WATER QUALITY SURVEY SUMMARY

FOR THE

MIMBRES RIVER WATERSHED

2009

Prepared by
New Mexico Environment Department
Surface Water Quality Bureau

July 2011

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PRINCIPAL INVESTIGATORS

Survey Leads

Monitoring and Assessment:	Shelly Lemon Danny Davis
Watershed Protection:	Dave Menzie Matt Schultz
Point Source Protection:	Steve Baumgarn
TMDLs:	Heidi Henderson
GIS/Mapping	Bill Skinner

Surface Water Quality Bureau (Santa Fe Office): (505) 827-0187
(online): www.nmenv.state.nm.us/swqb

Water quality surveys and assessments conducted by the New Mexico Environment Department Surface Water Quality Bureau are completed to fulfill Section 106 of the Clean Water Act [33 USC 1251 et seq.], *Work Program for Water Quality Management.* This project was funded by a grant from the U.S. Environmental Protection Agency.

***Cover Photos*:** *(Upper Left) Mimbres River at Cooney Campground – 8/25/2009*
(Lower Right) Mimbres River at Rancho del Rio below Dwyer, NM – 3/23/2009

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ALU	Aquatic Life Use
AP	Assessment Protocols
AU	Assessment Unit
BLM	Bureau of Land Management
CWA	Clean Water Act
CWAL	Coldwater Aquatic Life
cfu	Colony Forming Unit
DO	Dissolved Oxygen
FS	Fully Supporting designated use
HQCWAL	High Quality Coldwater Aquatic Life
MAS	Monitoring and Assessment Section
NS	Non Supporting designated use
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
QAPP	SWQB Quality Assurance Project Plan 2009
RBP	Rapid Bioassessment Protocol
ROD	Record of Decision
M-SCI	Mountain-Stream Condition Index
STORET	Storage and Retrieval System
SWQB	Surface Water Quality Bureau
TMDL	Total Maximum Daily Load
TNC	The Nature Conservancy
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
WQS	New Mexico Water Quality Standards
WWAL	Warmwater Aquatic Life
WWTP	Wastewater Treatment Plant

EXECUTIVE SUMMARY

The Monitoring and Assessment Section (MAS) of the Surface Water Quality Bureau (SWQB) conducted a water quality survey of the Mimbres River watershed between March and November, 2009. This survey focused on the mainstem of the Mimbres River from NM Highway 180 near Deming to its headwaters as well as a number of tributaries including Cold Creek, Gallinas Creek, McKnight Canyon Creek, and San Vicente Arroyo. Sampling was conducted on a monthly basis during the 2009 field season.

The purpose of this survey was to collect chemical, physical, and biological data to evaluate water quality within the Mimbres River watershed. Data are assessed against the New Mexico *Standards for Interstate and Intrastate Surface Waters* 20.6.4 NMAC and impaired waters are summarized in the 303(d) List of Assessed Surface Waters (303(d) List; NMED/SWQB 2010). Assessment conclusions presented in this report are based on the water quality standards and assessment protocols in place at the time the data were assessed. Therefore, the impairment conclusions in the most recent 303(d) List supersede assessment conclusions in this survey report if they should differ.

Water quality in the Mimbres River watershed was generally good. The lower portions of the Mimbres River were found to be impaired due to temperature, nutrients, and *E. coli*. Impairments due to cadmium and lead were found in Cold Springs Creek and from low dissolved oxygen in San Vicente Arroyo. No excursions from applicable water quality criteria were found in the Upper Mimbres River (Perennial reaches from Cooney Canyon to headwaters), McKnight Canyon Creek (Mimbres River to headwaters), or Gallinas Creek (Mimbres River to headwaters). The key findings of the surface water quality assessment are as follows:

- **Dissolved Cadmium:** the chronic aquatic life criterion was exceeded in Cold Springs Creek.
- **Dissolved Lead:** the chronic aquatic life criterion was exceeded in Cold Springs Creek.
- ***E. coli*:** the primary contact criterion was exceeded in the Lower Mimbres River (perennial reaches downstream of Willow Springs Canyon).
- **Nutrients:** the Lower Mimbres River (perennial reaches downstream of Willow Springs Canyon) and San Vicente Arroyo were enriched with nutrients;
- **Dissolved Oxygen:** San Vicente Arroyo exhibited extreme fluctuations in DO during the sonde deployment ranging from 1.4 mg/L to 12.5 mg/L.
- **Temperature:** temperature criteria were exceeded in the Lower Mimbres River (perennial reaches downstream of Willow Springs Canyon) and Middle Mimbres River (Willow Springs Canyon to Cooney Canyon).

Fish community data were collected at two sites along the mainstem of the Mimbres River: on the upper Nature Conservancy property and below Dwyer at Rancho del Rio. A mixture of warm-, cool-, and cold-water species was found. At the Nature Conservancy property, 70% of the species collected were non-native, the majority being rainbow trout (a cold water species). A notable exception was a single, native, federally-listed Chihuahua Chub. Conversely, 99% of the fish collected at the Rancho del Rio site were native species, overwhelmingly dominated by Rio Grande suckers (a cool water species).

1.0 INTRODUCTION

The Monitoring and Assessment Section (MAS) of the Surface Water Quality Bureau (SWQB) conducted a water quality survey of the Mimbres River watershed between March and November, 2009. This survey included 10 sampling sites (Figures 1 and 2; Table 1). Monitoring these sites enabled an assessment against New Mexico WQS (WQCC 2011) to determine if the waterbodies in this survey were meeting their designated uses. SWQB staff presented the monitoring plan at a public meeting on February 19, 2009 in Silver City, NM.

