	3 in.
DEVELOPMENT DATE:	---		

DEPTH | LITHOLOGY / FORMATION | WELL CONSTRUCTION

0
5
10

In accordance with 30 CFR 773.6(d)(3)(i) the lithology/ formation is confidential and has been removed by BHP Billiton Mine Management Company.



NORWEST CORPORATION

WELL INSTALLATION REPORT

WELL ID: CWA-1a
SITE: Navajo Mine
COUNTY: San Juan
STATE: New Mexico

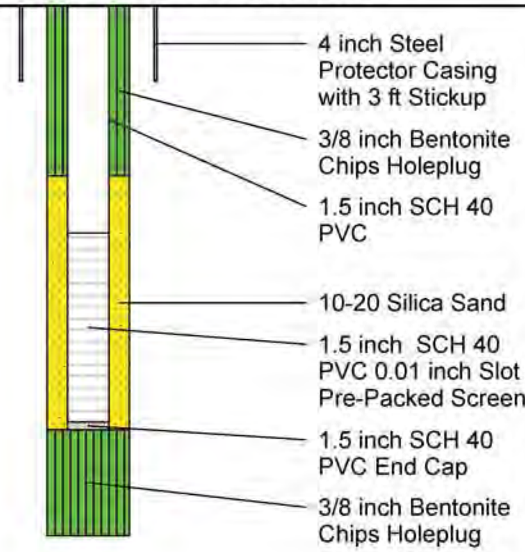
PAD ELEVATION: 5354.0 ft
NORTHING (NAD 27): N 2,012,939.6
EASTING (NAD 27): E 309,075.4

COMPLETION INFORMATION		DRILLING INFORMATION	
COMPLETION TYPE:	Monitoring Well	DRILLING CO.:	Boart-Longyear
COMPLETION ZONES:	6.0 - 11.0 ft bgs	GEOLOGIST:	O. Cannon
COMPLETION DEPTH:	11.2 ft bgs	METHOD OF DRILLING:	Direct Push
COMPLETION DATE:	3/12/12	HOLE DIAMETER:	3 in.
DEVELOPMENT DATE:	6/9/12		

DEPTH | LITHOLOGY / FORMATION | WELL CONSTRUCTION

0
5
10

In accordance with 30 CFR 773.6(d)(3)(i) the lithology/ formation is confidential and has been removed by BHP Billiton Mine Management Company.



NORWEST CORPORATION

WELL INSTALLATION REPORT

WELL ID:	CWA-2a	PAD ELEVATION:	5316.3 ft
SITE:	Navajo Mine	NORTHING (NAD 27):	N 2,007,180.3
COUNTY:	San Juan	EASTING (NAD 27):	E 308,041.1
STATE:	New Mexico		

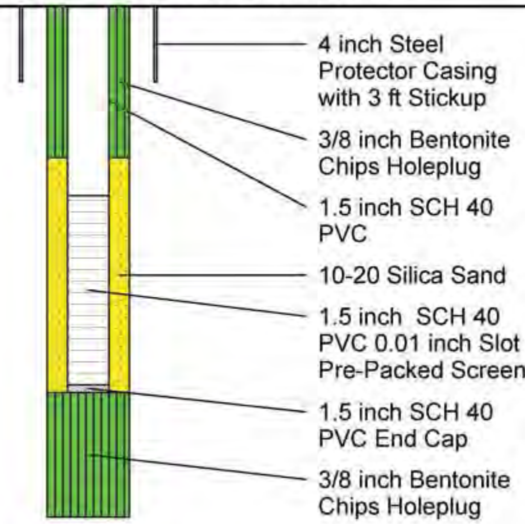
COMPLETION INFORMATION

COMPLETION TYPE: Monitoring Well
COMPLETION ZONES: 5.0 - 10.0 ft bgs
COMPLETION DEPTH: 10.2 ft bgs
COMPLETION DATE: 3/11/12
DEVELOPMENT DATE: ---

DRILLING INFORMATION

DRILLING CO.: Boart-Longyear
GEOLOGIST: O. Cannon
METHOD OF DRILLING: Direct Push
HOLE DIAMETER: 3 in.

DEPTH	LITHOLOGY / FORMATION	WELL CONSTRUCTION
0		
5	In accordance with 30 CFR 773.6(d)(3)(i) the lithology/ formation is confidential and has been removed by BHP Billiton Mine Management Company.	
10		



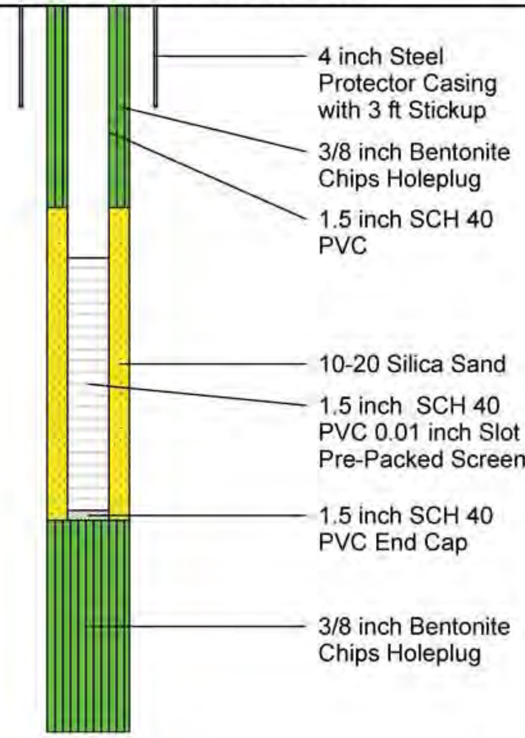
NORWEST CORPORATION

WELL INSTALLATION REPORT

WELL ID: CWA-3c
SITE: Navajo Mine
COUNTY: San Juan
STATE: New Mexico

PAD ELEVATION: 5310.5 ft
NORTHING (NAD 27): N 2,002,385.0
EASTING (NAD 27): E 306,102.9

COMPLETION INFORMATION		DRILLING INFORMATION	
COMPLETION TYPE:	Monitoring Wel	DRILLING CO.:	Monitoring Well
COMPLETION ZONES:	5.0 - 10.0 ft bgs	GEOLOGIST:	O. Cannon
COMPLETION DEPTH:	10.2 ft bgs	METHOD OF DRILLING:	Direct Push
COMPLETION DATE:	3/11/12	HOLE DIAMETER:	3 in.
DEVELOPMENT DATE:	---		

DEPTH	LITHOLOGY / FORMATION	WELL CONSTRUCTION
0 5 10	In accordance with 30 CFR 773.6(d)(3)(i) the lithology/ formation is confidential and has been removed by BHP Billiton Mine Management Company.	

NORWEST CORPORATION

WELL INSTALLATION REPORT

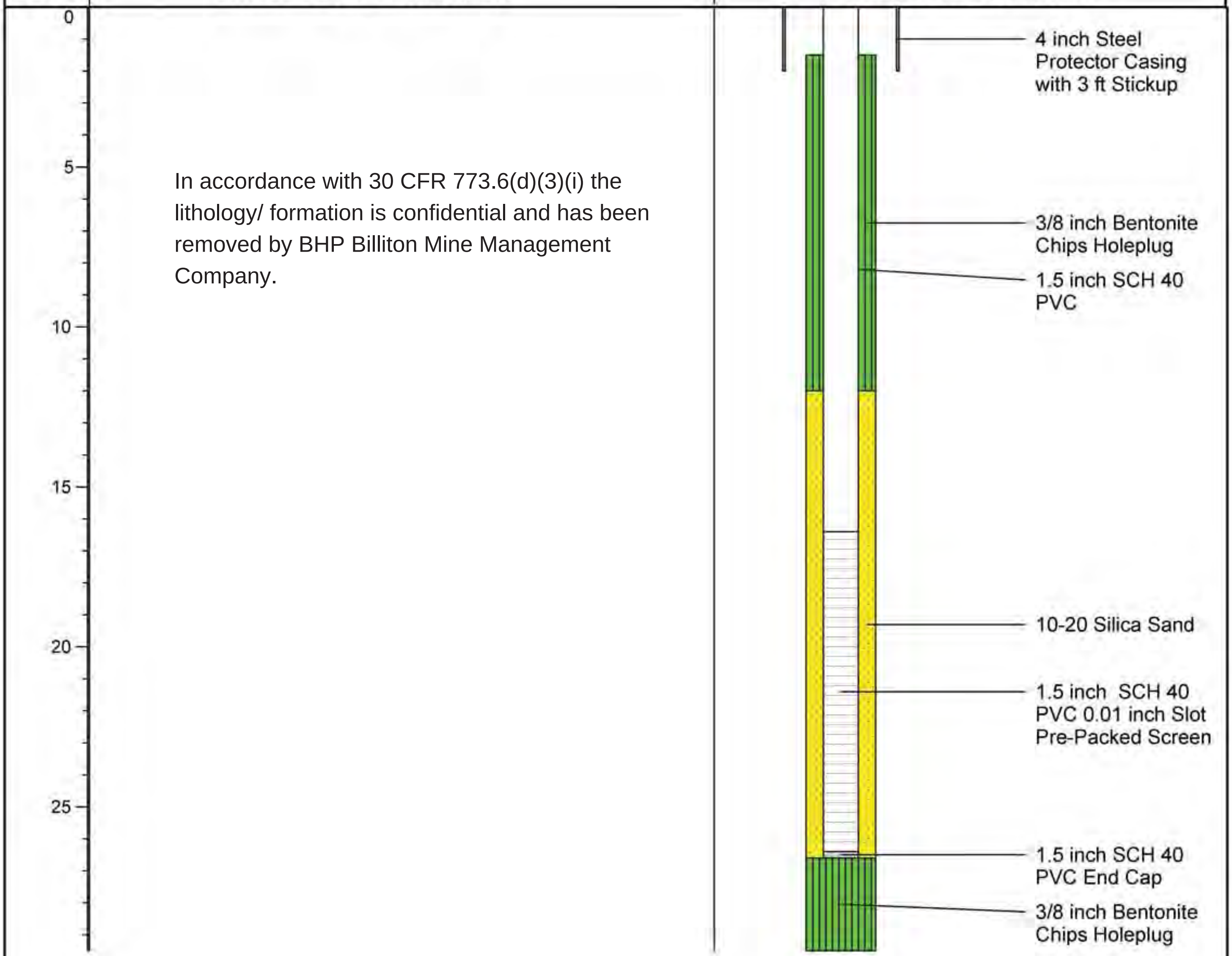
WELL ID: CWA-4
SITE: Navajo Mine
COUNTY: San Juan
STATE: New Mexico

PAD ELEVATION: 5259.0 ft
NORTHING (NAD 27): N 2,008,708.0
EASTING (NAD 27): E 298,116.4

COMPLETION INFORMATION		DRILLING INFORMATION	
COMPLETION TYPE:	Monitoring Well	DRILLING CO.:	Boart-Longyear
COMPLETION ZONES:	16.4 -26.4 fbgs	GEOLOGIST:	O. Cannon
COMPLETION DEPTH:	26.6 ft bgs	METHOD OF DRILLING:	Direct Push
COMPLETION DATE:	3/10/12	HOLE DIAMETER:	3 in.
DEVELOPMENT DATE:	6/9/12		

DEPTH | LITHOLOGY / FORMATION | WELL CONSTRUCTION

In accordance with 30 CFR 773.6(d)(3)(i) the lithology/ formation is confidential and has been removed by BHP Billiton Mine Management Company.



NORWEST CORPORATION

WELL INSTALLATION REPORT

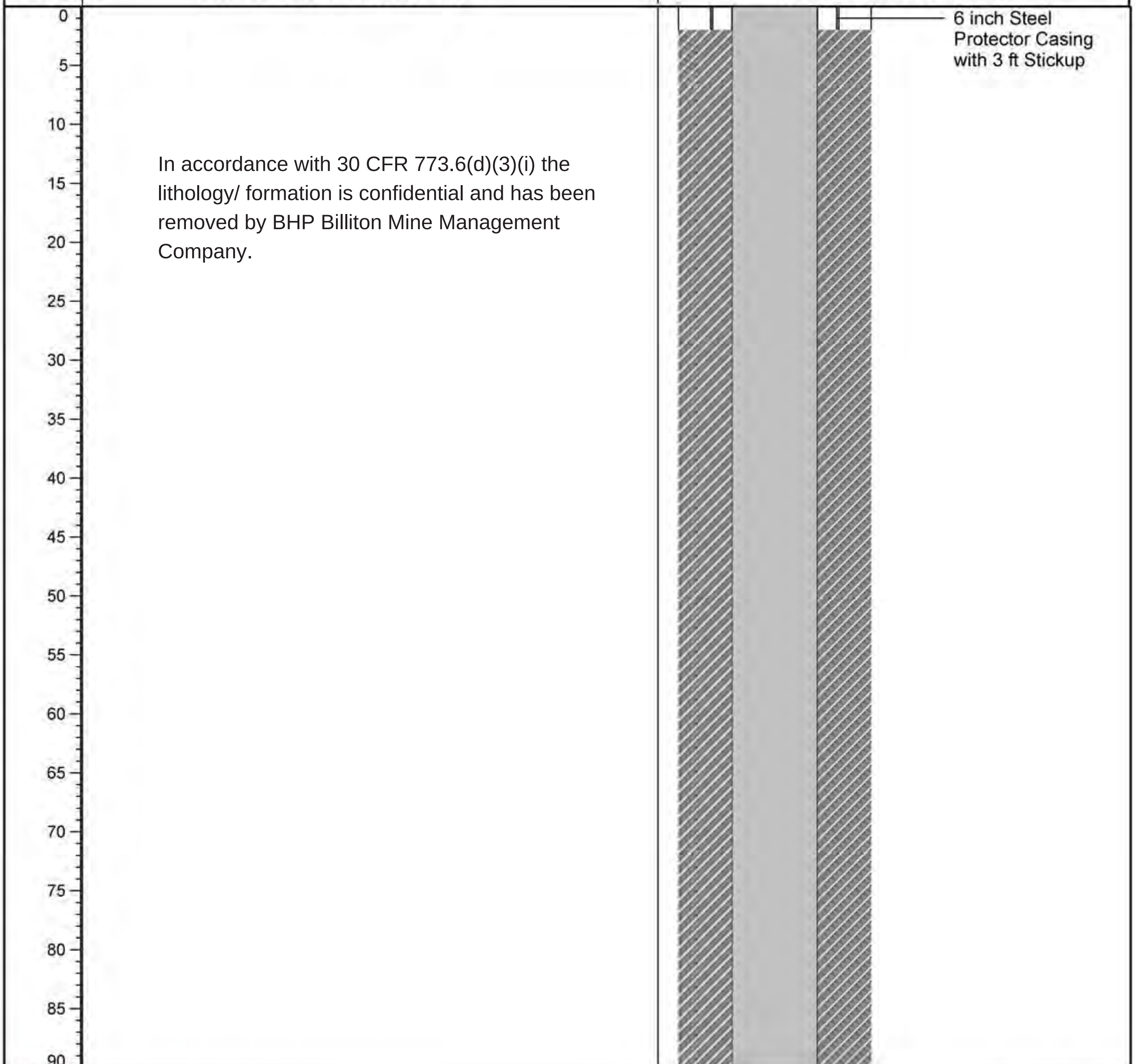
WELL ID: KF3-12-1
SITE: Navajo Mine
COUNTY: San Juan
STATE: New Mexico

PAD ELEVATION: 5398.4 ft
NORTHING (NAD 27): N 2,016,895.5
EASTING (NAD 27): E 304,658.7

COMPLETION INFORMATION		DRILLING INFORMATION	
COMPLETION TYPE:	Monitoring Well	DRILLING CO.:	Boart-Longyear
COMPLETION ZONES:	220-225 ft bgs	GEOLOGIST:	Landon Beck
COMPLETION DEPTH:	225.1 ft bgs	METHOD OF DRILLING:	Sonic Rotary
COMPLETION DATE:	4/25/12	HOLE DIAMETER:	9 in.
DEVELOPMENT DATE:	6/5/2012		

DEPTH | LITHOLOGY / FORMATION | WELL CONSTRUCTION

In accordance with 30 CFR 773.6(d)(3)(i) the lithology/ formation is confidential and has been removed by BHP Billiton Mine Management Company.



NORWEST CORPORATION

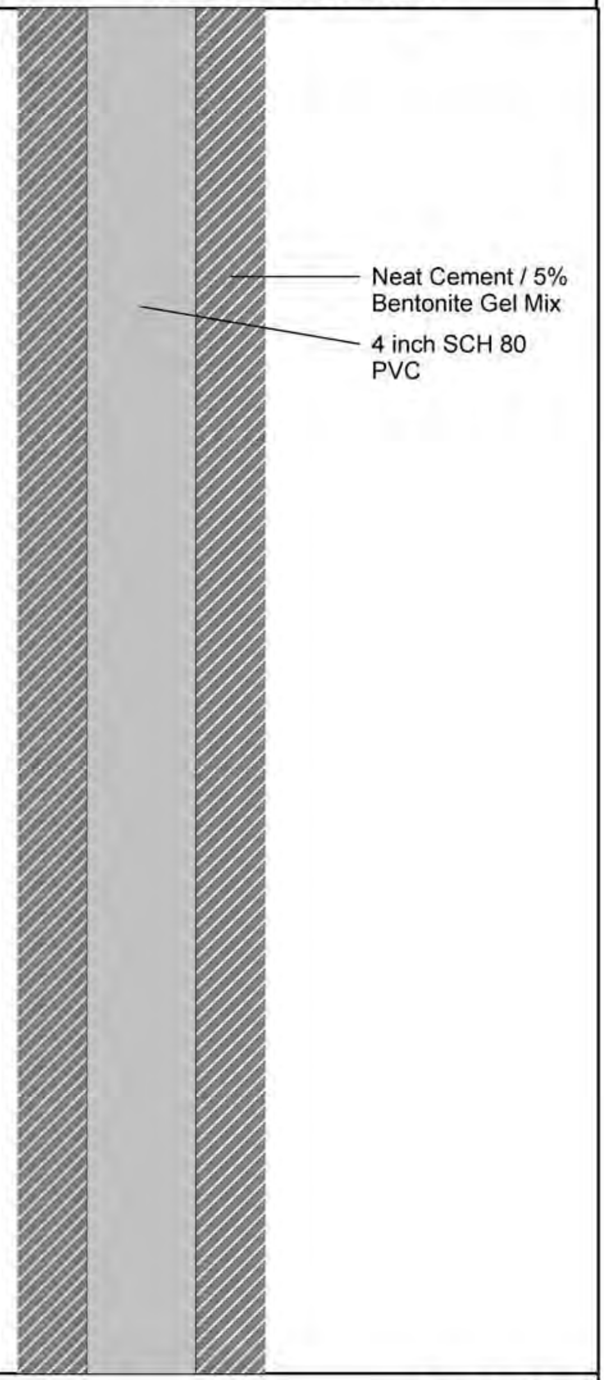
WELL INSTALLATION REPORT

WELL ID: KF3-12-1
SITE: Navajo Mine
COUNTY: San Juan
STATE: New Mexico

PAD ELEVATION: 5398.4 ft
NORTHING (NAD 27): N 2,016,895.5
EASTING (NAD 27): E 304,658.7

COMPLETION INFORMATION	
COMPLETION TYPE:	Monitoring Well
COMPLETION ZONES:	220-225 ft bgs
COMPLETION DEPTH:	225.1 ft bgs
COMPLETION DATE:	4/25/12
DEVELOPMENT DATE:	6/5/2012

DRILLING INFORMATION	
DRILLING CO.:	Boart-Longyear
GEOLOGIST:	Landon Beck
METHOD OF DRILLING:	Sonic Rotary
HOLE DIAMETER:	9 in.

DEPTH	LITHOLOGY / FORMATION	WELL CONSTRUCTION
90–180	In accordance with 30 CFR 773.6(d)(3)(i) the lithology/ formation is confidential and has been removed by BHP Billiton Mine Management Company.	

Depth scale: 90, 95, 100, 105, 110, 115, 120, 125, 130, 135, 140, 145, 150, 155, 160, 165, 170, 175, 180

NORWEST CORPORATION

WELL INSTALLATION REPORT

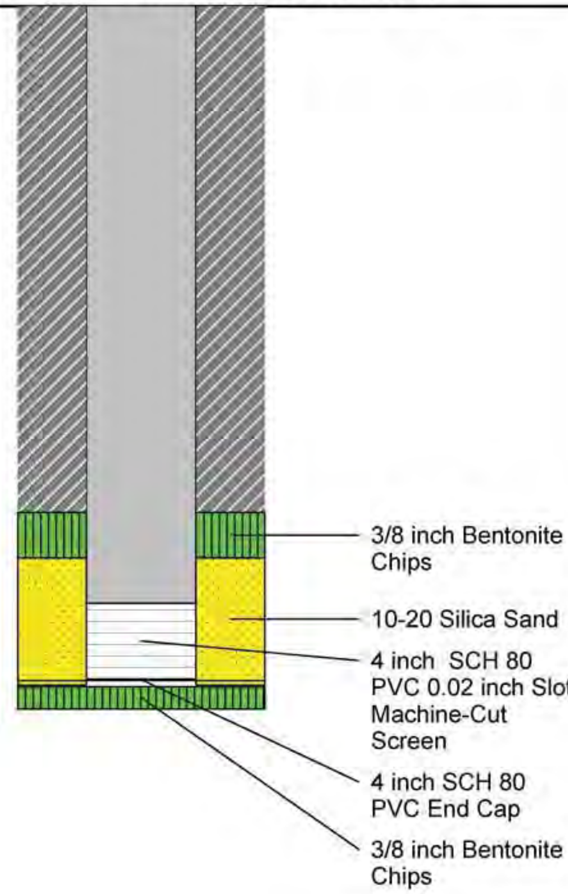
WELL ID:	KF3-12-1	PAD ELEVATION:	5398.4 ft
SITE:	Navajo Mine	NORTHING (NAD 27):	N 2,016,895.5
COUNTY:	San Juan	EASTING (NAD 27):	E 304,658.7
STATE:	New Mexico		

COMPLETION INFORMATION		DRILLING INFORMATION	
COMPLETION TYPE:	Monitoring Well	DRILLING CO.:	Boart-Longyear
COMPLETION ZONES:	220-225 ft bgs	GEOLOGIST:	Landon Beck
COMPLETION DEPTH:	225.1 ft bgs	METHOD OF DRILLING:	Sonic Rotary
COMPLETION DATE:	4/25/12	HOLE DIAMETER:	9 in.
DEVELOPMENT DATE:	6/5/2012		

DEPTH | LITHOLOGY / FORMATION | WELL CONSTRUCTION

180 185 190 195 200 205 210 215 220 225

In accordance with 30 CFR 773.6(d)(3)(i) the lithology/ formation is confidential and has been removed by BHP Billiton Mine Management Company.



NORWEST CORPORATION

WELL INSTALLATION REPORT

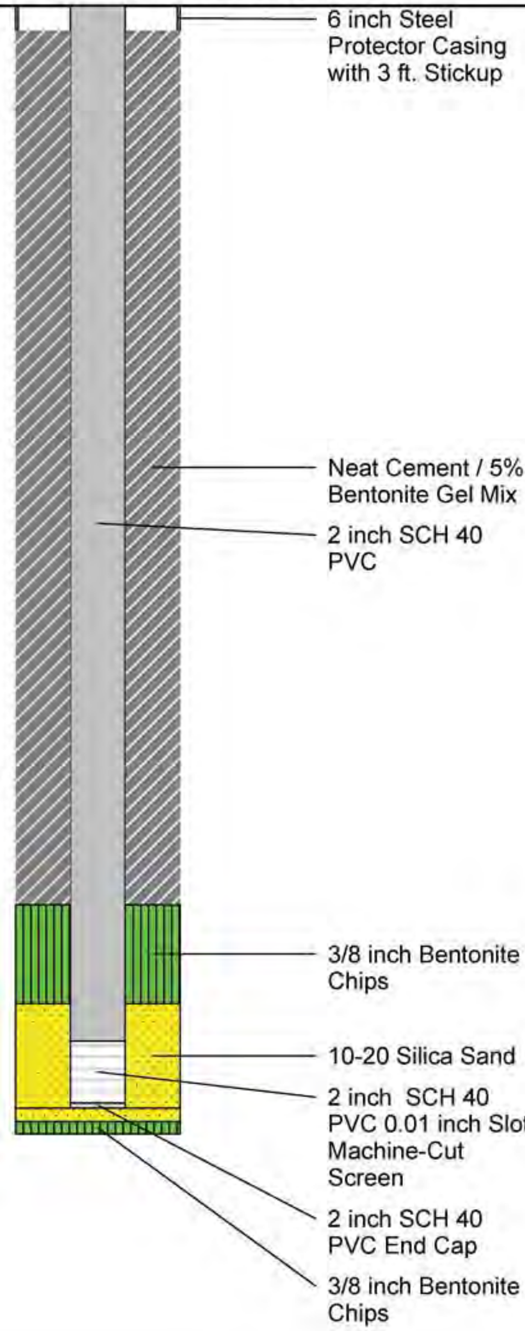
WELL ID:	KF3-12-2	PAD ELEVATION:	5365.6 ft
SITE:	Navajo Mine	NORTHING (NAD 27):	N 2,006,837.7
COUNTY:	San Juan	EASTING (NAD 27):	E 296,022.5
STATE:	New Mexico		

COMPLETION INFORMATION		DRILLING INFORMATION	
COMPLETION TYPE:	Monitoring Well	DRILLING CO.:	Boart-Longyear
COMPLETION ZONES:	80.5-90.0 ft bgs	GEOLOGIST:	Landon Beck
COMPLETION DEPTH:	90.4 ft bgs	METHOD OF DRILLING:	Sonic Rotary
COMPLETION DATE:	5/11/12	HOLE DIAMETER:	6 in.
DEVELOPMENT DATE:	6/6/2021		

DEPTH	LITHOLOGY / FORMATION	WELL CONSTRUCTION

DEPTH: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90

In accordance with 30 CFR 773.6(d)(3)(i) the lithology/ formation is confidential and has been removed by BHP Billiton Mine Management Company.



NORWEST CORPORATION

WELL INSTALLATION REPORT

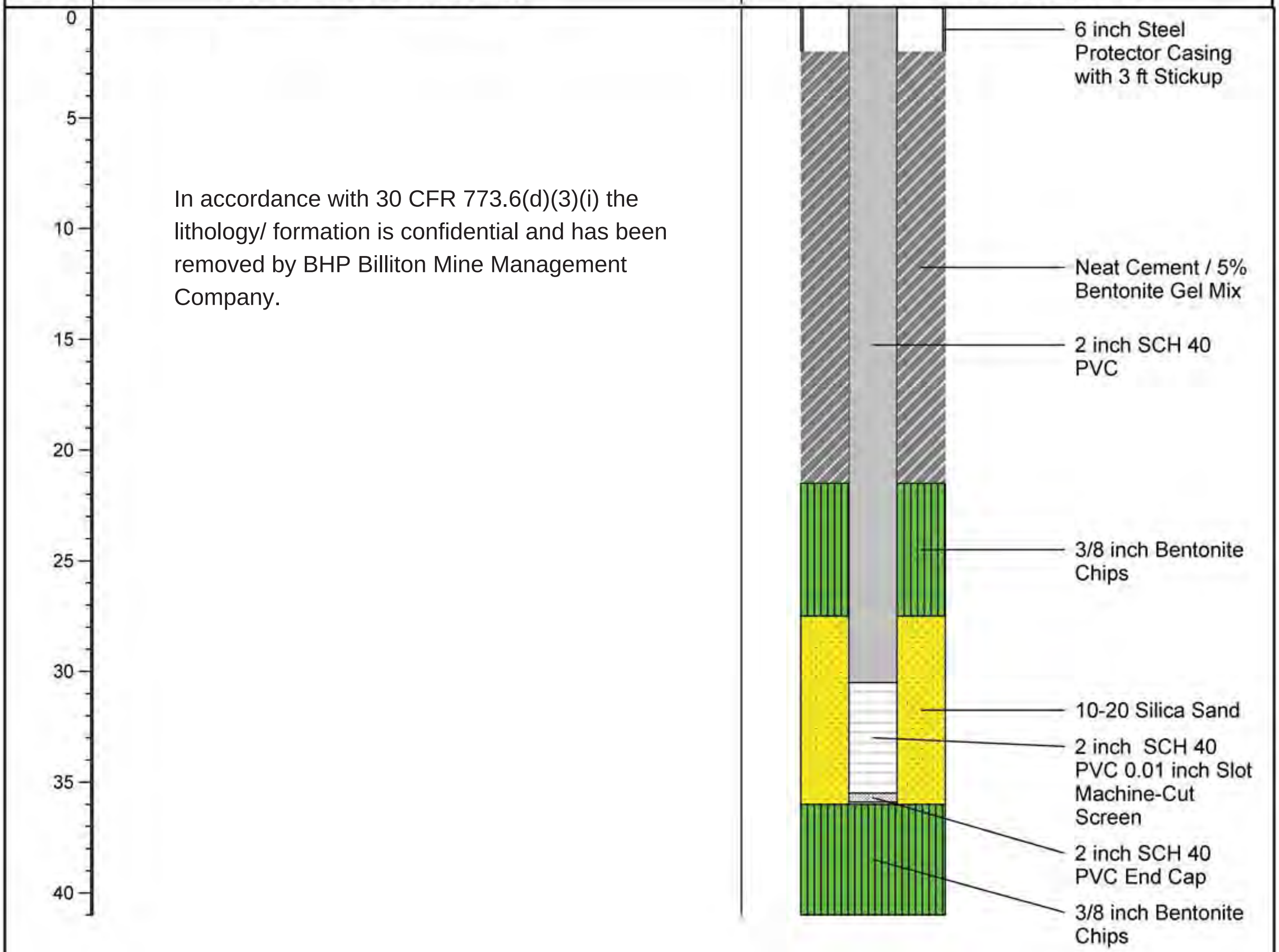
WELL ID: KF3-12-3
SITE: Navajo Mine
COUNTY: San Juan
STATE: New Mexico

PAD ELEVATION: 5295.5 ft
NORTHING (NAD 27): N 2,007,887.5
EASTING (NAD 27): E 300,506.7

COMPLETION INFORMATION		DRILLING INFORMATION	
COMPLETION TYPE:	Monitoring Well	DRILLING CO.:	Boart-Longyear
COMPLETION ZONES:	30.5-35.5 ft bgs	GEOLOGIST:	Landon Beck
COMPLETION DEPTH:	35.9 ft bgs	METHOD OF DRILLING:	Sonic Rotary
COMPLETION DATE:	5/13/2012	HOLE DIAMETER:	6 in.
DEVELOPMENT DATE:	6/6/2012		

DEPTH | LITHOLOGY / FORMATION | WELL CONSTRUCTION

In accordance with 30 CFR 773.6(d)(3)(i) the lithology/ formation is confidential and has been removed by BHP Billiton Mine Management Company.



NORWEST CORPORATION

WELL INSTALLATION REPORT

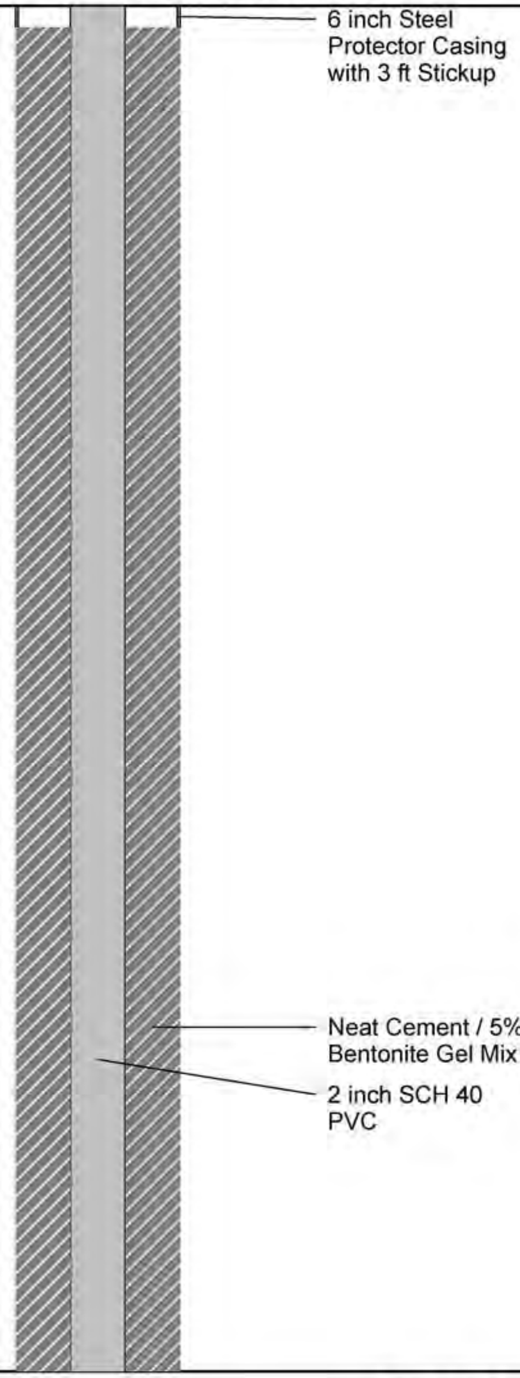
WELL ID:	KF4-12-1	PAD ELEVATION:	5,398.4 ft
SITE:	Navajo Mine	NORTHING (NAD 27):	N 2,016,911.2
COUNTY:	San Juan	EASTING (NAD 27):	E 304,659.9
STATE:	New Mexico		

COMPLETION INFORMATION		DRILLING INFORMATION	
COMPLETION TYPE:	Monitoring Well	DRILLING CO.:	Boart-Longyear
COMPLETION ZONES:	195-205 ft bgs	GEOLOGIST:	O. Cannon
COMPLETION DEPTH:	205.1 ft bgs	METHOD OF DRILLING:	Sonic Rotary
COMPLETION DATE:	4/25/2012	HOLE DIAMETER:	6 in.
DEVELOPMENT DATE:	6/5/2012		

DEPTH	LITHOLOGY / FORMATION	WELL CONSTRUCTION

DEPTH: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 115, 120, 125

In accordance with 30 CFR 773.6(d)(3)(i) the lithology/ formation is confidential and has been removed by BHP Billiton Mine Management Company.



NORWEST CORPORATION

WELL INSTALLATION REPORT

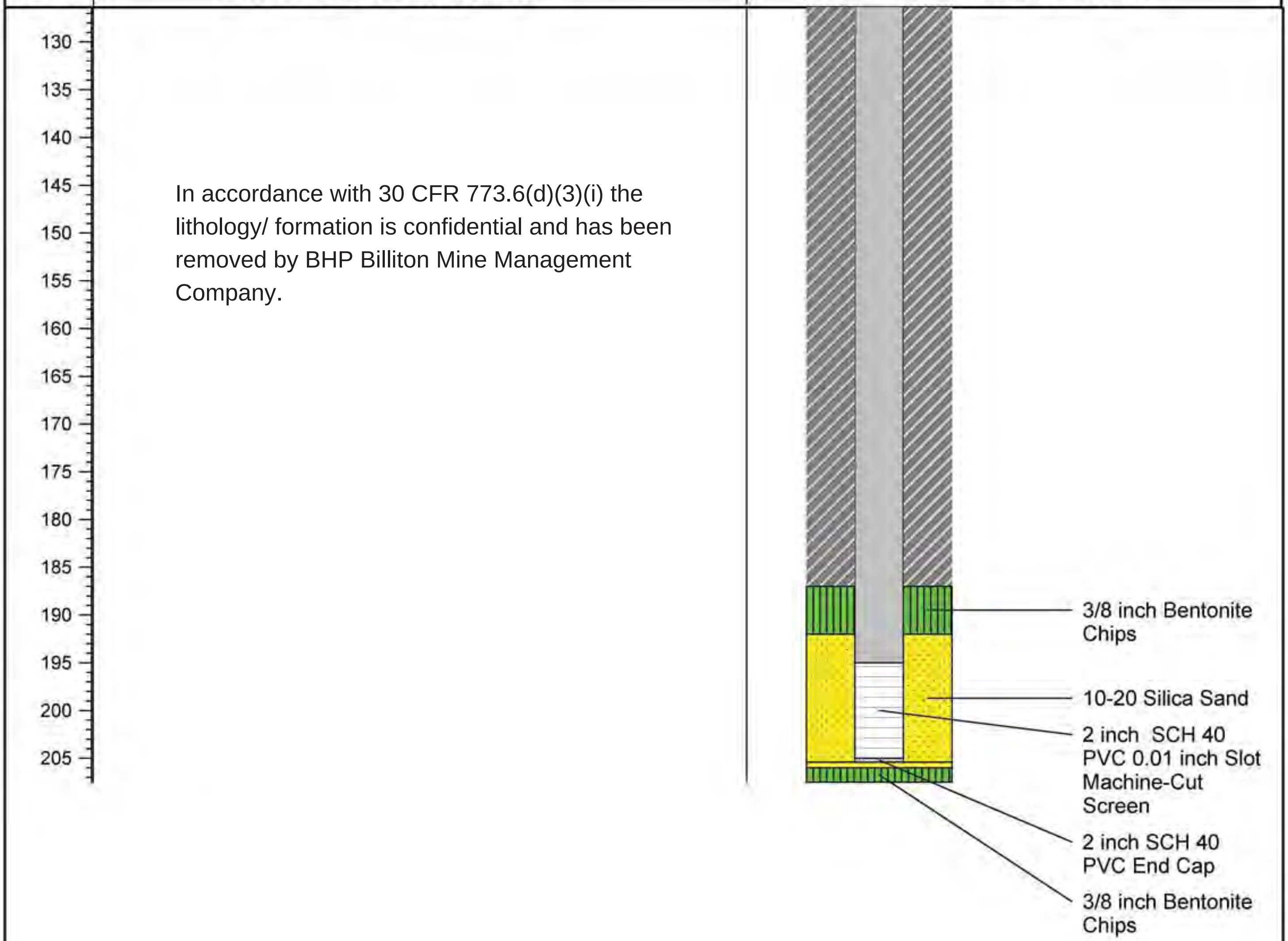
WELL ID: KF4-12-1
SITE: Navajo Mine
COUNTY: San Juan
STATE: New Mexico

PAD ELEVATION: 5,398.4 ft
NORTHING (NAD 27): N 2,016,911.2
EASTING (NAD 27): E 304,659.9

COMPLETION INFORMATION		DRILLING INFORMATION	
COMPLETION TYPE:	Monitoring Well	DRILLING CO.:	Boart-Longyear
COMPLETION ZONES:	195-205 ft bgs	GEOLOGIST:	O. Cannon
COMPLETION DEPTH:	205.1 ft bgs	METHOD OF DRILLING:	Sonic Rotary
COMPLETION DATE:	4/25/2012	HOLE DIAMETER:	6 in.
DEVELOPMENT DATE:	6/5/2012		

DEPTH | LITHOLOGY / FORMATION | WELL CONSTRUCTION

In accordance with 30 CFR 773.6(d)(3)(i) the lithology/ formation is confidential and has been removed by BHP Billiton Mine Management Company.



NORWEST CORPORATION

WELL INSTALLATION REPORT

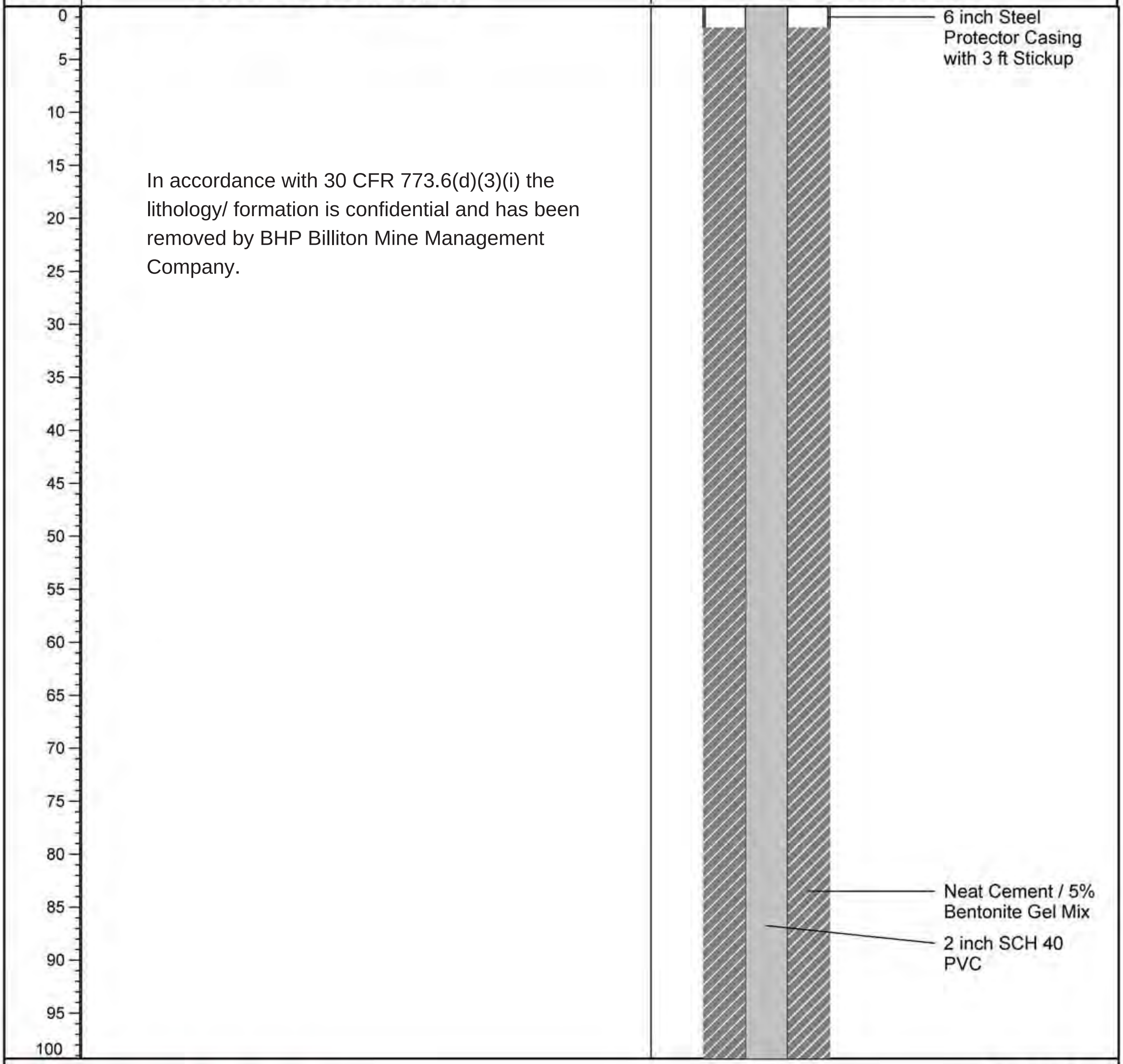
WELL ID: KF7-12-1
SITE: Navajo Mine
COUNTY: San Juan
STATE: New Mexico

PAD ELEVATION: 5,398.6 ft
NORTHING (NAD 27): N 2,016,928.8
EASTING (NAD 27): E 304,657.8

COMPLETION INFORMATION		DRILLING INFORMATION	
COMPLETION TYPE:	Monitoring Well	DRILLING CO.:	Boart Longyear
COMPLETION ZONES:	173.5-178.5 fbgs	GEOLOGIST:	O. Cannon
COMPLETION DEPTH:	178.9 ft	METHOD OF DRILLING:	Sonic Rotary
COMPLETION DATE:	5/8/2012	HOLE DIAMETER:	6 in.
DEVELOPMENT DATE:	6/5/2012		

DEPTH | LITHOLOGY / FORMATION | WELL CONSTRUCTION

In accordance with 30 CFR 773.6(d)(3)(i) the lithology/ formation is confidential and has been removed by BHP Billiton Mine Management Company.



NORWEST CORPORATION

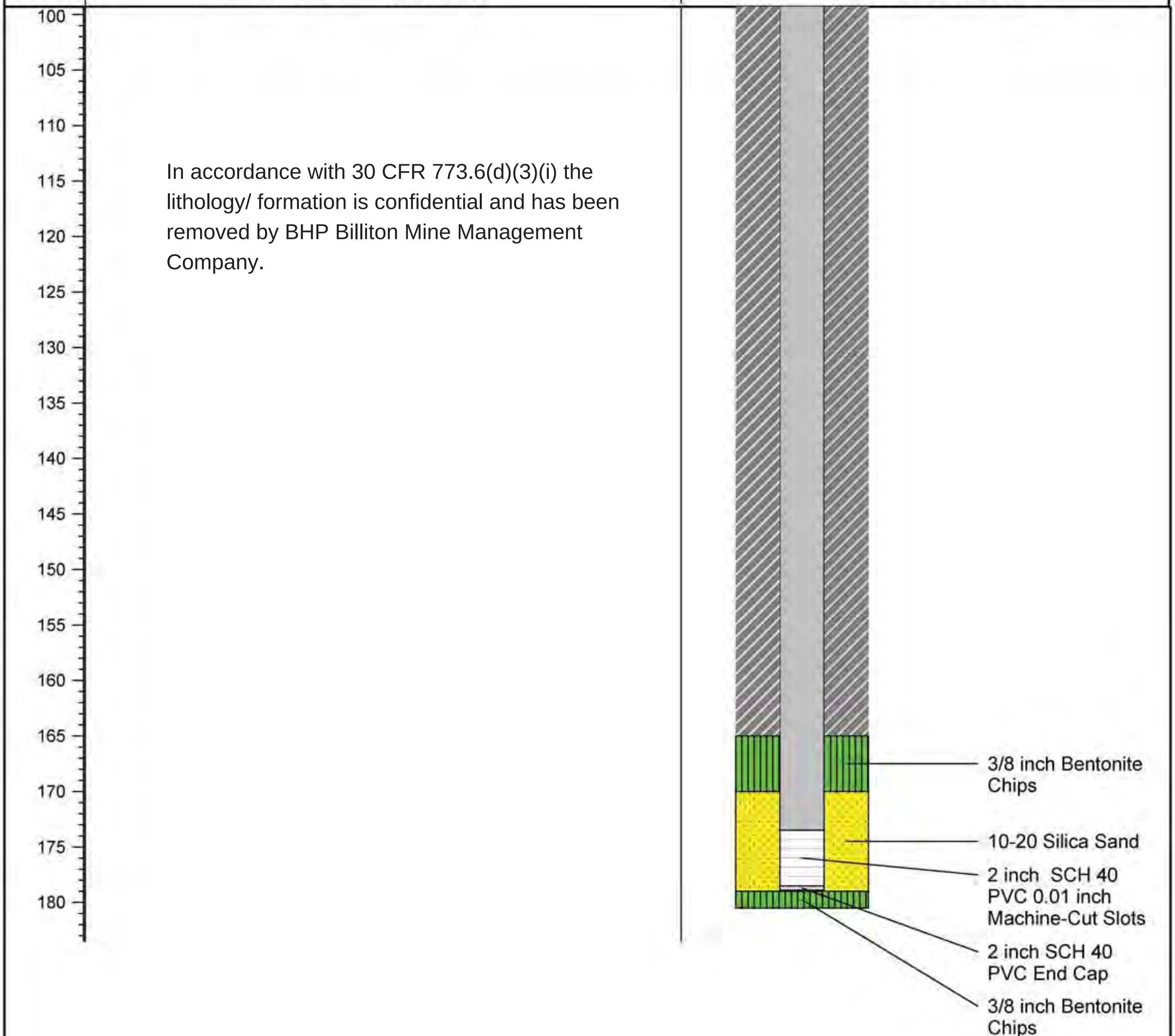
WELL INSTALLATION REPORT

WELL ID:	KF7-12-1	PAD ELEVATION:	5,398.6 ft
SITE:	Navajo Mine	NORTHING (NAD 27):	N 2,016,928.8
COUNTY:	San Juan	EASTING (NAD 27):	E 304,657.8
STATE:	New Mexico		

COMPLETION INFORMATION		DRILLING INFORMATION	
COMPLETION TYPE:	Monitoring Well	DRILLING CO.:	Boart Longyear
COMPLETION ZONES:	173.5-178.5 fbgs	GEOLOGIST:	O. Cannon
COMPLETION DEPTH:	178.9 ft	METHOD OF DRILLING:	Sonic Rotary
COMPLETION DATE:	5/8/2012	HOLE DIAMETER:	6 in.
DEVELOPMENT DATE:	6/5/2012		

DEPTH | LITHOLOGY / FORMATION | WELL CONSTRUCTION

In accordance with 30 CFR 773.6(d)(3)(i) the lithology/ formation is confidential and has been removed by BHP Billiton Mine Management Company.



