2.0 CANADIAN BACKGROUND

The Canadian Basin was intensively sampled by the Surface Water Quality Bureau (SWQB) from March to November 2002 and is addressed in this document. The Canadian Basin includes perennial reaches of the Canadian River from the Texas/New Mexico Border to Colorado/New Mexico, as well as tributaries that enter the Canadian River along those perennial reaches. Surface water quality monitoring stations were selected to characterize water quality of the stream reaches. Assessment units that will have a TMDL prepared in this document and those receiving de-list letters are discussed in their respective individual watershed sections. A number of assessment units could not be assessed due to insufficient data. These impairments will remain on the Integrated CWA §303(d)/§305(b) list of waters until additional data are available.

2.1 Location Description

The Canadian River watershed (US Geological Survey [USGS] Hydrologic Unit Codes [HUC] 11080001, 11080002, 11080003, 11080004, 11080005, 11080006, 11080007, 11080008, and 11090101) is part of the vast drainage system of the Arkansas River. The Canadian Watershed encompasses about one-sixth the land area of New Mexico or about 1720 square miles (1.1 million acres). Canadian River tributaries flow east and southeast from their origins on the east slopes of the Sangre de Cristo cordillera of northern New Mexico and southern Colorado. As it traverses the Great Plains in a southerly and then easterly direction, several perennial tributaries, including the Vermejo, Cimarron, Mora, and Conchas Rivers join the South Canadian River before it exits New Mexico toward Texas near Logan, New Mexico. The Canadian River flows generally east through the Texas panhandle into Oklahoma, where it drains a sizeable portion of that state before reaching its confluence with the Arkansas River just west of Fort Smith, Arkansas. The drainage system encompasses approximately 47,700 square miles in the three states.

The Canadian River is a braided, meandering system fed by the numerous streams and creeks and drains semi-deserts, plains, prairies, forests, and mountains. The vegetation of the New Mexican Canadian Watershed includes both the Great Plains and Rocky Mountain floras (Omernik 2006). As presented in Figure 2.1, land use is 39% forest, 44% grassland, 14% shrubland, 2% agricultural, and <1% urban.

Several species within this watershed are listed as either threatened or endangered by both State and federal agencies. Endangered species include the Southern redbelly dace (*Phoxinus erythrogaster*), Southwestern willow flycatcher (*Empidonax traillii extimus*), Least tern (*Sterna antillarum*), Black-footed ferret (*Mustela nigripes*), and Holy Ghost ipomopsis (*Holy Ghost ipomopsis*). Threatened species include the Arkansas River shiner (*Notropis girardi*), Suckermouth minnow (*Phenacobius mirabilis*), Arkansas River speckled chub (*Macrhybopsis tetranema*), Bald eagle (*Haliaeetus leucocephalus*), Mexican spotted owl (*Strix occidentalis lucida*), and Piping plover (*Charadrius melodus*).

2.2 Geology and Land Use

The laterally extensive pediments, topographically inverted basalt-capped mesas, and stripped structural surfaces of the Las Vegas Plateau of northeastern New Mexico gradually slope to the southeast away from the eastern flank of the Sangre de Cristo Mountains, which represent both the southern Rocky Mountain front in New Mexico as well as the eastern flank of the Rio Grande rift. The Canadian River has carved a deep bedrock canyon into the gently warped strata of the Las Vegas Plateau in response to a complex interaction of epeirogenic rock-uplift processes (characterized by domes, arches, and basins) and downstream baselevel fall caused by evaporite dissolution. The Las Vegas Plateau terminates to the south in a 250–300 meter high, embayed line of cliffs known as the Canadian escarpment. The canyon is deepest (~400 m) and widest (~1.5 km) where it breaches the escarpment north of Conchas Lake near Sabinoso, New Mexico (Wisniewski & Pazzaglia 2002).

Historic and current land uses in the watershed include farming, ranching, recreation, and municipal related activities (Raton, Springer, Angel Fire, Eagle Nest, Mora). Much of the land ownership adjacent to the river is private with the exceptions of Maxwell National Wildlife Refuge, Fort Union National Monument near Watrous, and national forest land in the higher elevations. The Bureau of Land Management and the State of New Mexico also own and manage tracts of public lands in the eastern portions of the watershed (refer to Figures 3.2 and 3.5). The Canadian watershed is located in Omernick Level III Ecoregion 21 (Southern Rockies) in the headwaters and Level III Ecoregion 26 (Southwestern Tablelands) in the lowlands. The elevation range for the various sampling sites in the survey was 5771’ to 8826’ above sea level.