Historic and current land uses in the Mimbres River watershed include mining, forestry, farming, ranching, and recreational activities. Land use/cover includes 70% rangeland, 27% forest, 2% barren soil, <1% agriculture, and <1% urban/residential (Figure 1). Land ownership is mainly United States Forest Service (USFS) in the headwaters and private at lower elevations; however the Bureau of Land Management (BLM) and State of New Mexico also own and manage tracts of public lands in the lower portions of this watershed. Land ownership is 58% private, 28% USFS, 10% State, 4% BLM, and <1% Department of Defense (Figure 2). The Mimbres River watershed is located in Omernick Level III Ecoregion 23 (Arizona/New Mexico Mountains) in the headwaters and Level III Ecoregion 24 (Chihuahuan Desert) in the lowlands. The elevation range for the various sampling sites in the survey spanned from 1,540 to 2,180 meters (5,052 to 7,152 feet above sea level). Annual precipitation ranges from 76 centimeters (30 inches) in the conifer forests at higher elevations to 25 centimeters (10 inches) in the semi-arid grasslands at lower elevations (NRCS 2007). Mean maximum July temperatures range from 27 to 33°C (81 to 92°F) while the average January minimum temperatures range from -11 to -4°C (12 to 24°F).

Numerous species within this watershed are listed as either threatened or endangered by both state and federal agencies. Threatened and endangered species in the Mimbres River watershed that are reliant on aquatic and riparian habitat include the Chihuahua Chub (*Gila nigrescens*), Gila Trout (*Oncorhynchus gilae gilae*), Chiricahua Leopard Frog (*Rana chiricahuensis*), and Common Black Hawk (*Buteogallus anthracinus*).

Water quality monitoring included measurement of field parameters, such as dissolved oxygen (DO), pH, temperature, turbidity, and conductivity, as well as sampling for ions, total nutrients, total and dissolved metals, and *E. coli*. Radionuclides, organics, and cyanide were monitored based on the proximity of some stations to potential sources or previous survey findings. Data loggers were deployed at select stations to collect long-term datasets for temperature, pH, DO, specific conductance, and turbidity. Data on physical habitat and biological communities were also collected. Habitat surveys included the measurement of channel dimensions such as cross-sectional profiles, longitudinal profiles, bankfull width and depth, and slope as well as canopy cover, and large woody debris estimations. Biological surveys included the collection of benthic macroinvertebrates, periphyton, and fish. Monitoring conducted at each site is summarized in Tables 2 and 3.