NORWEST CORPORATION

Appendix 3: Norwest Corporation - Technical Memo: Navajo Mine Monitoring Well CA-2 Installation

NORWEST
CORPORATION

950 South Cherry Street, Suite 800
Denver, CO 80246
Tel: (303) 782-0164 Fax: (303) 782-2560

TECHNICAL MEMORANDUM

To	Edward Epp, BHP Billiton New Mexico Coal	**Ref #**	350-22-TM-FINAL
CC	Art O'Hayre	**Date**	January 22, 2014
From	Landon Beck		
Subject	Navajo Mine Monitoring Well CA-2 Installation		

This technical memorandum (TM) documents the field activities conducted for the installation of the alluvial monitoring well CA-2, located in the Chinde Wetland at the BHP Billiton Navajo Mine. Due to the wetland environment in which CA-2 was to be located, access by traditional or even track-mounted Geoprobe, sonic or rotary drill rigs was not a feasible option. With the expected shallow target interval depth, a hand auger system was used to bore the hole and the screen and casing was installed by hand. The following were supervision activities and work performed by Norwest Corporation for this program:

- Conducted soil augering at CA-2; collected and described cuttings samples.
- Designed and installed 2" PVC monitoring well into augered hole as CA-2.
- Prepared location map figure, well installation report and lithology log. (attached)

The following **Location Map** shows CA-2, completed in 2013 as well as the rest of the monitoring wells that were completed at the Navajo Mine in 2012-2013.

Monitoring Well Installation

Field Activity Period

Activity	Start	Complete
Auger, sample, and log (1) 2-1/4" hole, complete as 2" PVC monitoring well (CA-2)	23 April 2013	23 April 2013

Methodology

Preparation:

- The CA-2 monitoring well location was intended to monitor the alluvium below the Chinde Wetland area therefore a location was targeted with consideration to be within reasonable proximity to the existing adjacent alluvial channel.
- The final location of the CA-2 was selected and bored with onsite consensus of BHP Billiton New Mexico Coal and Norwest representation in consideration of safe work access during installation and future monitoring activities.

CA-2 Installation:

- The **Location Map** shows the location of CA-2. The survey data for CA-2 with elevation at ground surface is:

Name	Northing	Easting	Elevation
CA-2	2048951	316967	5321.37 ft amsl
Projection: State Plane Datum: NAD27 Zone: New Mexico West Units: Feet			

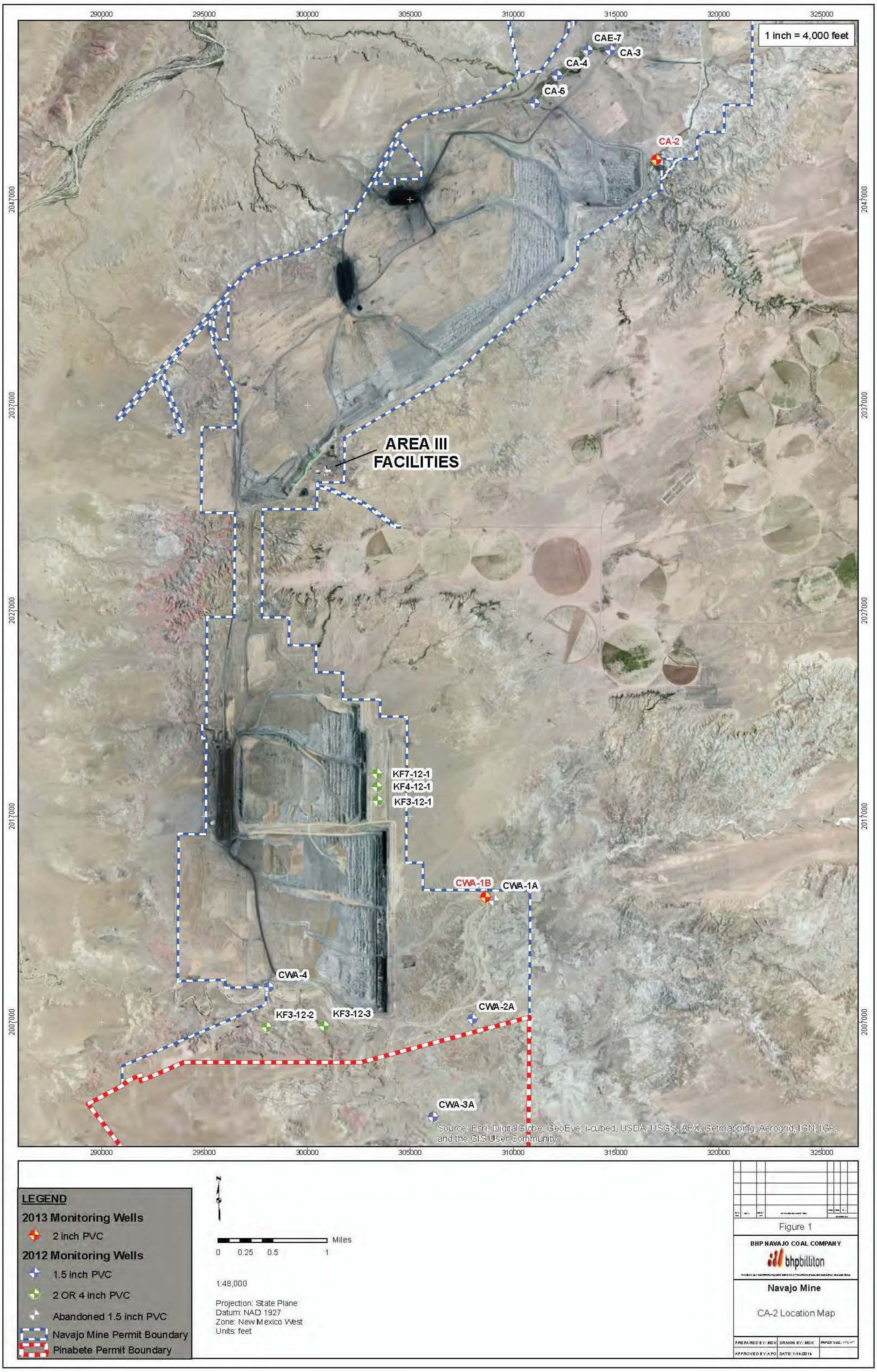
- One 2-1/4" soil boring was bored using an AMS Regular Soil Auger, with quick-connect rods as a hand-operated system.
- Two-inch diameter AMS auger samples were retrieved with every approximate one foot of advance vertically into the undisturbed subsurface soil.
- A Field Lithology Log form was used to record descriptions of soil materials and document presence of water-bearing zones by depth interval and is presented in the attached **Lithology Log**.
- The soil boring was advanced until penetrating substantially into a sand aquifer from 10.5 to 12.75 feet below ground surface (ftbgs). The total depth of boring was limited by collapsing borehole conditions within this sand aquifer.
- Saturated conditions were documented beginning at surface, in fact the boring location was in standing water approximately 0.5 feet in depth. This water flowed into the borehole during boring but quickly equalized as the clay interval was very impermeable; however it was clear from observation of the clay cuttings that from surface to 10.5 ftbgs this clay was naturally saturated.
- The well installation details are presented in the attached **Well Installation Report**; the well was completed with 2" flush joint schedule 40 PVC casing and screen. The screen section is factory-slotted 0.01". A natural filter pack was utilized, consisting of the formation sand encountered from 10.5 to 12.75 ftbgs collapsing around the screen section.
- A 4-1/2" X 6' locking steel casing wellhead protector was set into place to a depth of 3 ftbgs centered within the hand-dug 8" diameter X 2.5' deep starter hole. This slipped over the 2" PVC wellhead extending above ground surface. 3/8" bentonite chips were installed inside and outside of the wellhead protector in order to seal the surface water from the completion interval. As the bentonite was installed into standing water, it instantly hydrated. Furthermore, the clays encountered from surface to 10.5 ftbgs certainly swelled to seal against the 2-3/8" outer diameter of the PVC well casing.
- A 2' X 2' X 4" concrete pad was installed around the wellhead protector. **Photo 1 & 2**.
- This annular seal was confirmed by a CA-2 depth to water level measurement 1 hour after bentonite hydration that was 4.53 ftbgs and falling. The water was still standing in the wetland so at this time there was already a 4.53' head difference from surface to the screened aquifer.
- No bollards were installed as the location is within a wetland and no vehicle traffic could reach the well to impact it.

- Detailed field notes of activities at each location, including photograph subjects were recorded in an all-weather field book.

Closing:

- BHP Billiton New Mexico Coal to file this monitoring well installation TM of CA-2 with New Mexico Mining and Minerals Division (MMD) as well as complete internal documentation of the installation.

LOCATION MAP


1 inch = 4,000 feet
CAE-7
CA-3
CA-4
CA-5
CA-2
AREA III
FACILITIES
KF7-12-1
KF4-12-1
KF3-12-1
CWA-1B
CWA-1A
CWA-4
KF3-12-2
KF3-12-3
CWA-2A
CWA-3A
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community
290000
295000
300000
305000
310000
315000
320000
325000
2047000
2037000
2027000
2017000
2007000
LEGEND
2013 Monitoring Wells
2 inch PVC
2012 Monitoring Wells
1.5 inch PVC
2 OR 4 inch PVC
Abandoned 1.5 inch PVC
Navajo Mine Permit Boundary
Pinabete Permit Boundary
N
Miles
0 0.25 0.5 1
1:48,000
Projection: State Plane
Datum: NAD 1927
Zone: New Mexico West
Units: feet
Figure 1
BHP NAVAJO COAL COMPANY
bhpbilliton
Navajo Mine
CA-2 Location Map

WELL INSTALLATION REPORTS

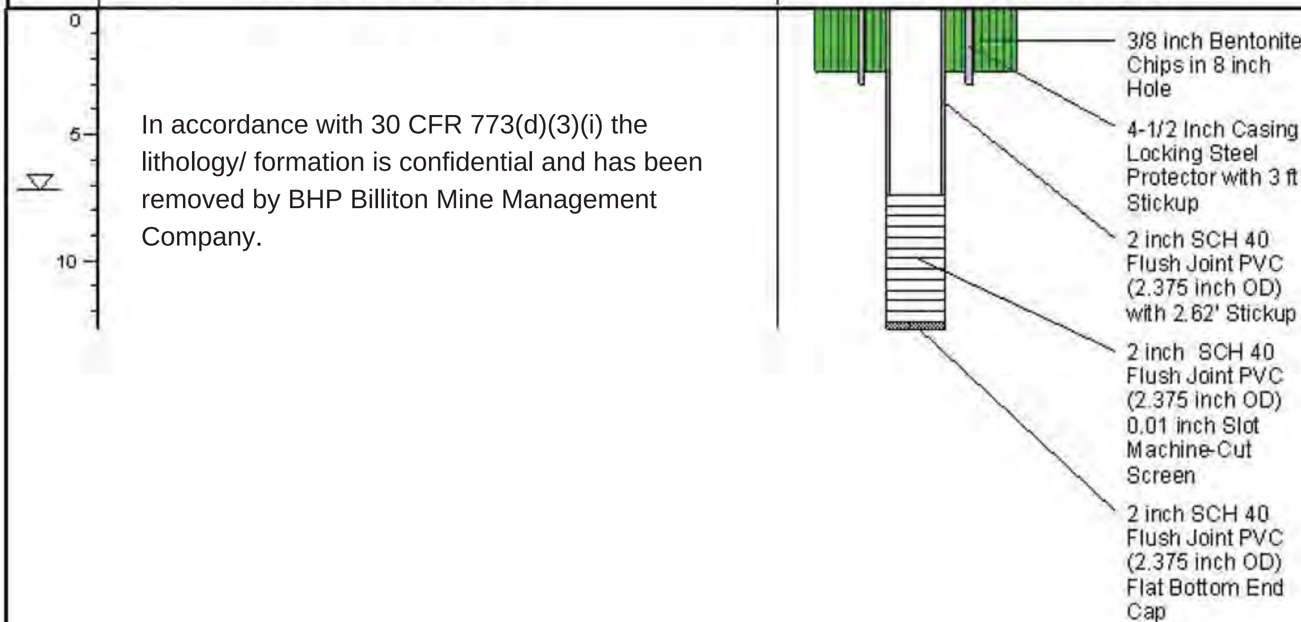
WELL INSTALLATION REPORT

WELL ID:	CA-2	PAD ELEVATION:	5321.37 ft asl
SITE:	Navajo Mine	NORTHING (NAD 27):	N 2048951
COUNTY:	San Juan	EASTING (NAD 27):	E 316967
STATE:	New Mexico		

COMPLETION INFORMATION		DRILLING INFORMATION	
COMPLETION TYPE:	Monitoring Well	DRILLING CO.:	Norwest Corporation
COMPLETION ZONES:	7.39 - 12.75 ft bgs	GEOLOGIST:	Landon Beck
COMPLETION DEPTH:	12.75 ft bgs	METHOD OF DRILLING:	Hand Auger
COMPLETION DATE:	4/23/13	HOLE DIAMETER:	2-1/4 in.
DEVELOPMENT DATE:	NA		

DEPTH | LITHOLOGY / FORMATION | WELL CONSTRUCTION

In accordance with 30 CFR 773(d)(3)(i) the lithology/ formation is confidential and has been removed by BHP Billiton Mine Management Company.



NORWEST CORPORATION

LITHOLOGY LOG

Well No. **CA-2**	Norwest Geologist/Supervisor Landon Beck	
Drilling Co.: Norwest Corp	Driller: Landon Beck	Drilling Method: Hand Auger - 2-1/4"
Date Commenced: 4/23/13	Date Completed: 4/23/13	TD 12.5 ft
Ground Elev. 5321.37 ft MSL	Pad Elev. 5,321.37 ft MSL	
Location Navajo Mine - Chinde Wetlands - Northing 2048951, Easting 316967		

Top (fbgs)	**Bottom (fbgs)**	**Description**
0.0	6.0	Clay, organic, saturated, light brown, some plant debris.
6.0	10.5	Clay, silty, saturated, light brown.
10.5	12.75	Sand, fine to medium-grained, subangular, fair sorting, some clay but likely sample contamination (slough) from overlying zones, saturated, medium light brown.
12.75	TD	Total depth drilled.

NORWEST CORPORATION

PHOTOS

Photo 1. CA-2 Completed Wellhead

Photo 2. CA-2 SCH 40 2" Flush Joint PVC Casing Inside Locking 4-1/2" Steel Casing Wellhead

Appendix 4: Norwest Corporation - Technical Memo: Navajo Mine Monitoring Well CWA-1A Replacement with CWA-1B

NORWEST
CORPORATION

950 SOUTH CHERRY STREET, SUITE 800
DENVER, CO 80246
TEL: (303) 782-0164 FAX: (303) 782-2560

TECHNICAL MEMORANDUM

To	Edward Epp, BHP Billiton New Mexico Coal	**Ref #**	350-23-TM-FINAL
CC	Art O'Hayre	**Date**	January 22, 2014
From	Landon Beck		
Subject	Navajo Mine Monitoring Well CWA-1A Replacement with CWA-1B		

This technical memorandum (TM) documents the field activities conducted for the replacement of alluvial monitoring well CWA-1A with CWA-1B. CWA-1A was completely silted-in during a major storm event that overtopped the well. The following were supervision activities and work performed by Norwest Corporation for this program:

- Supervised direct-push drilling of CWA-1B; collected, described, and photographed core samples.
- Designed and supervised well installation.
- Supervised abandonment of CWA-1A.
- Prepared location map figure, well installation report and lithology log. (attached)

The following **Location Map** shows CWA-1A, completed in 2012 and its replacement CWA-1B as well as the rest of the monitoring wells that were completed at the Navajo Mine in 2012.

Monitoring Well Replacement

Field Activity Period

Activity	Start	Complete
Drill, sample, and log 1 direct push drill hole, complete as 2" PVC monitoring well (CWA-1B) and abandon CWA-1A	25 March 2013	25 March 2013

Methodology

Preparation:

- CWA-1B is a replacement monitoring well therefore its' location was to be as near as reasonably possible to CWA-1A, targeting the same alluvial aquifer yet in a location less vulnerable to flooding.

- The final location of the CWA-1B was selected and drilled with onsite consensus of BHP Billiton New Mexico Coal, Norwest and Boart Longyear representation in consideration of safe work access during installation and future monitoring activities.

CWA-1B:

- The **Location Map** shows the final location of CWA-1B. The relative distances between the abandoned CWA-1A and replacement CWA-1B have been exaggerated to ease identification on this map. The survey location of CWA-1B with elevation at ground surface is:

Name	Northing	Easting	Elevation
CWA-1B	2012959	309052.3	5353.84 ft amsl
Projection: State Plane Datum: NAD27 Zone: New Mexico West Units: Feet			

- One 3” soil boring was advanced using a Geoprobe truck-mounted direct push drill rig, allowing continuous sample collection to total depth. See **Photo 1** of the Geoprobe.
- A Field Lithology Log form was used to record descriptions of soil materials and document presence of water-bearing zones by depth interval and is presented in the attached **Lithology Log**.
- Unconsolidated soil materials were qualitatively classified using the Unified Soil Classification system, e.g., SP, poorly graded sand. Color of soil materials was visually identified using a Munsell color classification system chart, e.g., dark yellowish brown (10YR4/2).
- Two-inch diameter AMS sample tubes were used together to sample soils. Core sample tubes were split open to be described and photographed.
- The soil boring was advanced until penetrating substantially below alluvium (1.6 feet) into weathered bedrock at 15.0 feet below ground surface. Saturated conditions were documented beginning at 6 feet below ground surface.
- The well installation details are presented in the attached **Well Installation Report**; the well was completed with 2” flush joint schedule 40 PVC casing and screen. The screen is factory-slotted 0.01” with an annular filter pack consisting of #2-/16 silica sand.
- A new 6” X 6’ square steel wellhead protector was pressed into place over the 2” PVC wellhead extending above ground surface. The four bollards from CWA-1A were salvaged and installed to protect the wellhead at CWA-1B. See **Photo 2**.
- Detailed field notes of activities at each location, including photograph subjects were recorded in an all-weather field book.

CWA-1A:

- The original CWA-1A Well Installation Report follows in the Well Installation Report section.
- The 6” X 6’ steel wellhead protector was pulled from the ground with a backhoe.

- The entire 14.2’ length of 1.5” PVC well casing was pulled from the ground in one section with the backhoe. The hole immediately collapsed upon itself as the casing was withdrawn; this is an effective and acceptable means of well abandonment for CWA-1A.

- The **Location Map** shows the location of the abandoned CWA-1A. The relative distances between the abandoned CWA-1A and replacement CWA-1B have been exaggerated to ease identification on this map. The survey location of the abandoned CWA-1A with elevation at ground surface is:

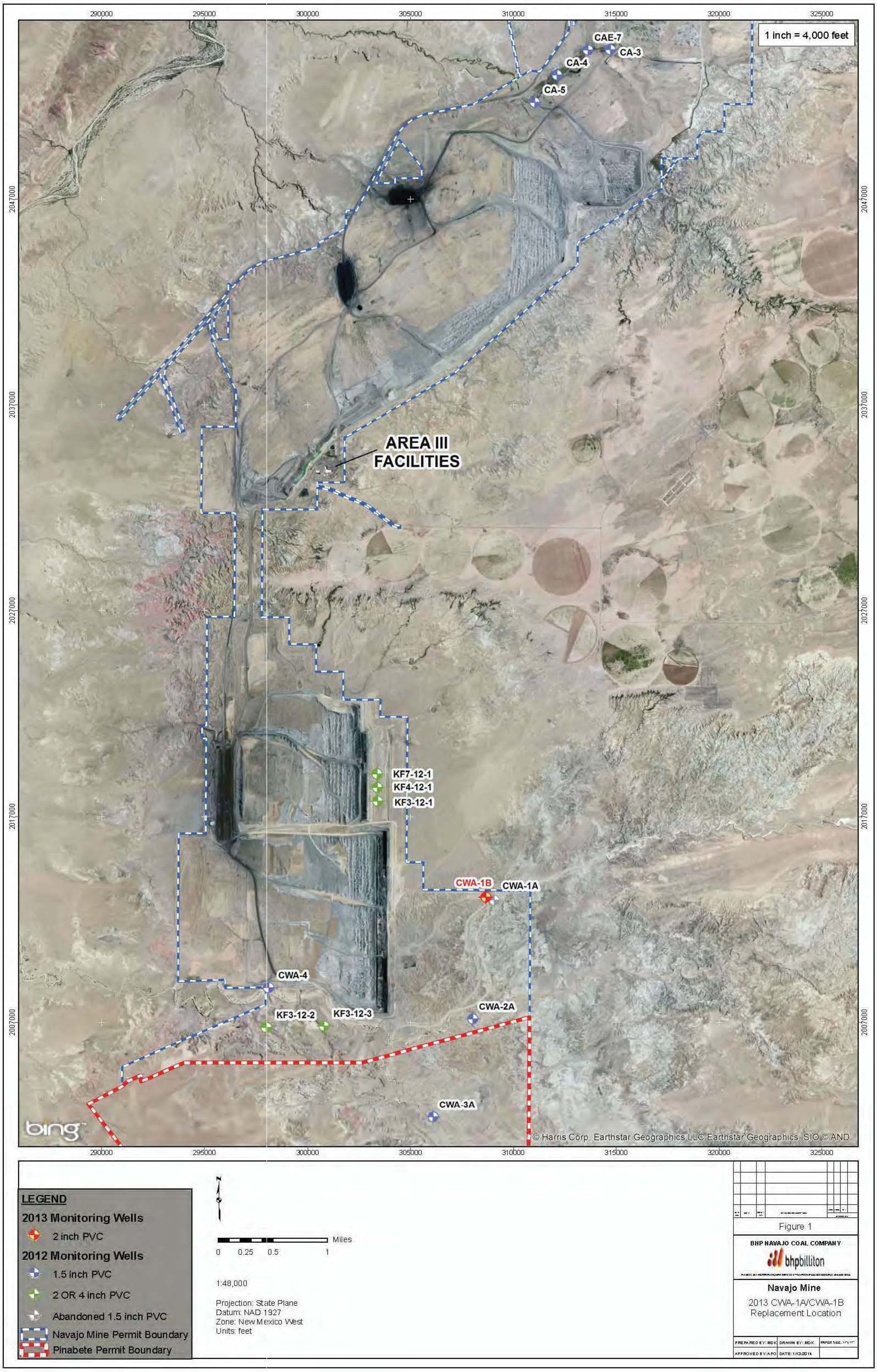
Name	Northing	Easting	Elevation
CWA-1A	2012940	309075.4	5354 ft amsl
Projection: State Plane Datum: NAD27 Zone: New Mexico West Units: Feet			

- The old casing and steel wellhead protector were removed from the location and properly disposed.

Closing:

- BHP Billiton New Mexico Coal to file this well installation and abandonment TM with New Mexico Mining and Minerals Division (MMD) as well as complete internal documentation of the installation of CWA-1B and abandonment of monitoring well CWA-1A.

LOCATION MAP


290000
295000
300000
305000
310000
315000
320000
325000
2047000
2037000
2027000
2017000
2007000
1 inch = 4,000 feet
CAE-7
CA-3
CA-4
CA-5
AREA III
FACILITIES
KF7-12-1
KF4-12-1
KF3-12-1
CWA-1B
CWA-1A
CWA-4
CWA-2A
KF3-12-2
KF3-12-3
CWA-3A
© Harris Corp, Earthstar Geographics LLC Earthstar Geographics SIO © AND
LEGEND
2013 Monitoring Wells
2 inch PVC
2012 Monitoring Wells
1.5 inch PVC
2 OR 4 inch PVC
Abandoned 1.5 inch PVC
Navajo Mine Permit Boundary
Pinabete Permit Boundary
N
Miles
0 0.25 0.5 1
1:48,000
Projection: State Plane
Datum: NAD 1927
Zone: New Mexico West
Units: feet
Figure 1
BHP NAVAJO COAL COMPANY
bhpbilliton
Navajo Mine
2013 CWA-1A/CWA-1B
Replacement Location
PREPARED BY: MDK
DRAWN BY: MDK
APPROVED BY: APO
DATE: 1/13/2014

WELL INSTALLATION REPORTS

WELL INSTALLATION REPORT

WELL ID: CWA-1B
SITE: Navajo Mine
COUNTY: San Juan
STATE: New Mexico

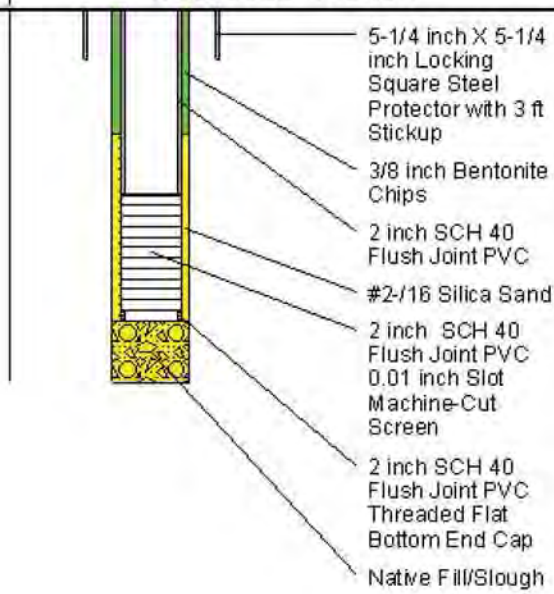
PAD ELEVATION: 5353.84 ft asl
NORTHING (NAD 27): N 2,012,959
EASTING (NAD 27): E 309,052.3

COMPLETION INFORMATION		DRILLING INFORMATION	
COMPLETION TYPE:	Monitoring Well	DRILLING CO.:	Boart-Longyear
COMPLETION ZONES:	7.37 - 12.09 ft bgs	GEOLOGIST:	Landon Beck
COMPLETION DEPTH:	12.5 ft bgs	METHOD OF DRILLING:	Direct Push
COMPLETION DATE:	3/25/13	HOLE DIAMETER:	3 in.
DEVELOPMENT DATE:	NA		

DEPTH | LITHOLOGY / FORMATION | WELL CONSTRUCTION

0
5
10
15

In accordance with 30 CFR 773.6(d)(3)(i) the lithology/ formation is confidential and has been removed by BHP Billiton Mine Management Company.



NORWEST CORPORATION

Page 1 of 1

WELL INSTALLATION REPORT

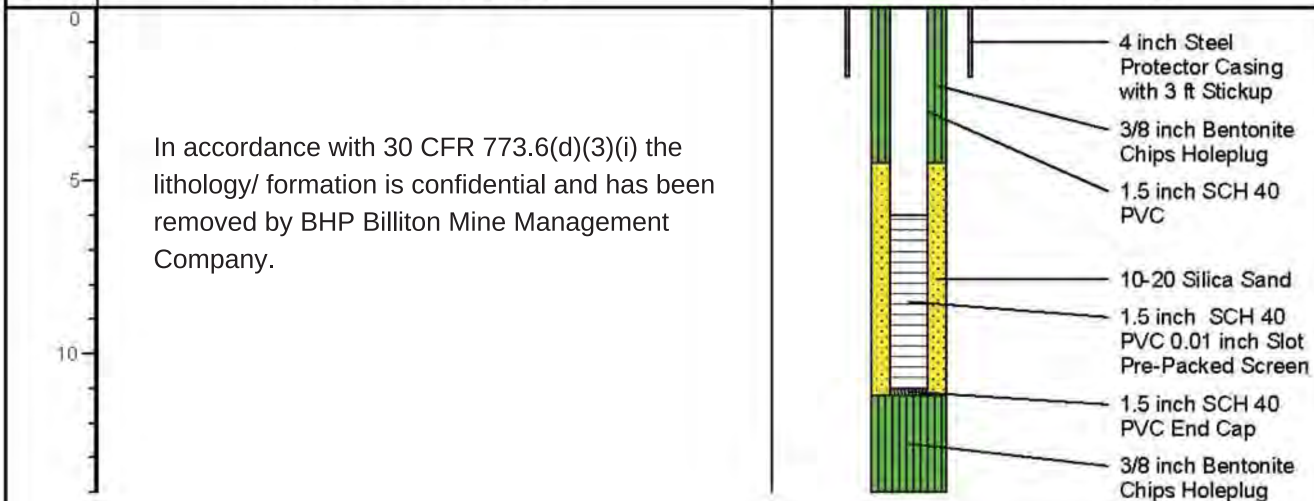
WELL ID: CWA-1a
SITE: Navajo Mine
COUNTY: San Juan
STATE: New Mexico

PAD ELEVATION: 5354.0 ft
NORTHING (NAD 27): N 2,012,939.6
EASTING (NAD 27): E 309,075.4

COMPLETION INFORMATION		DRILLING INFORMATION	
COMPLETION TYPE:	Monitoring Well	DRILLING CO.:	Boart-Longyear
COMPLETION ZONES:	6.0 - 11.0 ft bgs	GEOLOGIST:	O. Cannon
COMPLETION DEPTH:	11.2 ft bgs	METHOD OF DRILLING:	Direct Push
COMPLETION DATE:	3/12/12	HOLE DIAMETER:	3 in.
DEVELOPMENT DATE:	6/9/12		

DEPTH	LITHOLOGY / FORMATION	WELL CONSTRUCTION

In accordance with 30 CFR 773.6(d)(3)(i) the lithology/ formation is confidential and has been removed by BHP Billiton Mine Management Company.



NORWEST CORPORATION

LITHOLOGY LOG

Well No. CWA-1B	Norwest Geologist/Supervisor Landon Beck	
Drilling Co.: Boart Longyear	Driller: Don Hansen	Drilling Method: Direct-push - Geoprobe, 3"
Date Commenced: 3/25/13	Date Completed: 3/25/13	TD 15.0 ft
Ground Elev. 5,353.84 ft MSL	Pad Elev. 5,353.84 ft MSL	
Location Navajo Mine - Cottonwood Arroyo - N 2012959, E 309052.3		

Top (fbgs)	Bottom (fbgs)	Description
0.0	2.5	Sand, very fine to fine, well sorted (wind blown), moderate yellowish brown (10YR 5/4), dry.
2.5	4.0	Sand, silty, some wood/plant material, moderate yellowish brown (10YR 5/4), moist/damp.
4.0	5.0	Clay, silty, moderate yellowish brown (10YR 5/4).
5.0	13.4	Sand, fine, well sorted, moderate yellowish brown (10YR/5/4), saturated beginning at 6 feet.
13.4	15.0	Claystone, weathered, light olive gray (5Y 5/2), damp but not saturated.
15.0	TD	Total depth drilled.

NORWEST
CORPORATION

PHOTOS

Photo 1. Boart Longyear Geoprobe Mounted on Ford F-550 Box Truck

Photo 2. CWA-1B Completed

Appendix 5: Letter_120626_Groundwater Well Drilling and Surface Water Monitoring Site Status

USPS 7009 0960 0000 9762 6896

BHP Navajo Coal Company

BHP Billiton Limited
BHP Navajo Coal Company
PO Box 1717
16 Miles South of Fruitland on CR 6675
Fruitland, New Mexico 87416 USA
Tel +1 505 598 4200 Fax +1 505 598 3361
bhpbilliton.com

June 26, 2012

Mr. Mychal Yellowman
Navajo Mine Team Leader
Indian Programs Branch
Office of Surface Mining/Western Regional Coordinating Center
1999 Broadway, Suite 3320
Denver, Colorado 80202-3050
myellowman@osmre.gov

Re: Navajo Mine Permit Number NM-0003F;
Groundwater Well Drilling and Surface Water Monitoring Site Status

Dear Mr. Yellowman,

BHP Navajo Coal Company (BNCC) is submitting this letter to provide a status update on groundwater well drilling and surface water monitoring site installation at Navajo Mine.

Bedrock Replacement Wells – Lowe Pit Highwall

Due to expanded surface disturbance and Incidental Boundary Revision, three existing bedrock wells KF84-20A (#7 seam), KF84-20B (#4 seam), and KF84-20C (#3 seam) were abandoned. These have since been replaced by wells KF7-12-1 (#7 seam), KF4-12-1 (#4 seam) and KF3-12-1 (#3 seam). Results from drilling indicate that all three of these seams are dry; this will be confirmed after well development that will take place in June 2012. Monitoring of these wells will begin in 3rd Quarter 2012.

New Bedrock Wells – Area IV North

Two adjacent wells were originally planned in the northwest area of Area IV North, one to monitor the #8 seam and the other to monitor the #3 seam. Examination of the geologic model in this area shows that the #8 seam is thin, discontinuous, and split into as many as four child seams. Several communications between BNCC and OSM Hydrologists confirmed that installing adjacent wells in an upper seam (#8 or #7) and the lower #3 seam would not be possible due to geologic and operational constraints. It was decided that two separate #3 seam wells would be installed, one in each of the OSM prescribed areas. Both of these wells (KF3-12-2 and KF3-12-3) were successfully installed.

Alluvial Wells – Cottonwood Arroyo

The following alluvial wells were completed in the Cottonwood Arroyo drainage area:

- CWA-1: Installed adjacent to the main Cottonwood Arroyo, just inside the lease line in between

Area III Dixon area and Area IV North. This well replaces the hand-dug, dry well QACW-2B. At completion of drilling this well had approximately seven feet of water in the well bottom; well development will occur during June 2012.

- CWA-2: Installed in the upper reaches of the Middle Fork Cottonwood Arroyo. This well is dry.
  CWA-3: Installed along the upper reaches of South Fork Cottonwood Arroyo. Six inches of water was in the well bottom at end of drilling. The water level will be measured again, and development completed by hand if feasible.
- CWA-4: Installed along the North Fork Cottonwood Arroyo upstream of the Burnham Road crossing as a replacement for well GM-17. Six feet of water was measured in the well after drilling; well development will occur in June 2012.

Alluvial Wells – Chinde Arroyo and Wetlands
Three piezometers (CA-3, CA-4, CA-5) were installed in the “big fill” wetland area. These wells will be developed by hand due to vehicle access restrictions.

Two other off-lease wells, one upstream pre-packed well (CA-1) and one downstream pre-packed well (CA-6), will be installed via hand auger. As discussed and agreed upon at the OSM – BNCC meeting on February 27, 2012, BNCC must necessarily wait for requisite approvals prior to installing monitoring sites off-lease. BNCC is currently working with the Navajo Department of Water Resources Water Code Administration to acquire the approvals. Upon receipt of the required approvals, arrangements will be made for installation of these wells.

Flow Monitoring on Chinde and Cottonwood Arroyos
Seven ISCO 2110 Ultrasonic Flow Modules have been purchased and were delivered Monday, June 4, 2012. Downstream monitoring stations on Cottonwood and Chinde will be installed first. Construction of the Burnham Road has commenced, and as the construction progresses, upstream Cottonwood stations will be installed in culverts beneath the road. The upstream Chinde station will be installed once necessary permits and permissions have been acquired from the Navajo Nation EPA. Single Stage samplers will be installed in conjunction with each flow meter to collect water quality samples.

Updates to the permit water monitoring plan revision are planned for submittal in August, 2012. If you have any questions regarding this letter, please contact me at 505-598-2821 or Steven.R.Perkins@bhpbilliton.com.

Sincerely,

Steven Perkins
Superintendent Environmental Permitting and Technical Services

Appendix 6: Ground and Surface Water Quality Monitoring Results and Analysis

Hydrology Report For OSMRE's

Cumulative Hydrologic Impact Assessment (CHIA) Update

Table of Contents

List of Tables

List of Appendices

1.0 INTRODUCTION

This report summarizes the results of hydrologic data collected for the monitoring period comprised of calendar year (CY) 2012, 2013 and CY 2014 through September. The report also evaluates water quality and quantity trends of annual and quarterly hydrology data collected from 1985 through September 2014. The type of data collected includes surface water quality and quantity, groundwater quality and quantity, and precipitation quantity. Hydrology quantity and quality data are presented in tables in this report, and in appendices at the end of this report. A detailed discussion of the hydrology monitoring program can be found in the Navajo Mine Electronic Permit NM0003F, Part 6 - Section 42.

1.1 Hydrologic Setting

1.1.1 Surface Water

Navajo Mine has collected surface water data derived from precipitation based runoff events and to Navajo Agricultural Products Industries (NAPI) discharges since 1985. The purpose of monitoring surface water in the two main channels, Chinde Wash and Cottonwood Arroyo, is to document the quality and quantity of the hydrologic balance and to evaluate predictions made concerning the hydrologic balance in the Probable Hydrologic Consequences (PHC) section of the Navajo Mine Electronic Permit (NM0003F). This report summarizes water quality data collected from 1985 through September2014 for two active monitoring stations (CD-1A and CD-2A) on Chinde Arroyo. The report also summarizes data collected between 1998 and 1999 and from July 2013 through September 2014 on CNS-1, the downstream site on Cottonwood Arroyo. Data from recently established sites upstream on Cottonwood Arroyo (CN-2, CM-2, CS-2A, and CS-2B) is also summarized.

The station CNS-1 on the Cottonwood Arroyo located downstream at the mine permit boundary was washed out by a series of large surface water flows that occurred in the summer of 1999. Consequently, Navajo Mine, in agreement with OSMRE (May 3, 2000), discontinued monitoring for station CNS-1. This station was reactivated starting in the winter of 2012 and the first samples were captured during flow events in July 2013.

The new station CN-2 was established on Cottonwood North upstream of mining near the old station location CN-1. CM-2 is located on the Cottonwood Middle-Fork, upstream of the former site CM-1. The station CS-1 was located on the main stem of Cottonwood Arroyo within the lease area. Stations CS-2A and CS-2B were established at suitable locations on Cottonwood South-Fork tributaries upstream of the former station CS-1.

The relationship between the quality and quantity of water (hydrologic balance) of the monitored drainages at Navajo Mine is characteristic of typical sand-bed washes found in the arid, southwestern United States. The ephemeral flows in sand-bed washes that cross the permit boundary are extremely sediment rich and exhibit wide variations in water quality and quantity. The natural variability coupled with impacts from NAPI, including direct discharges from irrigation channels and groundwater return flows produce a complex monitoring environment.

1.1.2 Groundwater

Navajo Mine has collected groundwater data on annual and quarterly frequencies from 1985 to present. The groundwater-monitoring program for Navajo Mine is challenging for several reasons: (1) Monitoring sites are distributed over a large geographical area, 26.2 square miles, within several discrete coal resources that have been, are currently, or will be mined over an approximate 60-year period; (2) The coal seams are lenticular in nature, which limits the spatial continuity of discrete aquifers to localized areas; and (3) Lands within the permitted area are classified as Pre-SMCRA, Interim, or Permanent Program and the mine lease boundary abuts directly to planned and permitted mining activities. Therefore little land, undisturbed by mining activities, remains inside the permit boundary for the establishment of environmental monitoring locations.

Coal seams within the Cretaceous Fruitland Formation are the water bearing units that are monitored. Overburden and interburden strata between or overlying coal seams do not yield sufficient water to be monitored. Due to the low yield and poor water quality, local groundwater is not used for potable drinking water, as a livestock watering source, or for irrigation purposes.

Quaternary alluvial deposits fill valley bottoms of Chinde Arroyo and Cottonwood Arroyo to an average of 10 to 15 feet thick. These alluvial deposits range from fine-grained eolian sands to coarse-grained channel deposited gravels. The quality of groundwater, when present, is monitored in both of these unconfined alluvial fill deposits.

Groundwater monitoring conditions include both unconfined and confined groundwater flow. The naturally low water-yielding formations contain poor to very poor water quality due to elevated levels of dissolved constituents (total dissolved solids [TDS]). The natural elevated levels of TDS result from aquifer material consisting of alternating marine and nonmarine strata that are commonly cemented with gypsum ($CaSO_4$), calcite ($CaCO_3$), and other soluble salts (i.e., NaCl and KCl). In addition, these strata often contain minor trace elements such as barium, boron, and selenium. The spatial variation of cementation, porosity, and solubility of salts can cause wide variations in concentrations of major ions (Na, SO_4, and Cl) and trace elements. Thus, sporadic parameter concentrations above the reference criteria are expected and are occasionally observed throughout the data record.

1.1.3 Precipitation

Navajo Mine has collected climatological data since 1991 from two on-site meteorological monitoring stations: Met 1 and Met 2, and since 2007 from Met 3. The annual average net evaporation rate is 55.9 inches (Class A Pan method). The evaporation rate is a factor of approximately ten times greater than the average precipitation rate of 5.48 inches annually.

Most precipitation in the region occurs from July through September during localized, high-intensity, short-duration thunderstorms. Other precipitation in the region usually occurs as snow during winter months.

2.0 SURFACE WATER MONITORING PROGRAM

2.1 Approved Program

The surface-water monitoring program is comprised of two monitoring stations located on the Chinde Wash and five monitoring stations on Cottonwood Arroyo (Exhibit 8-1 - Electronic Permit NM0003F). Station CD-1A is located upstream of the Navajo Mine permit area and station CD-2A is located downstream of mining on Chinde Arroyo (Table 2-1). The Cottonwood Arroyo Station CNS-1 located on the main stem, downstream of mining, was reactivated starting in winter 2012-2013. The new station CN-2 was established on Cottonwood North-Fork upstream of mining at a suitable location near the old station location CN-1. Also, new stations CM-2, CS-2A and CS-2B were established at suitable upstream locations on Cottonwood tributaries near the lease boundary.

Table 2-1 Surface Water Monitoring Locations

Station ID	Drainage	Location
CD-1A	Chinde	Upstream
CD-2A	Chinde	Downstream
CN-2	North Fork Cottonwood	Upstream
CM-2	Middle Fork Cottonwood	Upstream
CS-2A	South Fork Cottonwood	Upstream
CS-2B	South Fork Cottonwood	Upstream
CNS-1	Cottonwood	Downstream

Data from these stations is used to assess water entering and leaving the permit area.

Flow in Chinde Wash was monitored with continuous flow monitoring equipment during CY 1999. The continuous flow data, in combination with synoptic quarterly field measurements, were used to analyze gain/loss in Chinde Wash (See gain/loss study below).

The majority of the stage data collected at station CD-1A from 1999 through 2001 may not be representative of actual flow stage within Chinde Wash. During that time period, culvert maintenance at the downstream outlet caused backwater conditions inside the culvert and beneath the sensor. The Bureau of Indian Affairs (BIA) undertook culvert work sporadically from 1999 through 2001. The artificial channel conditions and their influence on collecting representative stage data were reported to OSMRE in the quarterly hydrologic monitoring reports from 1999 through 2001.

Typically, the maintenance work was done in the fall and spring. During winter months, the pooled water inside the culvert froze solid, affecting stage readings in January and February of the following year. These conditions persisted until the ice melted and large flows eroded fill material to an elevation below the level of the culvert, eliminating the backwater area.

Grab samples are collected quarterly from surface water in the Chinde Wash at stations CD-1A and CD-2A. The water quality samples are analyzed for sediment concentrations and general chemical water quality parameters A combination of in-stream single-stage sediment samplers to sample water quality and in-stream crest gages to monitor peak flows were established at the upstream stations on the Cottonwood Arroyo tributaries and at the Cottonwood Arroyo downstream station CNS-1. Samples are collected from the stations on a quarterly basis.

2.2 Navajo Indian Irrigation Project Discharges

The Navajo Indian Irrigation Project (NIIP) directly discharges to the headwaters of both Cottonwood Arroyo and Chinde Wash. NIIP controls water distribution for NAPI. These direct discharges affect the hydrologic regime of the two channels. Direct discharges from NIIP occur throughout the irrigation season, which typically occurs from April through October. Chinde Wash is further affected by NAPI irrigation return flows in the form of springs which produce a perennial base flow to an otherwise ephemeral dry wash in the Chinde Arroyo.

Perennial flows in Chinde Wash combined with large, periodic, direct discharges have increased vegetative growth in the channel bottom. The large direct discharges have likely increased channel and bank erosion rates compared to background conditions. The net effect of NIIP irrigation activities for the Chinde is a volumetric increase in sediment transported downstream toward the permit boundary and the creation of a perennial, vegetated stream through the permit area.

Due to the artificial, perennial nature of Chinde Wash and possible gains/losses to surface flows, Navajo Mine completed a one-year study specifically to quantify gains/losses along specific reaches on the Chinde Wash. The main conclusions of the study (NM0003F, Part 6, Section 41, Probable Hydrologic Consequences) are provided below:

> *"Synoptic flow measurements and continuous flow data have adequately characterized and documented gains and losses of surface water flows along specific reaches of Chinde Wash. Specifically, the data collected support the conclusion that future reconstructed channels built in spoils will not significantly alter surface water flows due to vertical infiltration. The data also record that flow volume increased from CD-1A to CD-2A during large, high intensity storm events."*

The Cottonwood Arroyo is also affected by NIIP irrigation return flows; however, discharges have not produced perennial flow. The lack of perennial flow in Cottonwood compared to Chinde Wash is due to many factors, including; (1) the amount of water discharged from the NIIP canal; (2) the greater distance between the NIIP operations and Navajo Mine monitoring station (CN-2 is approximately 8 miles downstream from the NIIP canal); (3) a larger drainage area than Chinde Wash drainage area; (4) a different local geology and geomorphology; and (5) the greater distance from irrigation return flows from irrigated fields.

Although Cottonwood Arroyo lacks perennial flow, upstream NIIP discharges are eroding and remobilizing significant amounts of stored sediment from large Holocene, eolian sand dunes. Due to these discharges, very large headcuts and channel widening follows immediately downstream of the NIIP discharge points resulting in considerable sediment volume moving downstream toward Navajo Mine in the North Fork and Main Fork of Cottonwood Arroyo. This volume of sediment moving past monitoring stations

CN-1 and CNS-1 influenced data that was collected by Navajo Mine. Monitoring at these locations was discontinued in May 2000, but was reactivated in July 2013.

2.3 Surface Water Quantity

The Chinde Wash Study characterized both the NAPI and storm flows in detail upstream, downstream, and across the Navajo Mine. The results are presented in Electronic Permit NM0003F and include hydrographs for various flow events and a summary of flow volumes. Surface water quantity data collected with continuous stage recorders (including 1999 data) from Cottonwood Arroyo is summarized in Part 2, Section 18, PAP NM0003F.