2.3 Water Quality Standards

Water quality standards (WQS) for all assessment units in this document are set forth in sections, 20.6.4.305, 20.6.4.306, 20.6.4.307, and 20.6.4.309 of the *NM Standards for Interstate and Intrastate Surface Waters* (New Mexico Administrative Code [NMAC] 20.6.4) (NMAC 2006).

20.6.4.305 CANADIAN RIVER BASIN - The main stem of the Canadian river from the headwaters of Conchas reservoir upstream to the New Mexico-Colorado line, perennial reaches of the Conchas river, the Mora river downstream from the USGS gaging station near Shoemaker, the Vermejo river downstream from Rail canyon and perennial reaches of Raton, Chicorica and Uña de Gato creeks.

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

B. Criteria:

(1) In any single sample: pH within the range of 6.6 to 9.0, temperature 32.2°C (90°F) or less and TDS 3,500 mg/L or less at flows above 10 cfs. The use-specific numeric criteria set forth in 20.6.4.900 NMAC are applicable to the designated uses listed above in Subsection A of this section.

(2) The monthly geometric mean of E. coli bacteria 126 cfu/100 mL or less; single sample 410 cfu/100 mL or less (see Subsection B of 20.6.4.14 NMAC).

[20.6.4.305 NMAC - Rp 20 NMAC 6.1.2305, 10-12-00; A, 05-23-05]

20.6.4.306 CANADIAN RIVER BASIN - The Cimarron river downstream from state highway 21 in Cimarron to the Canadian river and all perennial reaches of tributaries to the Cimarron river downstream from state highway 21 in Cimarron.

A. Designated Uses: irrigation, warmwater aquatic life, livestock watering, wildlife habitat and secondary contact.

B. Criteria:

(1) In any single sample: pH within the range of 6.6 to 9.0, temperature 32.2°C (90°F) or less and TDS 3,500 mg/L or less at flows above 10 cfs. The use-specific numeric criteria set forth in 20.6.4.900 NMAC are applicable to the designated uses listed above in Subsection A of this section.

(2) The monthly geometric mean of E. coli bacteria 126 cfu/100 mL or less; single sample 410 cfu/100 mL or less (see Subsection B of 20.6.4.14 NMAC).

[20.6.4.306 NMAC - Rp 20 NMAC 6.1.2305.1, 10-12-00; A, 7-19-01; A, 05-23-05]

20.6.4.307 CANADIAN RIVER BASIN - Perennial reaches of the Mora river from the USGS gaging station near Shoemaker upstream to the state highway 434 bridge in Mora, all perennial reaches of tributaries to the Mora river downstream from the USGS gaging station at La Cueva in San Miguel and Mora counties, perennial reaches of Ocate creek and its tributaries downstream of Ocate, and perennial reaches of Rayado creek downstream of Miami lake diversion in Colfax county.

A. Designated Uses: marginal coldwater aquatic life, warmwater aquatic life, secondary contact, irrigation, livestock watering and wildlife habitat.

B. Criteria:

(1) In any single sample: temperature 25°C (77°F) or less and pH within the range of 6.6 to 9.0. The use-specific numeric criteria set forth in 20.6.4.900 NMAC are applicable to the designated uses listed above in Subsection A of this section.

(2) The monthly geometric mean of E. coli bacteria 126 cfu/100 mL or less; single sample 410 cfu/100 mL or less (see Subsection B of 20.6.4.14 NMAC).

[20.6.4.307 NMAC - Rp 20 NMAC 6.1.2305.3, 10-12-00; A, 05-23-05]

20.6.4.309 CANADIAN RIVER BASIN - The Mora river and perennial reaches of its tributaries upstream from the state highway 434 bridge in Mora, all perennial reaches of tributaries to the Mora river upstream from the USGS gaging station at La Cueva, perennial reaches of Coyote creek and its tributaries, the Cimarron river and its perennial tributaries above state highway 21 in Cimarron, all perennial reaches of tributaries to the Cimarron river north and northwest of highway 64, perennial reaches of Rayado creek and its tributaries above Miami lake diversion, Ocate creek and perennial reaches of its tributaries upstream of Ocate, perennial reaches of the Vermejo river upstream from Rail canyon and all other perennial reaches of tributaries to the Canadian river northwest and north of U.S. highway 64 in Colfax county unless included in other segments.