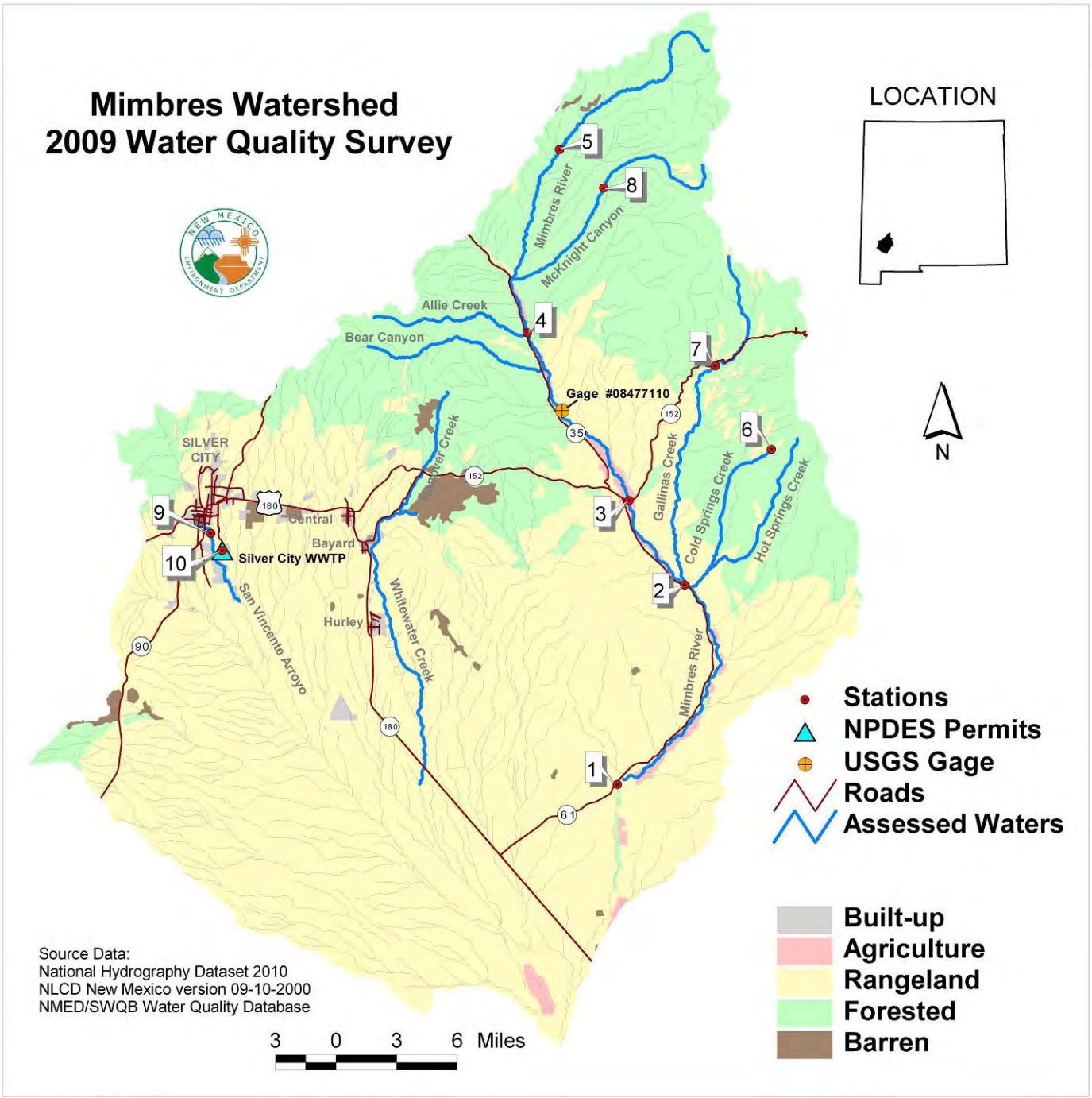

Figure 1. Land use/land cover in the Mimbres watershed

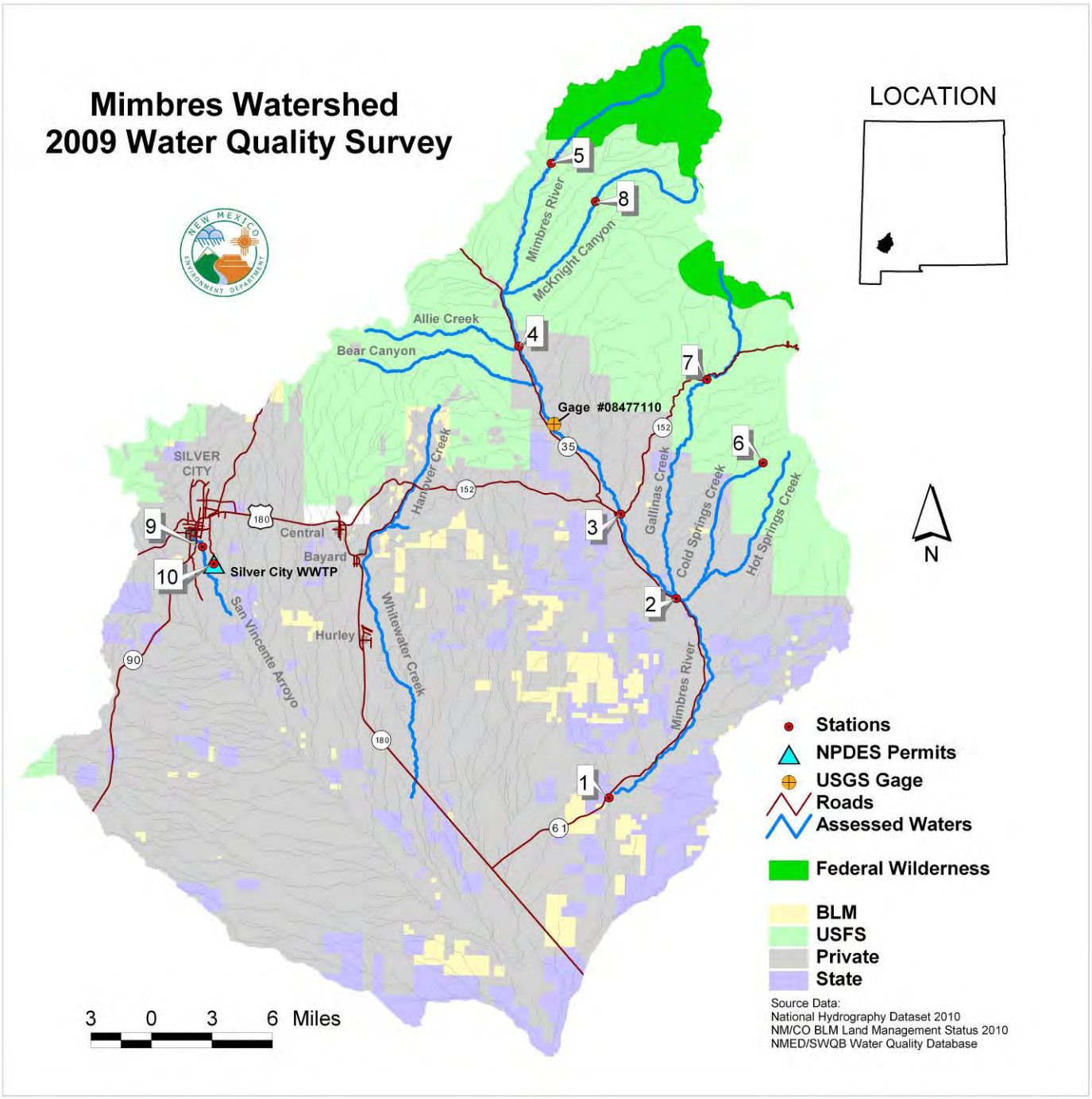

Figure 2. Land ownership in the Mimbres watershed

Table 1. Mimbres watershed sampling stations.

Station Number	STATION NAME	STATION ID (STORET ID*)	SAMPLING RATIONALE
1	Mimbres below Dwyer at Rancho del Rio	45Mimbre062.7	Location, access, furthest downstream location along perennial reach
2	Mimbres at Royal John Mine bridge (above confluence with Gallinas Creek)	45Mimbre085.7	Bracket Royal John Mining District
3	Mimbres near NM 152 bridge	45Mimbre094.6	Bracket bacteria sources below the village of San Lorenzo
4	Mimbres River at upper TNC Mimbres	45Mimbre112.2	Head of a perennial reach, downstream of gravel/sand extraction operation and lumber mill
5	Mimbres River near Cooney Campground	45Mimbre127.4	Represents the upper watershed
6	Cold Springs Creek above Mimbres River	45ColdSp009.3	Bracket Royal John Mining District
7	Gallinas Creek at lower Gallinas campground	45Gallin021.5	Location, access
8	McKnight Canyon Creek at trail crossing	45McKnig011.9	One of the largest contributors to the Mimbres. Possible reference site.
9	San Vicente Arroyo near Ancheta Mill	45SanVic053.9	Lower end of the perennial reach
10	Silver City WWTP	NM0020109	Characterize wastewater treatment plant effluent.

* "STORET ID" is the unique site identifier used to upload data to EPA's STOrage and RETrieval Data Warehouse. STORET is a repository for water quality, biological, and physical data collected by water resource management groups across the country. These organizations, including states, tribes, watershed groups, other federal agencies, volunteer groups and universities, submit data to the STORET Warehouse in order to make their data publically accessible. Data can then be re-used for analysis. For more information, visit the EPA's website at: http://www.epa.gov/storet/.

2.0 NEW MEXICO WATER QUALITY STANDARDS

State water quality standards (WQS) are codified in the New Mexico Administrative Code (NMAC) as *Standards for Interstate and Intrastate Surface Waters* (20.6.4 NMAC) (WQCC, 2011). The WQS set water quality goals by designating uses and establishing criteria to protect those uses, and they are periodically updated by the New Mexico Water Quality Control Commission. Water quality in the Mimbres River watershed was evaluated against the WQS, as

amended through January 14, 2011, to determine if waterbodies are supporting their designated uses. The applicable WQS for the Mimbres River watershed covered in this report are set forth below.