2.4 Surface Water Quality

Surface water quality data generated during 2013 through September 2014 are provided in Appendix 6-1 and statistical reports with historical data are presented in Appendix 6-2. The TDS concentrations are lower at the Cottonwood tributary upstream stations CS-2A and CS-2B that are not impacted by NAPI irrigation than at the Cottonwood tributary upstream stations CN-2 that is impacted by NAPI irrigation. The TDS concentrations at the Cottonwood downstream station CNS-1 are typically higher than at the tributary upstream stations not impacted by NAPI irrigation but lower than at the tributary upstream stations that are impacted by NAPI irrigation. The TSS concentrations are extremely variable at all the monitoring stations.

Time versus concentration plots were compiled for the following parameters: pH, specific conductance, total dissolved solids (TDS), total suspended sediment (TSS), total iron, dissolved iron, total manganese, dissolved manganese, sulfate, chloride, fluoride, boron, and selenium (Appendix 6-3). Total recoverable manganese and total recoverable iron were analyzed during the monitoring period for the samples from the Cottonwood Arroyo monitoring stations. These data were plotted and compared with total iron and total manganese concentrations previously monitored at CNS-1. The parameters graphed were selected because they are associated with regulatory requirements and because they are considered indicators for potential constituents resulting from mining activities.

For the main channels, upstream data is plotted against downstream data for the same parameters (Appendix 6-3). Caution must be exercised when making upstream-downstream comparisons of only water quality data because the plots do not account for differences in flow due to variations in precipitation duration and intensity and channel flow dynamics between monitoring stations, channel segments, and individual watersheds. Despite these limitations, the plots do show general agreement for chemical constituents, particularly in Chinde Wash.

Constituent levels in Chinde Wash flows are variable within a year. However, TDS, sulfate, chloride, and total iron concentrations appear to be higher at the downstream station CD-2A compared to the upstream station CD-1A. This is expected as dissolved ions typically increase in the downstream direction due to evapotranspiration influences. On the other hand, concentrations of total suspended solids, dissolved iron and dissolved manganese appear to be higher at the upstream station. The variability in fluoride concentrations and the mean fluoride concentration are both lower at the downstream station (CD-2A) compared to the upstream station (CD-1A). Boron outliers were observed at station CD-1A on 12/19/2007 and at station CD-2A on 2/28/2005. These outliers are about 3 orders of magnitude higher than the other boron concentrations, indicating that perhaps the results in ug/l were reported as mg/l concentrations. Selenium concentrations are similar at the two stations except for the 0.1 mg/l selenium spikes observed at station CD-2A on 12/5/2001 and on 3/24/2010.

Dissolved solid concentrations appear to be seasonal with the greatest concentrations occurring during winter periods and the lowest concentrations occurring during summer periods. This relationship provides an indication that NAPI irrigation return flows are impacting the Chinde Wash hydrologic system. In autumn, the pivot head irrigation systems are shut off, resulting in reductions of return flow. The reduced fresh water recharge from the irrigation return results in longer residence times and increased concentration of TDS in winter.

The variability in TSS concentrations and the mean TSS concentration at the downstream station (CNS-1) appear higher for the 2013-2014 monitoring period compared to the results obtained during the 1997-1999 monitoring period. TDS concentrations at the downstream station (CNS-1) appear similar in the 2013-2014 and the 1997-1999 monitoring periods.

Another tool for presenting and comparing water quality data are Piper trilinear diagrams. A trilinear diagram plots groupings of major dissolved ionic constituents in terms of percentages on an equilateral triangle. Applications of the diagram include determining the water type for a particular stream station or well, determining water sources or identifying mixtures of different water types. For this report, the trilinear diagrams are used for making comparisons of water types between upstream station samples and downstream station samples.

The trilinear diagram plot (Appendix 6-4) of grab samples collected at the Chinde Wash stations depicts a sodium-sulfate water type with minor differences between upstream and downstream stations. Samples from CD-2A have relatively less sodium and more sulfate and calcium than station CD-1A located nine miles upstream on the Chinde Wash. The difference in water types likely reflects the typical increase in calcium and sulfate concentrations in the small streams crossing the Fruitland Formation. Although sodium and chloride are in relatively lower proportions in the samples as indicated by the piper diagram, the concentrations of these constituents also increase in the downstream direction, indicating the effects of evaporation and the evapotranspiration by vegetation communities that has formed in the Chinde Wash. The same affect is likely the major cause for the increase in mean TDS concentrations from 952 mg/l upstream to 1441 mg/l downstream in Chinde Wash for surface water data recorded during 2013 through August 2014.

Water quality data plotted on the diagram for the stations on Chinde Wash and the CNS-1, CN-1, CN-2 and CS-1 stations on Cottonwood Arroyo depict relatively similar water types. The plots show minor differences in the relative composition of sulfate for stations

CN-1 and CN-2 on Cottonwood North. These results are for samples taken at approximately the same location but for different time periods. These differences are likely due to natural variability in ion composition in storm water flows and, perhaps, differences in NAPI irrigation influences between the two time periods. The relative composition of sulfate is similar at stations CN-1 and CN-2 on Cottonwood North and at the Chinde Wash downstream station CD-2A; however the waters at CD-2A are less sodium dominated and instead have slightly more calcium compared with the Chinde Wash upstream and Cottonwood Arroyo samples. Finally, the Cottonwood Arroyo upstream tributary station CS-2B samples are bicarbonate dominated and have little chloride and low sulfate compared to the samples from the other locations. The differences in the ionic composition at these locations are related to differences in source waters, evapotranspiration effects, and differences in local surficial geology and soils.

Due to the stochastic nature of water quality as a result of uneven and localized precipitation events, varied geologic conditions, and sources of surface water (i.e. precipitation events versus NAPI discharges and return flows), OSMRE agreed in 2012 to eliminate reference criteria for surface water flows. Navajo Mine will continue to monitor and report surface water quality measured at Navajo Mine. The 2013-2014 data continue to indicate that surface waters flows through the Navajo Mine permit area are not being significantly impacted by Navajo Mine operations. The greatest potential for any adverse impacts to the hydrologic system appear to result from NAPI irrigation return flows and direct discharges.

2.5 Summary

The surface water quality data reported is shown to be variable both historically and during the period between2013 and September 2014. The variability in water quality is representative of ephemeral sand-bed wash hydrologic environments with influences from irrigation discharges and return flows.

3.0 GROUNDWATER MONITORING PROGRAM

3.1 Approved Monitoring Program

In 2012 and 2013, Navajo Mine expanded its Groundwater Monitoring Program by drilling several new wells and by increasing the monitoring frequency at some existing wells. Twenty-two wells are now monitored at Navajo Mine. The geologic unit represented by each well is presented in Table 3-1. Data generated from 2013 through September 2014 from the monitoring wells are presented in Appendices 5 through 8. Well locations are shown on Exhibit 8-1 of Electronic Permit NM0003F.

The well identification number translates to the symbol for the geologic time period of the formation being monitored (i.e., K = Cretaceous); the symbol for the geologic formation that the well is completed in (i.e., f = Fruitland Formation); and the year it was constructed. The suffix (i.e., b) added to the end of the well number designates a well cluster at one location. Bedrock wells are sampled in the third quarter each year. Alluvial wells were sampled semi-annually until 2012, and are now sampled on a quarterly basis. A more detailed description of the Groundwater Monitoring Program is provided in Part 6, Section 42 of Electronic Permit NM0003F.

Table 3-1 Groundwater Wells and Major Units

Major Unit	Well Number	Location	Sampling Frequency
Coal Seam No. 8	Kf84-16	Bitsui	Annual
	KF83-1	Bitsui	Annual
	Kf84-18b	Hosteen/Yazzie	Annual
	Kf84-22a	Dixon	Annual
	Bitsui-2	Bitsui	Annual
Coal Seam No. 7	Kf84-22b	Dixon	Annual
	KF7-12-1	Lowe	Annual
Coal Seam No. 4-6	Kf84-18a	Hosteen/Yazzie	Annual
	KF4-12-1	Lowe	Annual
Coal Seam No. 3	KF3-12-1	Lowe	Annual
	KF3-12-2	Cottonwood	Annual
	KF3-12-3	Cottonwood	Annual
Quaternary Alluvium (QAL)	QAC-1	Chinde	Quarterly
	QACW-2	Cottonwood	Quarterly
	CWA-1b	Cottonwood	Quarterly
	CWA-2	Cottonwood	Quarterly
	CWA-3	Cottonwood	Quarterly
	CWA-4	Cottonwood	Quarterly
	CA-2	Chinde	Quarterly
	CA-3	Chinde	Quarterly
	CA-4	Chinde	Quarterly
	CA-5	Chinde	Quarterly

3.2 Groundwater Quality

Laboratory results for groundwater samples collected from 2013 through September are presented in Appendix 6-5. A statistical summary, listed by well number, of the historic data from 1985 through September 2014 is presented in Appendix 6-6. Time versus concentration plots for data generated from 1985 through September 2014 were compiled for the indicator parameters of pH, specific conductance, TDS, sulfate, selenium, potassium and magnesium. These data are presented in Appendix 6-7. The parameters graphed were selected because of their regulatory significance and because they are considered indicators for potential constituents resulting from mining activities.

Groundwater data from 2013 through September 2014 were compared to historic data to determine trends. In addition, the 2013 through September 2014 data were compared to reference criteria (Table 42-6 NM0003F). Sample parameters that were greater than reference criteria are identified and discussed below by geologic unit. Historic data from 1985 through September 2014 are plotted on Piper trilinear diagrams by geologic unit (Appendix 6-8).

3.2.1 Groundwater Quality – Coal Seams

An assessment of each geologic unit or coal seam is provided in this section.

3.2.1.1 No. 8 Coal Seam

No exceedances of reference criteria were noted in samples from KF84-22a and KF84-18b during the 2013 through September 2014 timeframe. Since Bitsui-2 was added to the sampling routine in 2012, a statistically significant number of groundwater samples have not yet been collected to develop reference criteria.

The Piper trilinear diagram of lab samples obtained from the No. 8 seam wells depicts some variability in the water type between wells (Appendix 6-8). The water type is dominated by sodium, and varies between sodium chloride (Kf84-18b) and sodium sulfate (Kf84-22a).

3.2.1.2 No. 7 Coal Seam

No parameters exceeded reference criteria in well KF84-22b in 2013. The water type in No. 7 Coal Seam is dominated by sodium, and varies between a sodium chloride (KF84-22b). KF84-20c was affected by mining activities in 2012 and was replaced with KF7-12-1. Well KF7-12-1 has been dry since it was added to the sampling routine in 2012.

3.2.1.3 No. 4-6 Coal Seam

No parameters measured in 2013 and 2014 from well KF84-18a exceeded reference criteria. KF84-18a water is classified as sodium chloride. KF84-20b had been dry since 1999. In 2012, the well was affected by mining activities and abandoned. It was replaced by KF4-12-1. Although KF4-12-1 contained some groundwater in September of 2012, the amount was insufficient to sample. KF4-12-1 has been dry during annual monitoring in 2013 and 2014 and will continue to be monitored annually to monitor groundwater recovery in the No. 4 Coal Seam adjacent to the Lowe Pit.

3.2.1.4 No. 2-3 Coal Seam

Well KF84-20a had insufficient water quantity to sample in 2011. The well was abandoned in 2012 and replaced with KF3-12-1. When the sample collected from KF3-12-1 in 2012 was compared to the reference criteria of the abandoned KF-84-21a, there were no exceedances. Well KF3-12-1 had insufficient water quantity to sample in 2013 and 2014. No. 3 Coal Seam Wells KF3-12-2 and KF3-12-3 were also installed in year 2012 the near the Cottonwood Pit. These wells were dry during annual monitoring visits in 2013 and 2014.

3.2.2 Pictured Cliffs Sandstone

Well KP84 was completed in the Pictured Cliffs Sandstone. Monitoring was discontinued 2002 (effective 8-8-02), because this well did not yield sufficient quantities of water for sample collection. The well was subsequently abandoned.

3.2.3 Quaternary Alluvium

The Navajo Mine Groundwater Monitoring Program was expanded in 2012 and 2013 to include four additional wells on the Cottonwood Arroyo and five additional wells in the Chinde Arroyo.

Monitoring well CWA-1a was installed along the Cottonwood North Branch in late-spring 2012. The well was damaged in July 2012 by a flood event to such a degree that it needed to be replaced. In April 2013, CWA-1a was abandoned and replaced with CWA-1b. Initial sampling of CWA-1b began in May 2013. The water is a calcium/sodium sulfate type water.

CWA-2 in the Middle Branch of Cottonwood Arroyo has been dry since installation. CWA-3, in the South Branch of Cottonwood Arroyo, upstream of mining, has occasionally had some water, but this amount has been insufficient to sample..

Monitoring Well QACW-2, on the Cottonwood Arroyo downstream of mining, has been dry since 1992. CWA-4 has been sampled quarterly in 2013 and 2014. The water is a sodium sulfate type water, as opposed to the sodium/calcium sulfate water in CWA-1b. Alluvial well CWA-1b was first sampled in August 2013. Reference criteria have not been developed for the recently installed wells CWA-1b and CWA-4. During the 2013-2014 monitoring period the TDS and sulfate concentrations were higher at the Cottonwood Arroyo upstream alluvial monitoring well CWA-1b compared to the concentrations observed at the Cottonwood Arroyo alluvial monitoring well CWA-4 located downstream of mining.

Monitoring Well QAC-1 has been monitored consistently since 1985. Groundwater samples collected from well QAC-1 quarterly during the 2013 through September 2014 monitoring period exceeded the reference criteria for TDS. The reference criteria for sulfate were exceeded in four of the seven quarterly samples collected during the monitoring period.

A long-term shift in pH levels in the range from 7.5 to 8.0 to pH levels in the range from 7.0 and 7.5 is evident at QAC-1, and appears to have stabilized at this range (Appendix 6-7). However, occasional spikes of pH to levels slightly above 8.0 are still observed. A long term trend of increasing conductivity appears to have leveled off, and may even be decreasing. Since 2009, conductivity appears to have dropped by approximately 2000 μmhos/cm from peak concentrations between 2004 and 2009. This trend is even more apparent in the chart of TDS. All of the TDS data collected in the 2013-2014 period is above the reference level of 13,400 mg/L. There are no apparent long-term trends in the concentrations of sulfate, selenium or potassium. A long term increasing concentration trend does appear in the plot for magnesium.

The monitoring record is too short to reliably detect trends in the constituent concentrations at the Chinde alluvial wells CA-2, CA-3, CA-4 and CA-5. Well CA-5, located just above the Big Fill, exhibits the highest TDS and sulfate concentrations while well CA-4, located within the cottonwood stand just above the Big Fill, exhibits the lowest TDS and sulfate concentrations for these wells that were recently completed in the Chinde alluvium. Likewise, the monitoring record is too short to reliably detect trends in the constituent concentrations at the recently completed Cottonwood alluvial wells CWA-1b and CWA-4.

3.3 Groundwater Quantity

Static water level elevations are presented as hydrographs in Appendix 6-7. The static water level elevation is measured from a designated location (reference elevation) at each well.

The hydrographs for the No. 8 coal seam monitoring wells show that water level elevations have increased for KF84-18b from 2002 to present. Water level elevations in KF84-22a show a decreasing trend that accelerated in about 2003. Well KF84-22b (No. 7 seam) also shows a decline in water level elevations. The decreasing trends above indicate drawdown due to advancing mining operations. The static water level elevation measurements for well KF84-18a (No. 4-6 seam) declined from the period of 1985 to 1996; stabilized from 1997 through 1998; since then static water level elevation measurements have remained relatively stable. Recovery and/or stabilization of water levels in the KF84-18 wells probably indicate recovery where pits have been backfilled. Static water level elevations in wells KF84-20a and KF84-21a (affected by mining operations and subsequently abandoned), completed in the No. 2-3 seams, had been gradually decreasing throughout the data record. These decreases indicated localized drawdown resulting from advancing mining operations.

The Navajo Mine Electronic Permit, Part 6, Section 41, Probable Hydrologic Consequences, Section 41.3.1 predicts a local drop in water level elevations for the water bearing units of the Fruitland Formation while mine-pits are open. Following mining, recharge to bedrock water bearing units adjacent to the mine is expected to result in gradual water level elevation increases.

The Chinde alluvium at the downstream lease boundary (QAC-1) is characterized by steadily increasing water level elevations. These water level elevation increases likely result from NAPI irrigation water return flows as opposed to precipitation. Water levels driven by precipitation would show much greater fluctuation over time due to drought and heavy precipitation cycles. Until recently, increasing concentrations in TDS and sulfate have also been observed. This increase in TDS and sulfate concentrations may be caused as rising groundwater encounters sediments previously enriched with soluble salts from capillarity. In addition, these sediments would be expected to be relatively non-weathered and therefore would be enriched in soluble minerals available for dissolution into groundwater. However, there are likely multiple factors leading to the increase in TDS, including evapotranspiration.

3.4 Summary

Constituent concentrations slightly above reference criteria were identified in groundwater samples from several wells during the 2013-2014 monitoring period. However, no trends in water quality parameters associated with mining activities were identified in bedrock wells. Trends in groundwater quantity and quality parameters at QAC-1 suggest that the NAPI irrigation water return flows could be affecting alluvial groundwater in the Chinde. Periodic, anomalous values (high or low) are considered typical of natural groundwater quality fluctuations for water bearing units at Navajo Mine. In both the bedrock units and the alluvium water types are typically dominated by sodium sulfate, although some wells have chloride or bicarbonate as the dominant anion.

As predicted by the PHC model, recorded static water levels show a decline in elevation of water levels in wells near the open pits.

4.0 PRECIPITATION

Continuous precipitation monitoring data is collected at Navajo Mine from three locations, Met I and Met II and Met III (locations shown in Electronic Permit NM003F Part 1, Section 9, Exhibit 9-1). Met I and II have collected continuous rainfall data since

April and May of 1991 respectively. Met III has collected rainfall data since April of 2006.

The mean annual precipitation for Navajo Mine, determined from data collected from 1991 through 2014 (for Met I, II) and III (starting from 2006), is 5.48 inches with a maximum of 9.07 inches recorded in 1997 and a minimum of 3.12 inches recorded in 2012.

The continuous precipitation data collected for the year 2012 is summarized in Table 4.1. Precipitation in 2012 was 3.02 inches below average at MET I, 1.89 inches below normal at MET II, and 2.5 inches below normal at MET III. Precipitation data combined from MET I, MET II and MET III for 2012 was 2.47 inches below normal.

The continuous precipitation data collected for 2013 is summarized in Table 4.2. Precipitation in 2013 was 1.63 inches above average at MET I, 1.27 inches above normal at MET II, and 0.05 inches above normal at MET III. Precipitation data combined from MET I, MET II and MET III for 2013 was 0.65 inches above normal.

The continuous precipitation data collected for Jan-August 2014 is summarized in Table 4.3. Precipitation was 0.11 inches below average (to the end of the 2nd quarter) at MET I, 0.45 inches below normal at MET II, and 0.71 inches below normal at MET III. Precipitation data combined from MET I, MET II and MET III for Jan-August 2014 was 0.40 inches below normal (to the end of the 2nd quarter).

Met Station data summarized in a tabular format can be found in Appendix 6-9.

Table 4.1 2012 Precipitation Summary

Station	Met Station 1 (in.)		Met Station II (in.)		Met Station III (in.)		Average Precipitation values (in.)	
	Normal[1]	2012	Normal[1]	2012	Normal[1]	2012	Normal[2]	2012
1st Qtr	1.18	0.42	0.92	0.35	0.97	0.24	1.02	0.34
2nd Qtr	1.32	0.16	0.89	0.35	0.95	0.34	1.05	0.28
3rd Qtr	2.14	1.56	1.95	1.8	2.74	2.05	2.28	1.80
4th Qtr	1.38	0.86	1.19	0.56	1.19	0.67	1.25	0.70
Total	6.02	3.00	4.95	3.06	5.84	3.30	5.60	3.12
Yearly Departure from normal	3.02 inches below average or 50% of normal		1.89 inches below average or 61% of normal		2.5 inches below average or 56% of normal		2.47 inches below average or 56% of normal	

1= Normal calculated using the quarterly averages of precipitation data from 1992-2012.
2= Normal calculated using the quarterly averages of precipitation data from 2007-2012.
3= Normal calculated using the average of quarterly averages of precipitation data from 1992-2012 for both Met I and Met II and quarterly values 2008-2012 for Met III.

Table 4.2 2013 Precipitation Summary

Station	Met Station 1 (in.)		Met Station II (in.)		Met Station III (in.)		Average Precipitation values (in.)	
	Normal[1]	2013	Normal[1]	2013	Normal[1]	2013	Normal[2]	2013
1st Qtr	1.19	1.35	0.92	1.08	0.97	0.96	1.03	1.13
2nd Qtr	0.99	0.40	0.87	0.45	0.88	0.48	0.91	0.44
3rd Qtr	2.23	3.94	2.01	3.18	2.75	2.80	2.33	3.31
4th Qtr	1.39	0.86	1.21	1.57	1.24	1.54	1.28	1.32
Total	5.80	7.43	5.01	6.28	5.83	5.78	5.55	6.20
Yearly Departure from normal	1.63 inches above average or 128% of normal		1.27 inches above average or 125% of normal		0.05 inches below average or 100% of normal		0.65 inches above average or 112% of normal	

1= Normal calculated using the quarterly averages of precipitation data from 1992-2013.
2= Normal calculated using the quarterly averages of precipitation data from 2007-2013.
3= Normal calculated using the average of quarterly averages of precipitation data from 1992-2013 for both Met I and Met II and quarterly values 2008-2013 for Met III.

Table 4.3 2014 (Jan -August) Precipitation Summary

Station	Met Station 1 (in.)		Met Station II (in.)		Met Station III (in.)		Average Precipitation values (in.)	
	Normal[1]	2014	Normal[1]	2014	Normal[1]	2014	Normal[2]	2014
	(Jan-August)		(Jan-August)		(Jan-August)		(Jan-August)	
1st Qtr	1.20	1.31	0.92	0.78	1.11	0.81	1.08	0.97
2nd Qtr	0.98	0.76	0.86	0.65	0.82	0.40	0.89	0.60
3rd Qtr	-	-	-	-	-	-	-	-
4th Qtr	-	-	-	-	-	-	-	-
Total	2.18	2.07	1.78	1.33	1.93	1.21	1.97	1.57
Yearly Departure from normal	0.11 inches below average or 95% of normal		0.45 inches below average or 75% of normal		0.71 inches below average or 63% of normal		0.40 inches below average or 80% of normal	

1= Normal calculated using the quarterly averages of precipitation data from 1992- August 2014.

2= Normal calculated using the quarterly averages of precipitation data from 2007- August 2014.

3= Normal calculated using the average of quarterly averages of precipitation data from 1992-August 2014 for both Met I and Met II and quarterly values 2008- August 2014 for Met II.

Appendix 6-1

2013 and 2014 Surface Water Sample Data

Appendix 6-1. 2013 2014 Surface Water Sample Data

Station Name	Sample Date	Lab pH S.U.	Lab Conduct umho/cm	TDS -180 mg/l	TSS mg/l	Settl. Solids mL/l	Alkalin as CaCO3 mg/l	Hardness as CaCO3 mg/l	Boron mg/l	Fluoride mg/l	Bicarb as CaCO3 mg/l	Bicarb as hCO3	Carb as CO3 mg/l	Hydroxide mg/l
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
CD-1A	3/26/2013	7.9	2600	1530	6	<0.5	450	362	0.60	2.80	427	520	12.0	<4
CD-1A	4/17/2013	8	1300	797	8	<0.5	260	219	0.20	1.40	246	300	6.0	<4
CD-1A	8/2/2013	8.4	1090	679	<2	--	260	205	0.2	1.3	230	280	19	<4
CD-1A	8/9/2013	8.5	1190	774	4	<1.0	300	227	0.3	0.6	263	320	22	<4
CD-1A	11/19/2013	8.3	2250	1490	10	<0.5	490	299	0.6	3	443	540	27	<4
CD-1A	3/10/2014	8	2340	1610	<2	<1.0	460	293	0.6	2.6	459	560	<4	<4
CD-1A	5/7/2014	8.3	527	342	79	<0.5	130	116	<0.1	0.4	131	160	<4	<4
CD-1A	8/18/2014	8.3	628	396	8	<0.5	160	153	0.1	0.7	164	200	<4	<4
CD-2A	4/17/2013	8.2	2590	1760	52	<0.5	260	484	0.2	1.3	254	310	8	<4
CD-2A	3/10/2014	8.2	3280	2410	6	<1.0	380	626	0.3	1.2	377	460	<4	<4
CD-2A	5/7/2014	8.4	1640	1130	18	<0.5	280	302	0.2	0.9	271	330	5	<4
CD-2A	8/18/2014	8	695	465	310	<0.5	140	120	0.1	0.7	139	170	<4	<4
CM-2	9/24/2013	8.4	--	300	22200	--	87	--	--	--	--	--	--	--
CM-2	10/22/2013	7.8	--	870	167000	--	100	--	--	--	--	--	--	--
CM-2	10/22/2013	7.8	--	1240	161000	--	110	--	--	--	--	--	--	--
CN-2	7/16/2013	8	2690	1830	52	640	98	343	0.1	1.7	98	120	<4	<4
CN-2	9/24/2013	7.5	--	1550	13200	--	120	--	--	--	--	--	--	--
CN-2	9/24/2013	7.5	--	1350	127000	--	150	--	--	--	--	--	--	--
CN-2	10/22/2013	7.6	--	1990	134000	--	120	--	--	--	--	--	--	--
CN-2	10/22/2013	7.6	--	1790	114000	--	98	--	--	--	--	--	--	--
CN-2	7/14/2014	7.5	--	--	304000	--	--	--	--	--	--	--	--	--
CN-2	7/14/2014	7.6	--	--	434000	--	--	--	--	--	--	--	--	--
CN-2	8/19/2014	7.2	--	--	246000	--	--	--	--	--	--	--	--	--
CN-2	8/19/2014	7.4	--	--	224000	--	--	--	--	--	--	--	--	--

Station Name	Sample Date	Chloride mg/l	Sulfate mg/l	Calcium mg/l	Magnesium mg/l	Potassium mg/l	Sodium mg/l	Bicarbonate meq/l	Chloride meq/l	Sulfate meq/l	Calcium meq/l
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
CD-1A	3/26/2013	120	620	96.6	29.4	1.5	416	6.99	3.39	12.91	4.82
CD-1A	4/17/2013	45	320	62.6	15.2	2.4	206	4.03	1.27	6.66	3.12
CD-1A	8/2/2013	19	280	58.6	14.3	1.5	169	4.59	0.54	5.83	2.92
CD-1A	8/9/2013	25	290	64.6	15.8	1.4	183	5.24	0.71	6.04	3.22
CD-1A	11/19/2013	110	560	81.5	23.1	1.1	413	8.85	3.10	11.66	4.07
CD-1A	3/10/2014	110	580	81.3	21.9	2	421	9.18	3.10	12.08	4.06
CD-1A	5/7/2014	7	120	34.1	7.4	2.3	65	2.62	0.20	2.50	1.70
CD-1A	8/18/2014	8	130	43.1	11.2	2.3	109	3.28	0.23	2.71	2.15
CD-2A	4/17/2013	110	930	141	32.1	11.3	413	4.17	3.10	19.36	7.04
CD-2A	3/10/2014	160	1200	181	42	9.1	528	7.54	4.51	24.98	9.03
CD-2A	5/7/2014	59	540	87.7	20.2	6.2	248	5.41	1.66	11.24	4.38
CD-2A	8/18/2014	9	180	37.8	6.1	6.8	98.1	2.79	0.25	3.75	1.89
CM-2	9/24/2013	--	--	--	--	--	--	--	--	--	--
CM-2	10/22/2013	--	--	--	--	--	--	--	--	--	--
CM-2	10/22/2013	--	--	--	--	--	--	--	--	--	--
CN-2	7/16/2013	88	1100	114	14.2	6.8	453	1.97	2.48	22.90	5.69
CN-2	9/24/2013	--	--	--	--	--	--	--	--	--	--
CN-2	9/24/2013	--	--	--	--	--	--	--	--	--	--
CN-2	10/22/2013	--	--	--	--	--	--	--	--	--	--
CN-2	10/22/2013	--	--	--	--	--	--	--	--	--	--
CN-2	7/14/2014	--	--	--	--	--	--	--	--	--	--
CN-2	7/14/2014	--	--	--	--	--	--	--	--	--	--
CN-2	8/19/2014	--	--	--	--	--	--	--	--	--	--
CN-2	8/19/2014	--	--	--	--	--	--	--	--	--	--

Appendix 6-1. 2013 2014 Surface Water Sample Data (Continued)

Station Name	Sample Date	Magnesium meq/l	Potassium meq/l	Sodium meq/l	Fe mg/l	Mn mg/l	Se mg/l	Total Fe mg/l	Total Mn mg/l	T-Rec Fe mg/l	T-Rec Mn mg/l	T-Rec Al mg/l	T-Rec Hg mg/l
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
CD-1A	3/26/2013	2.42	0.04	18.10	<0.05	0.17	0.008	0.15	0.168	--	--	--	--
CD-1A	4/17/2013	1.25	0.06	8.96	<0.05	0.058	0.002	0.35	0.064	--	--	--	--
CD-1A	8/2/2013	13.91	0.12	0.02	<0.05	0.057	0.001	0.08	0.057	--	--	--	--
CD-1A	8/9/2013	15.06	0.13	0.03	<0.05	0.071	0.002	0.08	0.067	--	--	--	--
CD-1A	11/19/2013	33.99	0.23	0.13	0.2	0.1	0.007	<0.05	0.094	--	--	--	--
CD-1A	3/10/2014	34.64	0.23	0.13	0.07	0.222	0.006	0.27	0.23	--	--	--	--
CD-1A	5/7/2014	5.35	0.07	0.01	<0.05	0.014	<0.001	2.2	0.043	--	--	--	--
CD-1A	8/18/2014	8.97	0.08	0.01	<0.05	0.04	0.003	0.36	0.046	--	--	--	--
CD-2A	4/17/2013	2.64	0.29	17.97	<0.05	0.014	0.002	1.6	0.032	--	--	--	--
CD-2A	3/10/2014	43.45	0.19	0.20	<0.05	0.013	0.005	0.21	0.015	--	--	--	--
CD-2A	5/7/2014	20.41	0.14	0.07	<0.05	0.011	<0.001	0.51	0.014	--	--	--	--
CD-2A	8/18/2014	8.07	0.07	0.01	0.11	0.006	0.001	7.77	0.087	--	--	--	--
CM-2	9/24/2013	--	--	--	--	--	--	--	--	563	9.51	606	--
CM-2	10/22/2013	--	--	--	--	--	--	--	--	2810	81.2	2410	--
CM-2	10/22/2013	--	--	--	--	--	--	--	--	3560	137	2680	--
CN-2	7/16/2013	37.28	0.05	0.11	<0.05	0.01	0.006	0.9	0.019	--	--	--	0.00002
CN-2	9/24/2013	--	--	--	--	--	--	--	--	3200	84.8	3080	--
CN-2	9/24/2013	--	--	--	--	--	--	--	--	1650	54.9	1620	--
CN-2	10/22/2013	--	--	--	--	--	--	--	--	3610	162	2950	--
CN-2	10/22/2013	--	--	--	--	--	--	--	--	2980	109	2540	--
CN-2	7/14/2014	--	--	--	--	--	--	--	--	3190	--	2960	--
CN-2	7/14/2014	--	--	--	--	--	--	--	--	3820	--	3320	--
CN-2	8/19/2014	--	--	--	--	--	--	--	--	4310	--	3970	--
CN-2	8/19/2014	--	--	--	--	--	--	--	--	3750	--	3610	--

Appendix 6-1. 2013 2014 Surface Water Sample Data (Continued)

Station Name	Sample Date	Lab pH S.U.	Lab Conduct umho/cm	TDS -180 mg/l	TSS mg/l	Settl. Solids mL/l	Alkalin as CaCO3 mg/l	Hardness as CaCO3 mg/l	Boron mg/l	Fluoride mg/l	Bicarb as CaCO3 mg/l	Bicarb as hCO3	Carb as CO3 mg/l	Hydroxide mg/l
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
CNS-1	7/12/2013	7.6	904	900	36600	--	250	95	<0.1	<0.1	254	310	<4	<4
CNS-1	7/16/2013	8.1	1440	880	281	<2	94	112	<0.1	1.3	98	120	<4	<4
CNS-1	7/16/2013	7.9	--	1000	524000	--	120	--	--	--	--	--	--	--
CNS-1	9/24/2013	8.2	--	410	9130	--	77	--	--	--	--	--	--	--
CNS-1	9/24/2013	8.1	--	360	40000	--	82	--	--	--	--	--	--	--
CNS-1	10/22/2013	7.6	--	940	112000	--	140	--	--	--	--	--	--	--
CNS-1	10/22/2013	7.7	--	940	68600	--	160	--	--	--	--	--	--	--
CNS-1	7/14/2014	7.6	--	--	312000	--	--	--	--	--	--	--	--	--
CNS-1	7/14/2014	7.6	--	--	261000	--	--	--	--	--	--	--	--	--
CNS-1	7/29/2014	7.6	--	--	182000	--	--	--	--	--	--	--	--	--
CNS-1	8/19/2014	7.4	--	--	909000	--	--	--	--	--	--	--	--	--
CNS-1	8/19/2014	7.2	--	--	685000	--	--	--	--	--	--	--	--	--
CNS-1	9/3/2014	8	--	--	58300	--	--	--	--	--	--	--	--	--
CS-2A	10/22/2013	8.5	--	430	24500	--	100	--	--	--	--	--	--	--
CS-2A	10/22/2013	8.5	--	390	28400	--	110	--	--	--	--	--	--	--
CS-2A	8/19/2014	7.7	--	--	195000	--	--	--	--	--	--	--	--	--
CS-2A	8/19/2014	7.8	--	--	157000	--	--	--	--	--	--	--	--	--
CS-2B	6/19/2013	8.3	830	650	65400	--	600	58	<0.1	<0.1	582	710	10	<4
CS-2B	10/22/2013	8.6	--	390	19300	--	95	--	--	--	--	--	--	--
CS-2B	10/22/2013	8.5	--	460	19000	--	120	--	--	--	--	--	--	--
CS-2B	8/19/2014	7.9	--	--	287000	--	--	--	--	--	--	--	--	--
CS-2B	8/19/2014	8	--	--	41600	--	--	--	--	--	--	--	--	--

Station Name	Sample Date	Chloride mg/l	Sulfate mg/l	Calcium mg/l	Magnesium mg/l	Potassium mg/l	Sodium mg/l	Bicarbonate meq/l	Chloride meq/l	Sulfate meq/l	Calcium meq/l
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
CNS-1	7/12/2013	5	210	34.3	2.2	6.6	156	5.08	0.14	4.37	1.71
CNS-1	7/16/2013	23	530	39.1	3.5	5.1	244	1.97	0.65	11.03	1.95
CNS-1	7/16/2013	--	--	--	--	--	--	--	--	--	--
CNS-1	9/24/2013	--	--	--	--	--	--	--	--	--	--
CNS-1	9/24/2013	--	--	--	--	--	--	--	--	--	--
CNS-1	10/22/2013	--	--	--	--	--	--	--	--	--	--
CNS-1	10/22/2013	--	--	--	--	--	--	--	--	--	--
CNS-1	7/14/2014	--	--	--	--	--	--	--	--	--	--
CNS-1	7/14/2014	--	--	--	--	--	--	--	--	--	--
CNS-1	7/29/2014	--	--	--	--	--	--	--	--	--	--
CNS-1	8/19/2014	--	--	--	--	--	--	--	--	--	--
CNS-1	8/19/2014	--	--	--	--	--	--	--	--	--	--
CNS-1	9/3/2014	--	--	--	--	--	--	--	--	--	--
CS-2A	10/22/2013	--	--	--	--	--	--	--	--	--	--
CS-2A	10/22/2013	--	--	--	--	--	--	--	--	--	--
CS-2A	8/19/2014	--	--	--	--	--	--	--	--	--	--
CS-2A	8/19/2014	--	--	--	--	--	--	--	--	--	--
CS-2B	6/19/2013	6	170	20.1	2	4.7	160	11.64	0.17	3.54	1.00
CS-2B	10/22/2013	--	--	--	--	--	--	--	--	--	--
CS-2B	10/22/2013	--	--	--	--	--	--	--	--	--	--
CS-2B	8/19/2014	--	--	--	--	--	--	--	--	--	--
CS-2B	8/19/2014	--	--	--	--	--	--	--	--	--	--

Station Name	Sample Date	Magnesium meq/l	Potassium meq/l	Sodium meq/l	Fe mg/l	Mn mg/l	Se mg/l	Total Fe mg/l	Total Mn mg/l	T-Rec Fe mg/l	T-Rec Mn mg/l	T-Rec Al mg/l	T-Rec Hg mg/l
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
CNS-1	7/12/2013	12.84	0.13	0.01	0.34	0.019		1010	16.6	--	--	--	--
CNS-1	7/16/2013	20.08	0.05	0.03	<0.05	0.015		7.65	0.091	--	--	--	--
CNS-1	7/16/2013	--	--	--	--	--	--	--	--	5840	177	97.8	--
CNS-1	9/24/2013	--	--	--	--	--	--	--	--	772	14.6	788	--
CNS-1	9/24/2013	--	--	--	--	--	--	--	--	964	25.4	880	--
CNS-1	10/22/2013	--	--	--	--	--	--	--	--	1780	52.8	1450	--
CNS-1	10/22/2013	--	--	--	--	--	--	--	--	1790	52.8	1470	--
CNS-1	7/14/2014	--	--	--	--	--	--	--	--	2910	--	2660	--
CNS-1	7/14/2014	--	--	--	--	--	--	--	--	3330	--	2910	--
CNS-1	7/29/2014	--	--	--	--	--	--	--	--	2780	--	2590	--
CNS-1	8/19/2014	--	--	--	--	--	--	--	--	9190	--	4570	--
CNS-1	8/19/2014	--	--	--	--	--	--	--	--	4260	--	3810	--
CNS-1	9/3/2014	--	--	--	--	--	--	--	--	1090	--	1100	--
CS-2A	10/22/2013	--	--	--	--	--	--	--	--	398	7.09	402	--
CS-2A	10/22/2013	--	--	--	--	--	--	--	--	624	12.7	559	--
CS-2A	8/19/2014	--	--	--	--	--	--	--	--	4340	--	4200	--
CS-2A	8/19/2014	--	--	--	--	--	--	--	--	2040	--	2020	--
CS-2B	6/19/2013	13.17	0.30	0.01	1.87	0.118	0.001	757	10.3	--	--	--	--
CS-2B	10/22/2013	--	--	--	--	--	--	--	--	315	5.65	--	--
CS-2B	10/22/2013	--	--	--	--	--	--	--	--	508	10.4	--	--
CS-2B	8/19/2014	--	--	--	--	--	--	--	--	2530	--	--	--
CS-2B	8/19/2014	--	--	--	--	--	--	--	--	4760	--	--	--

Appendix 6-2

Surface Water Statistical Report

Appendix 6-2: Surface Water Statistical Report

Station: ***CD-1a***

HISTORIC (1996-2012)

Parameter	Units	Mean	Standard Deviation	Median	Mode	Range	Minimum	Maximum	Count
pH	*(s.u.)*	8.2	0.2	8.3	8.2	1.3	7.3	8.6	107
EC	*(umhos/cm)*	1586	796	1530	2200	2800	260	3060	107
TDS	*(mg/l)*	1095	573	1100	785	2070	170	2240	107
TSS	*(mg/l)*	<191	559	20	<2.5	3639	<1	3640	107
Boron	*(mg/l)*	<6.9	68.02	<0.3	<0.05	703.98	<0.025	704.00	107
Fluoride	*(mg/l)*	<1.78	1.20	1.37	3.00	4.44	0.05	4.49	107
Chloride	*(mg/l)*	<51	39	38	<5	156	3	159	107
Sulfate	*(mg/l)*	484	248	540	460	1014	46	1060	107
Dissolved Fe	*(mg/l)*	<0.107	0.26	<0.025	<0.025	2.3	<0.005	2.29	107
Dissolved Mn	*(mg/l)*	<0.056	0.11	<0.025	<0.005	0.94	<0.0025	0.943	107
Se	*(mg/l)*	<0.006	0.011	<0.003	<0.003	0.100	<0.0005	0.100	107
Total Fe	*(mg/l)*	<3.66	12.12	0.37	<0.10	89.184	0.016	89.2	107
Total Mn	*(mg/l)*	<0.199	1.10	0.04	<0.030	11.395	<0.005	11.4	107

2013-2014

Parameter	Units	Mean	Standard Deviation	Median	Mode	Range	Minimum	Maximum	Count
pH	*(s.u.)*	8.2	0.2	8.3	8.3	0.6	7.9	8.5	8
EC	*(umhos/cm)*	1491	801	1245	N/A	2073	527	2600	8
TDS	*(mg/l)*	952	517	786	N/A	1268	342	1610	8
TSS	*(mg/l)*	<15	26	7	8	78	<1	79	8
Boron	*(mg/l)*	<0.3	0.23	<0.25	0.6	0.55	<0.05	0.6	8
Fluoride	*(mg/l)*	1.60	1.05	1.35	N/A	2.6	0.4	3	8
Chloride	*(mg/l)*	56	49	35	110	113	7	120	8
Sulfate	*(mg/l)*	363	200	305	N/A	500	120	620	8
Dissolved Fe	*(mg/l)*	<0.05	0.06	<0.03	<0.03	0.18	<0.03	0.20	8
Dissolved Mn	*(mg/l)*	0.092	0.070	0.065	N/A	0.208	0.014	0.222	8
Se	*(mg/l)*	<0.004	0.003	<0.003	0.002	0.008	<0.0005	0.008	8
Total Fe	*(mg/l)*	<0.44	0.723	<0.21	0.080	2.175	<0.03	2.200	8
Total Mn	*(mg/l)*	0.096	0.067	0.066	N/A	0.187	0.043	0.230	8
Aluminum, T-REC	*(mg/l)*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Iron, T-REC	*(mg/l)*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Manganese, T-REC	*(mg/l)*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Appendix 6-2: Surface Water Statistical Report

Station: ***CD-2a***

Historic (1997-2012)

Parameter	Units	Mean	Standard Deviation	Median	Mode	Range	Minimum	Maximum	Count
pH	*(s.u.)*	8.3	0.1	8.3	8.3	0.7	7.9	8.6	56
EC	*(umhos/cm)*	2281	1006	2235	3910	4620	390	5010	56
TDS	*(mg/l)*	1713	819	1555	1400	3620	250	3870	56
TSS	*(mg/l)*	<59.9	130	<17.9	8	838	<2.5	840	56
Boron	*(mg/l)*	<4.32	30.30	<0.30	0.30	226.95	<0.05	227.00	56
Fluoride	*(mg/l)*	1.24	0.43	1.20	1.60	2.42	0.29	2.71	56
Chloride	*(mg/l)*	83	51	76	135	169	5	174	56
Sulfate	*(mg/l)*	910	447	825	1550	1883	87	1970	56
Dissolved Fe	*(mg/l)*	<0.14	0.32	<0.03	<0.03	2.18	<0.01	2.18	56
Dissolved Mn	*(mg/l)*	<0.030	0.071	<0.010	<0.005	0.501	<0.003	0.503	56
Se	*(mg/l)*	<0.011	0.020	<0.005	<0.003	0.100	<0.001	0.100	56
Total Fe	*(mg/l)*	<1.31	2.06	<0.40	0.18	10.38	<0.03	10.40	56
Total Mn	*(mg/l)*	<0.410	2.802	<0.025	<0.010	20.998	<0.003	21.000	56

2013-2014

Parameter	Units	Mean	Standard Deviation	Median	Mode	Range	Minimum	Maximum	Count
pH	*(s.u.)*	8.2	0.2	8.2	8.2	0.4	8.0	8.4	4
EC	*(umhos/cm)*	2051	1127	2115	N/A	2585	695	3280	4
TDS	*(mg/l)*	1441	835	1445	N/A	1945	465	2410	4
TSS	*(mg/l)*	97	144	35	N/A	304	6	310	4
Boron	*(mg/l)*	0.20	0.08	0.20	0.20	0.20	0.10	0.30	4
Fluoride	*(mg/l)*	1.03	0.28	1.05	N/A	0.60	0.70	1.30	4
Chloride	*(mg/l)*	85	65	85	N/A	151	9	160	4
Sulfate	*(mg/l)*	713	447	735	N/A	1020	180	1200	4
Dissolved Fe	*(mg/l)*	<0.05	0.04	<0.03	<0.03	0.09	<0.03	0.11	4
Dissolved Mn	*(mg/l)*	0.011	0.004	0.012	N/A	0.008	0.0060	0.014	4
Se	*(mg/l)*	<0.002	0.002	<0.002	N/A	0.005	<0.001	0.005	4
Total Fe	*(mg/l)*	2.523	3.549	1.055	N/A	7.560	0.210	7.770	4
Total Mn	*(mg/l)*	0.037	0.034	0.024	N/A	0.073	0.014	0.087	4
Aluminum, T-REC	*(mg/l)*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Iron, T-REC	*(mg/l)*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Manganese, T-REC	*(mg/l)*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Appendix 6-2: Surface Water Statistical Report

Station: ***CN-2***

2013-2014

Parameter	Units	Mean	Standard Deviation	Median	Mode	Range	Minimum	Maximum	Count
pH	*(s.u.)*	7.5	0.2	7.5	7.5	0.8	7.2	8.0	9
TDS	*(mg/l)*	1702	252	1790	N/A	640	1350	1990	5
TSS	*(mg/l)*	177361	139466	134000	N/A	433948	52	434000	9
Alkalinity as CaCO3	*(mg/l)*	117	21	120	98	52	98	150	5
Aluminum, T-REC	*(mg/l)*	3006	711	3020	N/A	2350	1620	3970	8
Iron, T-REC	*(mg/l)*	3314	796	3405	N/A	2660	1650	4310	8
Manganese, T-REC	*(mg/l)*	102.7	45.3	96.9	N/A	107.1	54.9	162.0	4

Appendix 6-2: Surface Water Statistical Report

Station: ***CM-2***

2013

Parameter	Units	Mean	Standard Deviation	Median	Mode	Range	Minimum	Maximum	Count
pH	*(s.u.)*	8.0	0.3	7.8	7.8	0.6	7.8	8.4	3
TDS	*(mg/l)*	803	474	870	N/A	940	300	1240	3
TSS	*(mg/l)*	116733	81923	161000	N/A	144800	22200	167000	3
Alkalinity as CaCO3	*(mg/l)*	99	12	100	N/A	23	87	110	3
Aluminum, T-REC	*(mg/l)*	1899	1128	2410	N/A	2074	606	2680	3
Iron, T-REC	*(mg/l)*	2311	1560	2810	N/A	2997	563	3560	3
Manganese, T-REC	*(mg/l)*	75.9	63.9	81.2	N/A	127.5	9.5	137.0	3