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

B. Criteria:

(1) In any single sample: specific conductance 500 µmhos/cm or less, pH within the range of 6.6 to 8.8 and temperature 20°C (68°F) or less. The use-specific numeric criteria set forth in 20.6.4.900 NMAC are applicable to the designated uses listed above in Subsection A of this section.

(2) The monthly geometric mean of E. coli bacteria 126 cfu/100 mL or less; single sample 235 cfu/100 mL or less (see Subsection B of 20.6.4.14 NMAC).

[20.6.4.309 NMAC - Rp 20 NMAC 6.1.2306, 10-12-00; A, 7-19-01; A, 05-23-05]

[**NOTE: The segment covered by this section was divided effective 05-23-05. The standards for the additional segment are under 20.6.4.310 NMAC**.]

20.6.4.900 NMAC provides criteria applicable to attainable or designated uses unless otherwise specified in 20.6.4.101 through 20.6.4.899 NMAC. 20.6.4.13 NMAC lists general criteria that apply to all surface waters of the state at all times, unless a specific criterion is provided elsewhere in NMAC (2006).

2.4 Intensive Water Quality Sampling

The Canadian River watershed was intensively sampled by the SWQB in 2002. A brief summary of the survey and the hydrologic conditions during the intensive sample period is provided in the following subsections.

2.4.1 Survey Design

Surface water quality samples were collected monthly between March and November for the 2002 intensive SWQB study. Temperature data also were collected in 2002. Surface water quality monitoring stations were selected to characterize water quality of various assessment units (i.e., stream reaches and reservoirs) throughout the basin (Table 2.1, Figure 2.1). The locations of 2002 thermograph deployments in the Canadian River Basin are described in Section 6.0 (Table 6.1 and Figure 6.1). Stations were located to evaluate the impact of tributary streams and to determine ambient water quality conditions. Data results from grab sampling are housed in the SWQB provisional water quality database and were uploaded to USEPA's Storage and Retrieval (STORET) database.

All temperature and chemical/physical sampling and assessment techniques are detailed in the *Quality Assurance Project Plan* (QAPP, NMED/SWQB 2002) and the SWQB assessment protocols (NMED/SWQB 2004b & 2006). As a result of the 2002 monitoring effort and subsequent assessment of results, several surface water impairments were determined. Accordingly, these impairments were added to New Mexico's 2004-2006 Integrated CWA §303(d)/305(b) List (NMED/SWQB 2004a).

Table 2.1 SWQB 2002 Canadian River Basin Sampling Stations

Station	Station Location	STORET ID
1	Vermejo River below confluence with Leandro Creek	04Vermej094.1
2	Vermejo River at Juan Baca Canyon	04Vermej080.2
3	Vermejo River above York Canyon Creek	04Vermej076.0
4	York Canyon Creek above Vermejo River	04YorkCa000.1
5	Vermejo River below York Canyon Creek	04Vermej073.7
6	Vermejo River above Caliente Canyon	04Vermej060.8
7	Caliente Canyon above Vermejo River	04Calien000.1
8	Blosser Arroyo at Blosser Gap	04BlossA013.3
9	Vermejo River (downstream of) Dawson (below conf with Rail)	04Vermej038.8
10	VanBremmer Creek @ Hwy 64	04VanBre009.4
11	Vermejo River at I-25.	04Vermej002.9
12	Cimarron River above Springer WWTP	05Cimarr011.8
13	Cimarron River below Springer WWTP	05Cimarr010.4
14	Wheaton Creek ~ 0.5 mi above confluence with Ocate Creek	06Wheato000.8
15	Manuelas Creek above Ocate Creek	06Manuel008.7
16	Ocate Creek above village of Ocate	06OcateC063.0
17	Ocate creek @ I-25	06OcateC025.1
18	Little Coyote @ Hwy 434	07LitCoy001.3
19	Coyote Creek above Black Lake	07Coyote057.0
20	Coyote Creek below Black Lake at HWY 434	07Coyote047.9