20.6.4.98 INTERMITTENT WATERS - All non-perennial unclassified waters of the state, except those ephemeral waters included under 20.6.4.97 NMAC.

A. **Designated Uses:** livestock watering, wildlife habitat, marginal warmwater aquatic life and primary contact.

B. **Criteria:** the use-specific criteria in 20.6.4.900 NMAC are applicable to the designated uses, except that the following site-specific criteria apply: the monthly geometric mean of E. coli bacteria 206 cfu/100 mL or less, single sample 940 cfu/100 mL or less.

20.6.4.99 PERENNIAL WATERS - All perennial unclassified waters of the state.

A. **Designated Uses:** warmwater aquatic life, livestock watering, wildlife habitat and primary contact.

B. **Criteria:** the use-specific criteria in 20.6.4.900 NMAC are applicable to the designated uses, except that the following site-specific criteria apply: the monthly geometric mean of E. coli bacteria 206 cfu/100 mL or less, single sample 940 cfu/100 mL or less.

20.6.4.803 CLOSED BASINS - Perennial reaches of the Mimbres river downstream of the confluence with Willow Springs canyon and all perennial reaches of tributaries thereto.

A. **Designated Uses**: coldwater aquatic life, irrigation, livestock watering, wildlife habitat and primary contact.

B. **Criteria**: the use-specific numeric criteria set forth in 20.6.4.900 NMAC are applicable to the designated uses, except that the following segment-specific criteria apply: the monthly geometric mean of E. coli bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less.

20.6.4.804 CLOSED BASINS - Perennial reaches of the Mimbres river upstream of the confluence with Willow Springs canyon and all perennial tributaries thereto.

A. **Designated Uses**: irrigation, domestic water supply, high quality coldwater aquatic life, livestock watering, wildlife habitat and primary contact.

B. **Criteria**: the use-specific numeric criteria set forth in 20.6.4.900 NMAC are applicable to the designated uses, except that the following segment-specific criteria apply: specific conductance 300 μS/cm or less; the monthly geometric mean of E. coli bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less.

Subsection J of Section 20.6.4.900 NMAC, as referenced in the above site-specific criteria, provides a list of water chemistry analytes and their respective criteria. The table of numeric criteria provided in Section 900 is used for assessing water quality to determine if the water is supporting its designated uses (e.g., irrigation, livestock watering, human health, etc). Narrative criteria for sedimentation/siltation, plant nutrients, turbidity, and biological integrity are also addressed in this report and found in 20.6.4.13 NMAC, subsections A, E, J, and M, respectively.

Impairments for the Mimbres watershed are listed in Table 2 and may be found in Appendix A of the most recent version of the *State of New Mexico Integrated Clean Water Act §303(d)/§305(b) Report* (303(d) List; NMED/SWQB 2010). The 303(d) List is a catalog of all assessment units (AUs) with a summary of their current status (i.e. assessed/not assessed and impaired/not impaired). Once an AU is determined to be impaired, a total maximum daily load (TMDL) guidance document for stream restoration is developed specifically for that AU. AU names and WQS may change over time and the history of these changes is tracked in the Record of Decision (ROD) associated with this report. Use attainment determinations supported by data collected from this survey will be included in the 2012-2014 §303(d) List.

Table 2. Causes of impairment in the Mimbres watershed.

Assessment Unit	Cause of Impairment*	WQS (January 2011)
Mimbres River (Perennial reaches Cooney Cyn to headwaters)	none	20.6.4.804
Mimbres River (Perennial reaches Willow Sprs Cyn to Cooney Cyn)	nutrient/eutrophication biological indicators; dissolved oxygen; temperature	20.6.4.804
Mimbres River (Perennial reaches downstream of Willow Sprs Cyn)	fecal coliform; nutrient/eutrophication biological indicators; temperature	20.6.4.803
McKnight Canyon (Mimbres River to headwaters)	never assessed	20.6.4.804
Gallinas Creek (Mimbres River to headwaters)	none	20.6.4.98
Cold Springs Creek (Hot Springs Creek to headwaters)	never assessed	20.6.4.803
San Vicente Arroyo (Mimbres River to headwaters)	none	20.6.4.99

*From the 2010-2012 State of New Mexico Integrated Clean Water Act §303(d)/§305(b) Report (SWQB/NMED 2010)

3.0 METHODS

All data were collected in accordance with the procedures set forth in the *SWQB Quality Assurance Project Plan* (QAPP; NMED/SWQB 2009) and the *SWQB Standard Operating Procedures for Data Collection* (SOPs; NMED/SWQB 2007). Data collected during this study were combined with all other submitted data that met SWQB quality assurance requirements for assessment according to the most recent edition of the AP. Final designated use impairment status is housed in the assessment database.

4.0 SAMPLING SUMMARY

A map of the study area is provided in Figures 1 and 2. The station numbers, USEPA Storage and Retrieval database (STORET) identification codes, and sampling rationale of the stations selected for this survey are provided in Table 1. Stations were often chosen because they were within a perennial reach or to bracket potential pollutant sources. The stations were not necessarily located at AU breaks because of the semi-arid landscape of this watershed and lack of perennial flow along the entire AU. The Silver City Wastewater Treatment Plant (WWTP) effluent channel was also sampled to estimate pollutant loading into the receiving stream.

Water samples were analyzed for ions, total nutrients, total and dissolved metals, and *E. coli*, cyanide, radionuclides, and anthropogenic organic compounds. Variables such as dissolved oxygen (DO), pH, turbidity, and specific conductance were measured in the field. Data loggers (thermographs and sondes) were deployed to collect temperature, pH, DO, conductivity, and turbidity data over extended periods of time. Physical habitat and benthic macroinvertebrate communities were also surveyed. The specific types and number of sampling events conducted at each site are summarized in Table 3.

Table 3. Mimbres watershed sampling summary.