Appendix 6-2: Surface Water Statistical Report

Station: ***CS-2A***

2013-2014

Parameter	Units	Mean	Standard Deviation	Median	Mode	Range	Minimum	Maximum	Count
pH	*(s.u.)*	8.1	0.4	8.2	8.5	0.8	7.7	8.5	4
TDS	*(mg/l)*	410	28	410	N/A	40	390	430	2
TSS	*(mg/l)*	101225	87740	92700	N/A	170500	24500	195000	4
Alkalinity as CaCO3	*(mg/l)*	105	7	105	N/A	10	100	110	2
Aluminum, T-REC	*(mg/l)*	1795	1761	1290	N/A	3798	402	4200	4
Iron, T-REC	*(mg/l)*	1851	1812	1332	N/A	3942	398	4340	4
Manganese, T-REC	*(mg/l)*	9.9	4.0	9.9	N/A	5.6	7.1	12.7	2

Appendix 6-2: Surface Water Statistical Report

Station: ***CS-2B***

2013-2014

Parameter	Units	Mean	Standard Deviation	Median	Mode	Range	Minimum	Maximum	Count
pH	*(s.u.)*	8.3	0.3	8.3	N/A	0.7	7.9	8.6	5
TDS	*(mg/l)*	500	135	460	N/A	260	390	650	3
TSS	*(mg/l)*	86460	113725	41600	N/A	268000	19000	287000	5
Alkalinity as CaCO3	*(mg/l)*	272	285	120	N/A	505	95	600	3
Aluminum, T-REC	*(mg/l)*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Iron, T-REC	*(mg/l)*	2028	2079	1519	N/A	4445	315	4760	4
Manganese, T-REC	*(mg/l)*	8.0	3.4	8.0	N/A	4.8	5.7	10.4	2

Appendix 6-2: Surface Water Statistical Report

Station: ***CNS-1***

Historic (1997-1999)

Parameter	Units	Mean	Standard Deviation	Median	Mode	Range	Minimum	Maximum	Count
pH	*(s.u.)*	8.2	0.2	8.2	8.1	0.8	7.8	8.6	19
EC	*(umhos/cm)*	861	269	810	640	1000	590	1590	19
TDS	*(mg/l)*	639	189	580	540	790	360	1150	19
TSS	*(mg/l)*	97282	35178	84600	145000	120200	48800	169000	17
Boron	*(mg/l)*	0.08	0.08	0.06	0.05	0.37	0.03	0.39	18.00
Fluoride	*(mg/l)*	<0.74	0.22	0.80	0.81	0.96	<0.03	0.98	19.000
Chloride	*(mg/l)*	17	11	13	11	41	6	47	19
Sulfate	*(mg/l)*	277	157	268	N/A	668	50	718	19
Dissolved Fe	*(mg/l)*	<6.65	8.57	<3.33	<0.01	34.29	<0.01	34.30	18.000
Dissolved Mn	*(mg/l)*	0.337	0.430	0.150	0.005	1.345	0.005	1.350	19.000
Se	*(mg/l)*	0.003	0.001	0.003	0.003	0.003	0.003	0.005	19
Total Fe	*(mg/l)*	0.34	0.43	0.15	0.01	1.35	0.01	1.35	19
Total Mn	*(mg/l)*	5.843	6.207	4.920	N/A	22.040	0.060	22.100	19.000

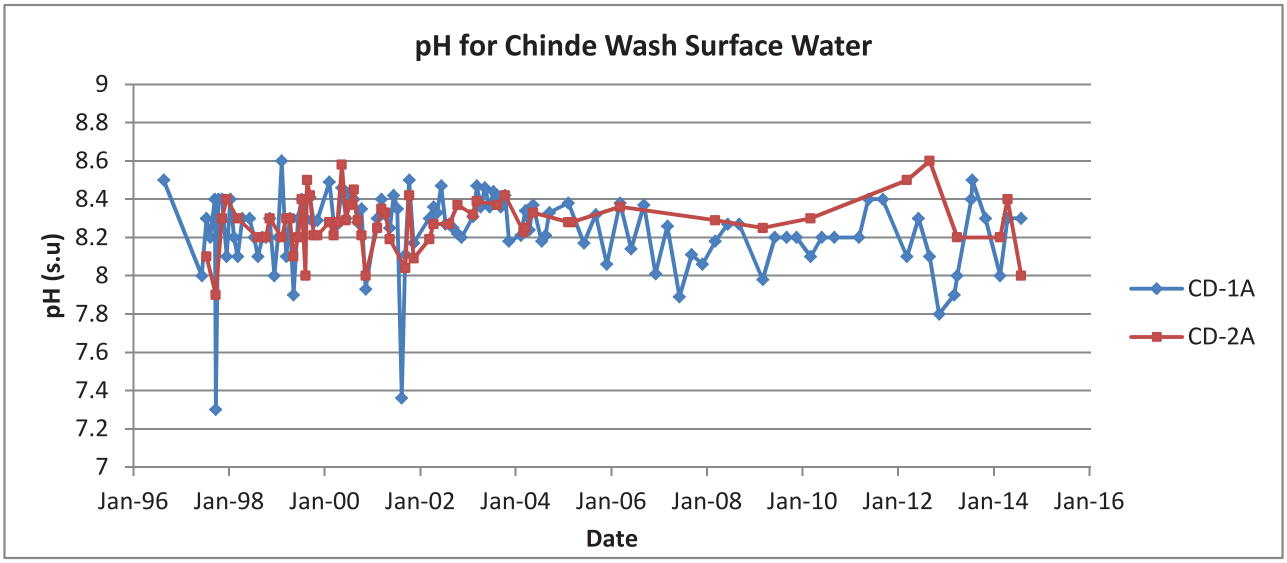
2013-2014

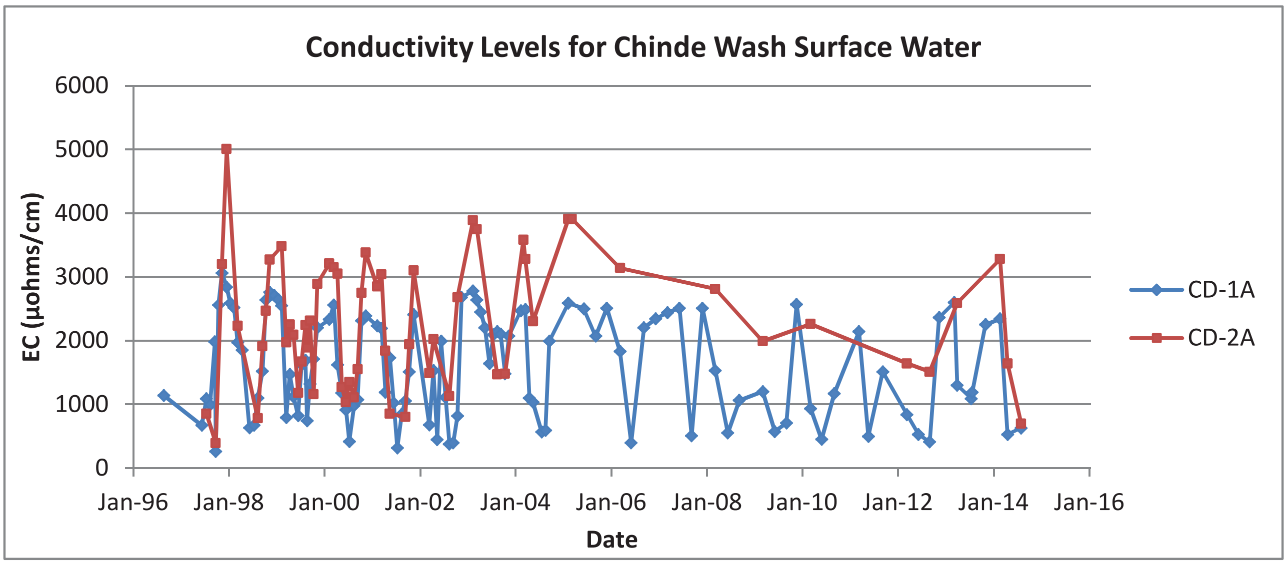
Parameter	Units	Mean	Standard Deviation	Median	Mode	Range	Minimum	Maximum	Count
pH	*(s.u.)*	7.7	0.3	7.6	7.6	1.0	7.2	8.2	13
EC	*(umhos/cm)*	1172	379	1172	N/A	536	904	1440	2
TDS	*(mg/l)*	776	270	900	940	640	360	1000	7
TSS	*(mg/l)*	245993	289494	112000	N/A	908719	281	909000	13
Boron	*(mg/l)*	<0.05	0.00	<0.05	<0.05	0.00	<0.05	<0.05	2
Fluoride	*(mg/l)*	<0.68	0.88	<0.68	N/A	1.25	<0.05	1.30	2
Chloride	*(mg/l)*	14	13	14	N/A	18	5	23	2
Sulfate	*(mg/l)*	370	226	370	N/A	320	210	530	2
Dissolved Fe	*(mg/l)*	<0.18	0.22	<0.18	N/A	0.32	<0.03	0.34	2
Dissolved Mn	*(mg/l)*	0.017	0.003	0.017	N/A	0.004	0.0150	0.019	2
Se	*(mg/l)*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total Fe	*(mg/l)*	508.825	708.768	508.825	N/A	1002.350	7.650	1010.000	2
Total Mn	*(mg/l)*	8.346	11.674	8.346	N/A	16.509	0.091	16.600	2
Aluminum, T-REC	*(mg/l)*	2030	1386	1470	N/A	4472	98	4570	11
Iron, T-REC	*(mg/l)*	3155	2522	2780	N/A	8418	772	9190	11
Manganese, T-REC	*(mg/l)*	64.5	65.1	52.8	52.8	162.4	14.6	177.0	5

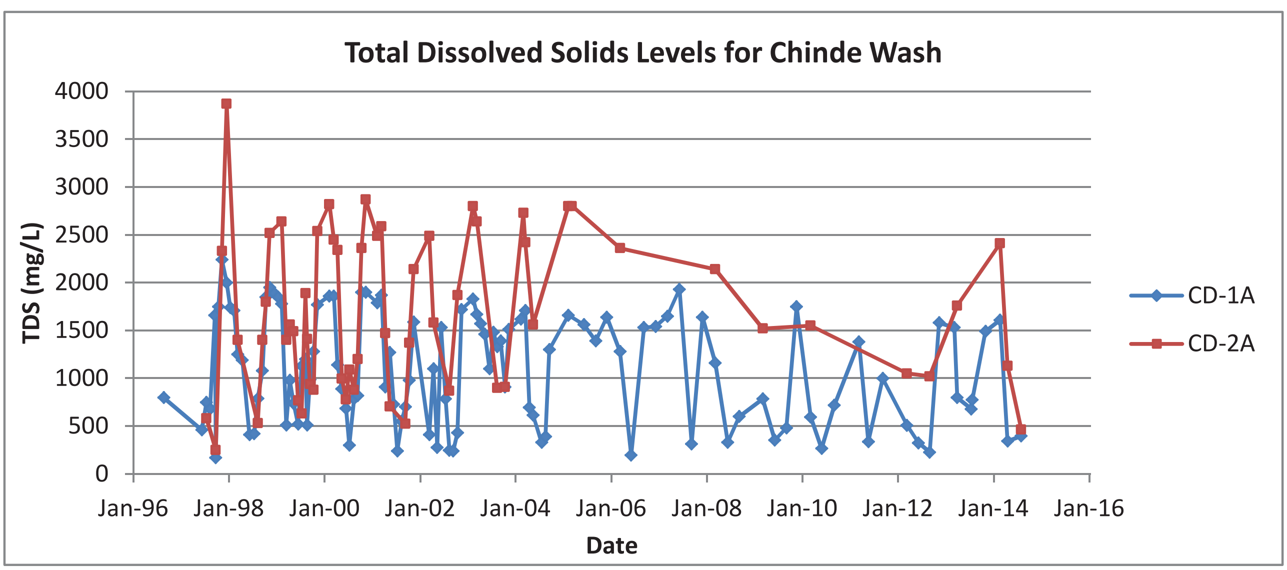
Appendix 6-3

Surface Water Time versus Concentration Graphs

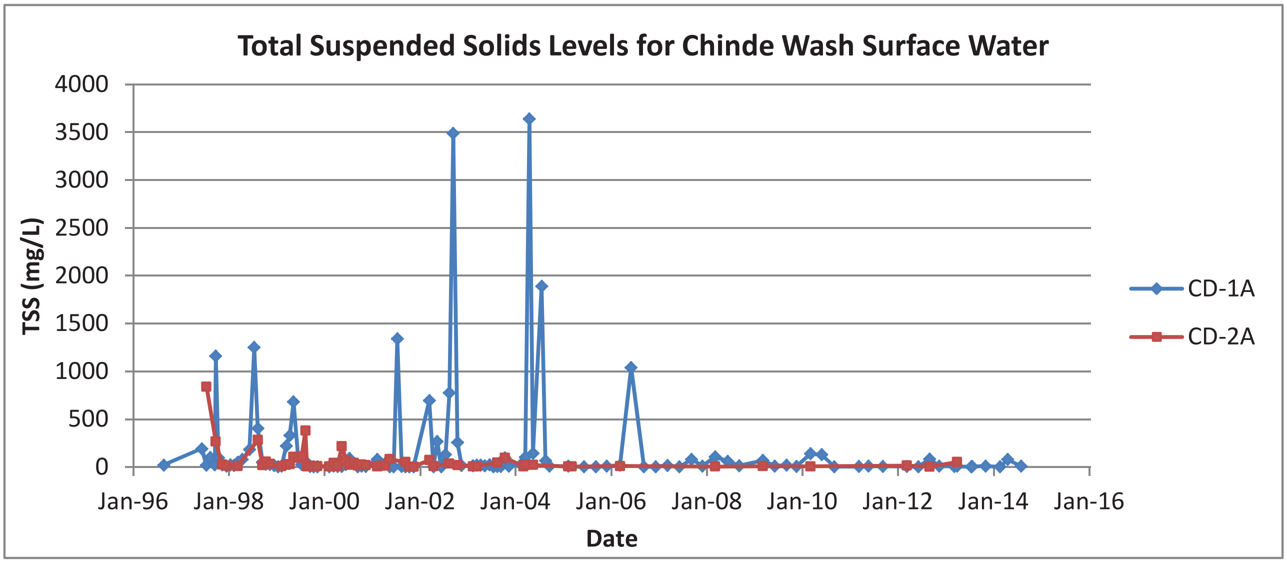
Appendix 6-3. Surface Water Time Versus Concentration Graphs

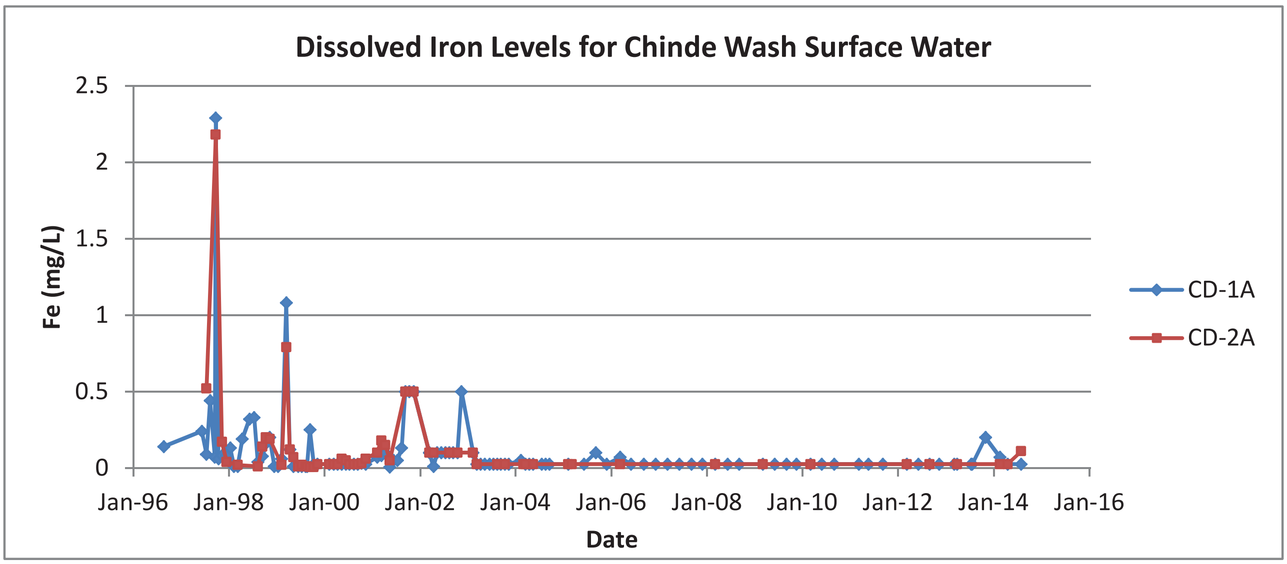


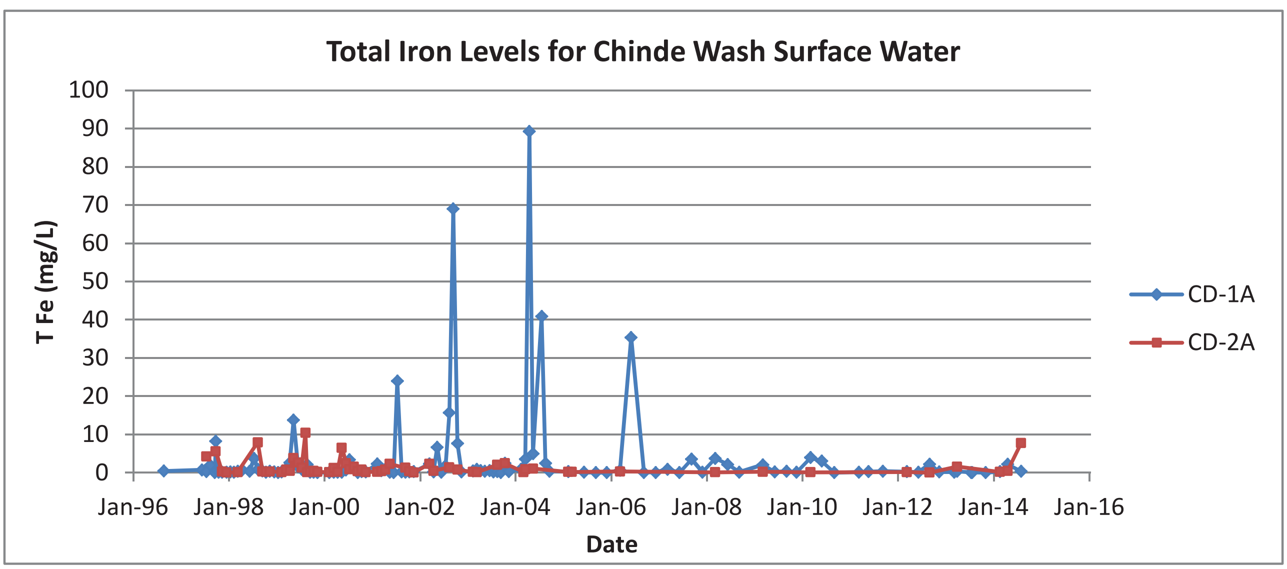




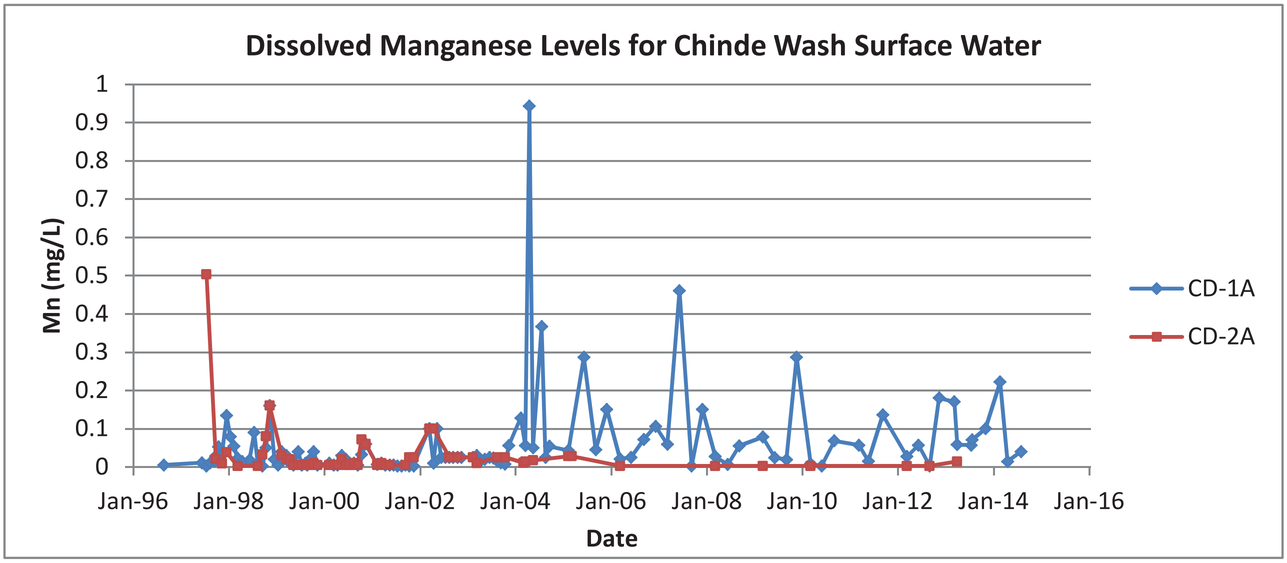
Appendix 6-3. Surface Water Time Versus Concentration Graphs

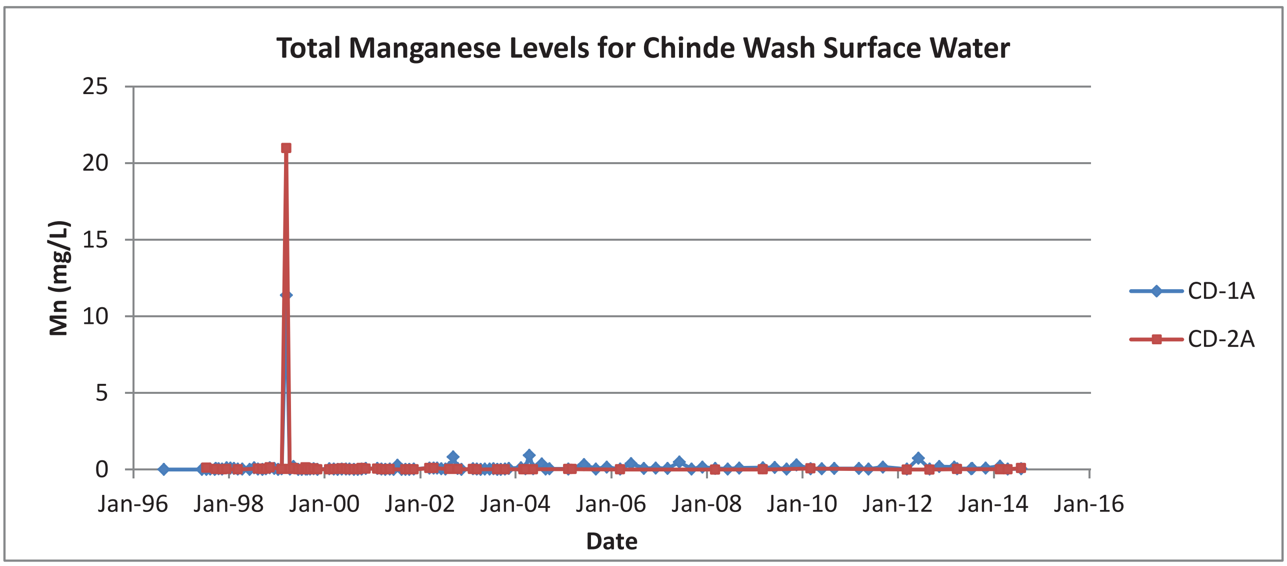


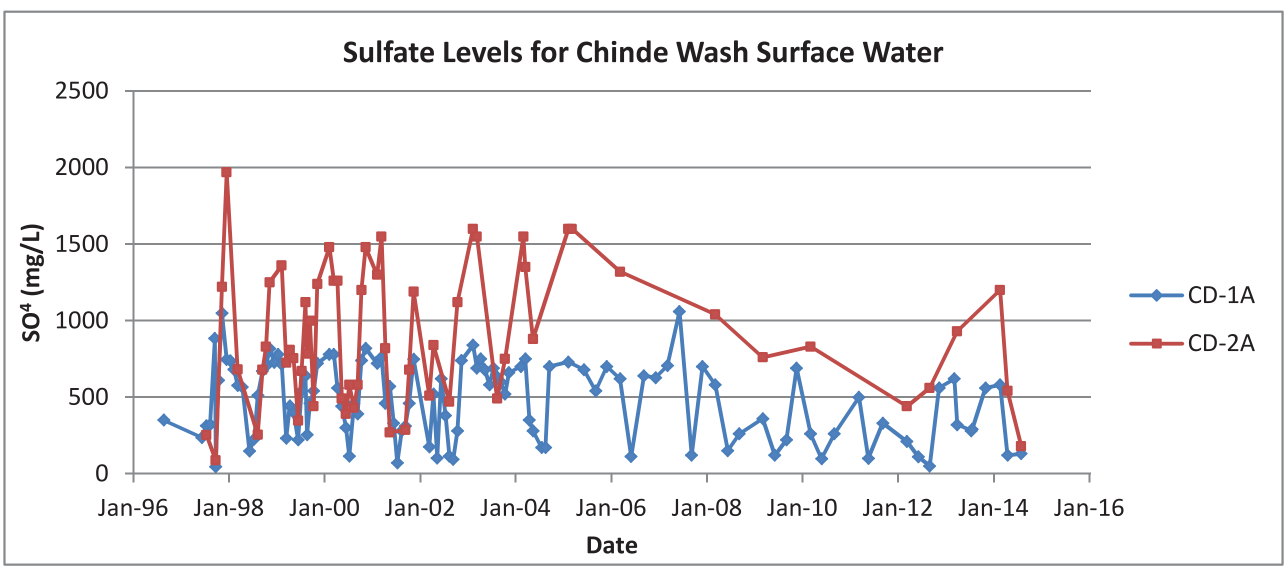




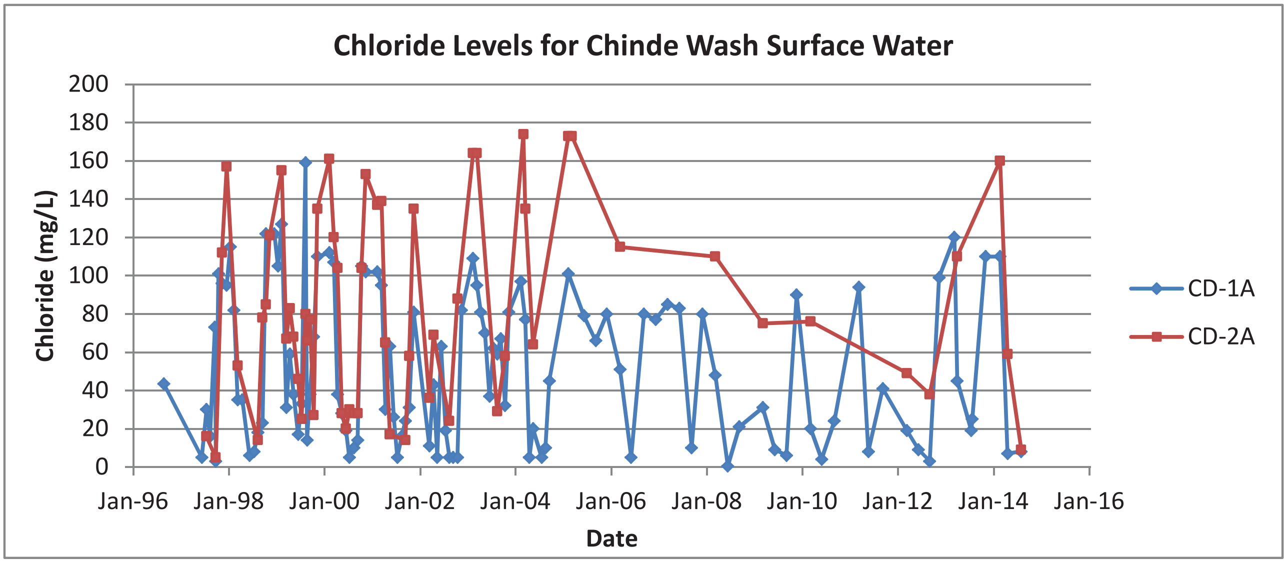
Appendix 6-3. Surface Water Time Versus Concentration Graphs

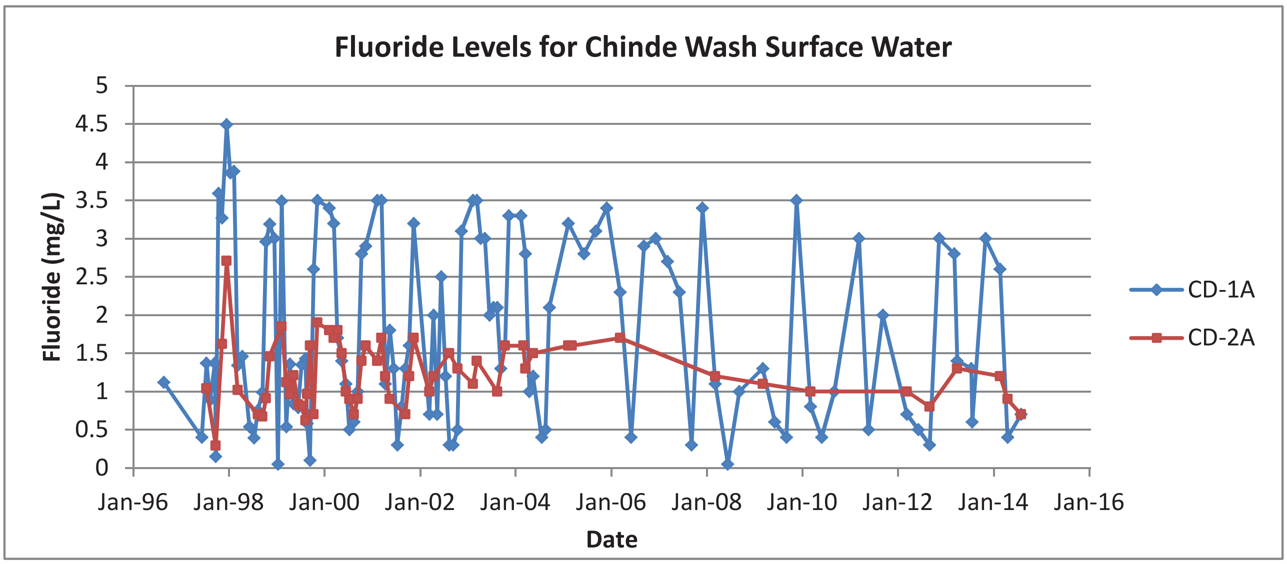


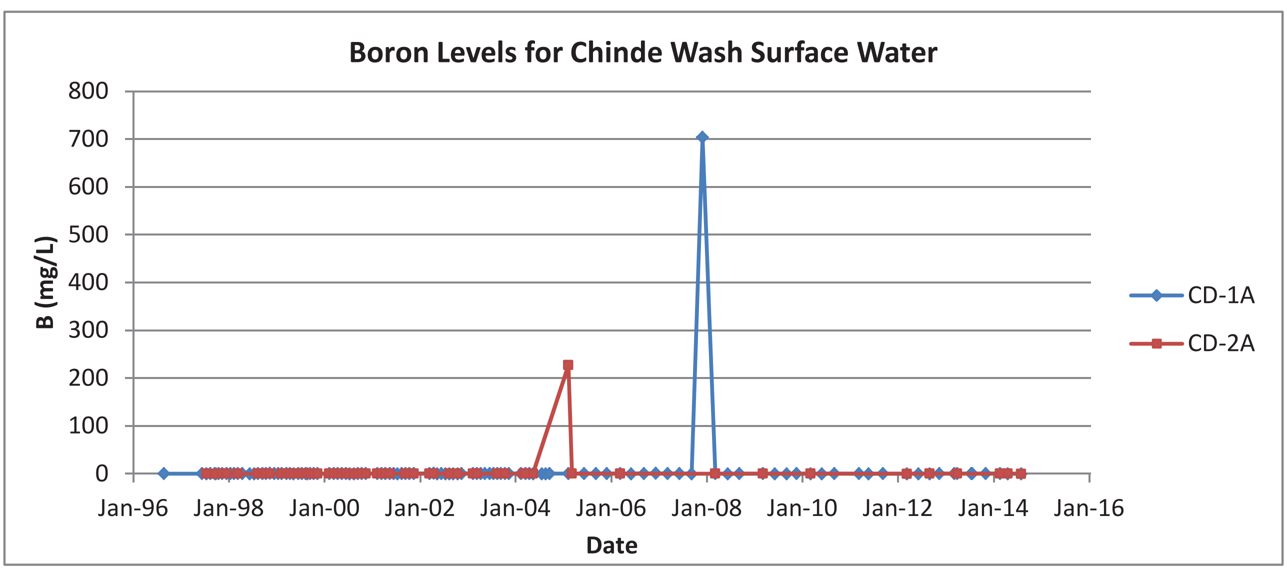




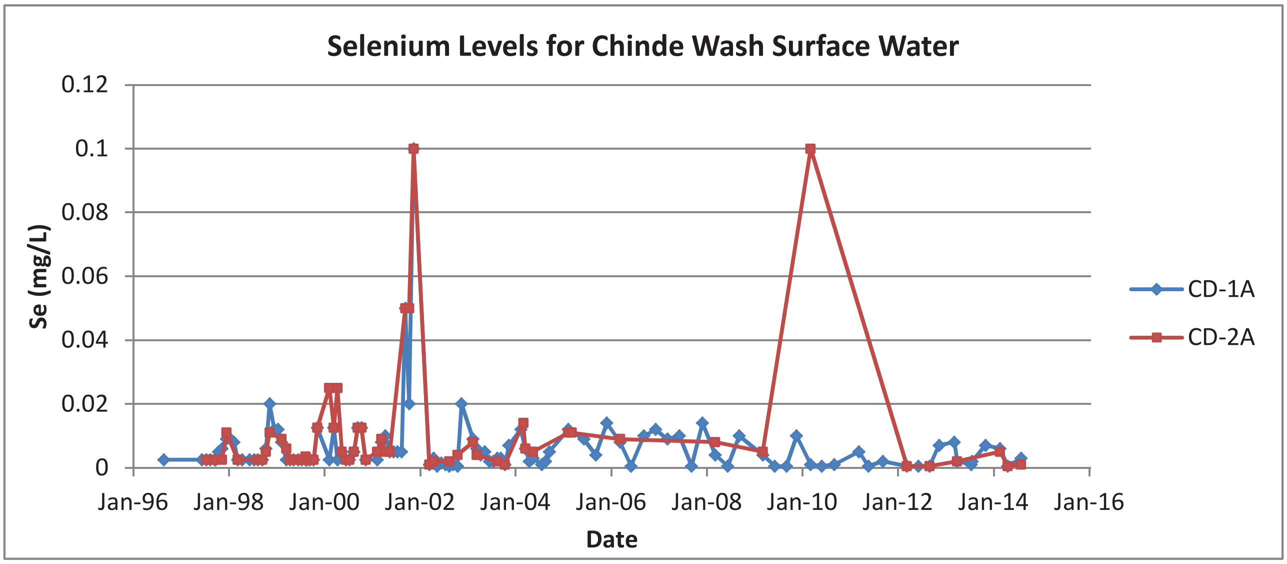
Appendix 6-3. Surface Water Time Versus Concentration Graphs



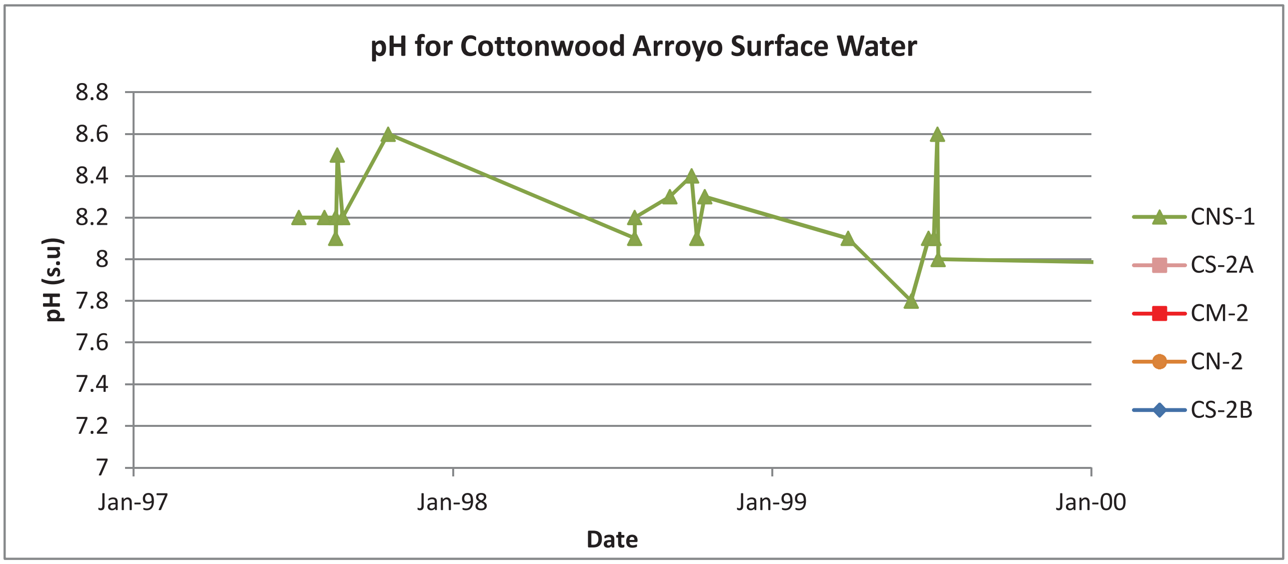


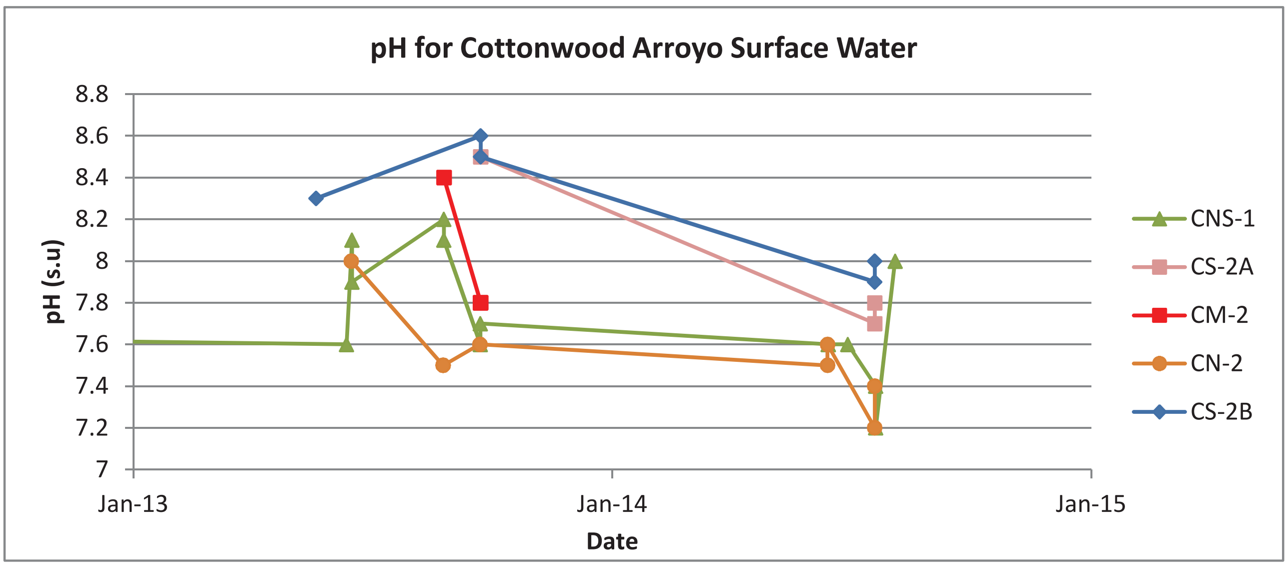


Appendix 6-3. Surface Water Time Versus Concentration Graphs

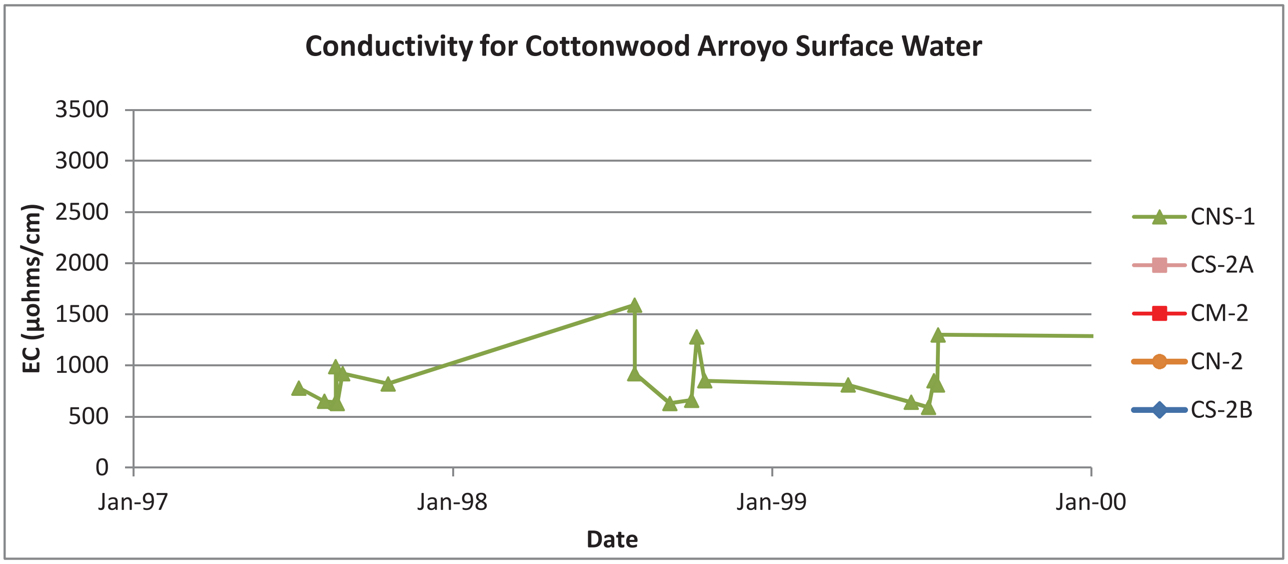


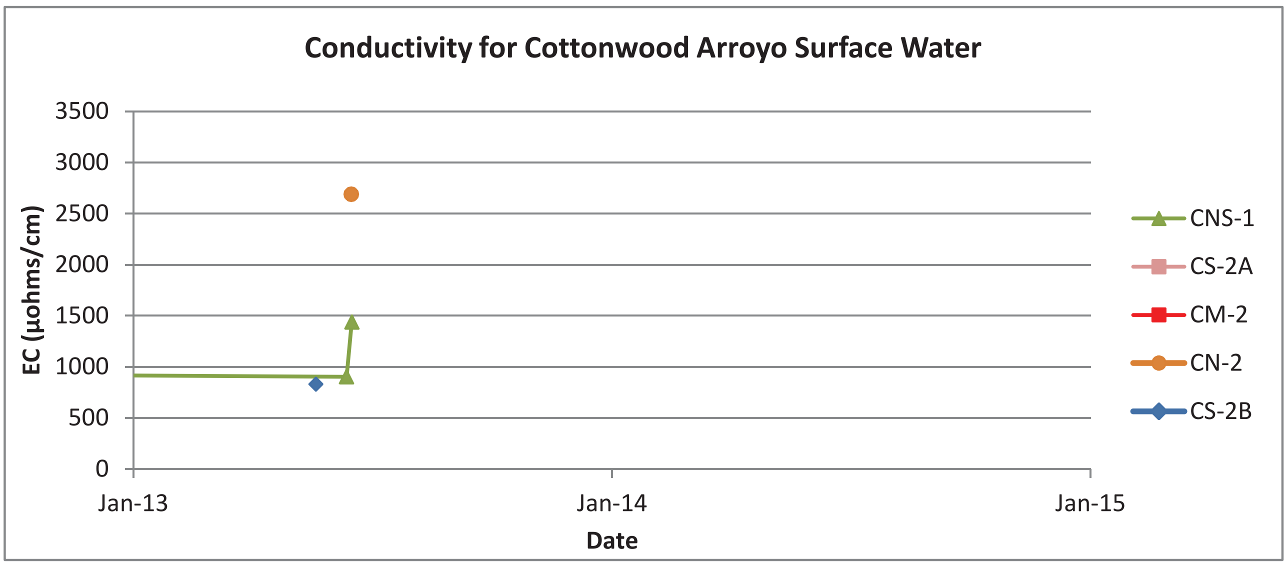
Appendix 6-3. Surface Water Time Versus Concentration Graphs



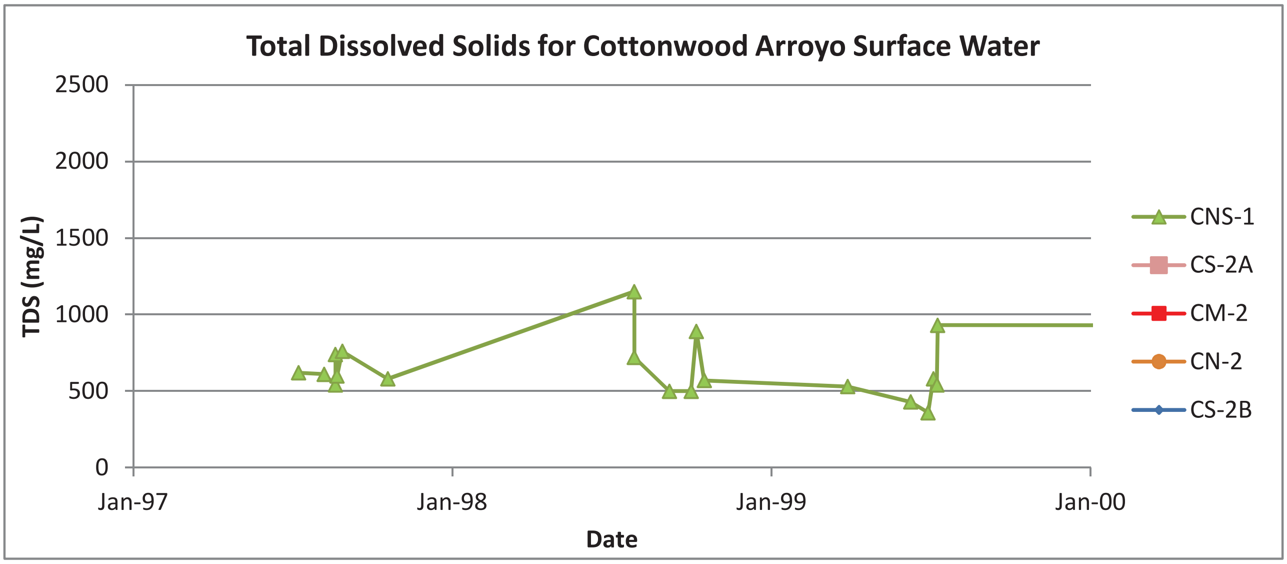


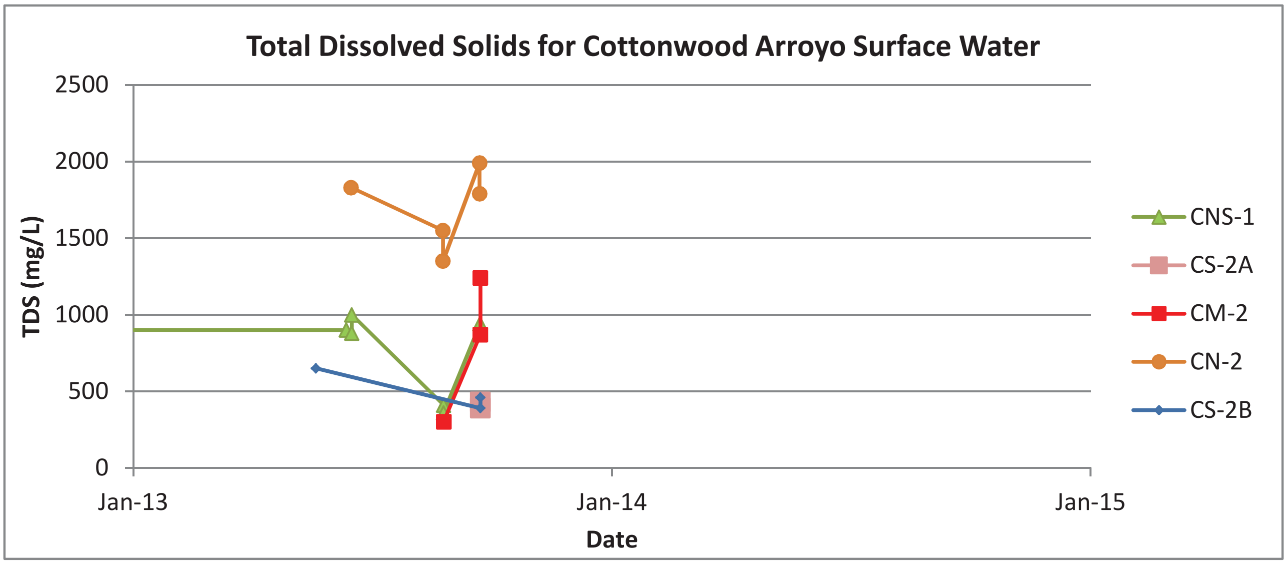
Appendix 6-3. Surface Water Time Versus Concentration Graphs