Station	Station Location	STORET ID
21	Coyote Creek at Harold Brock Fishing Area	07Coyote041.3
22	Coyote Creek at Coyote State Park above USGS gage	07Coyote040.0
23	Coyote Creek at USGS Gage at Thal Ranch	07Coyote004.2
24	Coyote Creek 1 mile above Mora River at Thal Ranch	07Coyote001.7
25	Mora River at Chacon 0.6 miles above gage	07MoraRi170.9
26	Mora River at Cleveland by bridge on Church Rd.	07MoraRi154.8
27	Rio de la Casa 4 miles above Mora River	07RioLaC006.2
28	Mora River above Mora WWTP lagoons	07MoraRi147.1
29	Mora River above Hatchery	07MoraRi147.2
30	Mora River below Mora WWTP lagoons	07MoraRi146.6
31	Mora River at La Cueva USGS gage	07MoraRi139.9
32	Mora River below El Queso	07MoraRi139.3
33	Buena Vista Ditch above Mora River	07BuenoVDitch
34	Santiago Creek at State Hwy 94 near Ledoux, NM	07Santia002.3
35	Rito Morphy at State Hwy 94 near Ledoux, NM	07RMorph001.6
36	Rito Cebolla @ Hwy 161	07RitoCe000.3
37	Rito de Gascon abv Rito San Jose	07RGasco002.0
38	Manuelitas Cr. abv Maestas Cr.	07Manuel020.9
39	Maestas Cr. abv Manuelitas Cr.	07Maesta000.4
40	Rito San Jose abv Manuelitas Cr.	07RSanJo000.5
41	Manuelitas Creek blw Rociada	07Manuel021.7
42	Manuelitas Creek at Hwy 94 bridge	07Manuel006.1
43	Sapello River ¼ mile inside Mosimann Ranch gate	07Sapell069.8
44	Sapello R. at San Ignacio	07Sapell052.4
45	Sapello R. at Hwy 518	07Sapell044.4
46	Sapello R. at Hwy 161 (near Watrous)	07Sapell000.1
47	Mora River @ Watrous	07MoraRi094.0
48	Mora R. at Black Willow Ranch.	07MoraRi086.0
49	Wolf Cr. abv Mora R.	07WolfCr000.6
50	Mora R. blw Shoemaker at Rd. 97	07MoraRi078.0