Station Name	Field Data[1]	Ions	Nutrients	Total Metals	Dissolved Metals	*E. coli*	Cyanide	Radionuclides	Organics	Thermograph	Sonde Deployment	Habitat Survey	Macroinvertebrates	Periphyton	Fish Community
Mimbres near Cooney Campground	7	7	7	4	4	7	2	2	2	✓	-	-	-	-	-
Mimbres River at upper TNC[2] Mimbres	8	8	8	4	4	7	2	-	-	✓	✓	✓	✓	✓	✓
Mimbres near NM 152 bridge	4	4	4	4	4	4	2	2	-	-	-	-	-	-	-
Mimbres at Royal John Mine bridge	8	8	8	4	4	7	2	-	-	✓	-	-	-	-	-
Mimbres below Dwyer at Rancho del Rio	8	8	8	4	4	7	2	2	2	✓	✓	✓	✓	✓	✓
McKnight Canyon Creek at trail crossing	7	7	7	4	4	7	2	2	-	✓	-	-	-	-	-
Gallinas Creek at lower Gallinas Campground	8	8	8	4	4	7	2	2	-	✓	-	-	-	-	-
Cold Springs Creek above Mimbres River	4	4	4	4	4	4	2	2	-	-	-	-	-	-	-
San Vicente Arroyo near Ancheta Mill	8	8	8	4	4	7	2	2	2	✓	✓	-	-	✓	-
Silver City WWTP	8	8	8	-	-	7	-	-	-	-	-	-	-	-	-

1 Field data include dissolved oxygen, pH, specific conductance, turbidity, and temperature
2 The Nature Conservancy

5.0 WATER QUALITY CRITERIA EXCEEDENCES

5.1 Water Quality Exceedences for Numeric Criteria

5.1.1 Grab Data

Grab data refers to samples or measurements collected from individual visits to survey stations and is distinct from data obtained with continuous monitoring devices over an extended period of time. Exceedences of the WQS criteria identified during this survey using grab data are documented in Table 4. Results indicate designated use impairments due to cadmium and lead in Cold Springs Creek and due to *E. coli* in the lower reach of the Mimbres River. Assessment and listing procedures can be found in the AP. A complete dataset can be obtained by contacting SWQB.

Table 4. Exceedences* of WQS criteria using grab data#.

Station Name	Dissolved Cadmium	Dissolved Lead	*E.coli*
Mimbres River near Cooney Campground	-	-	1/7
Mimbres River at upper TNC Mimbres	-	-	-
Mimbres River near NM 152 bridge	-	-	**3/4**
Mimbres River at Royal John Mine bridge	-	-	**4/7**
Mimbres River below Dwyer at Rancho del Rio	-	-	1/7
McKnight Canyon Creek at trail crossing	-	-	-
Gallinas Creek at lower Gallinas Campground	-	-	-
Cold Springs Creek above Mimbres River	**3/4**	**4/4**	-
San Vicente Arroyo near Ancheta Mill	-	-	-

* Exceedences are expressed as the ratio of the number of exceedences divided by the total number of samples for that parameter at that station. **BOLDED** ratios indicate designated use impairments.

\# All other parameters including field data from discrete sonde measurements did not exceed criteria.

5.1.2 Data from Continuous Monitoring Devices

Temperature data loggers (thermographs) were deployed at strategic locations within the study area. Multi-parameter sondes were also deployed to examine diel fluxes in pH and DO at stations that "failed" the Level 1 nutrient assessment indicating the potential of nutrient enrichment. The thermographs and sondes were programmed to record temperature, DO, conductivity, turbidity and pH hourly while deployed.

Large datasets generated from data loggers (e.g., sondes and thermographs) are assessed according to protocols developed specifically for such datasets (NMED/SWQB 2011). This is because, unlike a typically small grab sample dataset, it is not reasonable to list as not supporting on the basis of one or a few exceedences out of several hundred or thousand data points. Temperature DO, and pH standards criteria are typically associated with designated uses (20.6.4.900 NMAC); however occasionally there are segment-specific criteria that differ from the use-specific criteria. Assessment conclusions based on long-term thermograph and sonde datasets are summarized below (Table 5).

Table 5. Assessment summary of long-term thermograph and sonde datasets.

Station Name	Aquatic Life Use	Temperature Criterion (°C)	Temperature Assessment	pH Criterion (SU)	pH Assessment	DO Criterion (mg/L)	DO Assessment
Mimbres near Cooney Campground	HQCWAL	≤ 20	FS	6.6 – 8.8	no data	≥ 6	no data
Mimbres River at upper TNC Mimbres	HQCWAL	≤ 20	**NS***	6.6 – 8.8	FS	≥ 6	inconclusive[+]
Mimbres at Royal John Mine bridge	CWAL	≤ 20	**NS***	6.6 – 8.8	no data	≥ 6	no data
Mimbres below Dwyer at Rancho del Rio	CWAL	≤ 20	**NS***	6.6 – 8.8	FS	≥ 6	**NS***
McKnight Canyon Creek at trail crossing	HQCWAL	≤ 20	FS	6.6 – 8.8	no data	≥ 6	no data
Gallinas Creek at lower Gallinas Campground	MWWAL	≤ 32.2	FS	6.6 – 9.0	no data	≥ 5	no data
Cold Springs Creek above Mimbres River	CWAL	≤ 20	no data	6.6 – 8.8	no data	≥ 6	no data
San Vicente Arroyo near Ancheta Mill	WWAL	≤ 32.2	FS	6.6 – 9.0	FS	≥ 5	**NS***

"no data" = no long term dataset available to assess
NS = Not Supporting; FS = Fully Supporting
HQCWAL = high quality coldwater aquatic life; CWAL = coldwater aquatic life; WWAL = warmwater aquatic life
°C = degrees Celcius; SU = standard units; mg/L = milligrams per liter
***** Aquatic life use and/or criterion revision recommended.
[+] Reach appears to be dominated by groundwater input, thus a non-support designation would be inappropriate under Subsection I of 20.6.4.11 NMAC (due to natural causes clause).