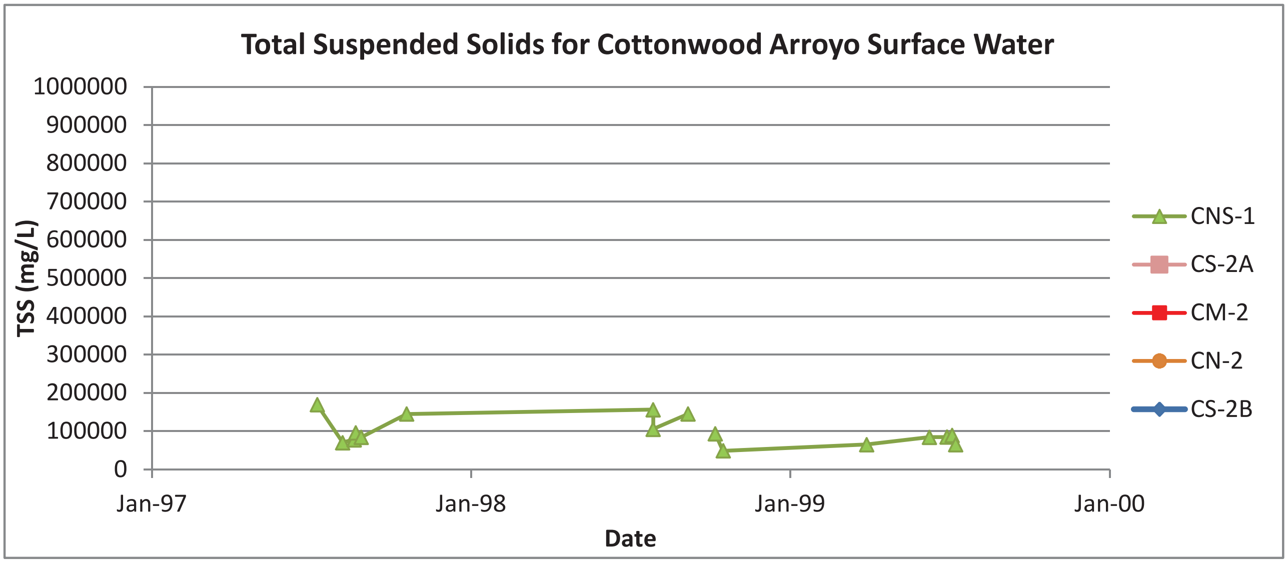


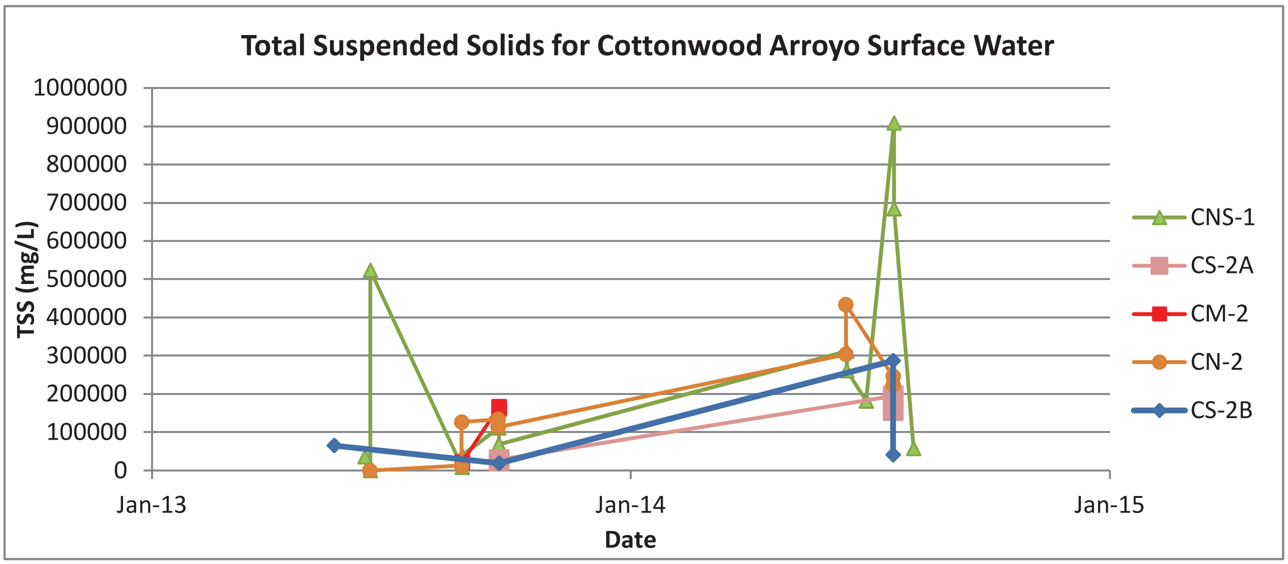
Appendix 6-3. Surface Water Time Versus Concentration Graphs



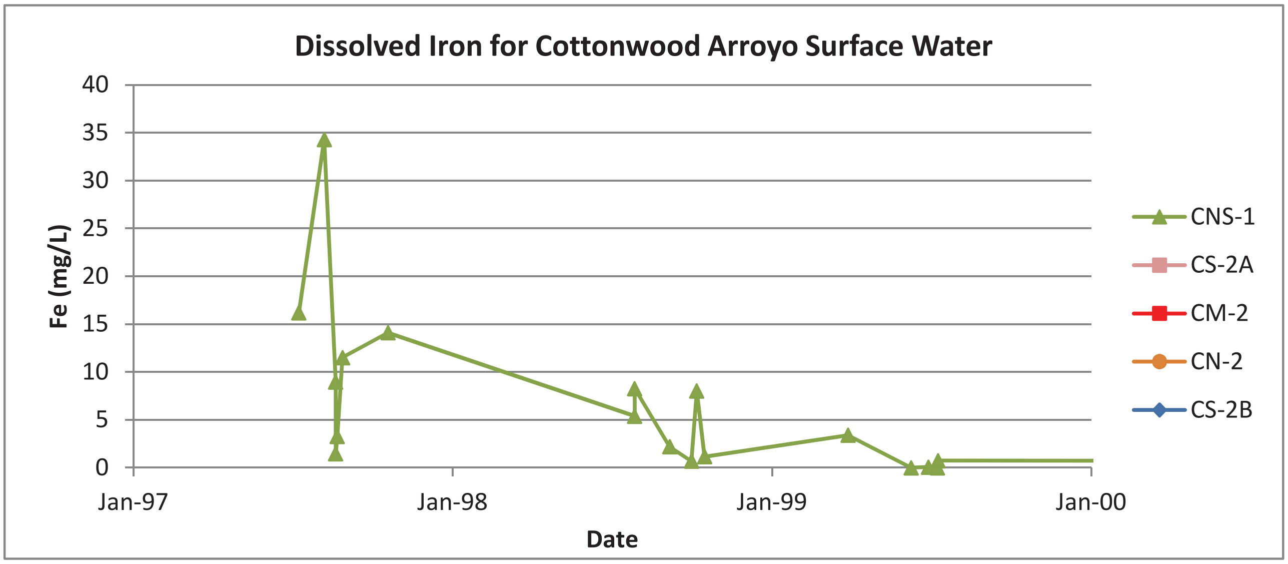


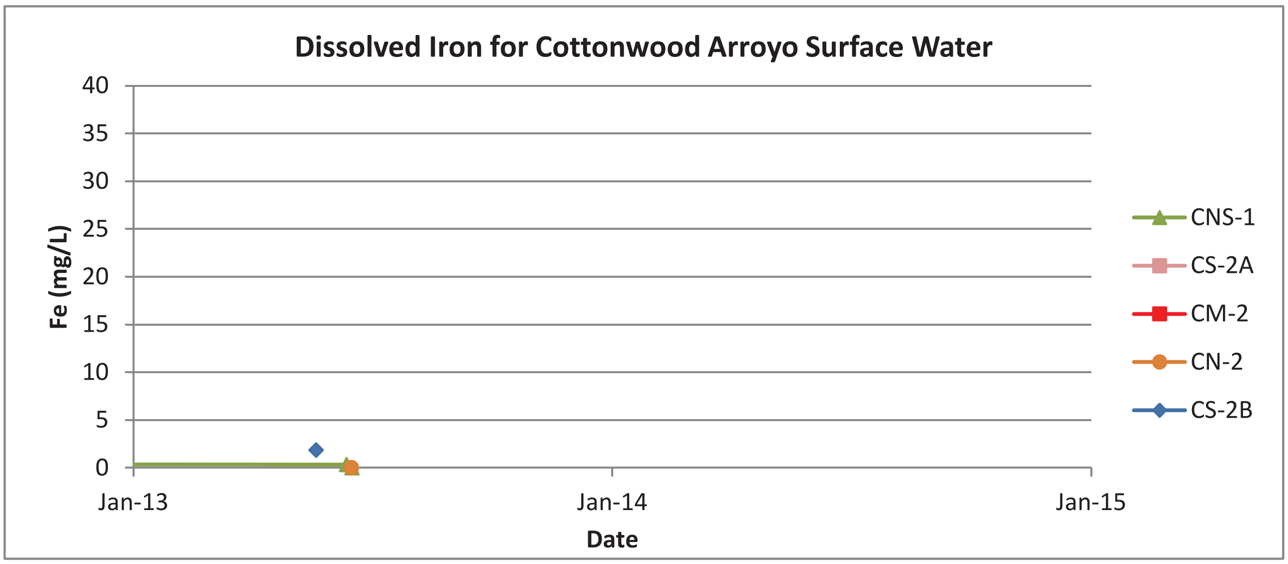
Appendix 6-3. Surface Water Time Versus Concentration Graphs



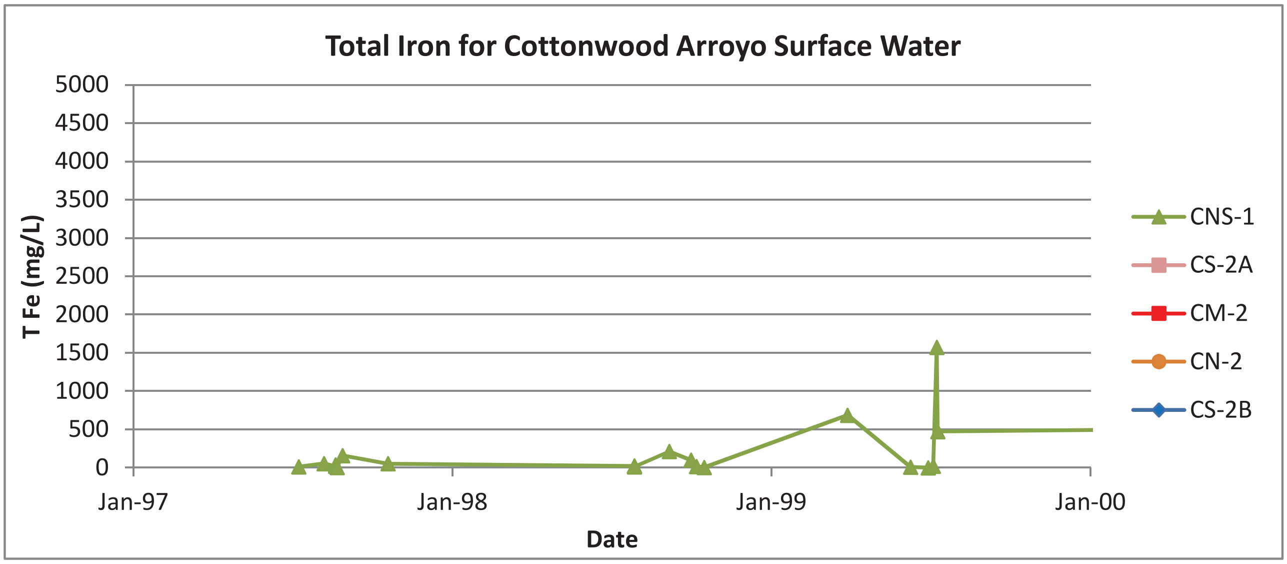


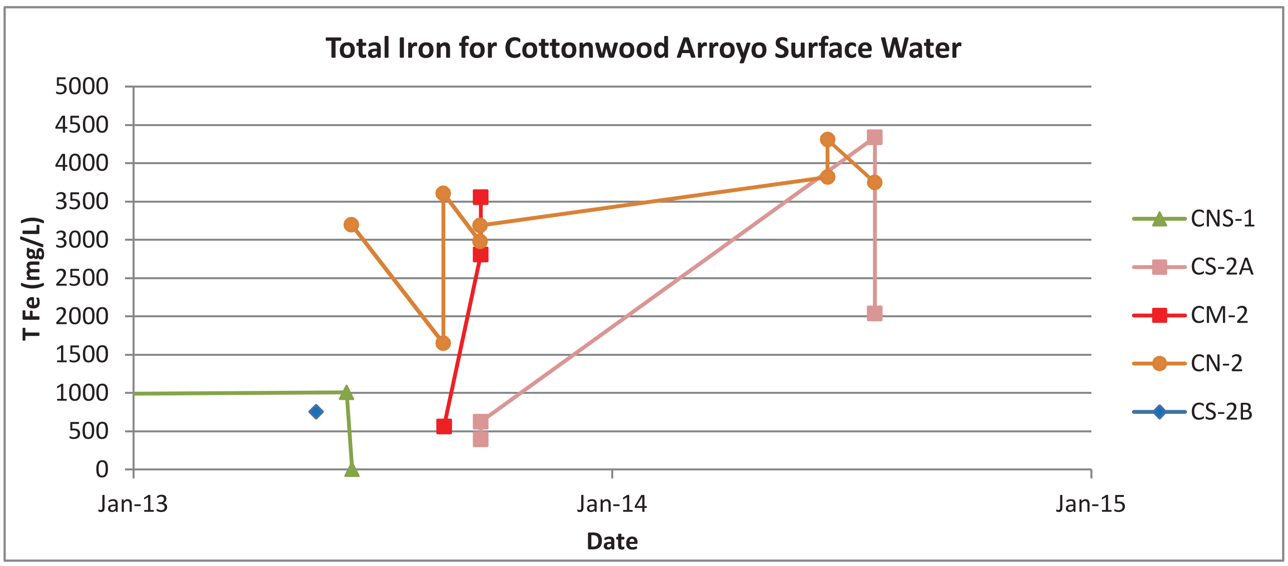
Appendix 6-3. Surface Water Time Versus Concentration Graphs



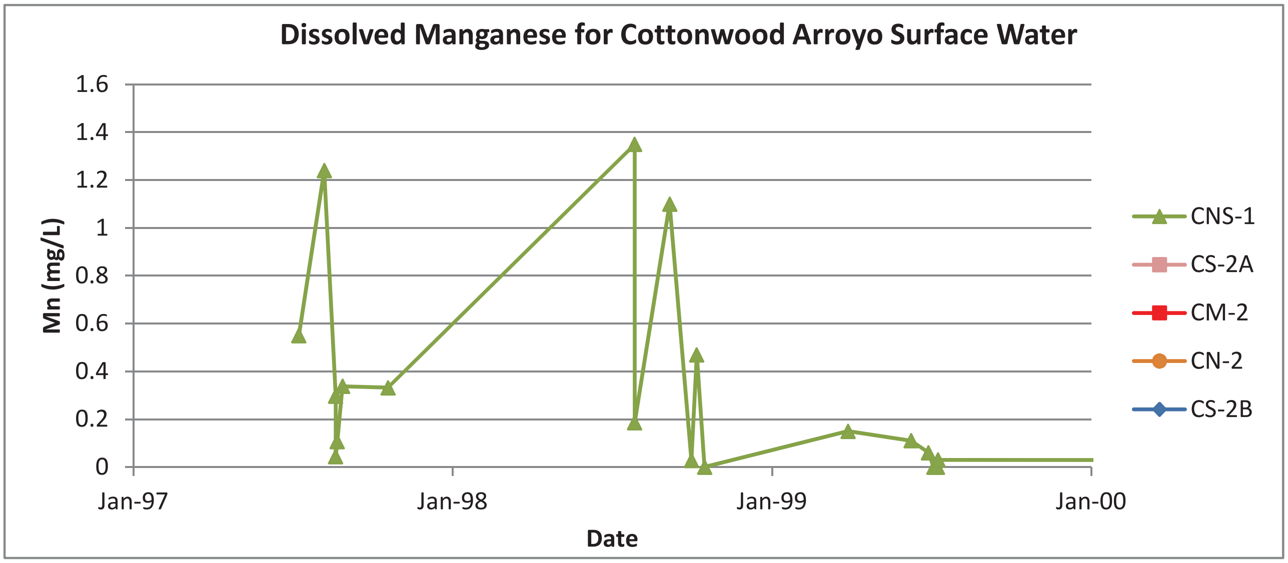


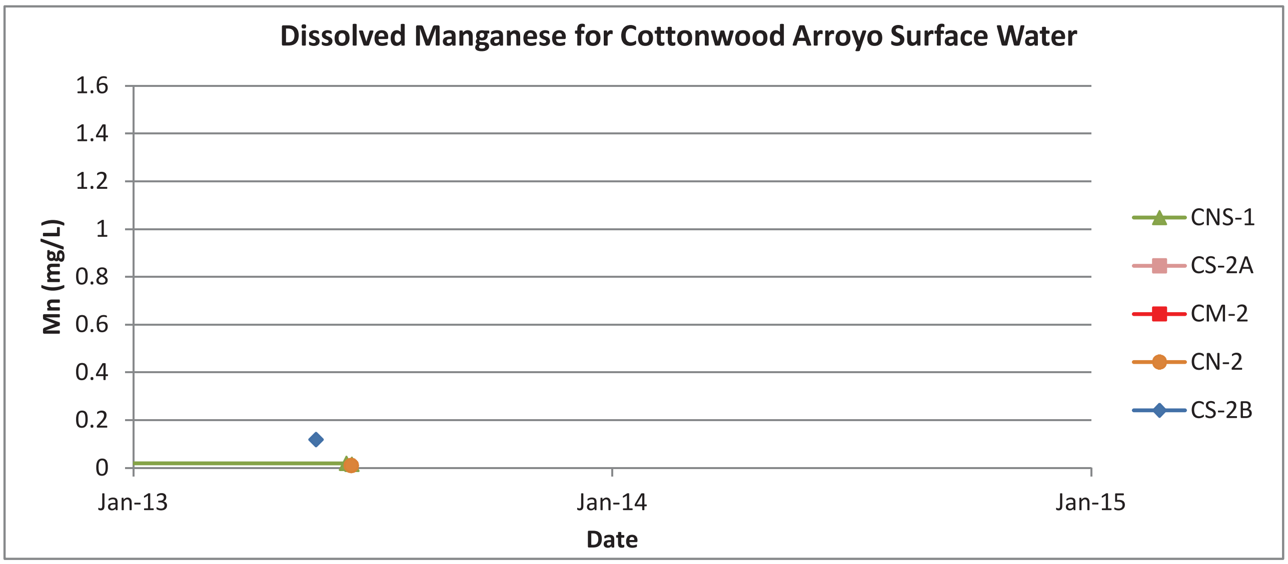
Appendix 6-3. Surface Water Time Versus Concentration Graphs



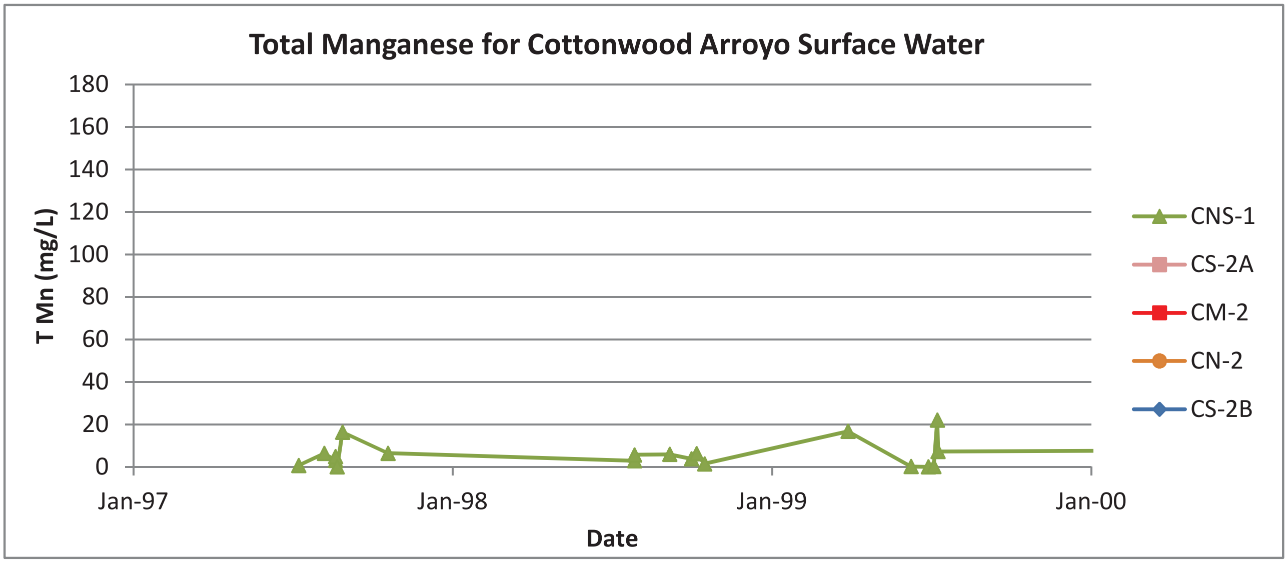


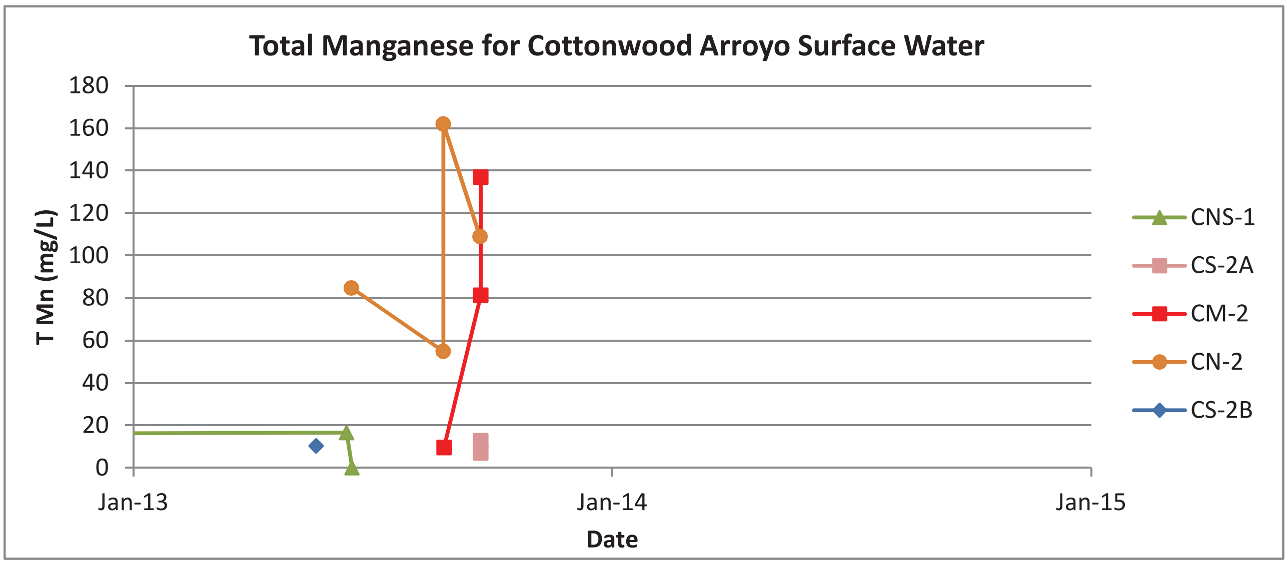
Appendix 6-3. Surface Water Time Versus Concentration Graphs



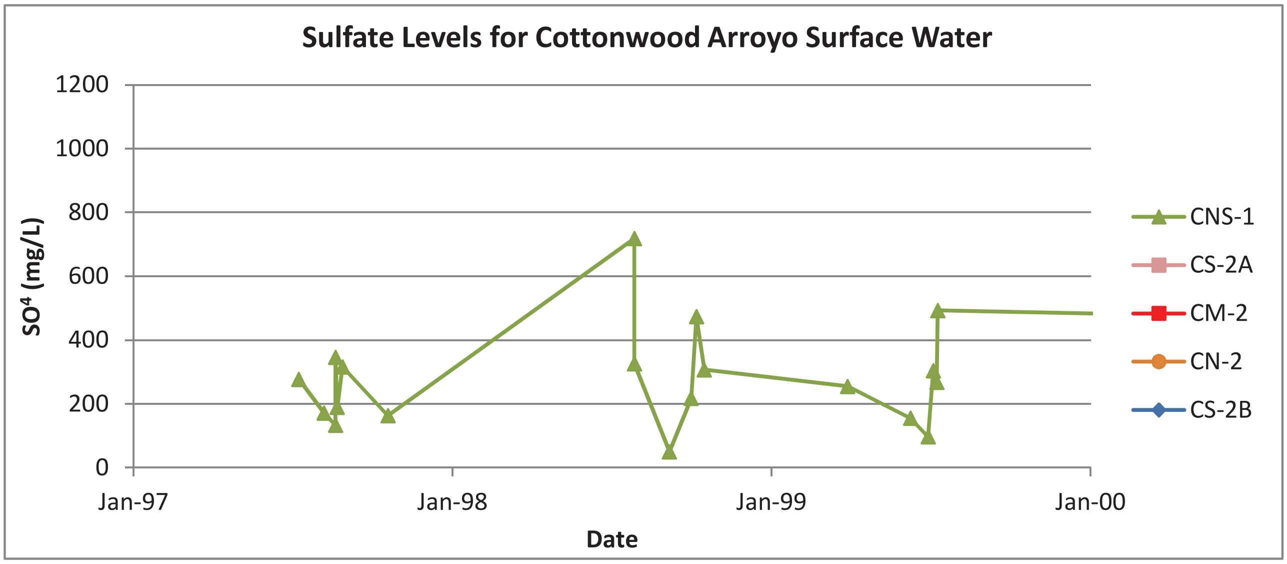


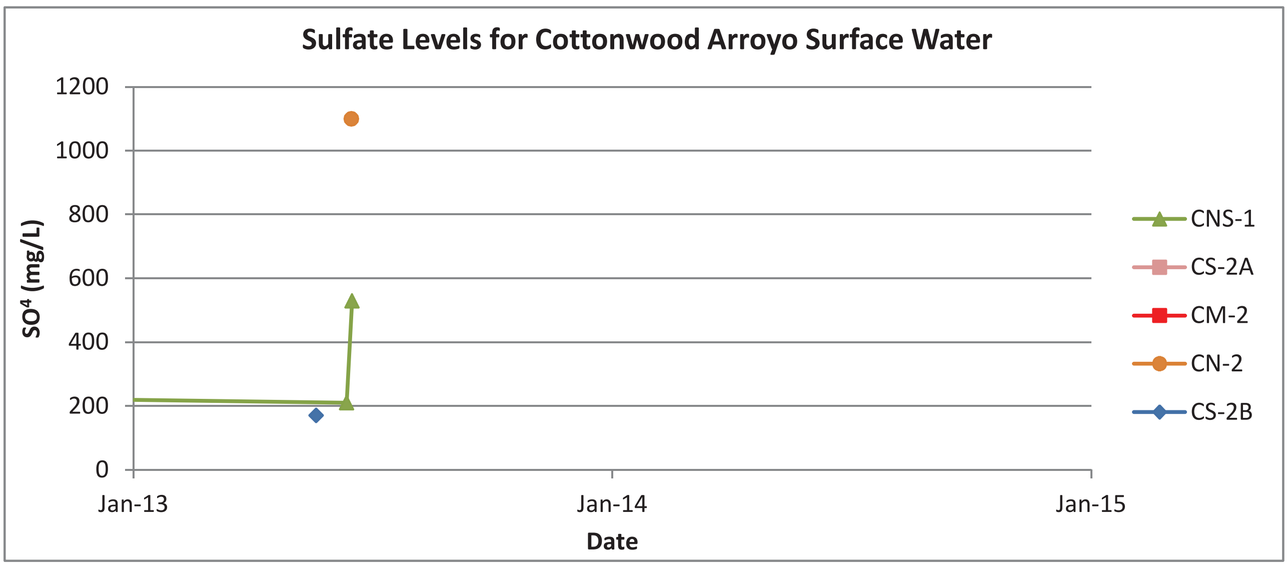
Appendix 6-3. Surface Water Time Versus Concentration Graphs



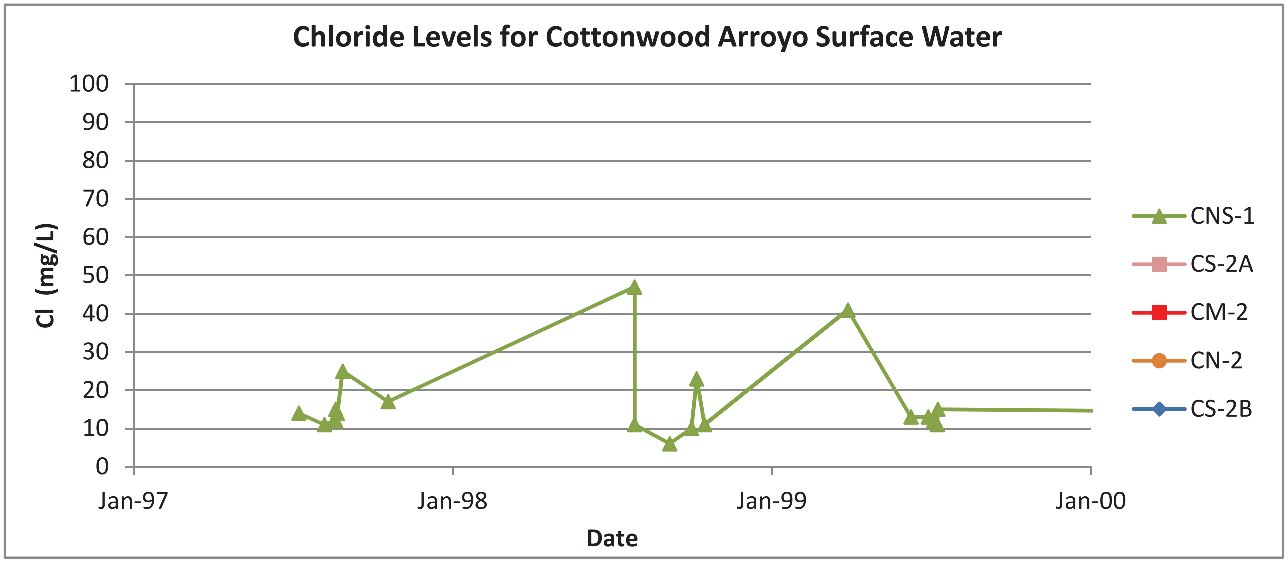


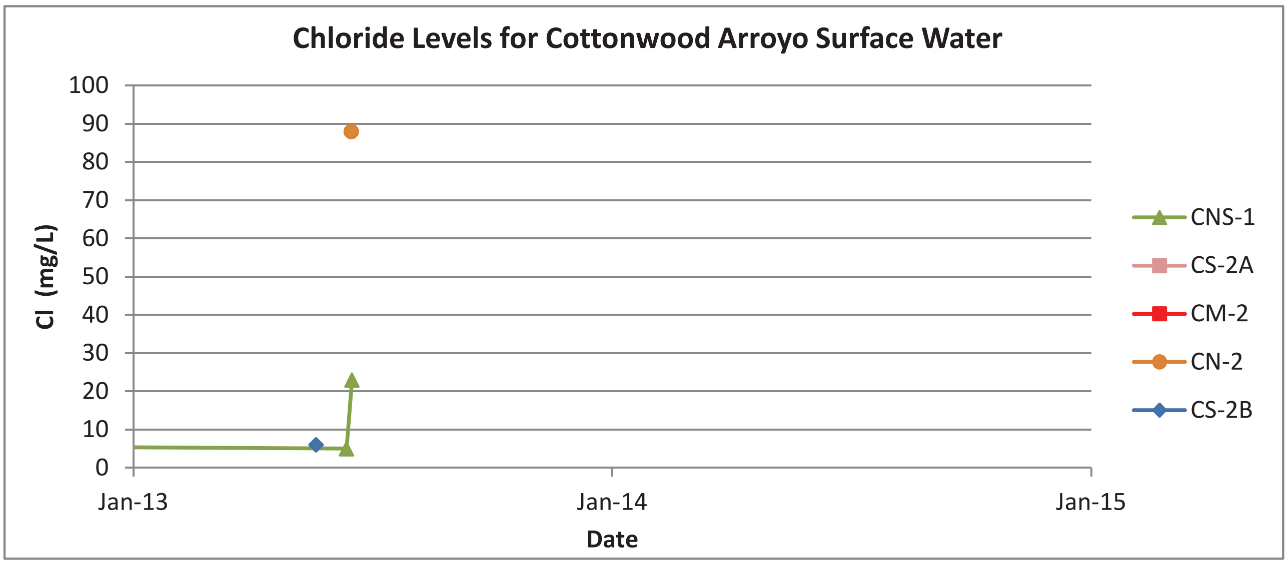
Appendix 6-3. Surface Water Time Versus Concentration Graphs



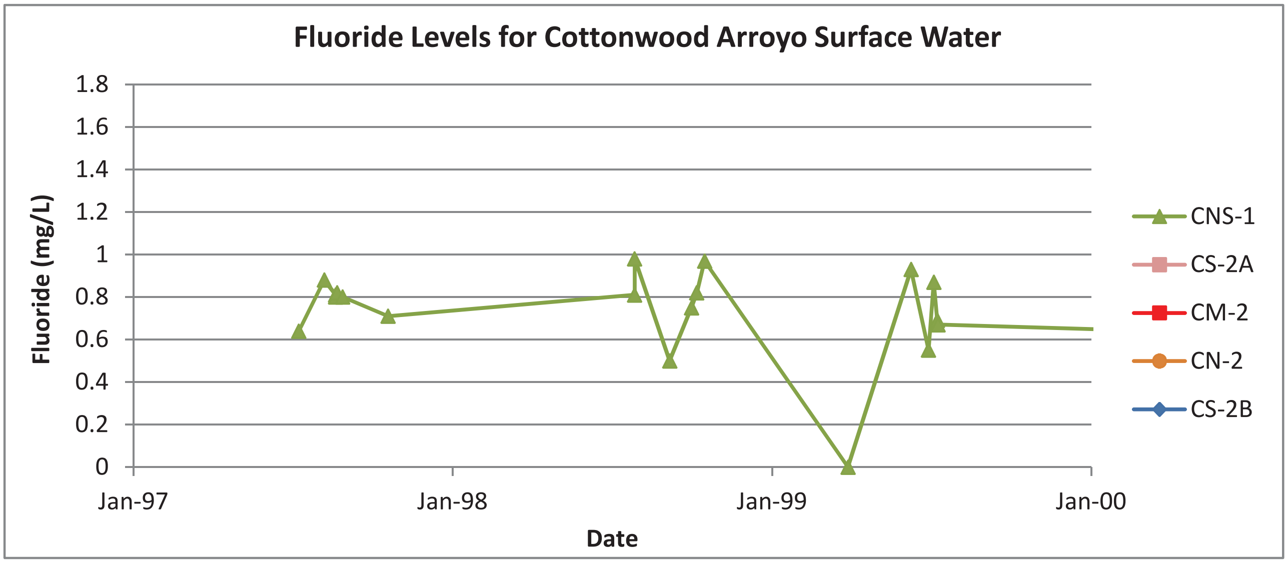


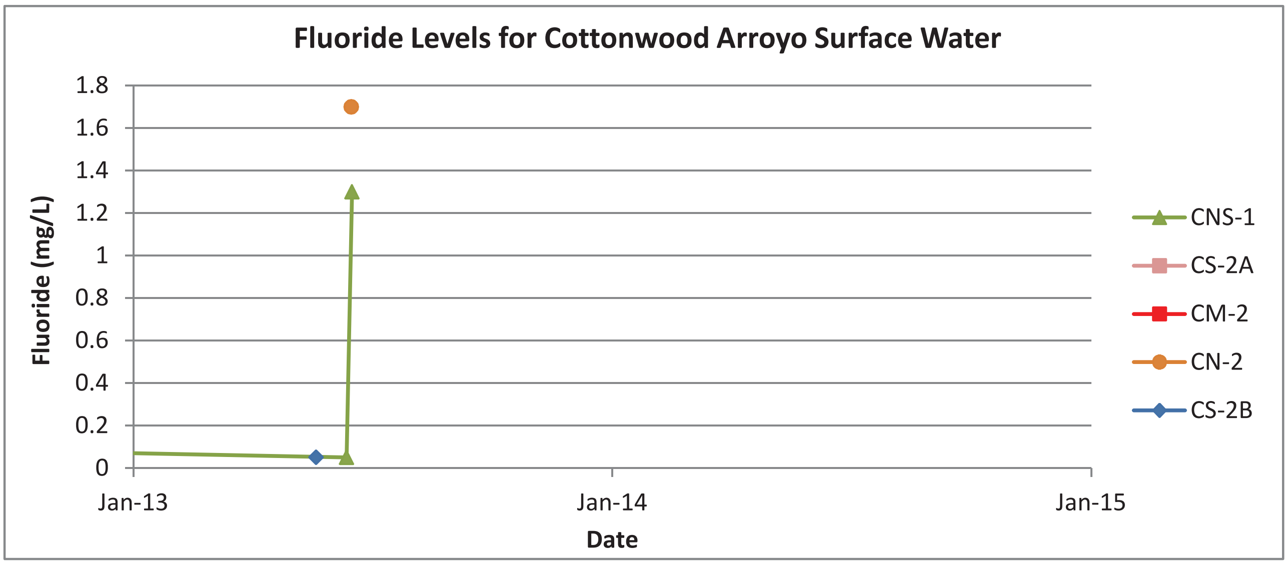
Appendix 6-3. Surface Water Time Versus Concentration Graphs



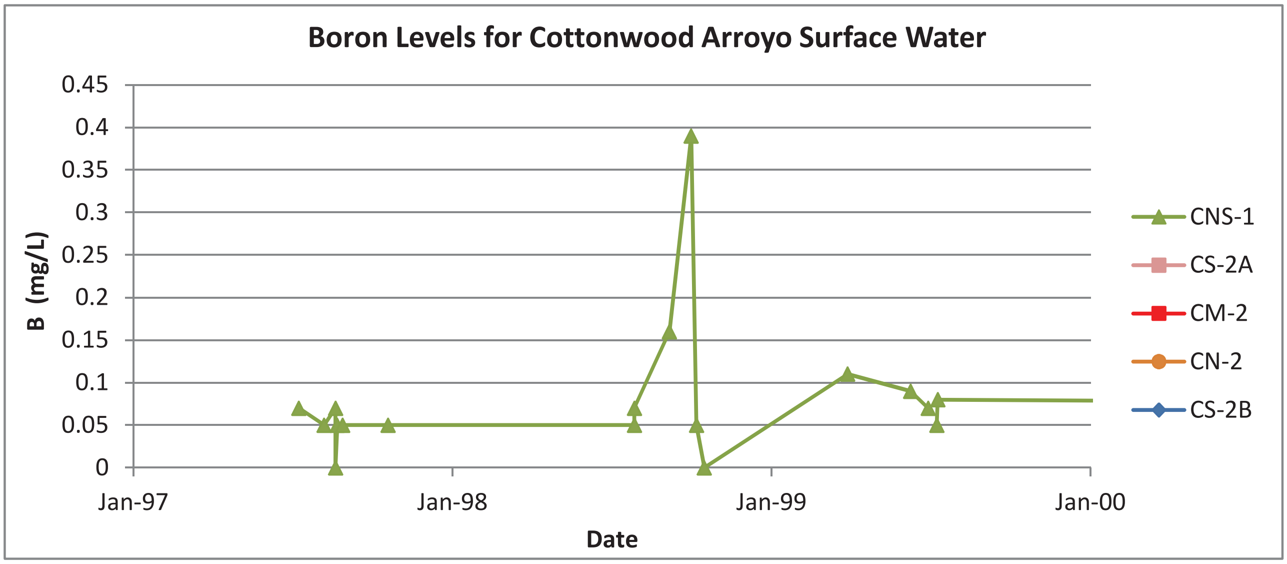


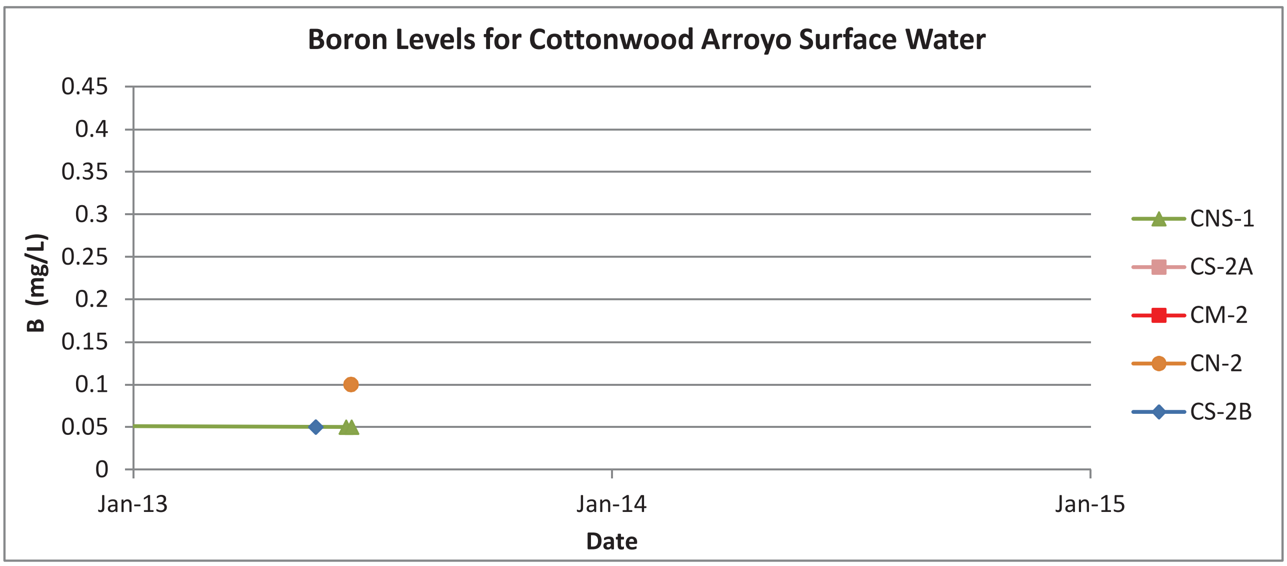
Appendix 6-3. Surface Water Time Versus Concentration Graphs



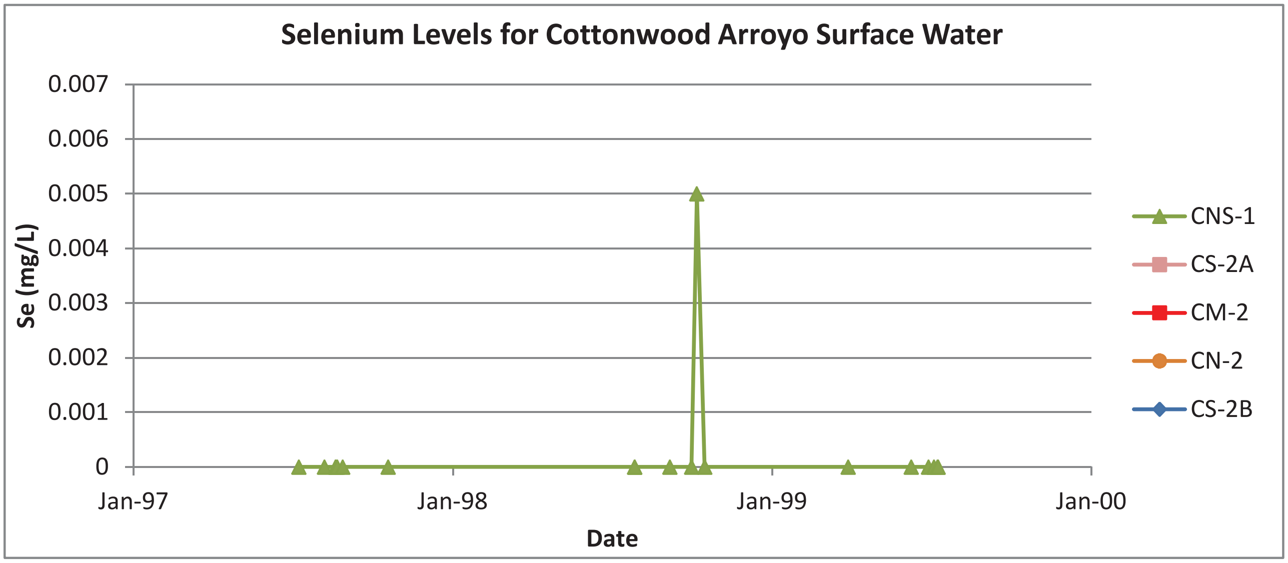


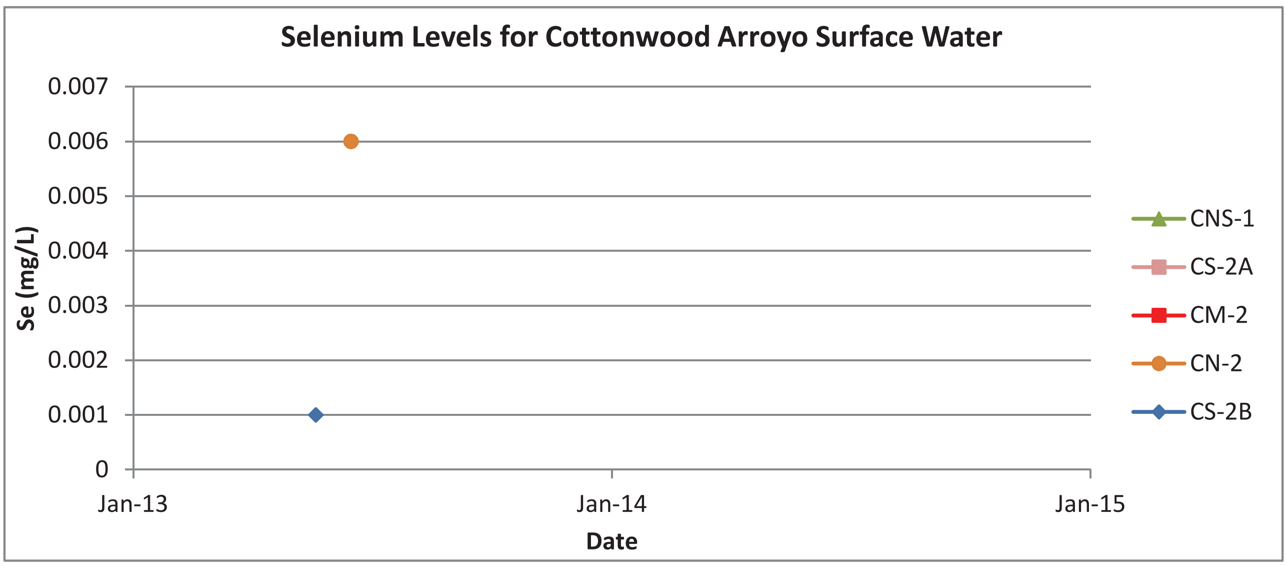
Appendix 6-3. Surface Water Time Versus Concentration Graphs