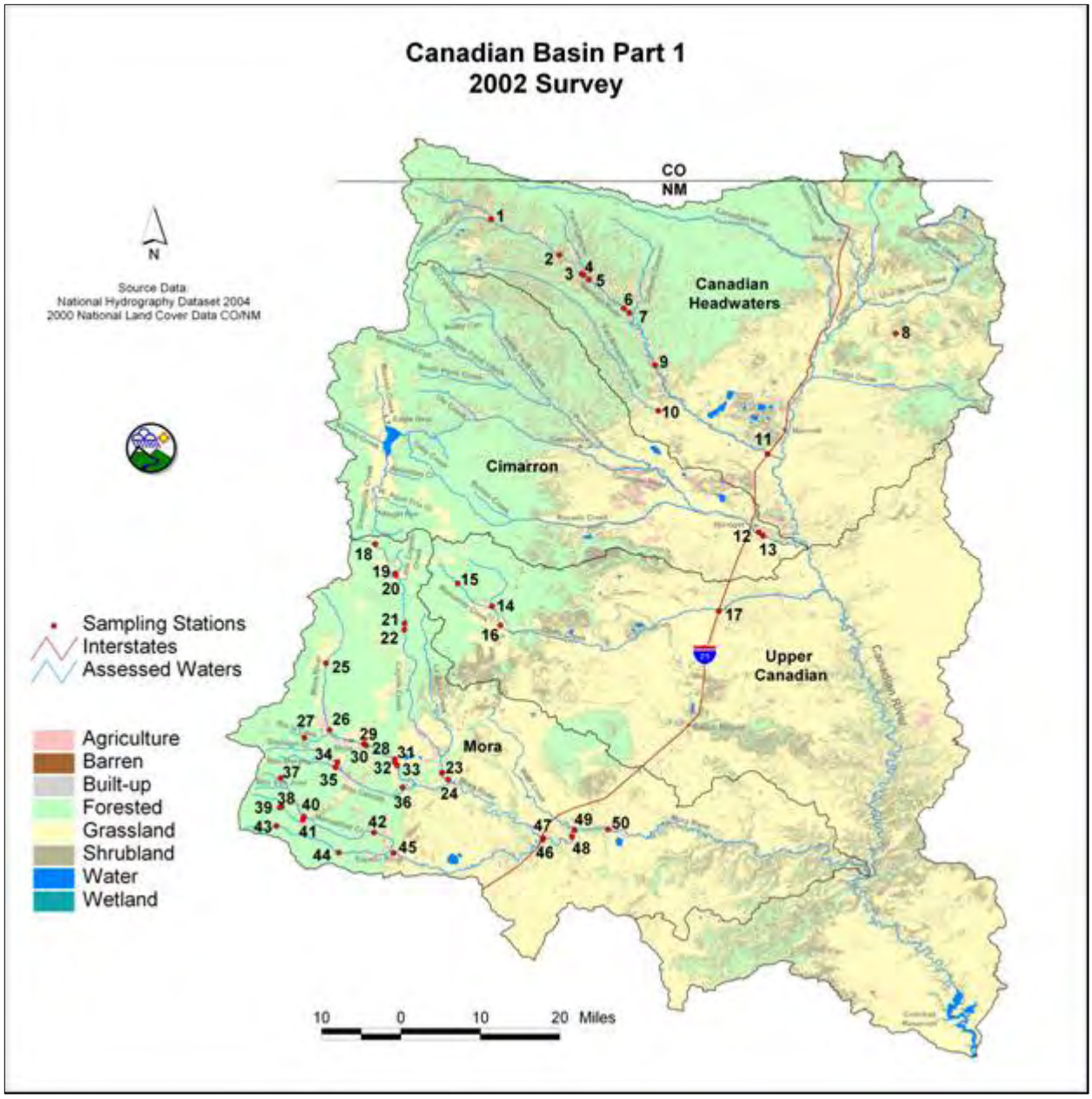

Figure 2.1 Land Use and 2002 Sampling Stations in the Canadian Watershed

2.4.2 Hydrologic Conditions

There are three active USGS gaging stations in the Upper Canadian and Mora Watersheds: the Vermejo River near Dawson, NM with a period of record from 1915 to present day; Coyote Creek near Golondrinas, NM with a period of record from 1917 to present day; and the Mora River at La Cueva, NM, which has a period of record from 1906 to present day. The annual daily mean streamflow for Vermejo River is 19.4 cubic feet per second (cfs); the annual daily mean streamflow for Coyote Creek near Golondrinas, NM is 12.8 cfs; and, the annual daily mean streamflow for the Mora River at La Cueva, NM is 28.2 cfs. Streamflow records (Figures 2.2, 2.3, and 2.4) illustrate the dry conditions that New Mexico is currently experiencing, which is particularly noticeable from 2000-2004.