5.2 Water Quality Exceedences for Narrative Criteria

5.2.1 Sedimentation Assessment

Substrate Composition

There are two components to sediment load that impact aquatic life: suspended load and bed load. Suspended load is quantified through the measurement of suspended sediment concentrations or total suspended solids. Bed load describes the particles that settle to or roll along the bottom (saltation) of the channel. Larger bed load particles provide increased interstitial space between particles, thus allowing for different aquatic communities than those

found among small particles with little or no space. The size of sediment particles progresses naturally from coarse, large particles in high gradient streams at high elevation with smaller watershed size, gradually decreasing to fine particles (i.e., sand, silt, and clay) in low elevation, lower gradient streams with large watersheds. Therefore, to determine whether a stream exhibits an unnaturally fine bed load, knowledge of the location of the stream segment within the watershed is necessary. Particles less than or equal to 2 mm are considered "fines", and "percent sand and fines" thresholds are used for assessment purposes. Other metrics in Table 6 describe the particle size classes found in the reach, including the median of the cumulative frequency distribution (D50) and the maximum particle size mobilized during a bankfull flow event (D84).

Table 6. Substrate composition data for the Mimbres watershed.

Station Name*	% Sand & Fines (≤ 2mm)	D50* (mm)	D84* (mm)
Mimbres River at upper TNC Mimbres	10%	24	78
Mimbres below Dwyer at Rancho del Rio	36%	10	57

* Values for D50 and D84 are calculated without bedrock values, if applicable.

Sedimentation/Siltation Assessment

Bedded sediments cannot be treated as introduced pollutants such as pesticides because they are not uniquely generated through human input or disturbance. Rather, bedded sediments are components of natural systems that are present even in pristine settings and to which stream organisms have evolved and adapted. Therefore, the detection of a sediment imbalance is more difficult than detecting an absolute concentration or percentage that represents a clear biological impact (Jessup et al. 2010).

A stream may be considered impacted by sediment if its substrate characteristics are: 1) not similar to expectations for undisturbed sites in the same environmental setting, or 2) detectably affecting the biota. In the first case, substrate may be more fine, more coarse, more unstable, or more stable than expected under broadly-recognized, undisturbed conditions (reference or best available conditions) for that particular environmental setting. This, in itself, can be an indication that streambed substrates are impacted by human disturbance. Biotic responses to disturbed substrates can be variable, but sub-optimal biotic conditions are often associated with unbalanced sediment.

The sedimentation/siltation assessment protocol was substantially revised in 2011. This effort included the identification of sediment characteristics that are expected under the range of environmental settings in New Mexico, especially in undisturbed or best available reference streams. The goal of this characterization was to enable SWQB to identify situations where sedimentation/siltation expectations are not met, using sediment indicators that show responsiveness to disturbance. Examining the relationships between biological measures and sediment indicators helped to identify where disturbance caused sediment imbalance and biologically-relevant habitat degradation. The results of these analyses led to quantitative,

sedimentation threshold recommendations for New Mexico perennial streams. See Appendix C of NMED/SWQB 2011 for details.

Habitat surveys were conducted at two study sites to collect data for the sedimentation/siltation assessment**.** The ecoregion, associated sediment site class, watershed size, and elevation of each station where habitat data were collected are shown below (Table 7).

Table 7. Characteristics of study sites.

Station Number	Station Name	Watershed Area (km^2)	Elevation (m)	Level IV Ecoregion	Sediment Site Class
2	Mimbres River at upper TNC Mimbres	269	1876	23b	Foothills
5	Mimbres below Dwyer at Rancho del Rio	1080	1540	24b	Xeric

To determine if there is excessive sedimentation/siltation in a stream reach, two levels of assessment are performed according to the AP. The first level considers the simpler indicator of biological impairment. The second refines the assessment with the more complex indicator of geomorphic impairment when the first level threshold is exceeded. The percent sand and fines (%SaFN) indicator, based on a reach-wide pebble count, is used in the level one assessment because it is easily measured and strongly related to biological metrics. The percent sand and fines is calculated by adding the % sand and % silt-clay fractions.

Sediment assessment results are reported below (Table 8). Two sites on the mainstem of the Mimbres River were found to be fully supporting their designated uses with respect to sedimentation/siltation.

Table 8. Sediment assessments for the Mimbres watershed.

Station Name	Sediment Site Class	Level One %SaFN Threshold	% SaFN*	Level One Sediment Assessment
Mimbres River at upper TNC Mimbres	Foothills	<37%	10.5%	FS
Mimbres below Dwyer at Rancho del Rio	Xeric	<74%	36.2%	FS

* Percent sand and fines
FS = fully supporting

5.2.2 Macroinvertebrate Community

In 2010, the New Mexico Water Quality Control Commission adopted the following narrative criterion (20.6.4.13 Subsection M):

Biological integrity: Surface waters of the state shall support and maintain a balanced and integrated community of aquatic organisms with species composition, diversity and functional organization comparable to those of natural or minimally impacted water bodies of a similar type and region.

To date, benthic macroinvertebrate sampling has been the primary form of biomonitoring utilized by SWQB, followed by periphyton and fish. The macroinvertebrate community is generally the first to show a response to stressors such as fine sediment, therefore information regarding the macroinvertebrate community is important to determine the overall integrity of the stream.

Macroinvertebrate Sampling

By collecting data on the macroinvertebrate community composition, changes indicating stress on the community can be identified. Depending on the ecoregion of the study site, this is done by utilizing either the Mountain Stream Condition Index (M-SCI; Jacobi et al. 2006) or the Rapid Bioassessment Protocol (RBP; Plafkin et al. 1989; Barbour et al. 1999). The M-SCI or RBP score is based on a comparison of selected metric scores obtained from macroinvertebrate communities and is used to compare the study site to the reference site or reference condition in order to determine the degree of impairment. Threshold values for M-SCI and RBP scores appear in Table 9. Assessments of benthic macroinvertebrate communities are presented below (Table 10).

Table 9. M-SCI and RBP thresholds and assessment conclusions

M-SCI Index[1]	RBP % of reference site[2]	Resulting Aquatic Life Use Support Determination
> 56.7	> 83%	Full Support
≤56.7 – 37.2	≤83 – 79%	Indeterminate[3]
≤37.2	≤ 79%	Not Supporting

1 The M-SCI is used for Ecoregions 21 and 23.
2 RBP scores (as % of reference site) are used for Ecoregions 22, 24, 25, and 26.
3 List as Not Supporting if a second sample within a 5-year period confirms value in this range.