Appendix 6-3. Surface Water Time Versus Concentration Graphs





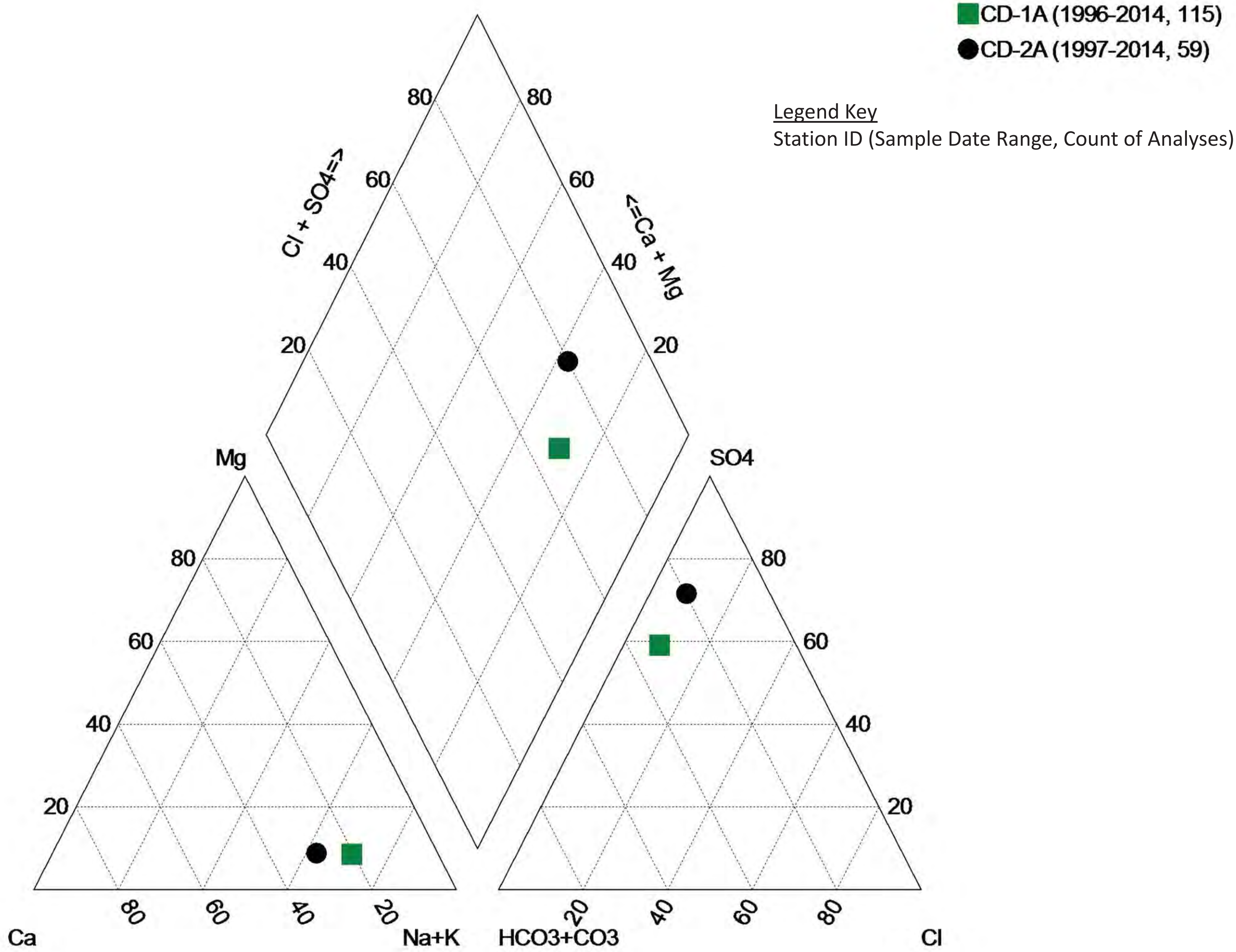
Appendix 6-4

Surface Water Trilinear Diagrams:

-Chinde

-Cottonwood

-Chinde and Cottonwood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CD-2A (1997-2014, 59)
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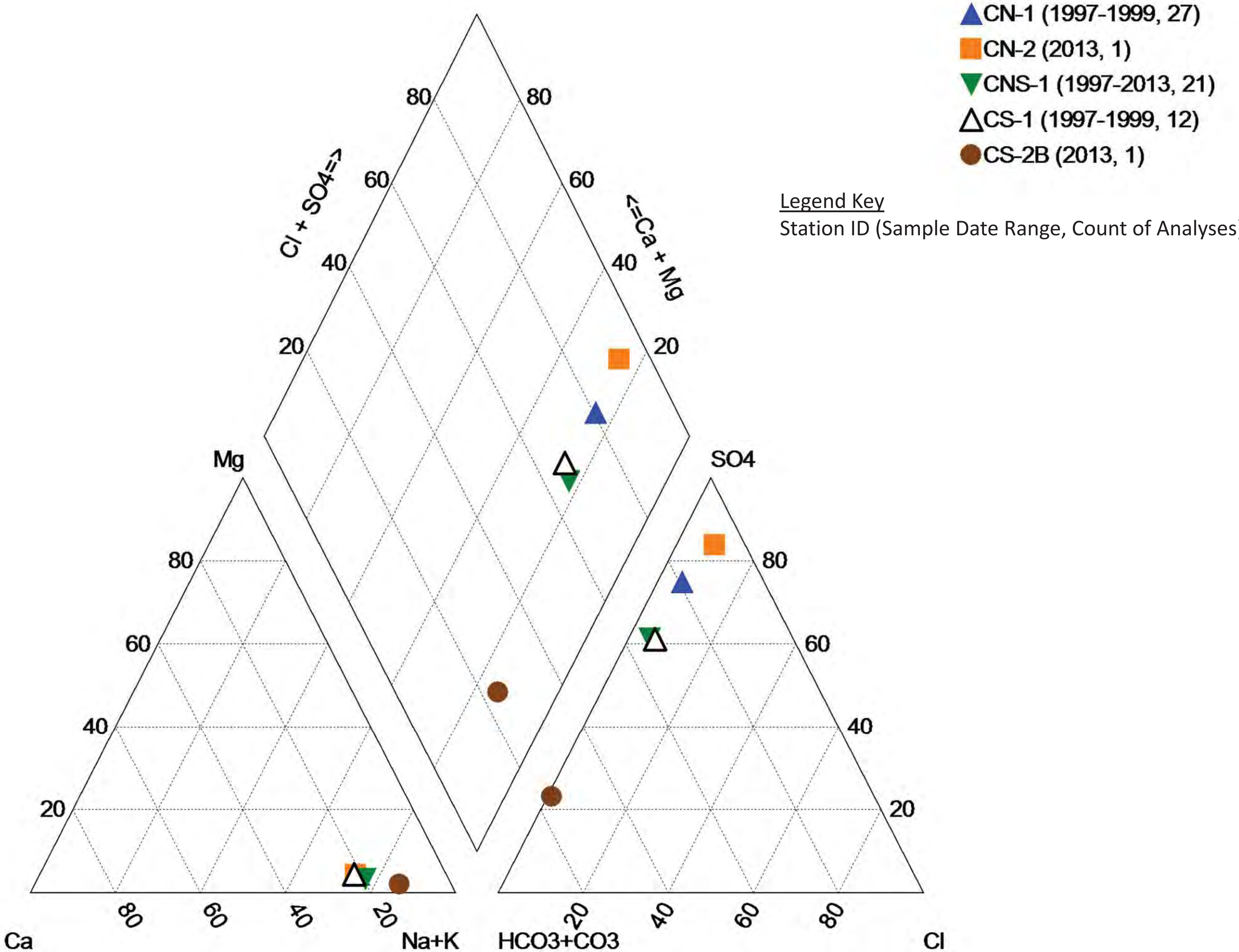
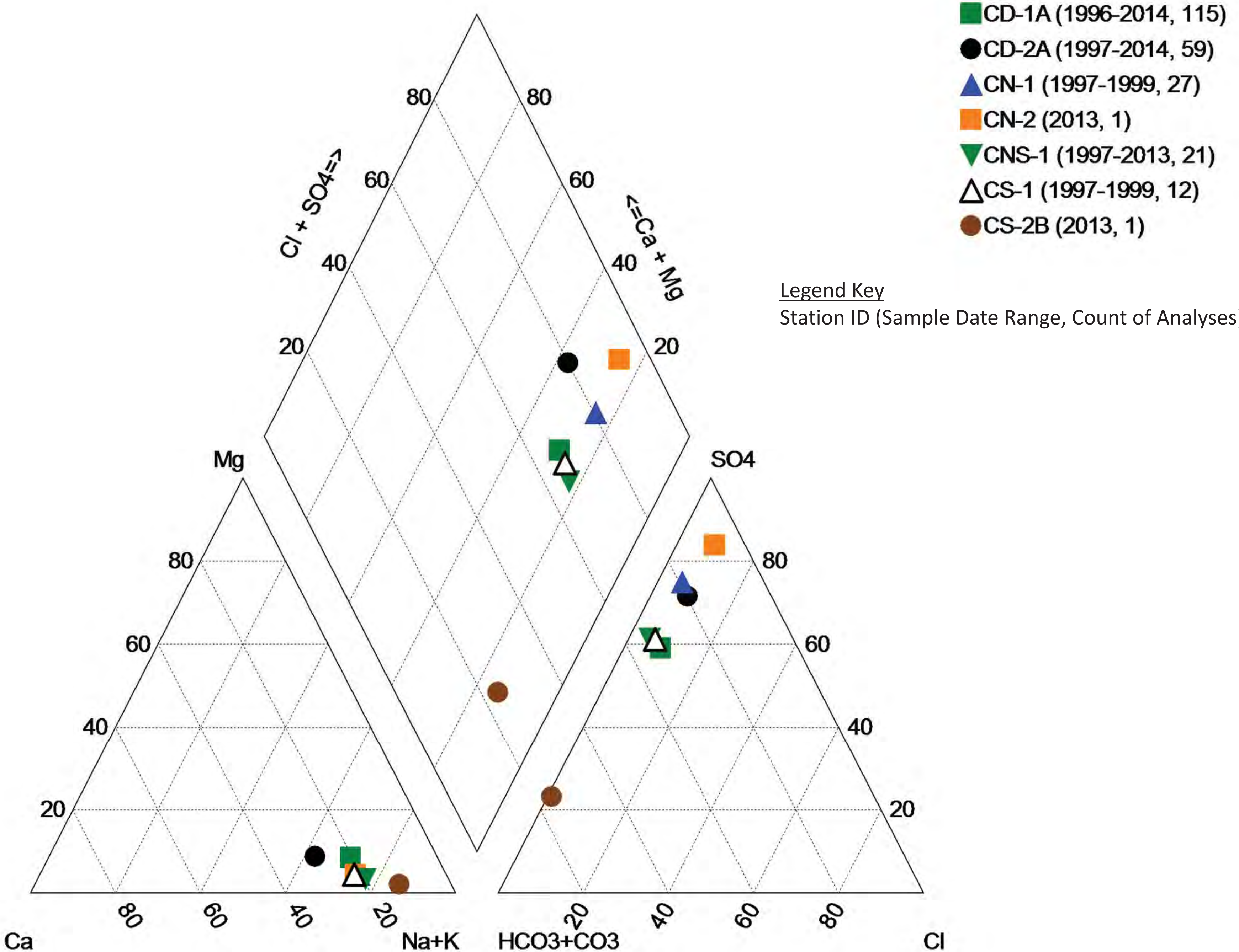
<=Ca + Mg
Mg
Ca
Na+K
SO4
HCO3+CO3
Cl
80
60
40
20


CN-1 (1997-1999, 27)
CN-2 (2013, 1)
CNS-1 (1997-2013, 21)
CS-1 (1997-1999, 12)
CS-2B (2013, 1)
Legend Key
Station ID (Sample Date Range, Count of Analyses)
Cl + SO4=>
<=Ca + Mg
Mg
SO4
Ca
Na+K
HCO3+CO3
Cl
80
60
40
20


CD-1A (1996-2014, 115)
CD-2A (1997-2014, 59)
CN-1 (1997-1999, 27)
CN-2 (2013, 1)
CNS-1 (1997-2013, 21)
CS-1 (1997-1999, 12)
CS-2B (2013, 1)
Legend Key
Station ID (Sample Date Range, Count of Analyses)
Cl + SO4=>
<=Ca + Mg
Mg
SO4
Ca
Na+K
HCO3+CO3
Cl
80
60
40
20

Appendix 6-5

2012-14 Groundwater Quality Report

Coal Seam 2-3: 2012 & 2014 Lab Data

Well Name	Sample Date	Lab pH S.U.	Lab Conduct umho/cm	TDS -180 mg/l	Cl mg/l	SO4 mg/l	Ca mg/l	Mg mg/l	K mg/l	Na mg/l	Se mg/l
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

KF84-20A was abandoned in February, 2012. KF3-12-1 was drilled to replace it.

Well Name	Sample Date	Lab pH S.U.	Lab Conduct umho/cm	TDS -180 mg/l	Cl mg/l	SO4 mg/l	Ca mg/l	Mg mg/l	K mg/l	Na mg/l	Se mg/l
KF3-12-1	9/27/2012	8.2	3200	1840	240	47	9.4	4.5	79.6	735	<0.001
KF3-12-1	8/19/2013	Insufficient water for sample									
KF3-12-1	7/18/2014	Insufficient water for sample									
KF3-12-2	8/30/2012	Insufficient water for sample									
KF3-12-2	9/23/2013	Insufficient water for sample									
KF3-12-2	7/18/2014	Insufficient water for sampleG									
KF3-12-3	8/30/2012	Dry									
KF3-12-3	9/23/2013	Dry									
KF3-12-3	7/18/2014	Dry									

Coal Seam 4-6: 2012 & 2014 Lab Data

Well Name	Sample Date	Lab pH S.U.	Lab Conduct umho/cm	TDS -180 mg/l	Cl mg/l	SO4 mg/l	Ca mg/l	Mg mg/l	K mg/l	Na mg/l	Se mg/l
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
KF84-18A	9/27/2012	7.6	22400	11600	8300	1	176	49.3	17.5	4580	<0.001
KF84-18A	9/20/2013	8	10100	11300	8100	43	151	48.2	19.4	4500	<0.001
KF84-18A	8/26/2014	7.5	19600	11600	7100	<10	139	43.2	19	4320	<0.001

KF84-20B was abandoned in February, 2012. KF4-12-1 was drilled to replace it.

Well Name	Sample Date	Lab pH S.U.	Lab Conduct umho/cm	TDS -180 mg/l	Cl mg/l	SO4 mg/l	Ca mg/l	Mg mg/l	K mg/l	Na mg/l	Se mg/l
KF4-12-1	9/27/2012	Insufficient water for sample									
KF4-12-1	8/19/2013	Insufficient water for sampleG									
KF4-12-1	7/18/2014	Dry									

Coal Seam 7: 2012 & 2014 Lab Data

Well Name	Sample Date	Lab pH S.U.	Lab Conduct umho/cm	TDS -180 mg/l	Cl mg/l	SO4 mg/l	Ca mg/l	Mg mg/l	K mg/l	Na mg/l	Se mg/l
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

KF84-20C was abandoned in February, 2012. KF7-12-1 was installed to replace it.

Well Name	Sample Date	Lab pH S.U.	Lab Conduct umho/cm	TDS -180 mg/l	Cl mg/l	SO4 mg/l	Ca mg/l	Mg mg/l	K mg/l	Na mg/l	Se mg/l
KF84-22B	9/13/2012	No sample									
KF84-22B	9/19/2013	8.1	12400	5670	3900	5*	61.1	18.8	12.8	2540	<0.001
KF84-22B	7/18/2014	Insufficient water to sample									
KF7-12-1	9/27/2012	Insufficient water to sample									
KF7-12-1	8/19/2013	Insufficient water to sampleG									
KF7-12-1	7/18/2014	Dry									

Coal Seam 8: 2012 to 2014 Lab Data

Well Name	Sample Date	Lab pH S.U.	Lab Conduct umho/cm	TDS -180 mg/l	Cl mg/l	SO4 mg/l	Ca mg/l	Mg mg/l	K mg/l	Na mg/l	Se mg/l
KF84-18B	9/27/2012	7.2	17100	8790	5600	1	147	28.2	12.5	3440	<0.001G
KF84-18B	9/9/2013	7.5	18300	8980	5700	12	148	30.3	16.1	3770	<0.001G
KF84-18B	8/26/2014	Well damaged. Repairs being scheduled.G									
KF84-22A	9/13/2012	No sampleG									
KF84-22A	9/19/2013	8.0	6650	4140	270	2300	14.6	3.5	6.1	1620	0.002
KF84-22A	7/18/2014	Insufficient water to sampleG									
Bitsui-2	9/20/2012	8.0	10600	7240	800	1800	12.6	5.3	7.2	2600	0.162G
Bitsui-2	12/6/2012	8.2	9980	6660	810	1700	11.5	5.3	8.3	2600	0.003G
Bitsui-2	3/26/2013	8.0	10700	6980	870	2200	12.7	4.7	8.4	2530	0.307G
Bitsui-2	6/4/2013	8.0	10400	7550	890	2500	12.8	4.9	8.7	2600	0.011G
Bitsui-2	9/20/2013	8	10200	6100	900	2300	11.5	4.6	8.5	2550	0.008
Bitsui-2	12/20/2013	8.0	10800	7350	860	2300	12	4.6	7.7	2570	<0.001G
Bitsui-2	3/12/2014	7.9	10200	7030	870	2300	13.5	5.4	7.9	2710	ND
Bitsui-2	6/3/2014	8	9760	7330	710	1800	11.4	4.7	8.1	2640	0.015
Bitsui-2	8/6/2014	8.2	9970	7330	680	1700	11.8	4.58	7.6	2400	<0.006

Quarternary Alluvium Groundwater 2012-2014 Lab Data

Well Name	Sample Date	Lab pH S.U.	Lab Conduct umho/cm	TDS -180 mg/l	Cl mg/l	SO4 mg/l	Ca mg/l	Mg mg/l	K mg/l	Na mg/l	Se mg/l
QAC-1	3/5/2012	7.2	23300	15700	5600	4000	432	142	16.1	4810	<0.001
QAC-1	6/6/2012	7.4	23400	15700	5900	4200	485	158	18.3	5060	<0.001
QAC-1	9/18/2012	7.4	22700	14300	5900	4400	436	143	18.1	4850	<0.001
QAC-1	12/3/2012	7.2	22600	15400	5400	4300	431	142	16.9	4820	<0.001
QAC-1	2/13/2012	7.3	23400	15400	5800	5300	452	150	18.9	5230	0.002
QAC-1	4/17/2013	7.3	23000	14300	5400	5000	442	146	17.6	5150	<0.001
QAC-1	8/21/2013	7.3	23100	13500	5800	5300	452	155	16.8	4900	<0.001
QAC-1	11/4/2013	7.4	21300	15900	5200	4800	423	138	17.8	4890	<0.001
QAC-1	3/6/2014	7.3	21900	15400	5400	5100	447	144	18.4	4870	<0.001
QAC-1	5/27/2014	7.3	22700	15800	4800	4100	411	146	16.5	4840	<0.001
QAC-1	9/4/2014	7.2	20800	16100	5000	4300	438	143	16.7	5010	<0.001
CA-2	5/9/2013	6.9	6130	4830	190	2200	566	130	7.1	980	<0.001
CA-2	8/9/2013	6.6	6010	4660	190	2300	525	120	7.2	932	<0.001
CA-2	12/5/2013	6.9	5850	4930	200	2400	509	119	7	876	<0.001
CA-2	3/4/2014	6.7	5950	4840	190	2400	520	119	5.6	891	<0.001
CA-2	5/20/2014	6.6	6120	5030	150	2300	471	128	7.2	951	<0.001
CA-2	8/7/2014	6.6	5800	4590	130	1900	483	111	6.6	883	<0.001

Quarternary Alluvium Groundwater 2012-2014 Lab Data

Well Name	Sample Date	Lab pH S.U.	Lab Conduct umho/cm	TDS -180 mg/l	Cl mg/l	SO4 mg/l	Ca mg/l	Mg mg/l	K mg/l	Na mg/l	Se mg/l
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
CA-3	9/19/2012	7.1	6140	5100	58	3300	445	232	2.6	771	<0.001
CA-3	12/3/2012	7.1	8100	6790	290	3700	529	276	4.4	1320	<0.001
CA-3	2/13/2013	7.4	8310	7090	270	4300	467	250	3.2	1640	<0.001
CA-3	4/22/2013	7.0	5720	4920	82	3100	424	224	2.3	749	<0.001
CA-3	8/26/2013	7	6430	5190	110	4000	466	225	3.5	950	<0.001
CA-3	12/19/2013	6.9	5350	4760	66	3000	504	227	2	602	<0.001
CA-3	3/5/2014	7.1	5990	5070	110	3300	448	157	6	979	0.001
CA-3	5/22/2014	6.9	6460	6070	61	3500	487	203	5	1040	<0.001
CA-3	8/7/2014	7	5730	5140	52	2900	476	193	2.6	728	<0.001
CA-4	9/20/2012	7.0	3820	2700	37	1200	286	50.6	4.3	591	0.011
CA-4	11/15/2012	7.9	3500	2540	40	1200	262	42.8	5	581	<0.001
CA-4	3/4/2013	7.5	4100	2970	78	1500	323	48.7	5.9	661	<0.001
CA-4	5/2/2013	7.1	3950	2910	66	1500	299	45.7	5.4	643	<0.001
CA-4	8/26/2014	7.0	4470	3150	85	1900	340	58.4	5.2	742	0.001
CA-4	12/19/2013	7.0	4560	3390	76	1800	354	59.6	5.8	696	0.001
CA-4	3/6/2014	7	4630	3560	84	2000	343	60.2	6.4	762	0.001
CA-4	5/22/2014	7	4000	3220	47	1500	305	52.6	5	706	<0.001
CA-4	7/29/2014	7.7	3560	2490	85	1300	79.2	15.4	3.9	696	<0.001
CA-5	9/27/2012	7.3	4160	3420	64	1700	354	45.9	3.8	685	<0.001
CA-5	11/15/2012	8.1	11700	9070	130	5800	128	110	10.1	2960	0.002
CA-5	3/5/2013	7.8	11500	9000	180	5700	141	93.6	9.4	2770	0.002
CA-5	5/2/2013	7.8	11300	8870	180	5600	129	101	9.4	2710	0.002
CA-5	9/23/2013	8.0	11400	7780	170	5800	137	116	9.7	2730	0.002
CA-5	12/10/2013	7.8	11200	9290	180	5900	138	112	9.2	2760	0.001
CA-5	3/3/2014	7.8	11300	8770	170	5900	156	103	10.5	2640	0.001
CA-5	5/21/2014	8.5	11500	10000	130	5800	149	117	10.2	3030	0.001
CWA-1a	Well damaged by flood event shortly after being drilled										
CWA-1a	Well damaged										
CWA-1a	Well damaged										
CWA-1b	6/12/2013	7.4	4560	4020	56	2400	482	56.5	5.5	616	<0.001
CWA-1b	8/5/2013	7.3	4530	3910	59	2400	497	58.5	6.2	627	0.001*
CWA-1b	10/31/2013	7.3	4430	3880	65	2200	511	58.7	5.9	548	0.001*
CWA-1b	2/27/2014	7.3	4730	4100	77	2400	516	66.5	5.9	646	0.001
CWA-1b	5/14/2014	7.4	4720	4080	62	2500	503	64.9	5.3	731	0.001*
CWA-1b	7/30/2014	7.6	5020	4420	59	2500	534	63.1	5.9	726	0.001*
CWA-2	9/18/2012	Dry									
CWA-2	10/1/2012	Dry									
CWA-2	1/25/2013	Dry									
CWA-2	4/11/2013	Dry									
CWA-2	8/5/2013	Dry									
CWA-2	10/31/2013	Dry									
CWA-2	2/13/2014	Dry									
CWA-2	4/29/2014	Dry									
CWA-2	7/18/2014	Dry									

Quarternary Alluvium Groundwater 2012-2014 Lab Data

Well Name	Sample Date	Lab pH S.U.	Lab Conduct umho/cm	TDS -180 mg/l	Cl mg/l	SO4 mg/l	Ca mg/l	Mg mg/l	K mg/l	Na mg/l	Se mg/l
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
CWA-3	9/18/2012	Dry									
CWA-3	10/1/2012	Dry									
CWA-3	1/25/2013	Dry									
CWA-3	4/11/2013	Dry									
CWA-3	8/5/2013	Dry									
CWA-3	10/31/2013	Dry									
CWA-3	2/13/2014	Dry									
CWA-3	5/14/2014	Insufficient Water to Sample									
CWA-3	7/18/2014	Insufficient Water to Sample									
CWA-4	9/18/2012	7.7	3560	2450	88	1300	79.3	15.5	5.1	704	0.003
CWA-4	12/11/2012	7.8	3640	2360	110	1100	82.4	16.8	4.4	738	<0.001
CWA-4	3/4/2013	7.6	3700	2180	110	1300	81.1	16.5	4.3	782	<0.001
CWA-4	4/22/2013	7.9	3690	2180	130	1300	71.4	14.6	4.1	759	<0.001
CWA-4	8/27/2014	7.7	3680	2390	99	1400	76	15.9	4.1	757	<0.001
CWA-4	12/10/2013	7.7	3560	2530	110	1300	74.6	14.8	3.8	719	<0.001
CWA-4	3/4/2013	7.7	3650	2560	110	1300	85.6	17	4.5	780	<0.001
CWA-4	5/14/2014	7.8	3620	2450	97	1400	78.9	16.1	4.1	773	0.001*
CWA-4	7/29/2014	7.7	3560	2490	85	1300	79.2	15.4	3.9	696	0.001*

Appendix 6-6

Groundwater Statistical Report

APPENDIX 6-6 GROUNDWATER STATISTICAL REPORT

CA-2 (2013-2014)

	Stats					
	pH	*EC*	*TDS*	*Chloride*	*Sulfate*	*Selenium*
	(s.u.)	*(umhos/cm)*	*(mg/l)*	*(mg/l)*	*(mg/l)*	*(mg/l)*
Mean	6.68	5946	4810	172	2260	<0.0005
Standard Deviation	0.13	127	183	30	207	0.000
Median	6.60	5950	4840	190	2300	<0.0005
Mode	6.60	N/A	N/A	190	2300	0.001
Range	0.30	320	440	70	500	0.000
Minimum	6.60	5800	4590	130	1900	<0.0005
Maximum	6.90	6120	5030	200	2400	<0.001
Count	5	5	5	5	5	5

CA-3 (2012-2014)

	Stats					
	pH	*EC*	*TDS*	*Chloride*	*Sulfate*	*Selenium*
	(s.u.)	*(umhos/cm)*	*(mg/l)*	*(mg/l)*	*(mg/l)*	*(mg/l)*
Mean	7.06	6470	5570	122	3456	<0.0006
Standard Deviation	0.15	1046	861	92	469	0.0002
Median	7.00	6140	5140	82	3300	<0.0005
Mode	7.10	N/A	N/A	110	3300	<0.0005
Range	0.50	2960	2330	238	1400	0.0005
Minimum	6.90	5350	4760	52	2900	<0.0005
Maximum	7.40	8310	7090	290	4300	0.001
Count	9	9	9	9	9	9

CA-4 (2012-2014)

	Stats					
	pH	*EC*	*TDS*	*Chloride*	*Sulfate*	*Selenium*
	(s.u.)	*(umhos/cm)*	*(mg/l)*	*(mg/l)*	*(mg/l)*	*(mg/l)*
Mean	7.19	4144	3077	62	1578	<0.0018
Standard Deviation	0.31	373	327	19	282	0.003
Median	7.00	4100	3150	66	1500	<0.0005
Mode	7.00	N/A	N/A	N/A	1500	<0.0005
Range	0.90	1130	1020	48	800	0.0105
Minimum	7.00	3500	2540	37	1200	<0.0005
Maximum	7.90	4630	3560	85	2000	0.011
Count	9	9	9	9	9	9

APPENDIX 6-6 GROUNDWATER STATISTICAL REPORT (Continued)

CA-5 (2012-2014)

	Stats					
	pH	*EC*	*TDS*	*Chloride*	*Sulfate*	*Selenium*
	(s.u.)	*(umhos/cm)*	*(mg/l)*	*(mg/l)*	*(mg/l)*	*(mg/l)*
Mean	7.89	10573	8411	147	5289	<0.0015
Standard Deviation	0.32	2412	1966	40	1355	0.0006
Median	7.80	11300	9000	170	5800	0.002
Mode	7.80	11500	N/A	180	5800	0.002
Range	1.20	7540	6580	116	4200	0.0015
Minimum	7.30	4160	3420	64	1700	<0.0005
Maximum	8.50	11700	10000	180	5900	0.002
Count	9	9	9	9	9	9

CWA-1b (2013-2014)

	Stats					
	pH	*EC*	*TDS*	*Chloride*	*Sulfate*	*Selenium*
	(s.u.)	*(umhos/cm)*	*(mg/l)*	*(mg/l)*	*(mg/l)*	*(mg/l)*
Mean	7.38	4686	4078	64	2400	<0.0005
Standard Deviation	0.13	226	215	7	122	0.0002
Median	7.30	4720	4080	62	2400	<0.0005
Mode	7.30	N/A	N/A	59	2400	<0.0005
Range	0.30	590	540	18	300	0.001
Minimum	7.30	4430	3880	59	2200	<0.0005
Maximum	7.60	5020	4420	77	2500	0.001
Count	5	5	5	5	5	5

CWA-4 (2012-2014)

	Stats					
	pH	*EC*	*TDS*	*Chloride*	*Sulfate*	*Selenium*
	(s.u.)	*(umhos/cm)*	*(mg/l)*	*(mg/l)*	*(mg/l)*	*(mg/l)*
Mean	7.73	3629	2399	104	1300	<0.0008
Standard Deviation	0.09	57	139	14	87	0.0008
Median	7.70	3640	2450	110	1300	<0.0005
Mode	7.70	3560	2450	110	1300	<0.0005
Range	0.30	140	380	45	300	0.0025
Minimum	7.60	3560	2180	85	1100	<0.0005
Maximum	7.90	3700	2560	130	1400	0.003
Count	9	9	9	9	9	9

APPENDIX 6-6 GROUNDWATER STATISTICAL REPORT (Continued)

QAC-1 (1985-2014)

	Stats							
	pH	*EC*	*TDS*	*Boron*	*Fluoride*	*Chloride*	*Sulfate*	*Selenium*
	(s.u.)	*(umhos/cm)*	*(mg/l)*	*(mg/l)*	*(mg/l)*	*(mg/l)*	*(mg/l)*	*(mg/l)*
Mean	7.41	18964	13843	1.46	1.37	4256	4539	<0.018
Standard Deviation	0.27	4875	1698	0.24	1.40	996	707	0.058
Median	7.32	20100	13700	1.46	0.85	4500	4420	0.002
Mode	7.30	14000	14300	1.40	0.70	4900	4400	0.001
Range	1.17	25420	9800	2.18	7.50	5000	5300	0.500
Minimum	7.02	1280	7700	0.74	0.01	1200	500	<0.0005
Maximum	8.19	26700	17500	2.92	7.50	6200	5800	0.500
Count	119	119	117	71	71	119	118	119

Appendix 6-7

Groundwater Static Water Levels and

Time versus Concentration Graphs for:

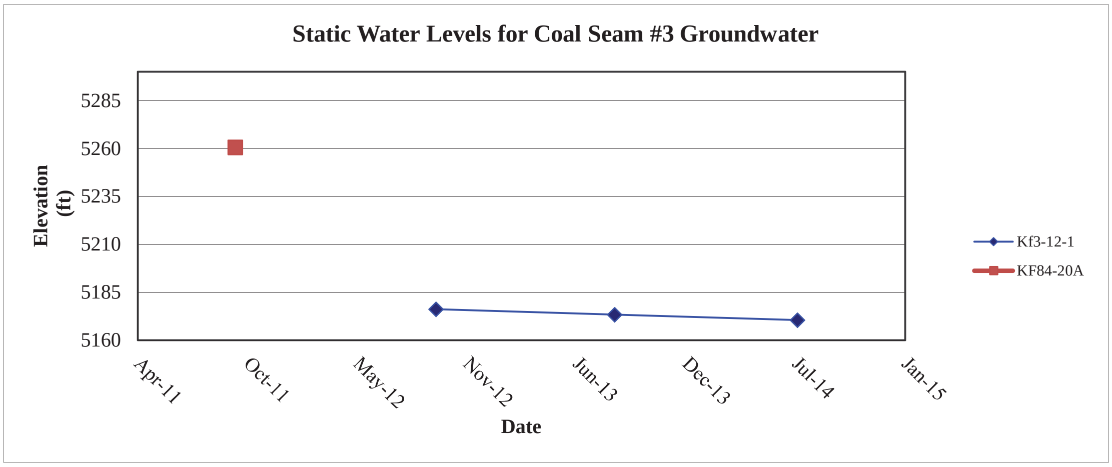
-Coal Seam 4-6

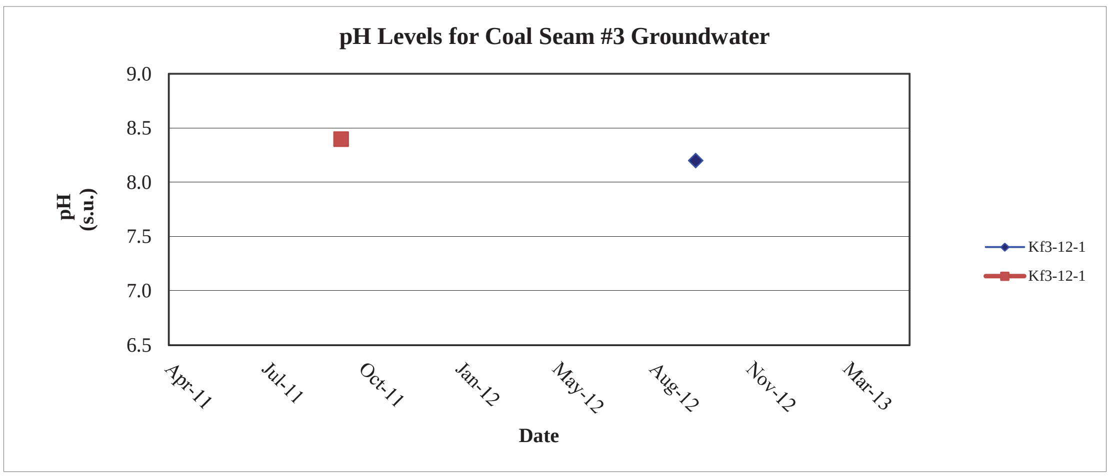
-Coal Seam 7

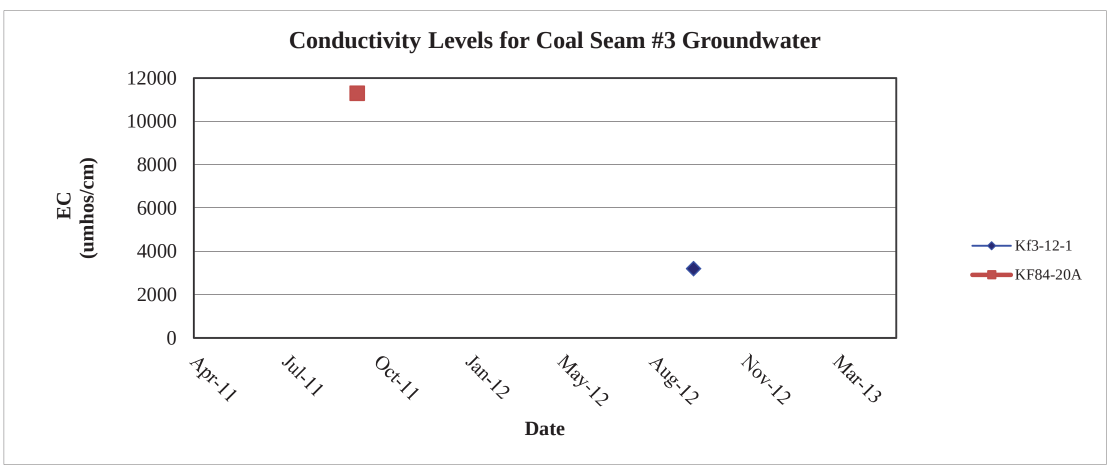
-Coal Seam 8

-QAL

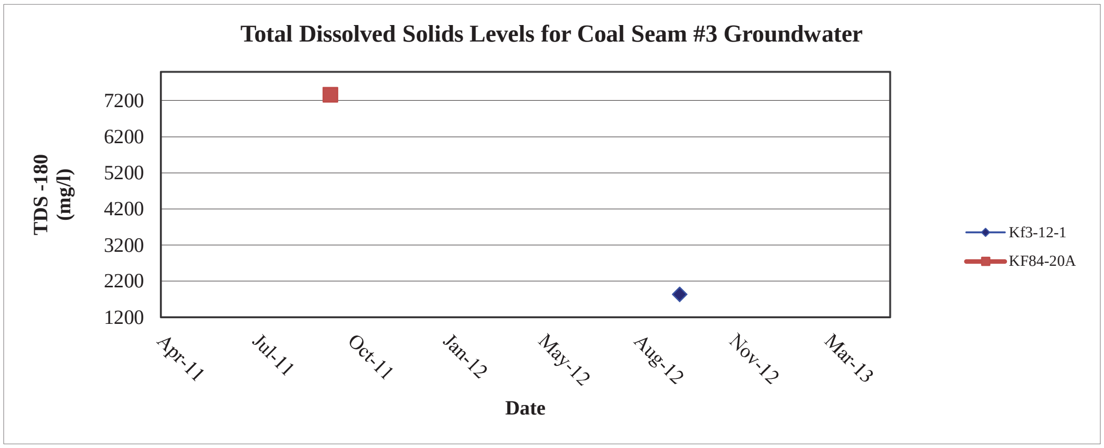
Appendix 6-7: Groundwater Static Water Levels and Time Versus Concentration Graphs for Coal Seam 3

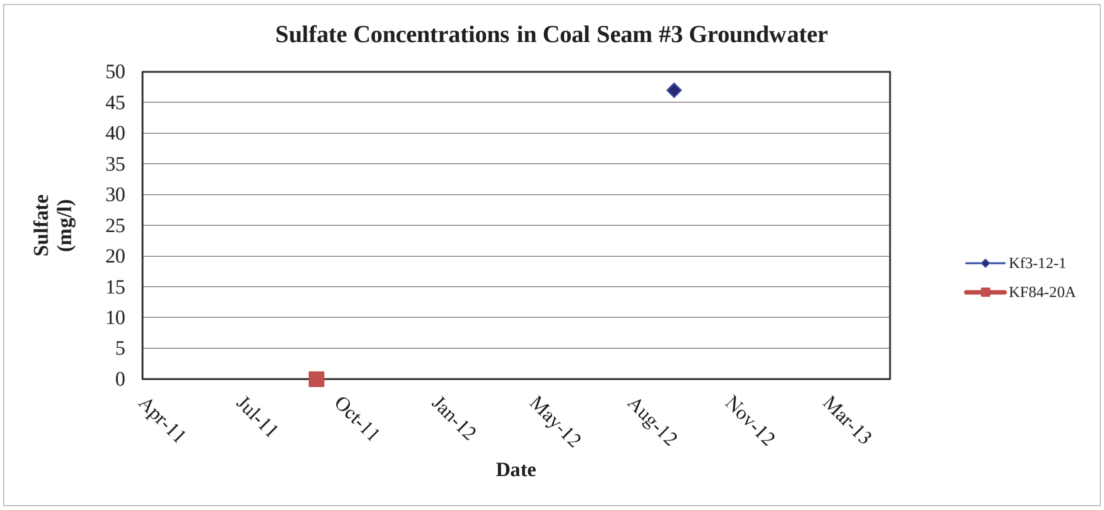


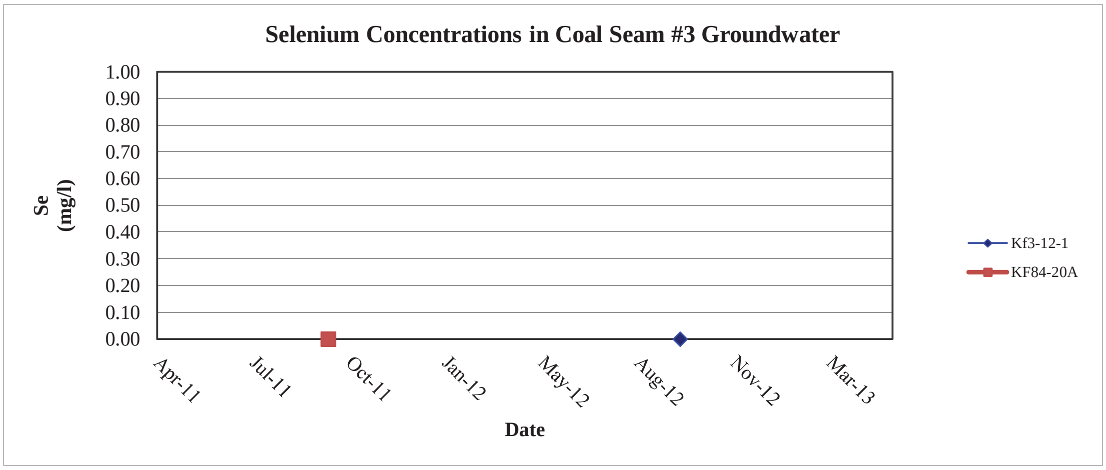




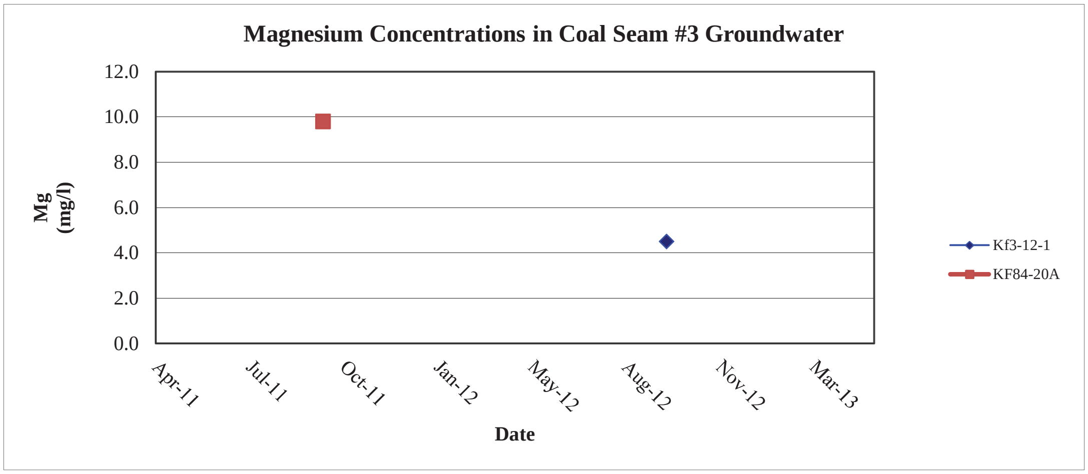
Appendix 6-7: Groundwater Static Water Levels and Time Versus Concentration Graphs for Coal Seam 3

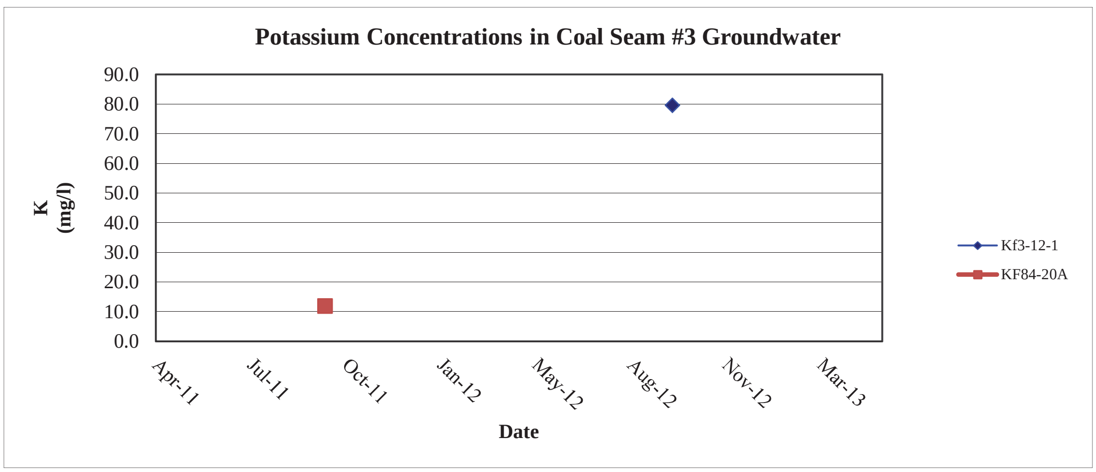




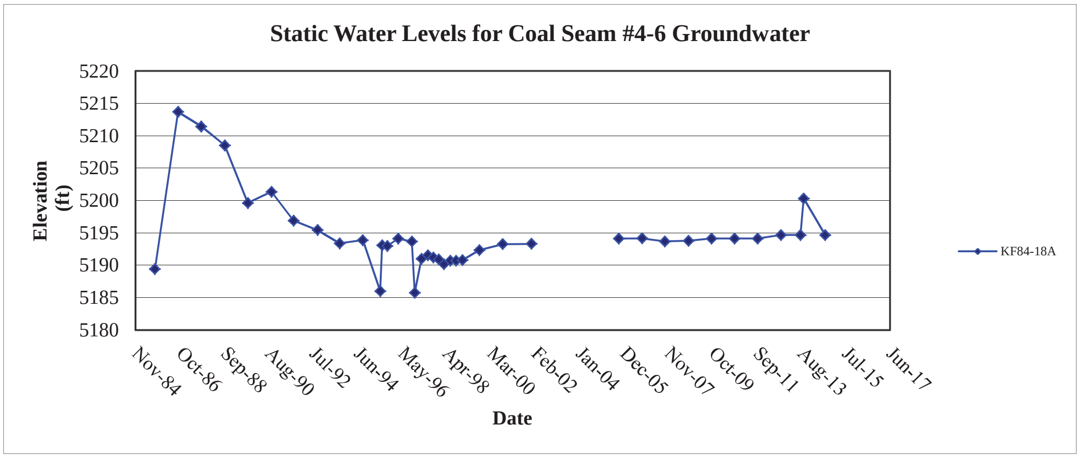


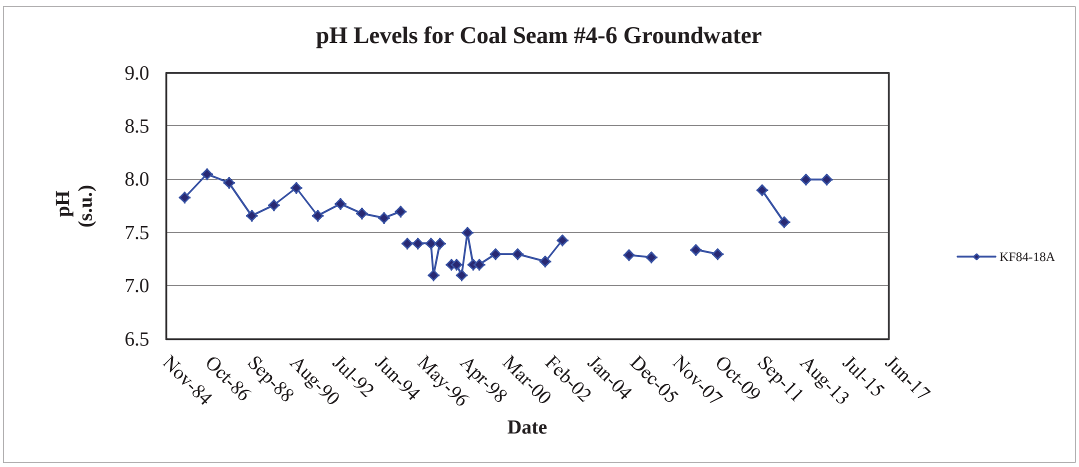
Appendix 6-7: Groundwater Static Water Levels and Time Versus Concentration Graphs for Coal Seam 3

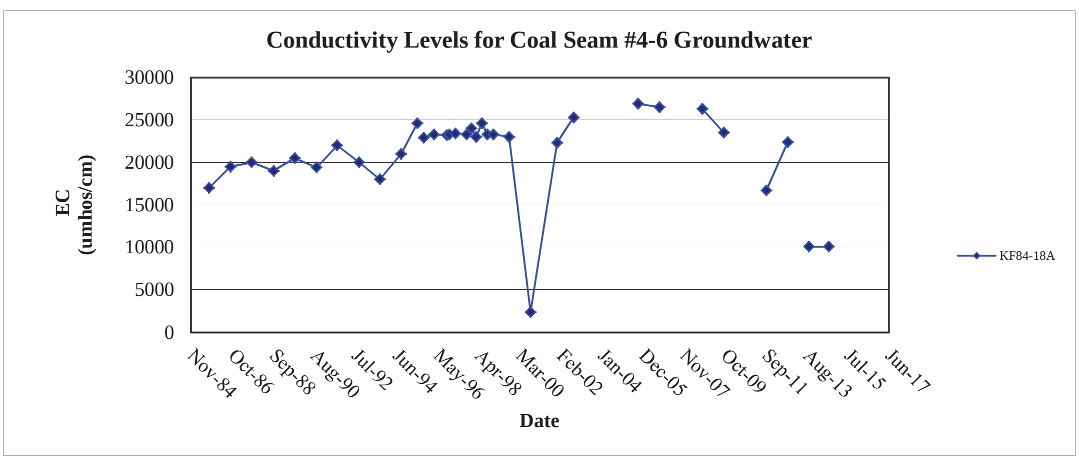




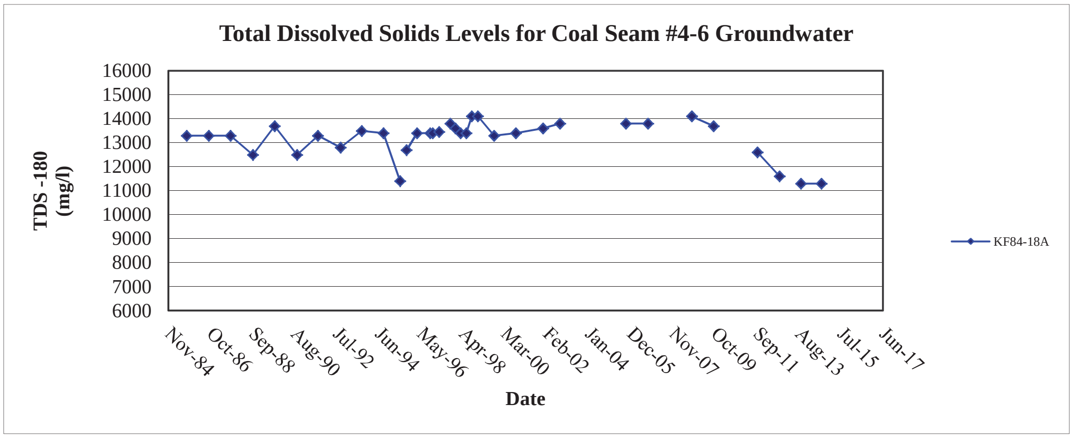
Appendix 6-7: Groundwater Static Water Levels and Time verses Concentration Graphs for Coal Seams 4-6

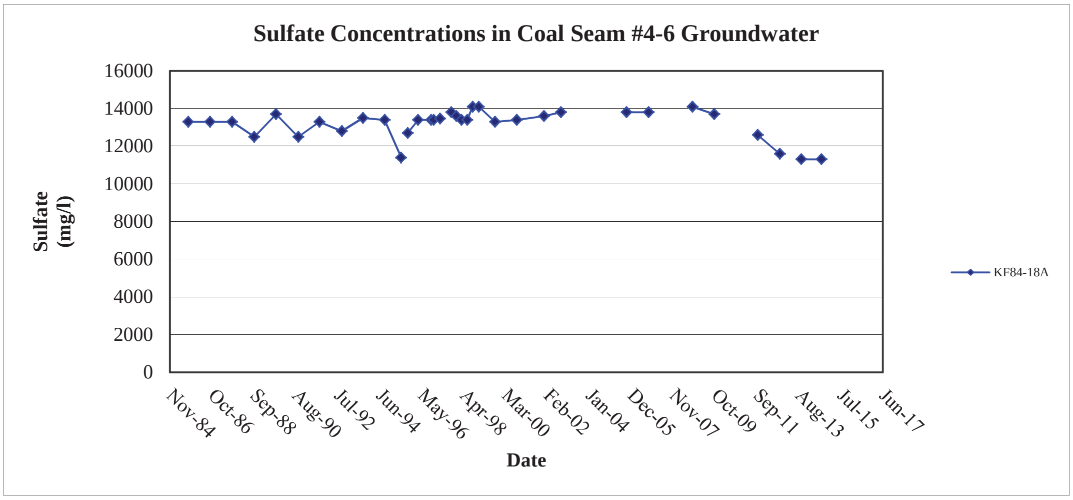


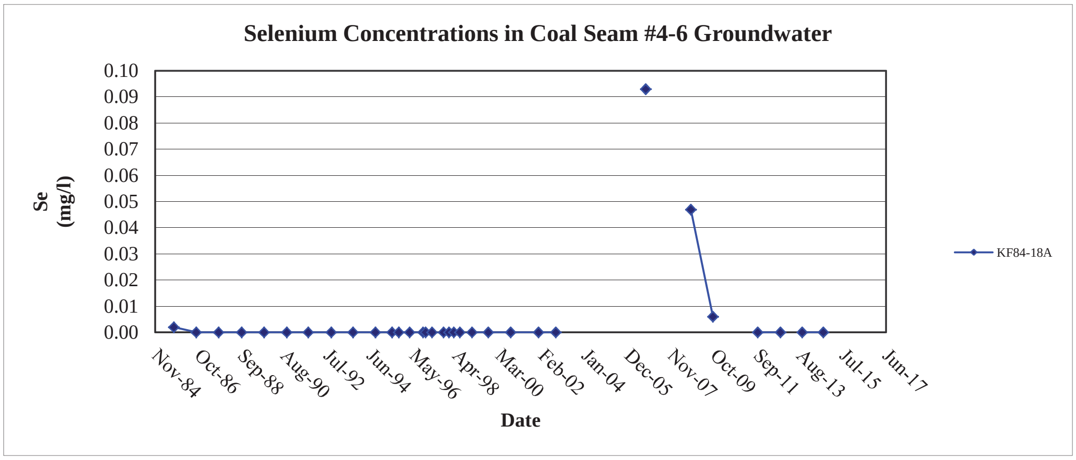




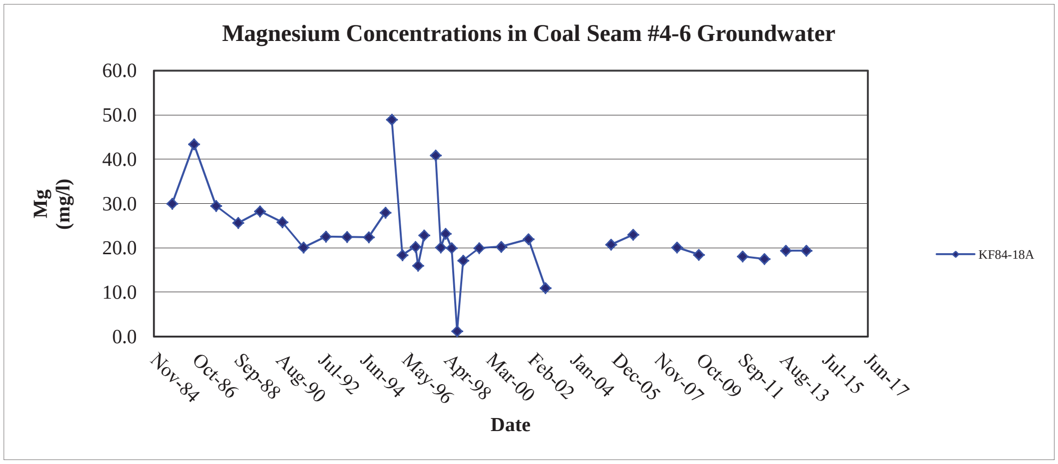
Appendix 6-7: Groundwater Static Water Levels and Time verses Concentration Graphs for Coal Seams 4-6

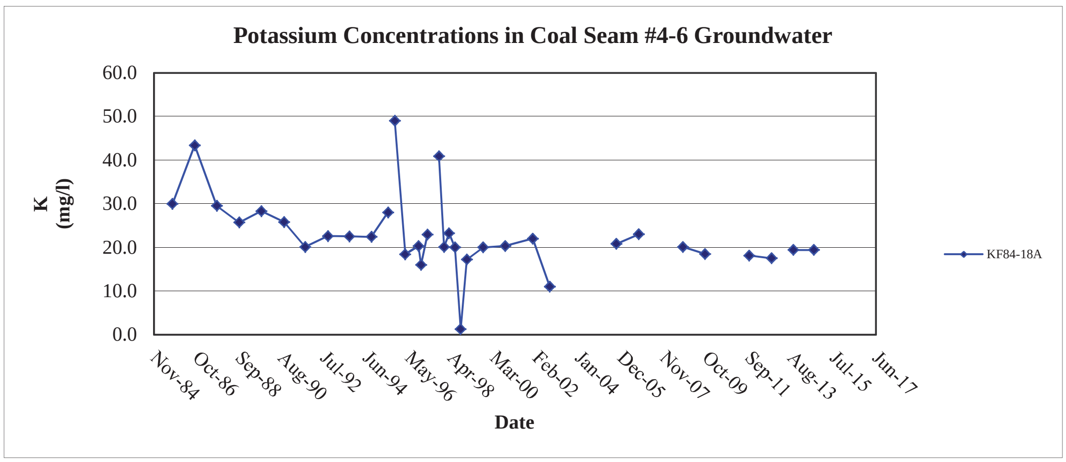




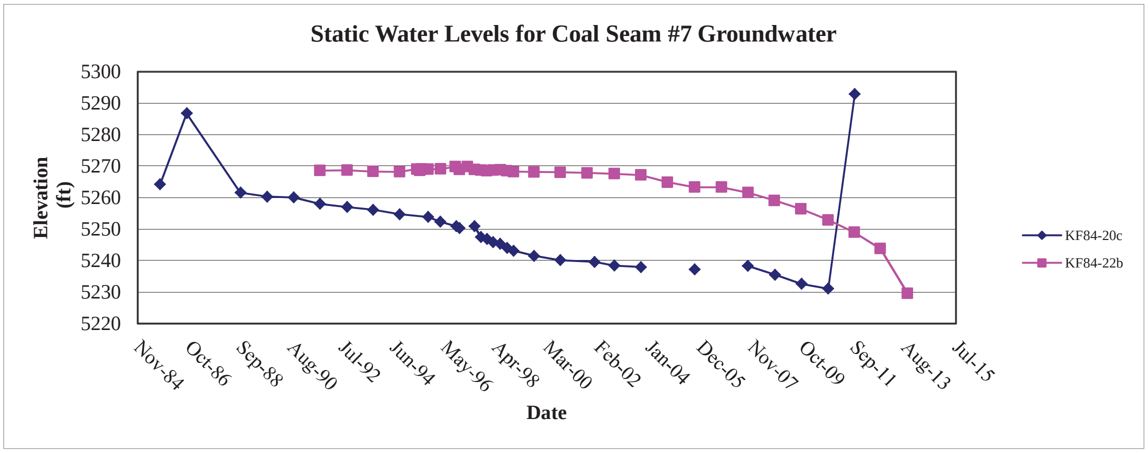


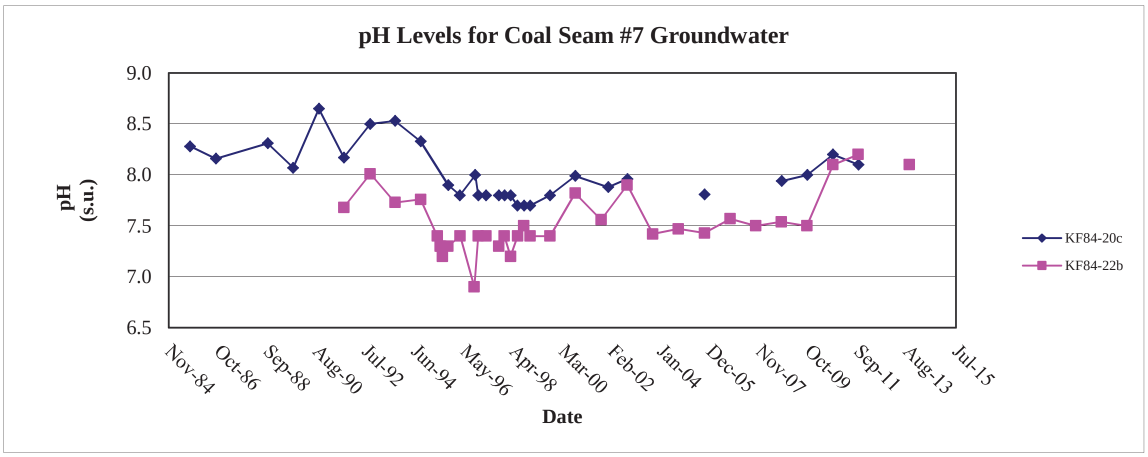
Appendix 6-7: Groundwater Static Water Levels and Time verses Concentration Graphs for Coal Seams 4-6

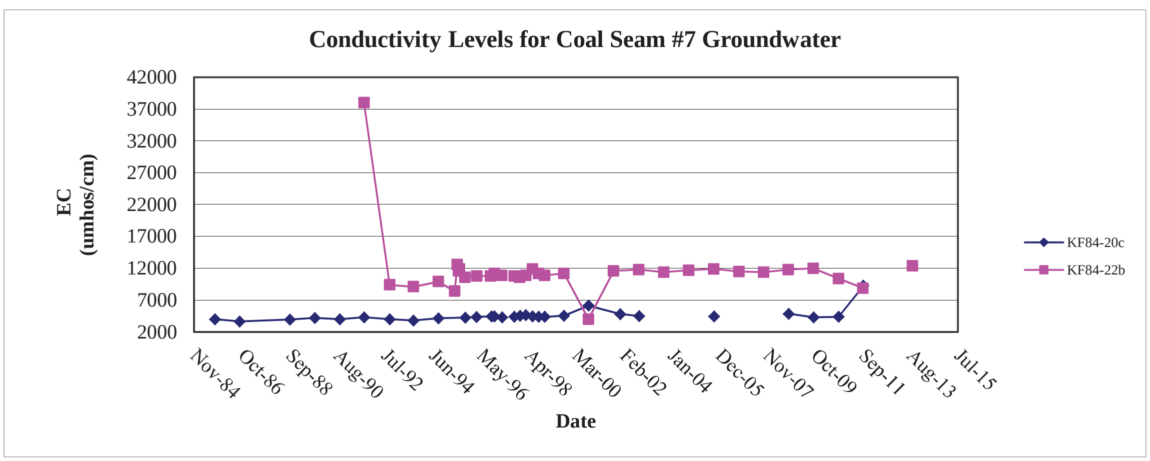




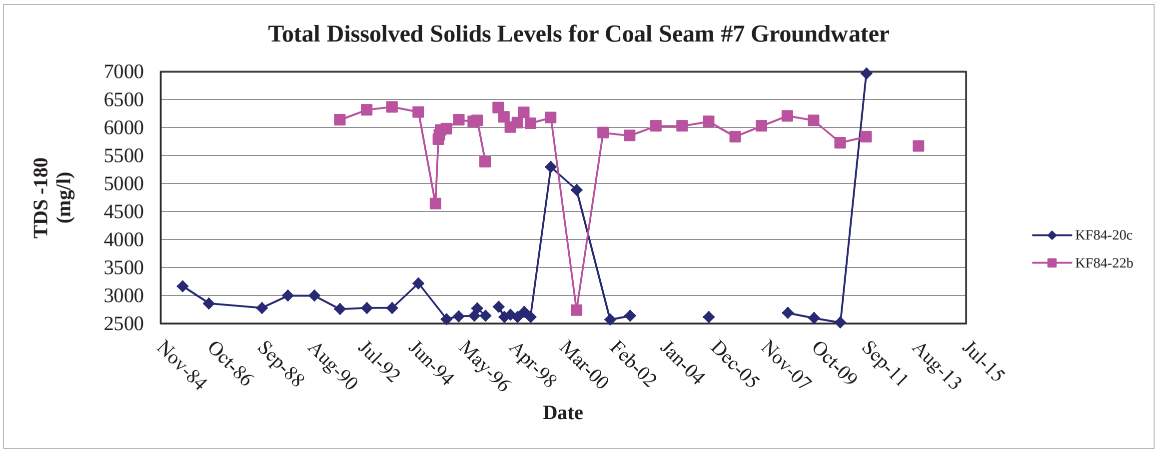
Appendix 6-7. Groundwater Static Water Levels and Time verses Concentration Graphs for Coal Seam 7

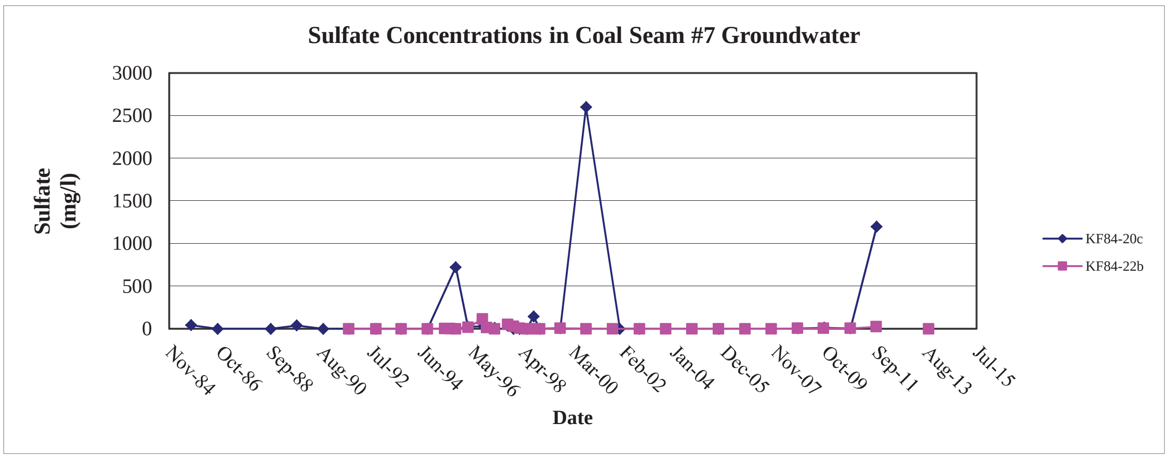


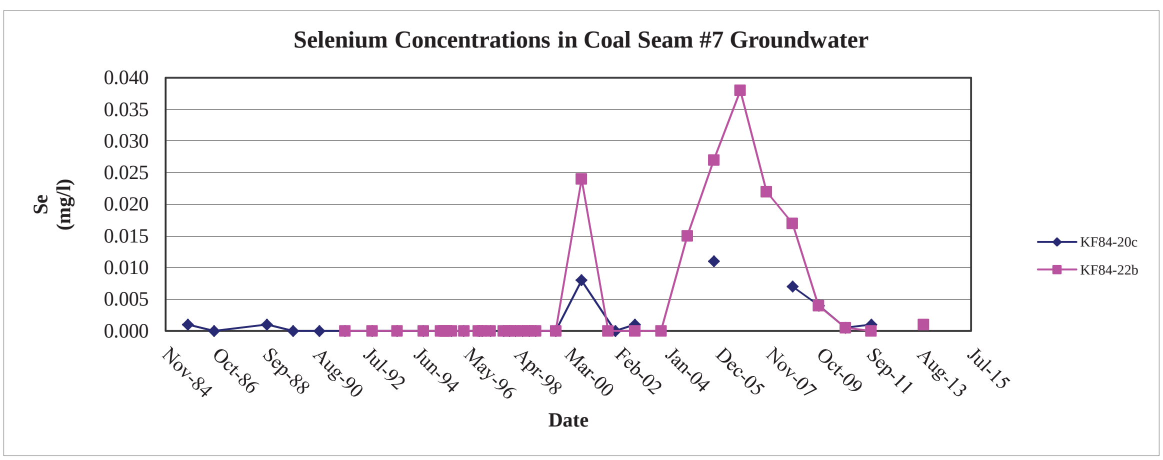




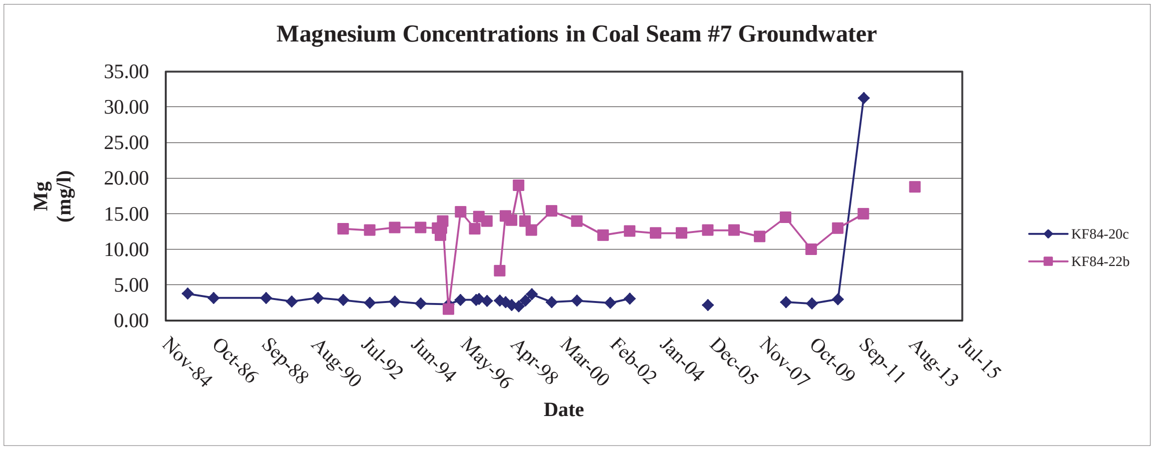
Appendix 6-7. Groundwater Static Water Levels and Time verses Concentration Graphs for Coal Seam 7

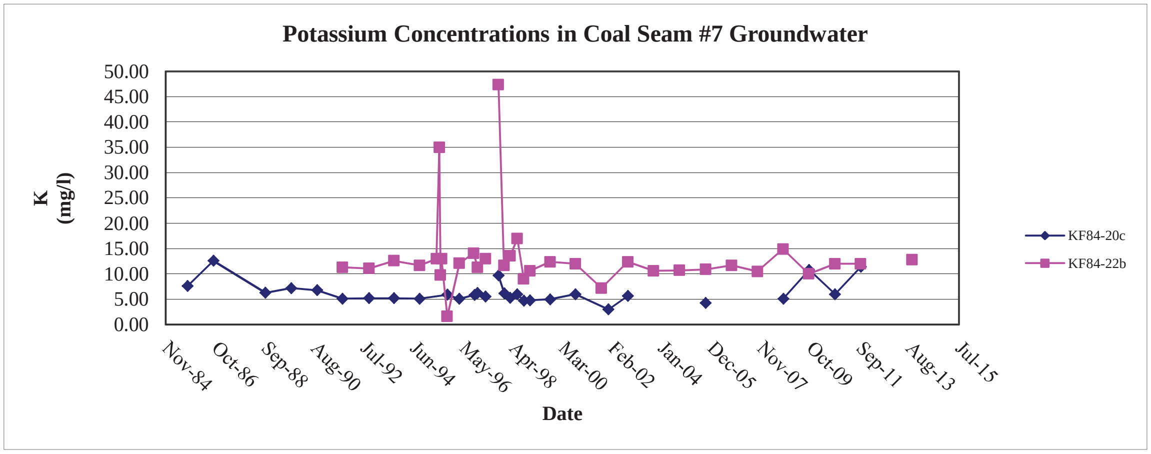




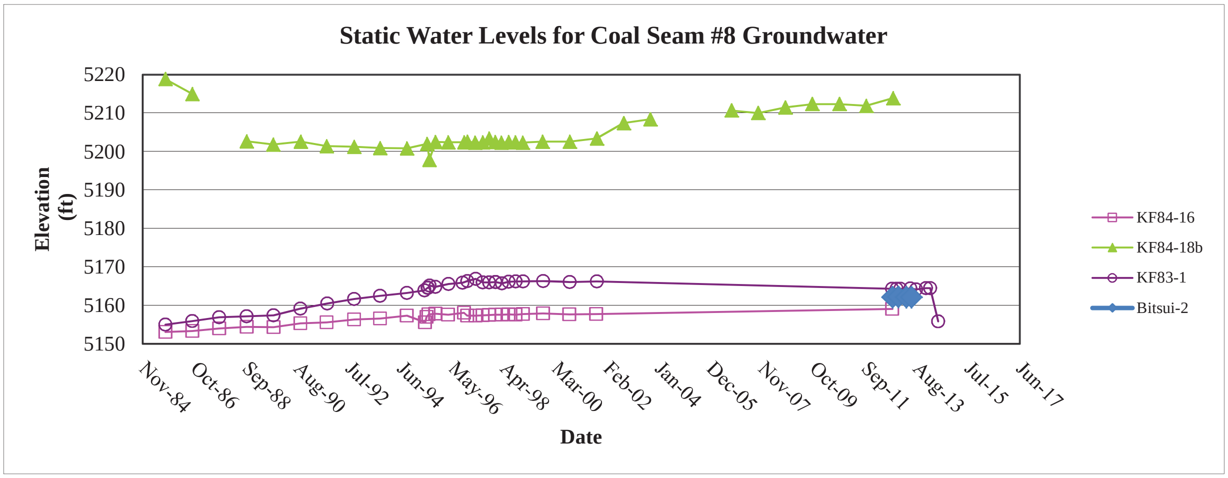


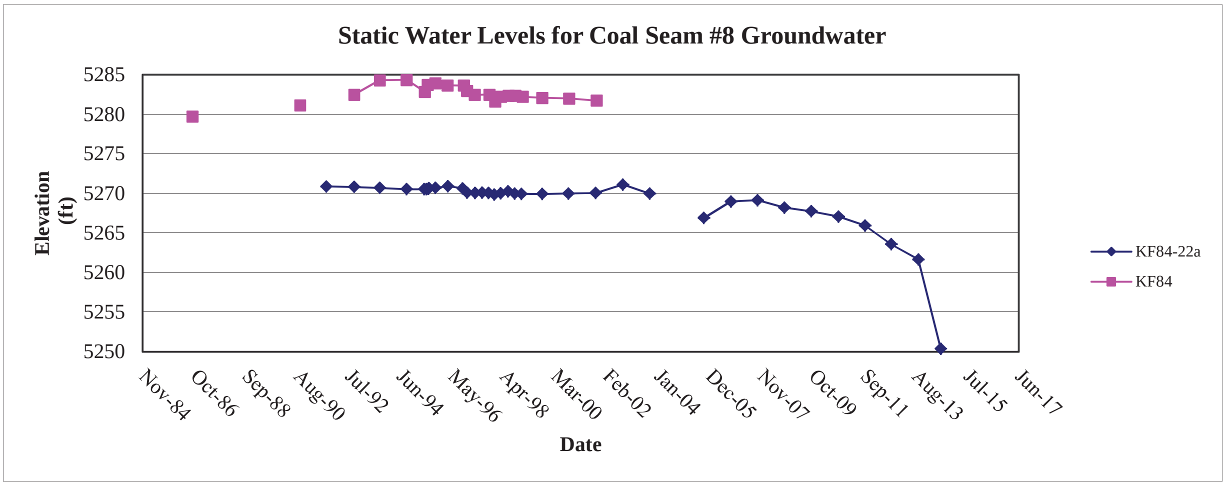
Appendix 6-7. Groundwater Static Water Levels and Time verses Concentration Graphs for Coal Seam 7

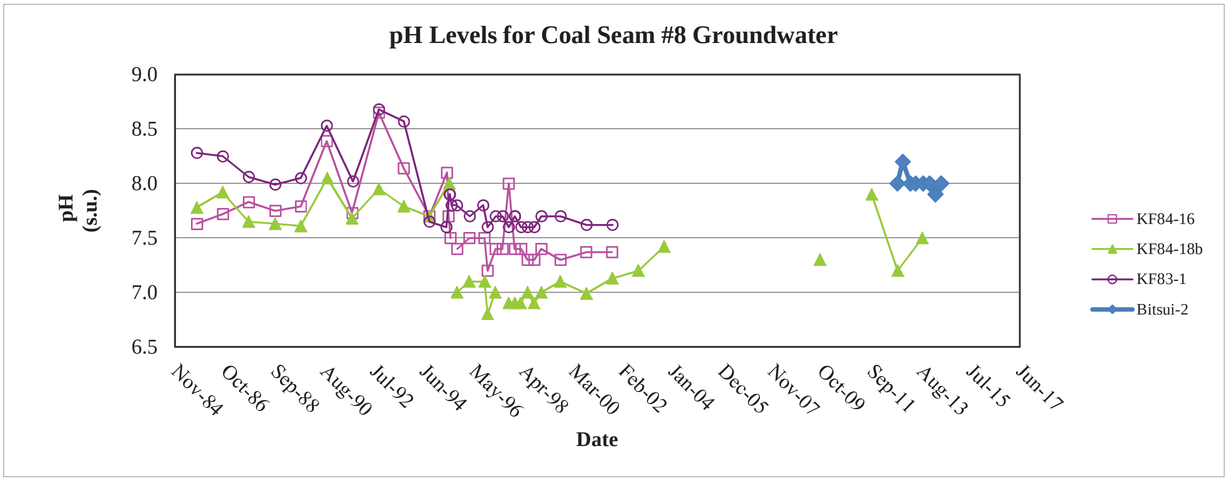




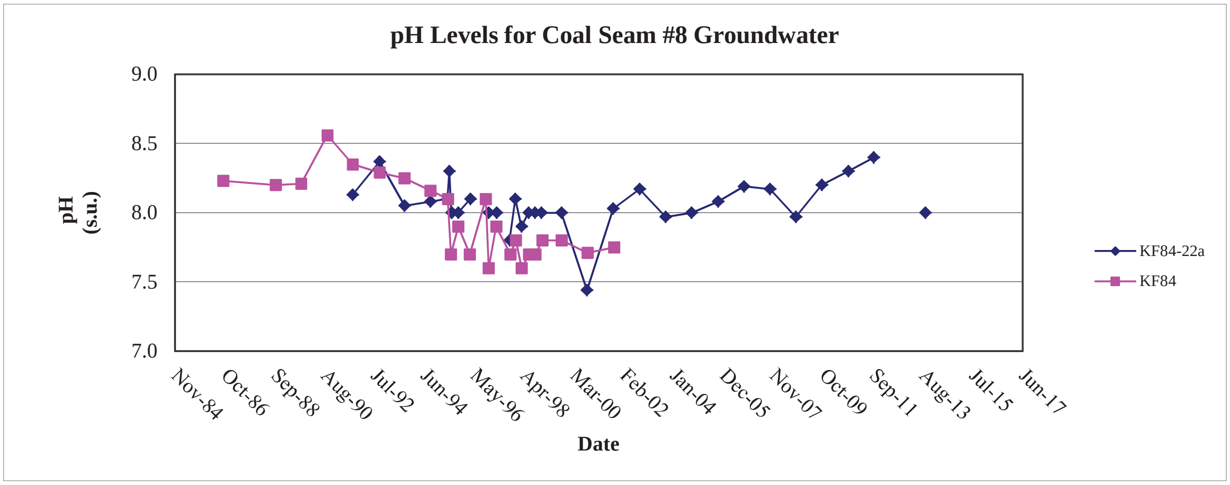
Appendix 6-7: Groundwater Static Water Levels and Time verses Concentration Graphs for Coal Seam 8

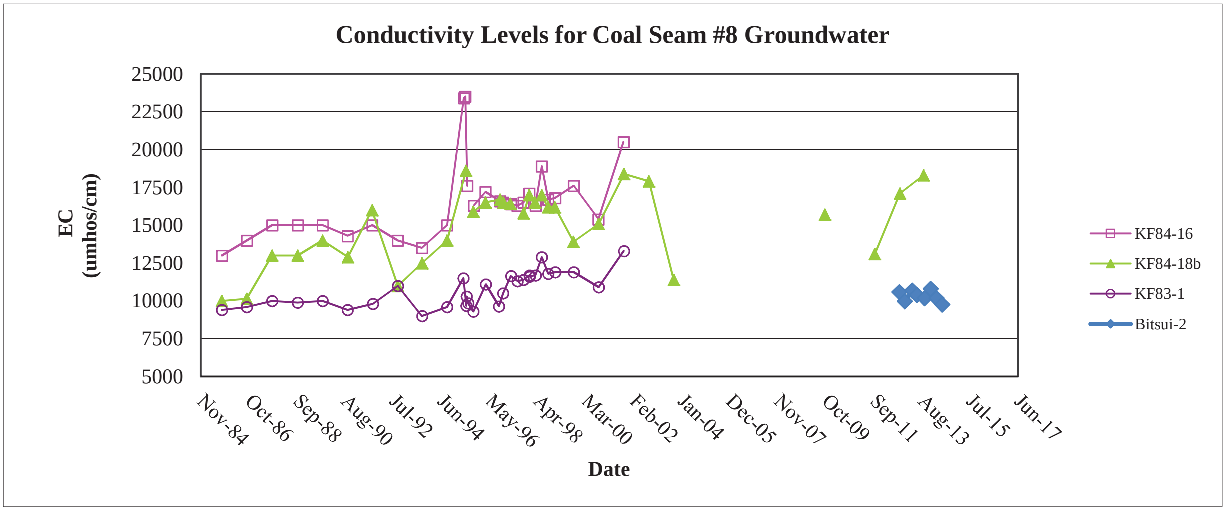


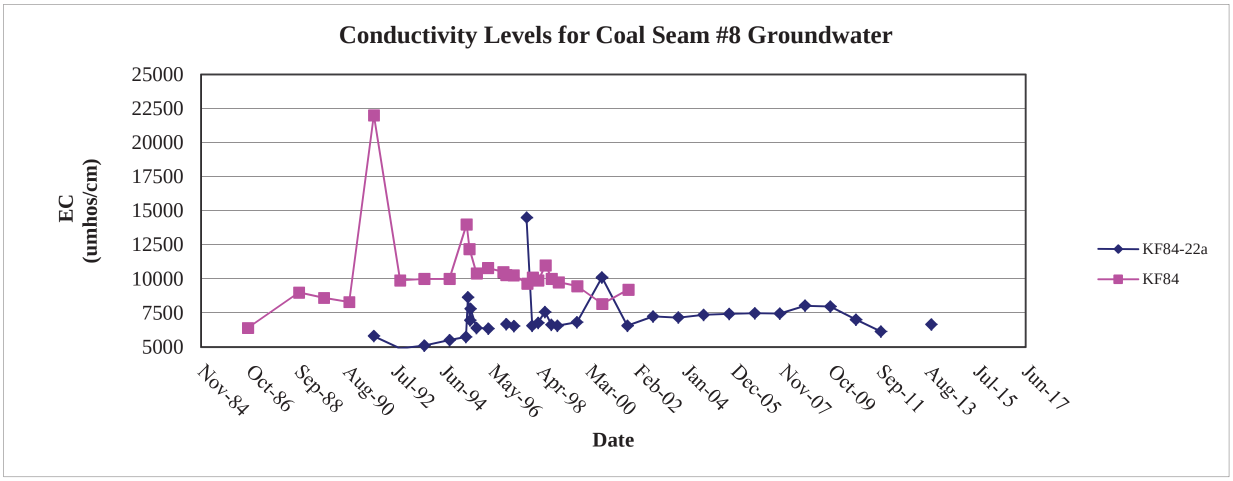




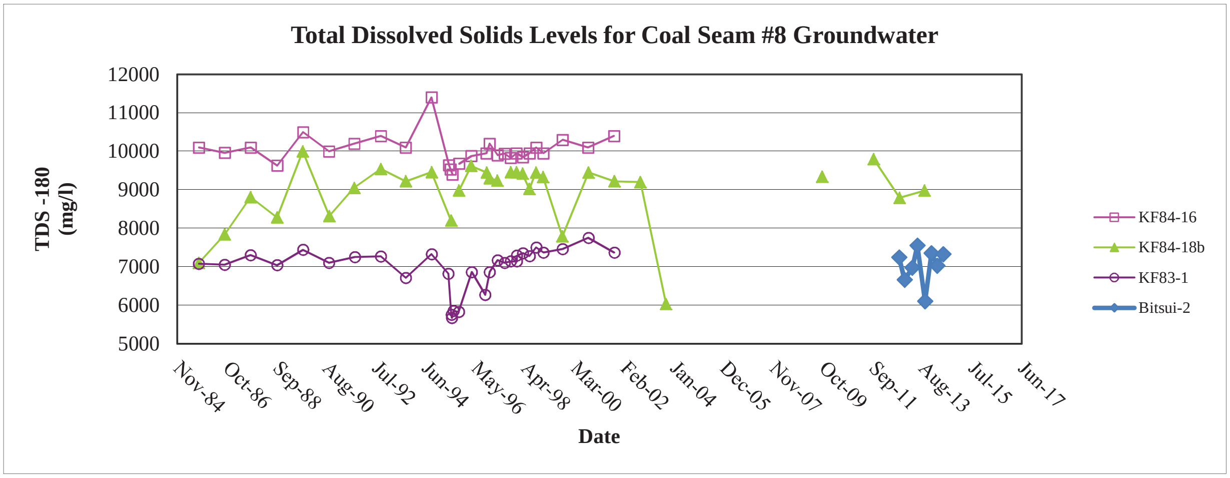
Appendix 6-7: Groundwater Static Water Levels and Time verses Concentration Graphs for Coal Seam 8

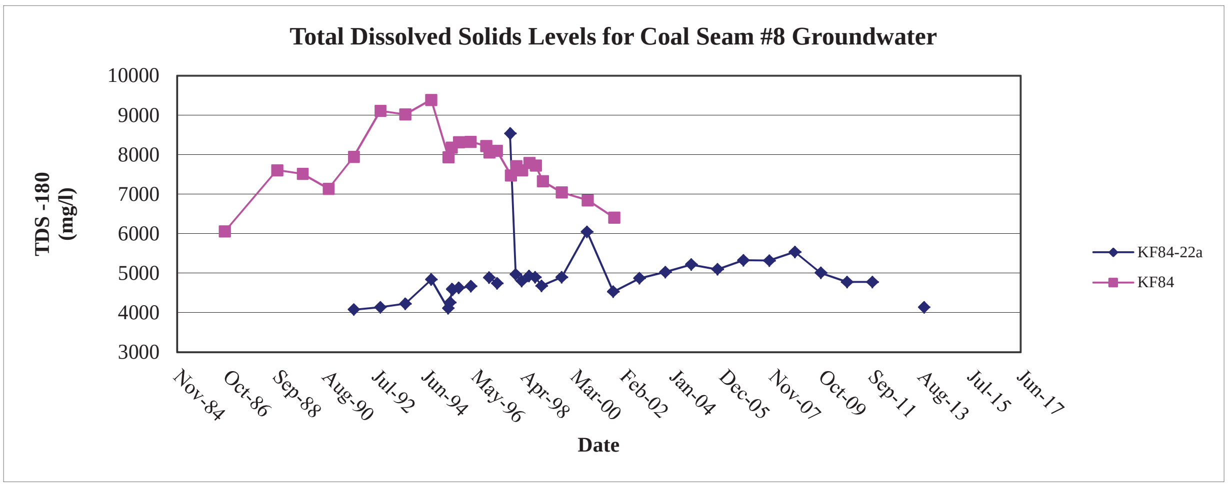


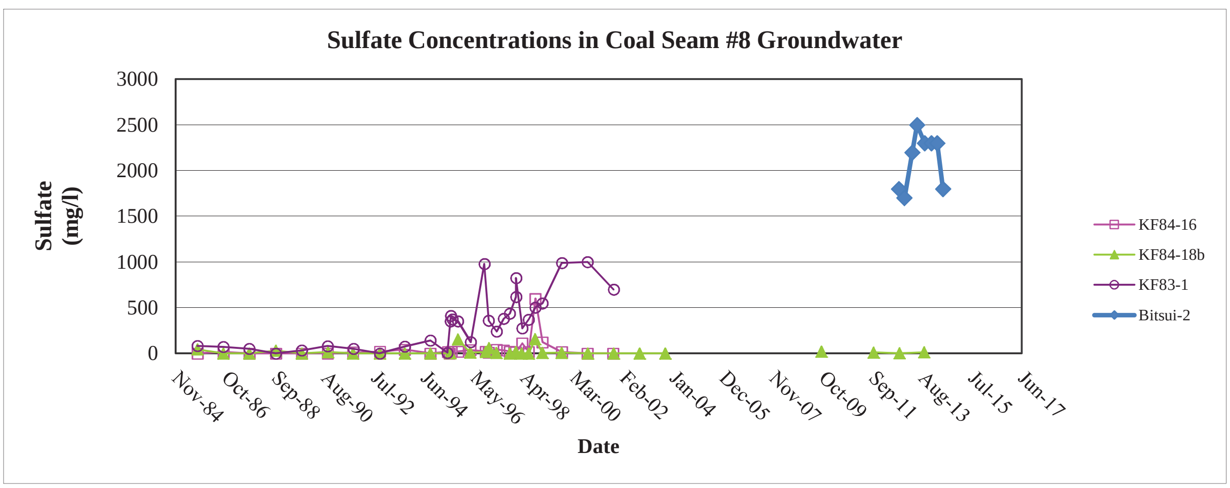




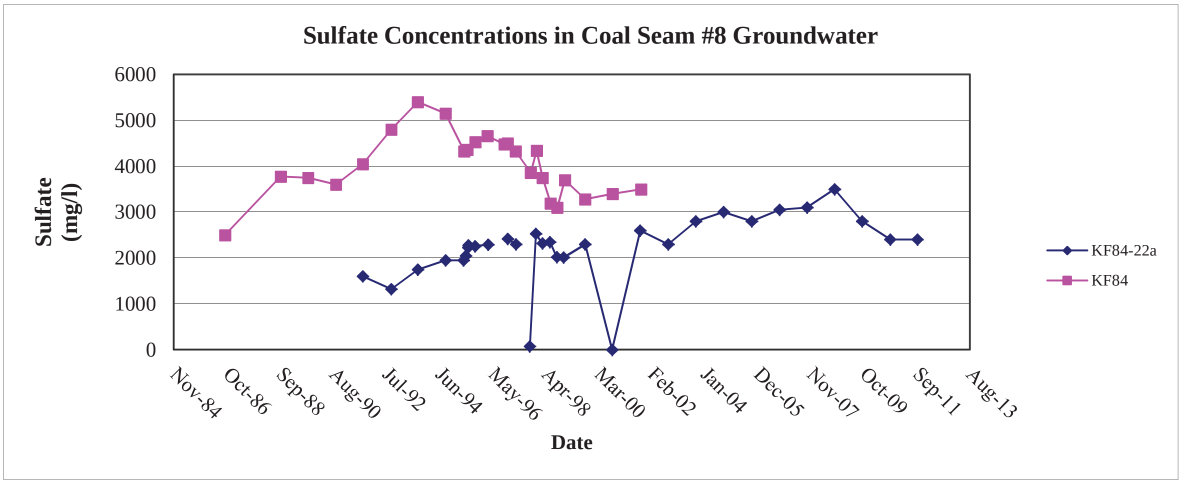
Appendix 6-7: Groundwater Static Water Levels and Time verses Concentration Graphs for Coal Seam 8