Table 10. Macroinvertebrate assessments for the Mimbres watershed.

Station Name	Ecoregion	Elevation (m)	Watershed Area (km^2)	M-SCI Score	RBP Score / % of reference	Biological Assessment
Mimbres at upper TNC	23b	1876	269	61.59	--	FS
Mimbres at Rancho del Rio	24b	1540	1080	--	28 / 67%	**NS**
Blue Creek 0.5 mile abv Gila R.	24c	1208	360	--	42 / 100%	*reference*

FS = fully supporting; **NS** = not supporting.

Macroinvertebrate data were assessed at two sites (Table 10). The M-SCI threshold of 56.70 was used to determine biological impairment for the Mimbres River at the upper Nature Conservancy property. This site had an M-SCI score greater than 56.7 indicating no impairment. The Mimbres River at the Rancho del Rio site is located at the bottom of the last perennial stretch of the Mimbres River where the mountains transition into desert grasslands (Photo 1). This site is near the ecoregion boundary and is more closely associated with Ecoregion 24b, Chihuahuan Desert Grasslands, therefore it was assessed using the RBP approach, as allowed by the AP. The RBP score for this site was 67% of the reference site. This AU will be listed for unidentified benthic-macroinvertebrate impairment.

Photo 1. Mimbres River at Rancho del Rio below Dwyer, NM.

5.2.3 Periphyton Community and Nutrient Assessment

Periphyton Sampling

The periphyton community is another biological indicator that can express system stress in ways that the macroinvertebrate community may not reveal. The use of periphyton community data is still in early stages of development and does not provide conclusive information on stream health. Periphyton is collected in biological surveys for a community composition analysis and for the quantification of chlorophyll *a* for the second level of nutrient assessments. A level 1 nutrient screen is performed at each survey station to determine if excess nutrients may be an issue for the reach. If necessary, a series of data is collected for the level 2 nutrient survey to determine impairment status.

Level 2 Nutrient Assessments

Level 2 nutrient surveys were conducted at sites that were previously listed as impaired due to plant nutrients or where the level 1 nutrient assessment indicated the possibility of nutrient impairment, as described in the AP. The level 2 nutrient survey consists of evaluating data for a number of indicators including total phosphorus, total nitrogen, dissolved oxygen, pH, and periphyton chlorophyll *a* concentration in order to perform a weight-of-evidence based impairment determination. Chlorophyll *a* is a quantitative measure of algal biomass which is the direct or indirect cause of most problems associated with nutrient impairment. The indicators are compared to the applicable criteria or threshold values to generate an exceedence ratio (Table 11). Threshold values for total phosphorus, total nitrogen, and chlorophyll *a* are dependent on the ecoregion and designated aquatic life use of the stream.

Level 2 nutrient surveys were conducted in three assessment units. The lower AU (Mimbres River - perennial reaches downstream of Willow Springs Canyon) was determined to be impaired for nutrients because three or more indicators exceeded threshold values as noted in Table 11. The upper AU (Mimbres River - perennial reaches Willow Springs Canyon to Cooney Canyon) appears to be dominated by groundwater inflow, thus DO values did not meet the criterion. In addition, chlorophyll *a* was below the threshold indicating nuisance algae is not occurring due to elevated nutrient concentrations thus the reach was assessed as fully supporting its designated use. San Vicente Arroyo (Mimbres River to headwaters) exhibited extreme fluctuations in DO during the sonde deployment. Stream flow conditions at the time of this survey indicate that this stream may have intermittent or ephemeral reaches. Since DO fluctuations in this reach appear to be the result of a combination of environmental variables (e.g., stream flow conditions, sunlight, temperature, etc.) and not the result of nuisance algae growth (chlorophyll *a* value was well below the threshold), more information is needed to make a final assessment conclusion.

Table 11. Level 2 nutrient assessments for the Mimbres watershed.

Assessment Unit	**Ecoregion – Aquatic Life Use**	**DO & pH – Long-term datasets**	**DO %Sat. – grab** (#of exceedences)	**DO conc – grab** (#of exceedences)	**pH – grab** (#of exceedences)	**Total Nitrogen** (#of exceedences)	**Total Phosphorus** (#of exceedences)	**Chlorophyll *a* exceedence?**	**Nutrient Assessment**
Mimbres River (Perennial reaches Willow Sprs Cyn to Cooney Cyn)	AZ/NM Mountains - HQCWAL	**DO is INC**[1] pH is FS	3/9[1]	1/9	0/9	**3/9**	**9/9**	no	FS[1]
Mimbres River (Perennial reaches d/s of Willow Sprs Cyn)	Chihuahuan Desert - CWAL	**DO is NS** pH is FS	**2/9**	1/9	0/9	0/9	**9/9**	no	**NS**

Assessment Unit	Ecoregion – Aquatic Life Use	DO & pH – Long-term datasets	DO %Sat. – grab (#of exceedences)	DO conc – grab (#of exceedences)	pH – grab (#of exceedences)	Total Nitrogen (#of exceedences)	Total Phosphorus (#of exceedences)	Chlorophyll *a* exceedence?	Nutrient Assessment
San Vicente Arroyo (Mimbres River to headwaters)	Chihuahuan Desert - WWAL	**DO is NS** pH is FS	**2/8**[2]	**2/8**[2]	0/8	1/8	**5/8**	no	**NS**[2]

NS = Not Supporting; FS = Fully Supporting ; INC = Inconclusive
HQCWAL = high quality coldwater aquatic life; CWAL = coldwater aquatic life; WWAL = warmwater aquatic life
Bolded cells indicate parameters that exceeded thresholds or allowed exceedence ratios.

[1] DO assessment is *inconclusive* because reach appears to be dominated by groundwater input. DO fluctuations in this reachdo not appear to be caused by nuisance algae growth (chl-a below threshold), therefore reach is considered Fully Supporting with respect to the narrative plant nutrients standard.

[2] San Vicente Arroyo had extreme fluctuations in DO ranging from 1.4 – 12.5 mg/L and 19.5 - 172.5 local percent saturation. This may have been due to the lack of flow that was observed during the field season. San Vicente Arroyo will be listed as impaired under Category 5C (additional data will be collected before a TMDL is scheduled).

5.2.4 Fish Community Data

People's activities near streams and rivers can reduce the quality of aquatic habitat necessary for fish survival and reproduction. To prevent unintended effects of human actions, it is important to know a little about fish and their needs (Table 12). Fish community data are collected for the development and refinement of water quality standards, development of fish-based biocriteria and bioassessment procedures, and to document and characterize the fish community for comparison with future or past records.

Fish community composition can be correlated with physical habitat to provide information about how changes may be impacting the fish community. Cold-water fish, such as trout and salmon, require aquatic habitats with abundant insects or small fish as a food source, clear cold water with year-round temperatures below 20ºC (68ºF) and high levels of dissolved oxygen, and a stony or gravelly channel substrate for spawning. Warm-water fish, such as dace and catfish, can tolerate higher temperatures of up to 32ºC (90ºF), as well as lower oxygen levels and muddy or sandy substrates. They are also much more tolerant to mediocre or poor water quality than cold-water fish and are often found in places where cold-water fish would normally exist but where the degraded habitat prevents their occurrence. Fish collection data for the Mimbres watershed appear below (Table 13).

Table 12. Characteristics of fish species found in the Mimbres River watershed.

Scientific Name	Common Name	Native	Temperature	Gravel Spawner	Feeding Guild	Water Quality Tolerance
Gila nigrescens	Chihuahua chub	Yes	Cool	No	Insectivore	Sensitive
Agosia chrysogaster	Longfin dace	No	Warm	No	Omnivore	Tolerant
Oncorhynchus mykiss	Rainbow trout	No	Cold	Yes	Insectivore, Piscivore	Sensitive
Catostomus (Pantosteus) plebeius	Rio Grande sucker	Yes	Cool	Yes	Omnivore	Intermediate
Rhinichthys osculus	Speckled dace	No	Cool	Yes	Insectivore	Intermediate

Table 13. Fish community data from sites in the Mimbres River watershed

	STATION:	Mimbres River at upper TNC (45Mimbre112.2)	Mimbres at Rancho del Rio (45Mimbre062.7)
Scientific name	**Common name**		
Gila nigrescens	Chihuahua chub	1	0
Agosia chrysogaster	Longfin dace	10	2
Oncorhynchus mykiss	Rainbow trout	89	0
Catostomus (Pantosteus) plebeius	Rio Grande sucker	44	533
Rhinichthys osculus	Speckled dace	6	0
	# of Individuals	150	535
	Total # of Taxa	5	2
	% Native	30%	>99%
	% Non-native	70%	<1%
	% Coldwater	*59%*	*n/a*
	% Coolwater	*34%*	*>99%*
	%Warmwater	*7%*	*<1%*

In the Mimbres River at the upper Nature Conservancy (TNC) property, the fish community was dominated by rainbow trout, and secondarily by Rio Grande sucker. Only one Chihuahua chub (federally listed as threatened; state listed as endangered) was collected. However, further upstream where more suitable habitat (deep pools with cover) existed, eight more Chihuahua

chub were collected (these fish were not included in the data from the sampled reach). The fish found in this section of the Mimbres River indicate this reach is in a transition zone with a mix of both cold- and cool-water species being found. In addition, water quality appears to be relatively good since the community was dominated by a sensitive species and supports a population of Chihuahua chub. The presence of a majority of gravel spawners also indicate the channel substrate is of good quality with a mix of cobbles and gravels and high oxygen content.

In the Mimbres River below Dwyer, NM at Rancho del Rio, the fish community was dominated by Rio Grande suckers, with only two longfin dace collected. This is in marked contrast with the collection performed at the same location in 2002, when longfin dace (a warm-water species) comprised 81% of the catch; however in both instances, only those two species were collected. The fish found in the lower section of the Mimbres River from both historic (2002) and current (2009) datasets indicate this reach is also in a transition zone with a mix of both cool- and warm-water species being found. In addition, water quality appears to be moderately good since the community was dominated by a species with an intermediate tolerance to water quality degradation. The presence of a majority of gravel spawners also indicate the channel substrate is of good quality with a mix of cobbles and gravels and a high enough oxygen content to allow eggs to survive.

6.0 CONCLUSIONS

As a result of assessing data generated during this survey the following conclusions were made:

- **Upper Mimbres River** – No water quality impairments were identified.
- **Middle Mimbres River –**The existing impairment for temperature was confirmed. This reach appears to be dominated by groundwater input resulting in low dissolved oxygen values, therefore a non-support designation would be inappropriate under the "natural causes" exception listed in Subsection I, Paragraph (1) of 20.6.4.11 NMAC. In addition, "*...undesireable aquatic life or... a dominance of nuisance species...*" (Paragraph E of 20.6.4.13 NMAC) is not occurring due to elevated levels of nutrients (i.e., chlorophyll-*a* was less than the applicable threshold), thus the reach is considered fully supporting with respect to plant nutrients.
- **Lower Mimbres River** – The existing impairments for temperature, nutrients, and bacteria (*E. coli*) were confirmed.
- **McKnight Canyon Creek –** No water quality impairments were identified.
- **Gallinas Creek –** No water quality impairments were identified.
- **Cold Springs Creek –** This stream is impaired for dissolved cadmium and dissolved lead standards associated with the chronic aquatic life criteria.
- **San Vicente Arroyo –** This AU exceeded dissolved oxygen and nutrient standards associated with its warm water aquatic life designation. Stream flow conditions and water quality at the time of this survey indicate that this stream may have intermittent or ephemeral reaches. Additional data will be collected before a TMDL is scheduled.

Guidance documents for stream restoration (i.e., TMDLs), will be prepared or updated by SWQB to address the above noted impairments. Additional data will be collected in future water quality surveys and during TMDL development. When water quality standards have been attained the reach will be moved to the appropriate category on the 303(d) List.

7.0 REFERENCES

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