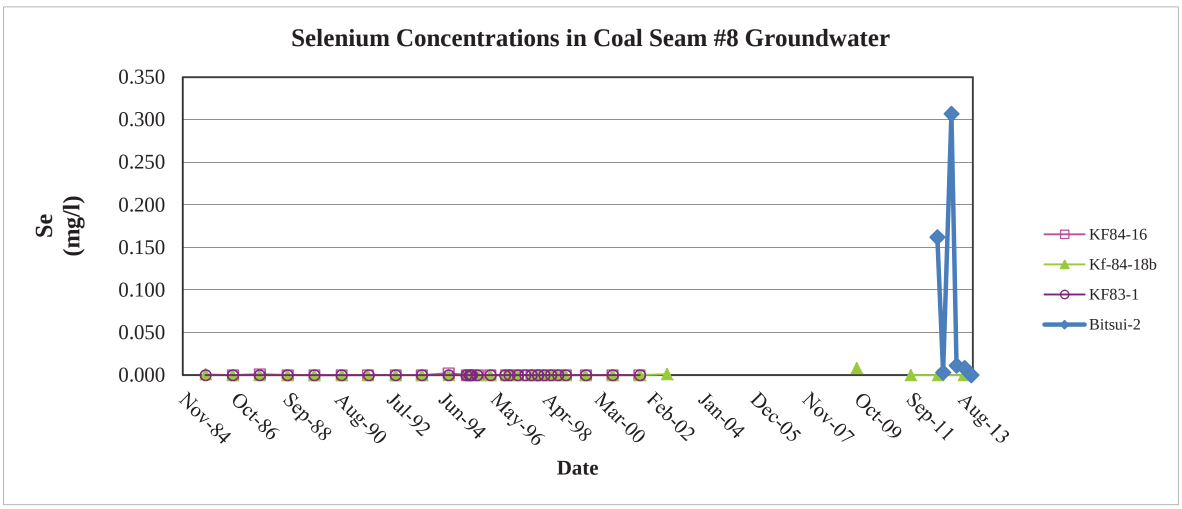


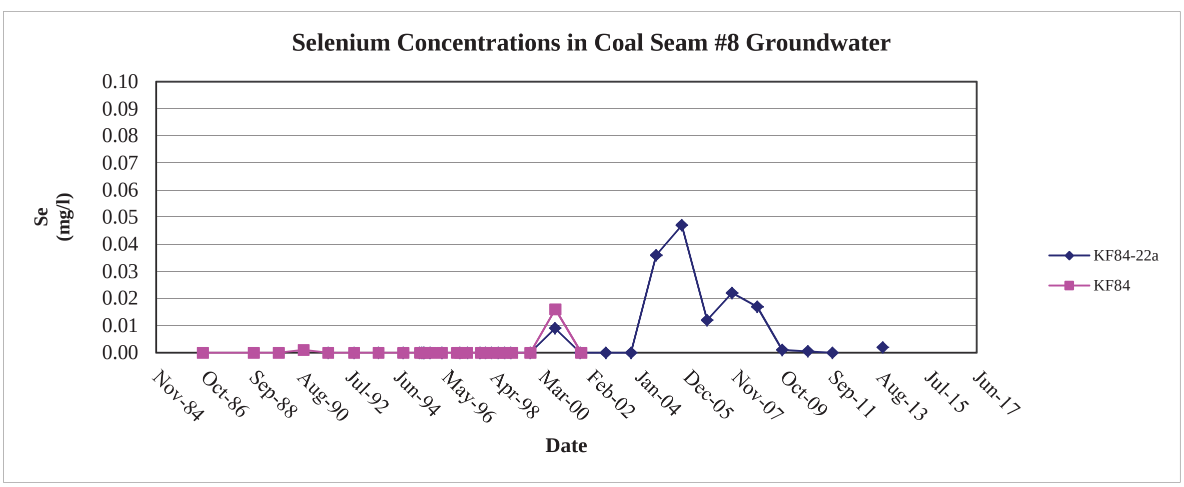




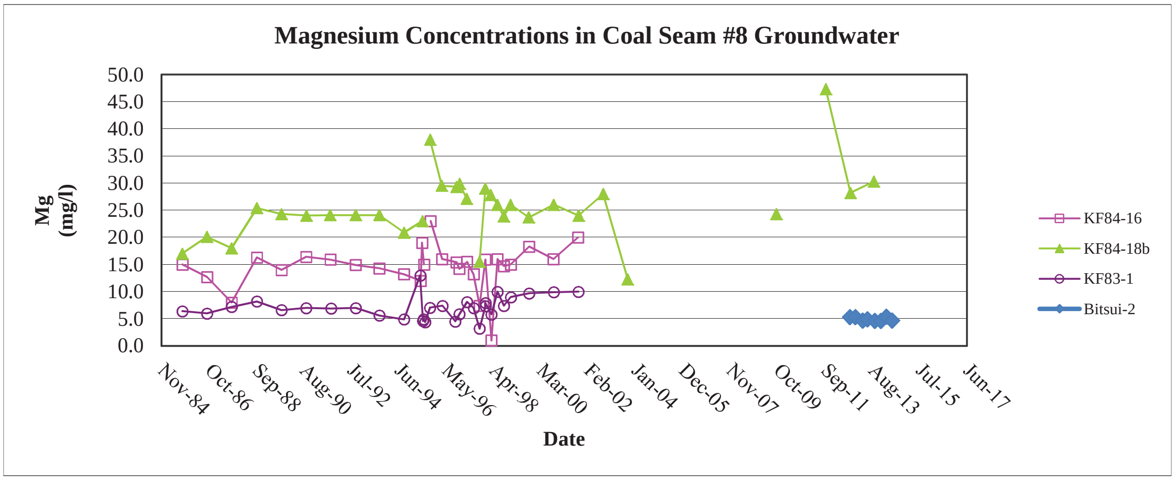
Appendix 6-7: Groundwater Static Water Levels and Time verses Concentration Graphs for Coal Seam 8

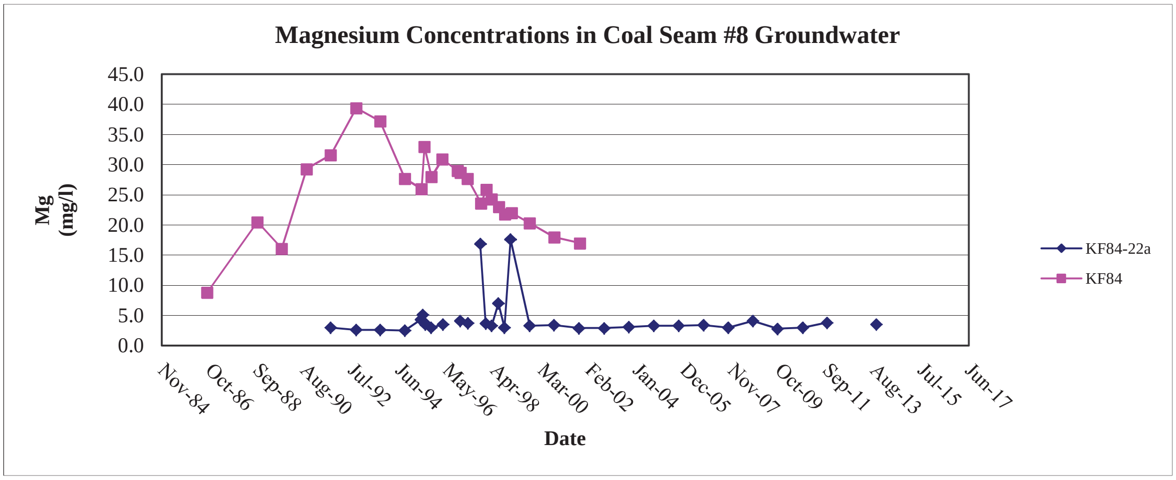


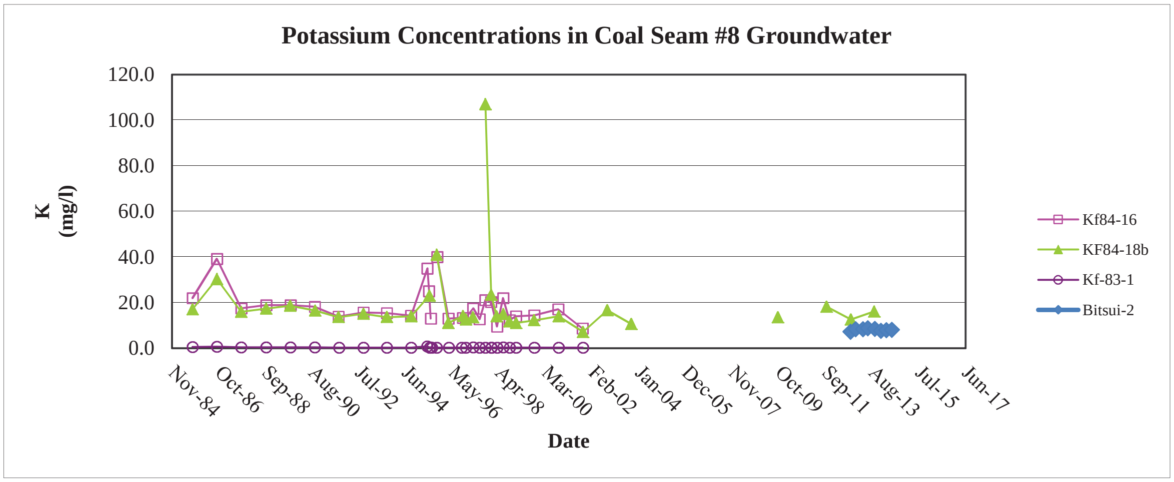




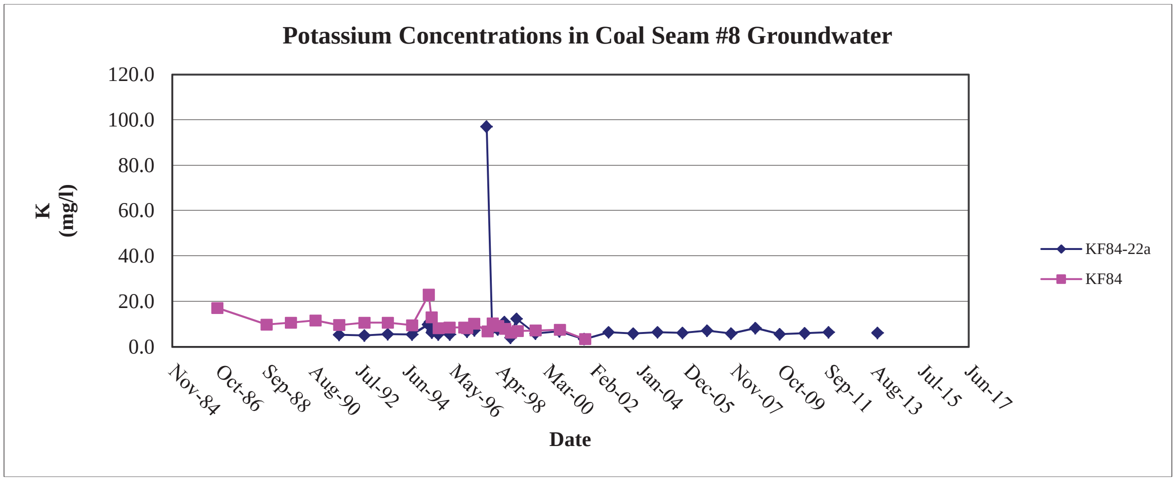
Appendix 6-7: Groundwater Static Water Levels and Time verses Concentration Graphs for Coal Seam 8



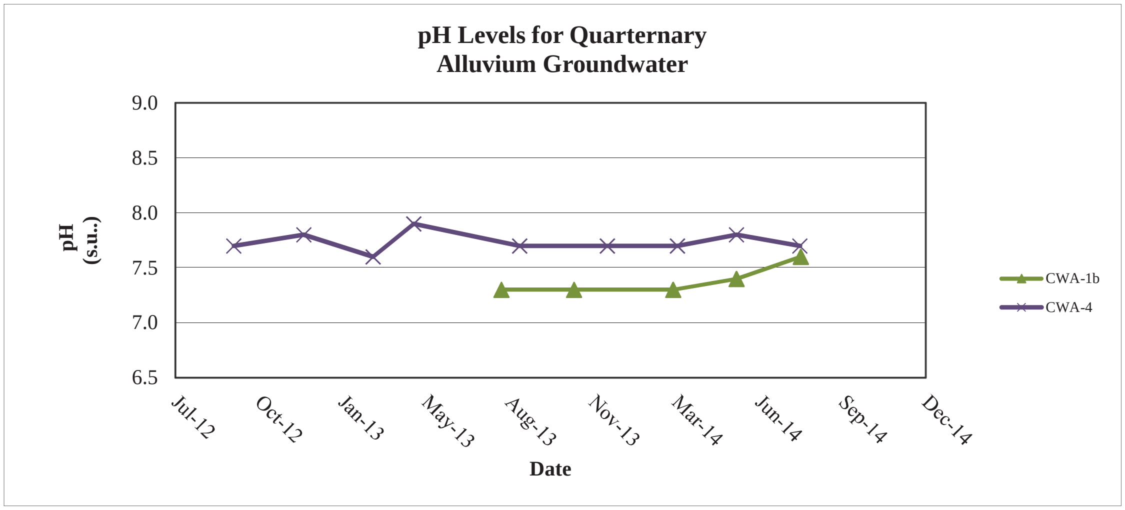


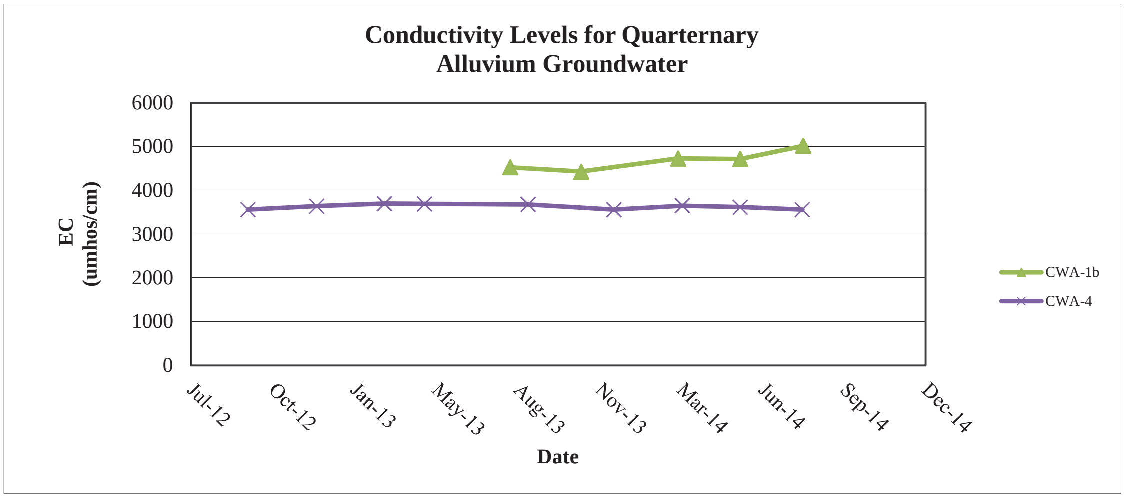


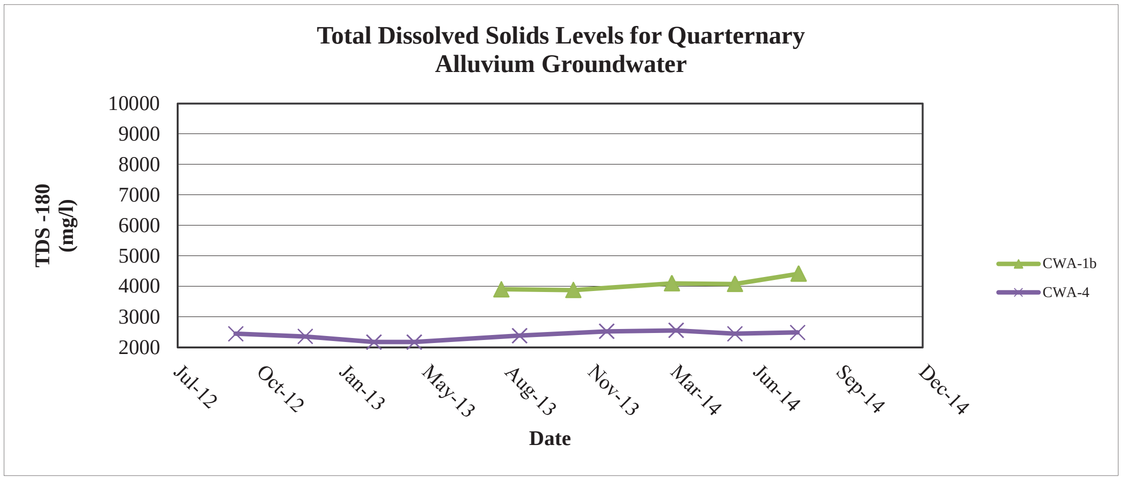
Appendix 6-7: Groundwater Static Water Levels and Time verses Concentration Graphs for Coal Seam 8



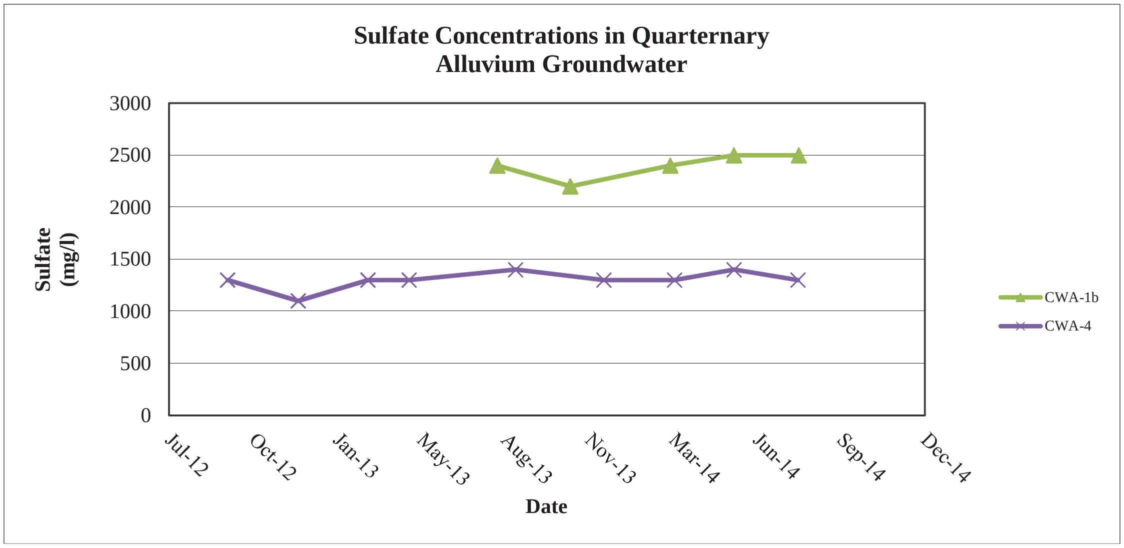
Appendix 6-7: Groundwater Static Water Levels and Time versus Concentration Graphs for Cottonwood Alluvial Wells

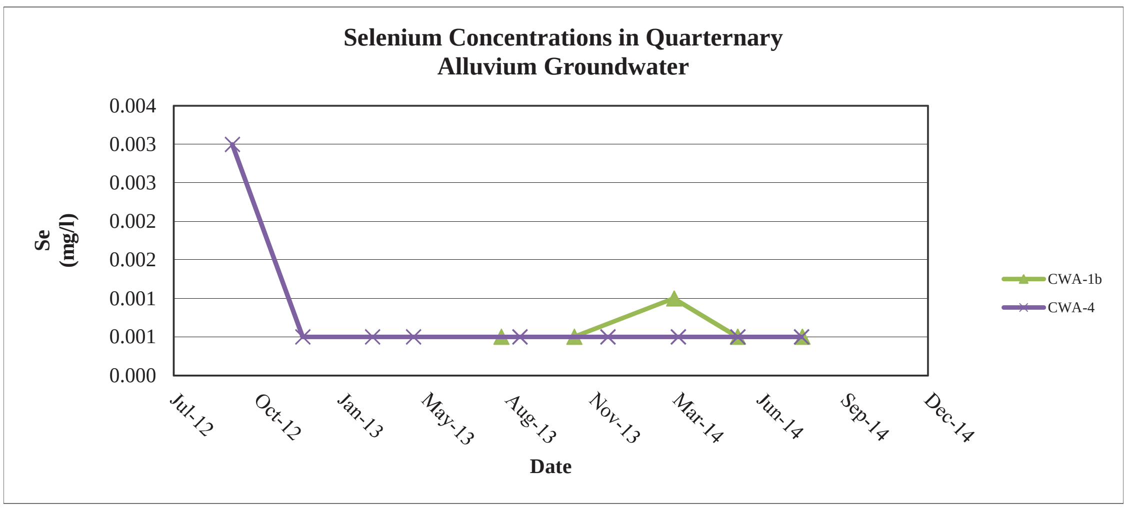


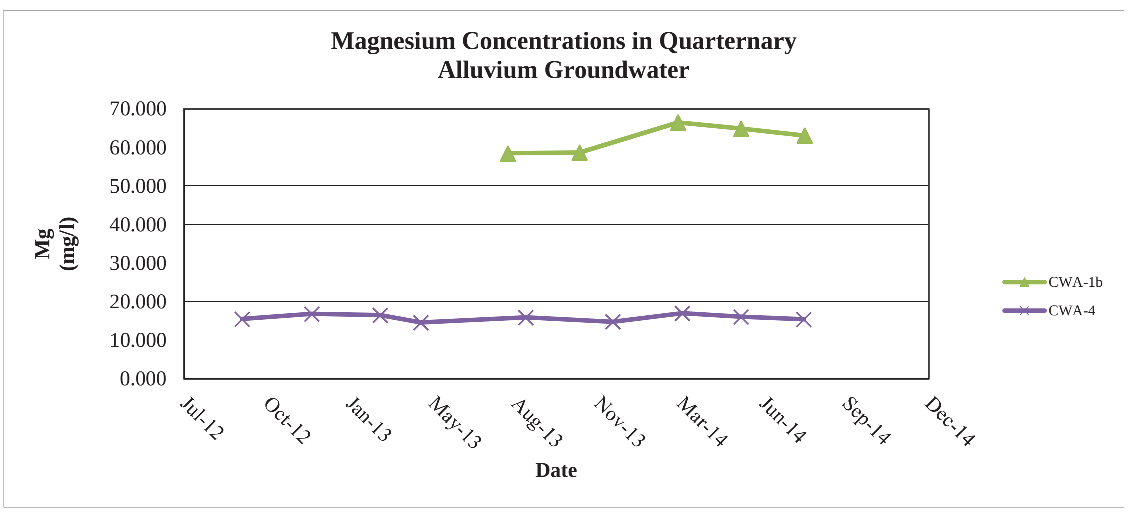




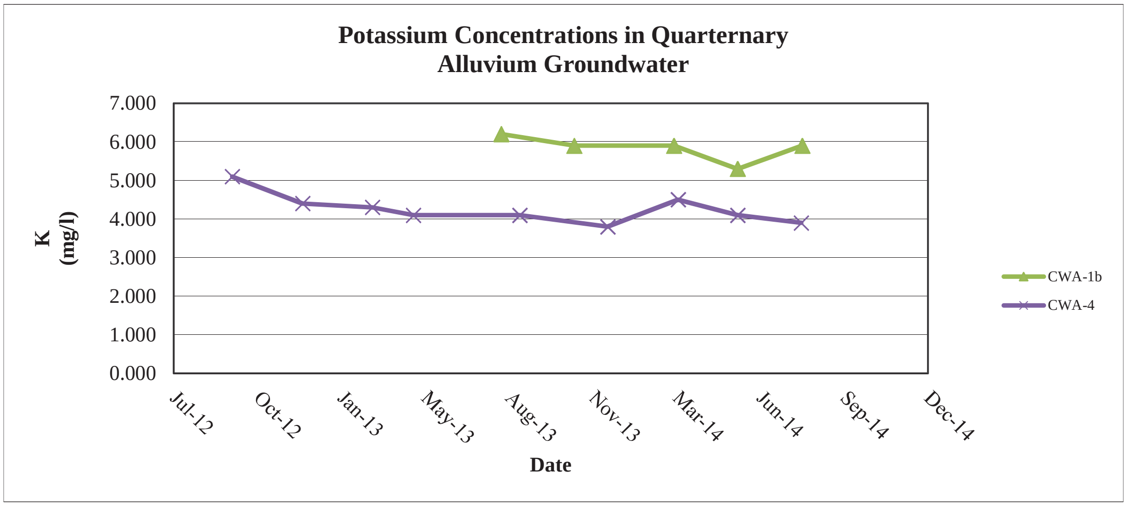
Appendix 6-7: Groundwater Static Water Levels and Time versus Concentration Graphs for Cottonwood Alluvial Wells







Appendix 6-7: Groundwater Static Water Levels and Time versus Concentration Graphs for Cottonwood Alluvial Wells

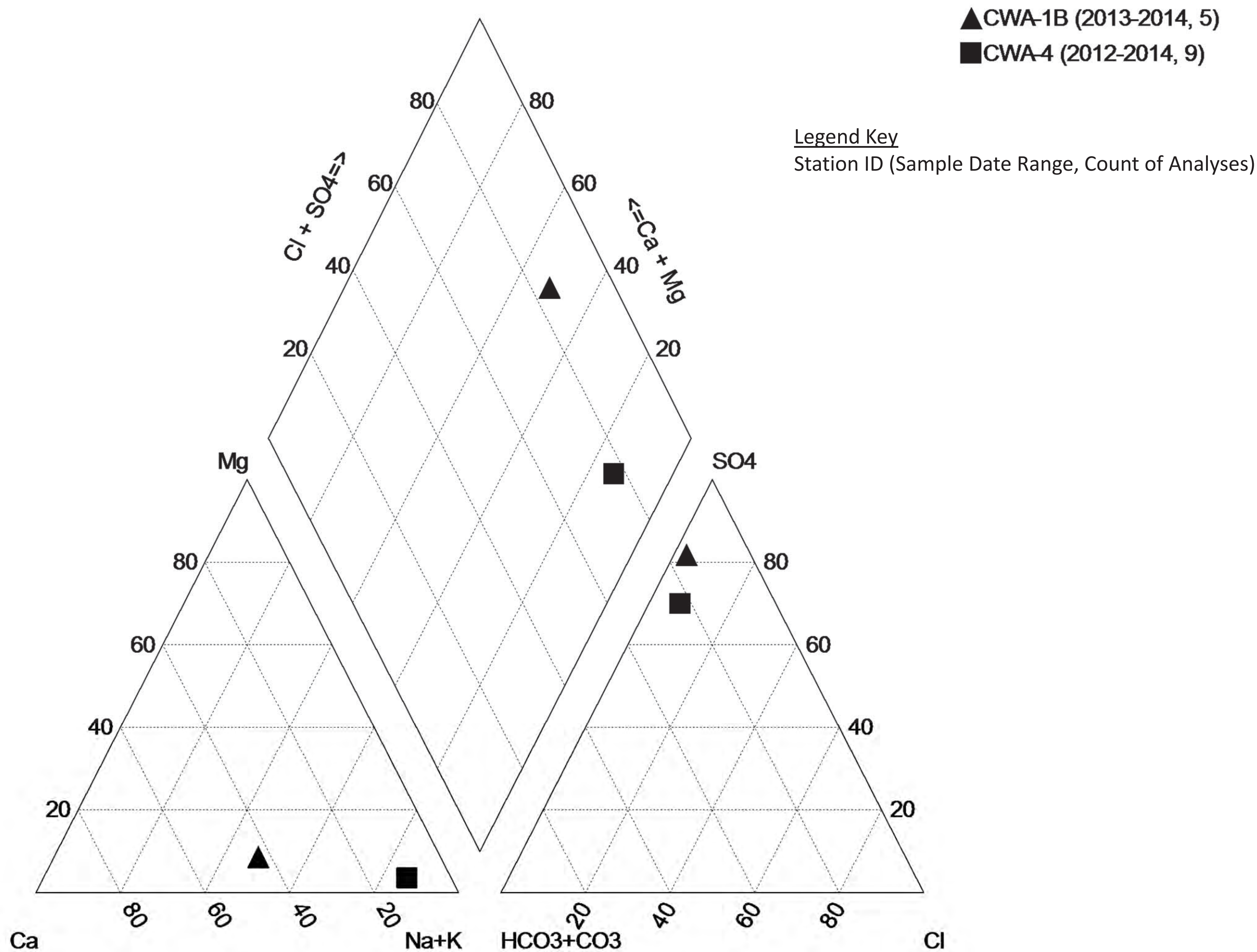


Appendix 6-8

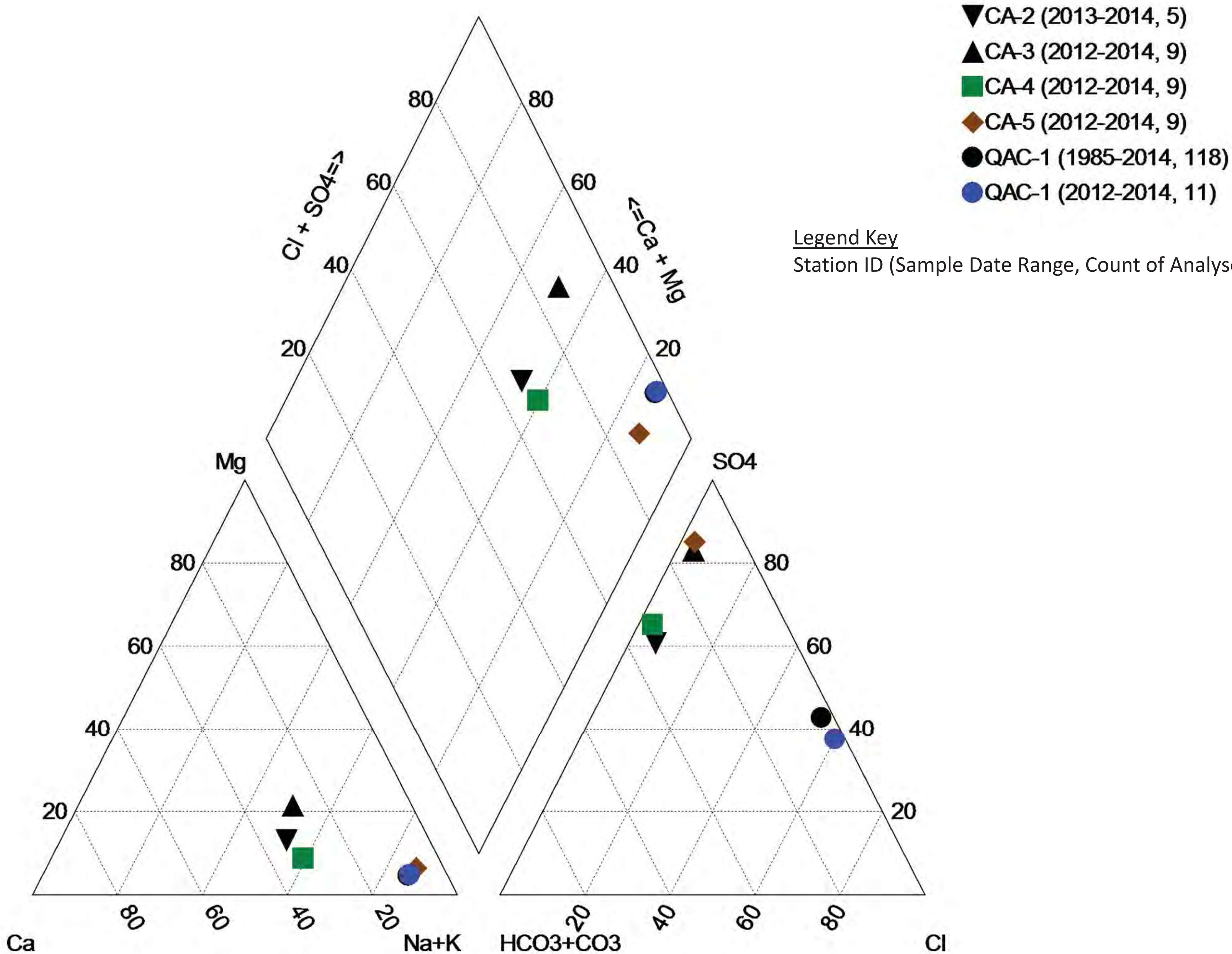
Groundwater Piper Trilinear Diagrams-Alluvium:

-QAL-Chinde

-QAL-Cottonwood



CWA-1B (2013-2014, 5)
CWA-4 (2012-2014, 9)
Legend Key
Station ID (Sample Date Range, Count of Analyses)
Cl + SO4=>
<=Ca + Mg
80
60
40
20
Mg
SO4
Ca
Na+K
HCO3+CO3
Cl



Legend Key
Station ID (Sample Date Range, Count of Analyses)

Appendix 6-9

Navajo Mine Total Precipitation Data

NAVAJO MINE PRECIPITATION DATA (inches)

NAVAJO MET I	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL TOTAL	ANNUAL MONTHLY MAXIMUM	ANNUAL MONTHLY MINIMUM
1991	*	*	*	0.1	0.71	0.11	0.28	0.78	1.52	0.47	1.96	1.43		1.96	0.1
1992	0.14	0.17	0.97	0.04	1.27	0.01	0.88	1.58	0.52	0.39	0.19	0.48	6.64	1.58	0.01
1993	1.79	0.69	0.48	0.12	0.19	*	0.01	2.55	0.55	0.89	*	0.07	7.34	2.55	0.01
1994	0.04	0.38	0.12	0.24	1.27	0.11	0.18	0.59	1.18	0.85	0.47	0.42	5.85	1.27	0.04
1995	0.44	0.28	0.79	1.2	0.45	0.38	0.13	0.76	0.97	0.03	0.18	0.49	6.1	1.2	0.03
1996	0.16	0.31	0.24	0.14	0.14	0.67	0.08	0.36	0.47	1.73	0.32	0.16	4.78	1.73	0.08
1997	0.53	0.1	0	2.62	0.71	0.66	1.02	1.61	1.28	0.26	0.54	0.6	9.93	2.62	0
1998	0.24	0.53	0.23	0.03	0.01	0	0.54	1.37	0.68	1.87	1.00	0.04	6.54	1.87	0
1999	0.16	0	0.14	1.18	1.43	0.41	1.29	3.34	0.23	0.01	0.13	0.14	8.46	3.34	0
2000	0.47	0.1	1.8	0	0	0.05	0.28	0.57	0.35	1.14	0.46	0.14	5.36	1.8	0
2001	0.39	0.41	1.39	0.36	0.6	0.01	0.32	1.23	0.31	0.26	0.41	0.36	6.05	1.39	0.01
2002	0.01	0	0.06	0.32	0	0	0.09	0.22	2.77	1.33	0.57	0.26	5.63	2.77	0
2003	0.18	1.15	0.37	0.01	0.06	0	0.01	0.66	0.22	1.12	0.07	0.03	3.88	1.15	0
2004	0.19	0.38	0.01	0.06	0.03	0.04	0.37	0.16	1.78	0.56	0.56	0.14	4.28	1.78	0.01
2005	1	1.3	0.33	0.86	0.22	0.23	0.21	1.67	0	0.72	0	0.02	6.56	1.67	0
2006	0.12	0.04	0.12	0.28	0.01	0	1.26	0.18	0.63	1.35	0	0.28	4.27	1.35	0
2007	0.38	0.3	0	0.06	0.23	0.02	1.23	1.34	0.54	0.16	0.01	0.2	4.47	1.34	0
2008	0.62	0.68	0.02	0.08	0.27	0.03	0.99	1.01	0.08	0.39	0.67	0.61	5.45	1.01	0.02
2009	0.19	0.15	0.13	0.47	1.3	0.47	0.15	0.03	0.08	0.47	0.19	0.12	3.75	1.3	0.03
2010	1.2	0.85	0.72	0.23	0.1	0.13	0.54	1.25	0.81	1.05	0.06	0.57	7.51	1.25	0.06
2011	0.15	0.04	0.24	0.91	0.47	0	0.56	0.2	0.42	1.71	0.62	0.18	5.50	1.71	0
2012	0.06	0.3	0.06	0	0.05	0.11	0.84	0.29	0.43	0.14	0.12	0.6	3.00	0.84	0
2013	0.87	0.16	0.11	0.34	0.11	0.33	0.11	0.99	2.84	0.9	0.67	0.17	7.60	2.84	0.11
2014	0.06	0.28	0.97	0.22	0.28	0.26	0.43	1.11	-	-	-	-	3.6	1.11	0.06
Monthy Average	0.42	0.38	0.38	0.42	0.42	0.17	0.49	0.99	0.81	0.77	0.42	0.33	5.86	1.75	0.02

Data collected from Custer plot (2000). MET II substituted in portions (2004) and (2007) due to missing data at MET I

NAVAJO MINE PRECIPITATION DATA (inches)

NAVAJO MET II	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL TOTAL	ANNUAL MONTHLY MAXIMUM	ANNUAL MONTHLY MINIMUM
1991	*	*	*	*	1.01	0.27	0.05	1.33	0.12	0.19	0.2	0.29			
1992	0.1	0.11	0.87	0.01	0.88	0.02	0.04	2.47	0.57	0.33	0.1	0.27	5.77	2.47	0.01
1993	1.23	0.5	0.33	0.2	0.55	*	0.07	1.13	1.18	0.8	0.45	*	6.44	1.23	0.07
1994	0.01	0.5	0.14	0.27	1.07	0.13	0.6	0.19	1.02	0.69	0.33	0.3	5.25	1.07	0.01
1995	0.19	0.22	0.35	0.61	0.37	0.31	0.2	0.96	0.58	0.01	0.07	0.44	4.31	0.96	0.01
1996	0.06	0.16	0.07	0.05	0.03	1.15	0.42	0.88	0.26	0.93	0.29	0.06	4.36	1.15	0.03
1997	0.22	0.05	0	2.23	0.87	0.27	1.38	1.26	0.94	0.23	0.27	0.48	8.2	2.23	0
1998	0.1	0.33	0.17	0.05	0	0	0.38	0.52	0.48	1.5	0.67	0.01	4.21	1.5	0
1999	0.13	0	0.38	1.04	0.94	0.11	0.84	2.19	0.17	0	0	0.04	5.84	2.19	0
2000	0.34	0.05	1.5	0.03	0	0.01	0.5	0.54	0.14	0.93	0.27	0.1	4.41	1.5	0
2001	0.25	0.28	0.93	0.19	0.35	0.01	0.94	1.03	0.16	0.10	0.11	0.25	4.60	1.03	0.01
2002	0	0	0.03	0.27	0	0	0.13	0.39	2.36	0.84	0.49	0.16	4.67	2.36	0
2003	0.14	0.79	0.35	0.17	0.08	0.01	0.66	0.92	0.69	0.88	0.49	0.05	5.23	0.92	0.01
2004	0.19	0.38	0.01	0.04	0	0.1	0.2	0.03	1.45	0.87	0.42	0.13	3.82	1.45	0
2005	0.65	1.26	0.22	0.63	0.25	0.08	0.48	1.06	0.4	0.56	0	0.1	5.69	1.26	0
2006	0.12	0.02	0.12	0.08	0.08	0.07	1.15	0.05	0.03	1.32	0	0.39	3.43	1.32	0
2007	0.39	0.38	0.38	0.36	1.38	0.01	1.23	1.27	0.3	0.19	0.43	0.12	6.44	1.38	0.01
2008	0.81	0.51	0.06	0.04	0.18	0.15	0.37	0.09	0	0.35	0.45	0.37	3.38	0.81	0
2009	0.19	0.1	0.18	0.4	0.44	0.21	0.06	0.07	0.1	0.35	0.16	0.14	2.40	0.44	0.06
2010	0.99	0.45	0.36	0.21	0.08	0.14	0.17	0.64	0.51	2.91	0.03	0.46	6.95	2.91	0.03
2011	0.00	0.09	0.14	0.99	0.11	0.00	0.81	0.3	1.29	1.19	0.25	0.26	5.43	1.29	0.00
2012	0.00	0.14	0.21	0.00	0.08	0.27	1.28	0.15	0.37	0.08	0.04	0.44	3.06	1.28	0.00
2013	0.79	0.00	0.09	0.23	0.22	0.00	0.5	1.13	1.55	0.56	0.90	0.11	6.08	1.55	0.00
2014	0.02	0.17	0.59	0.16	0.29	0.20	0.75	1.72	-	-	-	-	3.90	1.72	0.02
Monthy Average	0.31	0.29	0.31	0.37	0.39	0.15	0.54	0.81	0.64	0.69	0.28	0.23	5.00	1.47	0.01

NAVAJO MINE PRECIPITATION DATA (inches)

NAVAJO MET III	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL TOTAL	ANNUAL ANNUAL MONTHLY MAXIMUM	ANNUAL ANNUAL MONTHLY MINIMUM
2006	.	.	.	0	0.08	0.09	1.05	0.1	0.89	1.7	0	0.73			
2007	0.39	0.39	0.42	0.23	1.32	0.11	0.4	0.62	0.75	0.07	0.44	0.56	5.7	1.32	0.07
2008	0.89	0.52	0.09	0.06	0.39	0.07	2.49	2.81	0.18	0.56	0.48	0.55	9.09	2.81	0.06
2009	0.35	0.35	0.37	0.41	0.55	0.28	0.31	0.1	0.2	0.58	0.19	0.18	3.87	0.58	0.1
2010	1.1	0.75	0.59	0.17	0.13	0.17	0.87	2	1.1	0	0	0	6.88	2	0
2011	0.03	0.17	0.48	1.26	0.18	0.00	0.54	0.51	1.5	1.21	1.04	0.58	7.5	1.5	0
2012	0.01	0.16	0.07	0.00	0.15	0.19	1.20	0.32	0.53	0.13	0.18	0.36	3.3	1.2	0
2013	0.70	0.03	0.23	0.43	0.13	0.02	0.75	1.08	0.97	0.56	0.87	0.11	5.88	1.08	0.02
2014	0.03	0.18	0.60	0.12	0.14	0.14	0.72	2.37	-	-	-	-	4.3	2.37	0.03
Monthy Average	0.50	0.34	0.32	0.32	0.37	0.12	0.95	0.94	0.77	0.60	0.40	0.38	6.03	1.50	0.04

MET station III installed April 2006 in Area 4North

NAVAJO MINE PRECIPITATION DATA (inches)

MET I & II Average	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL TOTAL	MONTHLY MAXIMUM	MONTHLY MINIMUM
1991	.	.	.	.	0.86	0.19	0.17	1.06	0.82	0.33	1.08	0.86	#DIV/0!	1.08	0.165
1992	0.12	0.14	0.92	0.03	1.08	0.02	0.46	2.03	0.55	0.36	0.15	0.38	6.21	2.03	0.015
1993	1.51	0.60	0.41	0.16	0.37	.	0.04	1.84	0.87	0.85	0.45	0.07	6.89	1.84	0.040
1994	0.03	0.44	0.13	0.26	1.17	0.12	0.39	0.39	1.10	0.77	0.40	0.36	5.55	1.17	0.025
1995	0.32	0.25	0.57	0.91	0.41	0.35	0.17	0.86	0.78	0.02	0.13	0.47	5.21	0.91	0.020
1996	0.11	0.24	0.16	0.10	0.09	0.91	0.25	0.62	0.37	1.33	0.31	0.11	4.57	1.33	0.085
1997	0.38	0.08	0.00	2.43	0.79	0.47	1.20	1.44	1.11	0.25	0.41	0.54	9.07	2.43	0.000
1998	0.17	0.43	0.20	0.04	0.01	0.00	0.46	0.95	0.58	1.69	0.84	0.03	5.38	1.69	0.000
1999	0.15	0.00	0.26	1.11	1.19	0.26	1.07	2.77	0.20	0.01	0.07	0.09	7.15	2.77	0.000
2000	0.41	0.08	1.65	0.02	0.00	0.03	0.39	0.56	0.25	1.04	0.37	0.12	4.89	1.65	0.000
2001	0.32	0.35	1.16	0.28	0.48	0.01	0.63	1.13	0.24	0.18	0.26	0.31	5.33	1.16	0.010
2002	0.01	0.00	0.05	0.30	0.00	0.00	0.11	0.31	2.57	1.09	0.53	0.21	5.15	2.57	0.000
2003	0.16	0.97	0.36	0.09	0.07	0.01	0.34	0.79	0.46	1.00	0.28	0.04	4.56	1.00	0.005
2004	0.19	0.38	0.01	0.05	0.02	0.07	0.29	0.10	1.62	0.72	0.49	0.14	4.05	1.62	0.010
2005	0.83	1.28	0.28	0.75	0.24	0.16	0.35	1.37	0.20	0.64	0.00	0.06	6.13	1.37	0.000
2006	0.12	0.03	0.12	0.18	0.05	0.04	1.21	0.12	0.33	1.34	0.00	0.34	3.85	1.34	0.000
2007	0.39	0.34	0.19	0.21	0.81	0.02	1.23	1.31	0.42	0.18	0.22	0.16	5.46	1.31	0.015
2008	0.72	0.60	0.04	0.06	0.23	0.09	0.68	0.55	0.04	0.37	0.56	0.49	4.42	0.72	0.040
2009	0.19	0.13	0.16	0.44	0.87	0.34	0.11	0.05	0.09	0.41	0.18	0.13	3.08	0.87	0.050
2010	1.10	0.65	0.54	0.22	0.09	0.14	0.36	0.95	0.66	1.98	0.05	0.52	7.23	1.98	0.045
2011	0.08	0.07	0.19	0.95	0.29	0.00	0.69	0.25	0.86	1.45	0.44	0.22	5.47	1.45	0.000
2012	0.03	0.22	0.14	0.00	0.07	0.19	1.06	0.22	0.40	0.11	0.08	0.52	3.03	1.06	0.000
2013	0.83	0.08	0.10	0.29	0.17	0.17	0.31	1.06	2.20	0.73	0.79	0.14	6.84	2.20	0.080
2014	0.04	0.23	0.78	0.19	0.29	0.23	0.59	1.42	-	-	-	-	3.76	1.42	0.040
Met I & II Average	0.37	0.33	0.35	0.40	0.40	0.16	0.52	0.90	0.72	0.73	0.35	0.27	5.43	1.54	0.03

NAVAJO MINE PRECIPITATION DATA (inches)

Annual Total inches

	Met I	Met II	Met III	AVERAGE
1991	*	*		
1992	6.64	5.77		6.21
1993	7.34	6.44		6.89
1994	5.85	5.25		5.55
1995	6.1	4.31		5.21
1996	4.78	4.36		4.57
1997	9.93	8.2		9.07
1998	6.54	4.21		5.38
1999	8.46	5.84		7.15
2000	5.36	4.41		4.89
2001	6.05	4.6		5.33
2002	5.63	4.67		5.15
2003	3.88	5.23		4.56
2004	4.28	3.82		4.05
2005	6.56	5.69		6.13
2006	4.27	3.43	*	3.85
2007	4.47	6.44	5.7	5.54
2008	5.45	3.38	9.09	5.97
2009	3.75	2.4	3.87	3.34
2010	7.51	6.95	6.88	7.11
2011	5.5	5.43	7.5	6.14
2012	3	3.06	3.3	3.12
2013	7.6	6.08	5.88	6.52
2014**	3.61	3.9	4.3	3.94
			Mine Average =	5.53

* Year was excluded from average - 12 months of data not captured
** Totals only through August, 2014

Max	9.93	8.2	9.09	9.07
Min	3	2.4	3.3	3.12

Mean 1992-2001	6.02
Mean 1992-2002	5.94
Mean 1992-2003	5.83
Mean 1992-2004	5.69
Mean 1992-2005	5.72
Mean 1992-2006	5.60
Mean 1992-2007	5.59
Mean 1992-2008	5.62
Mean 1992-2009	5.49
Mean 1992-2010	5.57
Mean 1992-2011	5.60
Mean 1992-2012	5.48
Mean 1992-2013	5.53
Mean 1992-2014**	5.46