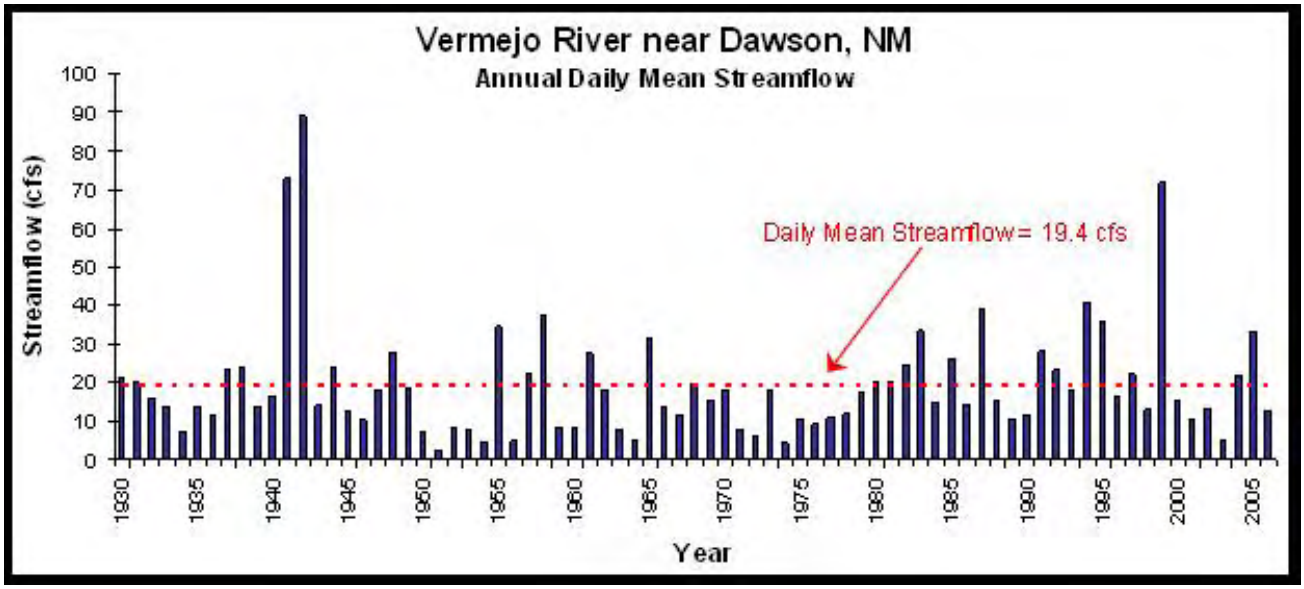

Figure 2.2 Vermejo River near Dawson, NM (01 Oct 1996 – 30 Sept 2006)

During the 2002 watershed survey, flows in the Vermejo River (USGS Gage 07203000) were below average with an annual daily mean streamflow of 13.3 cfs, approximately 31% below the "normal" streamflow of 19.4 cfs.

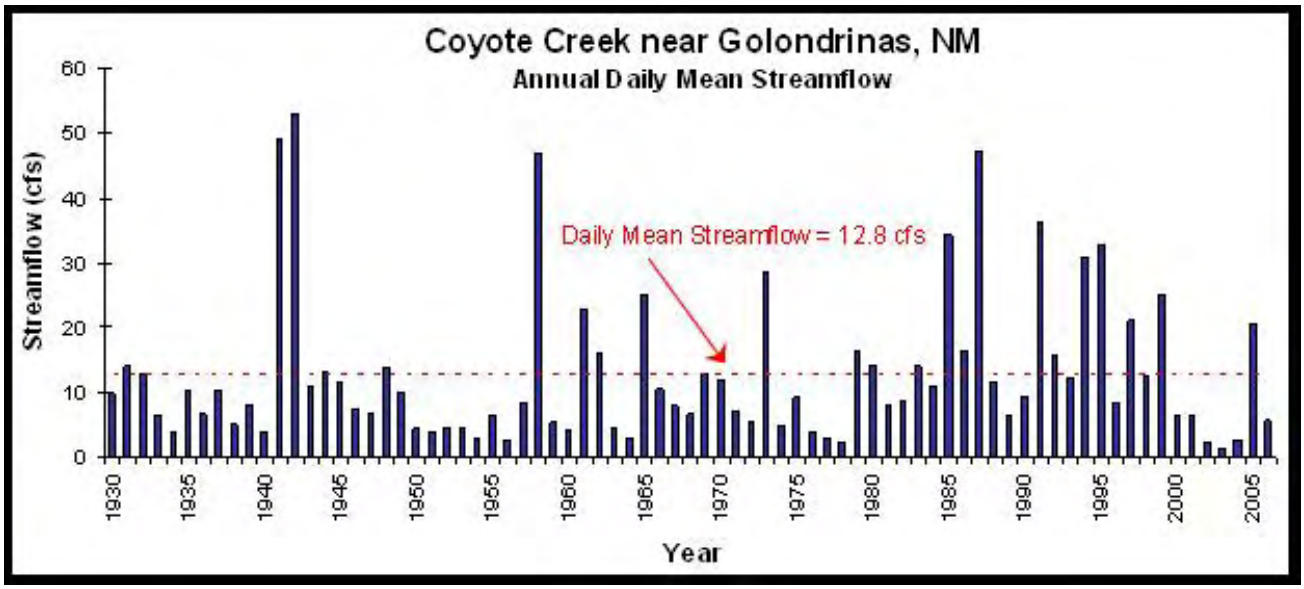

Figure 2.3 Coyote Creek near Golondrinas, NM (01 Oct 1996 – 30 Sept 2006)

Flows in Coyote Creek (USGS Gage 07215500) during the 2002 survey year were well below normal with an annual average daily mean streamflow of 2.38 cfs, approximately 81% below the "normal" streamflow of 12.8 cfs.

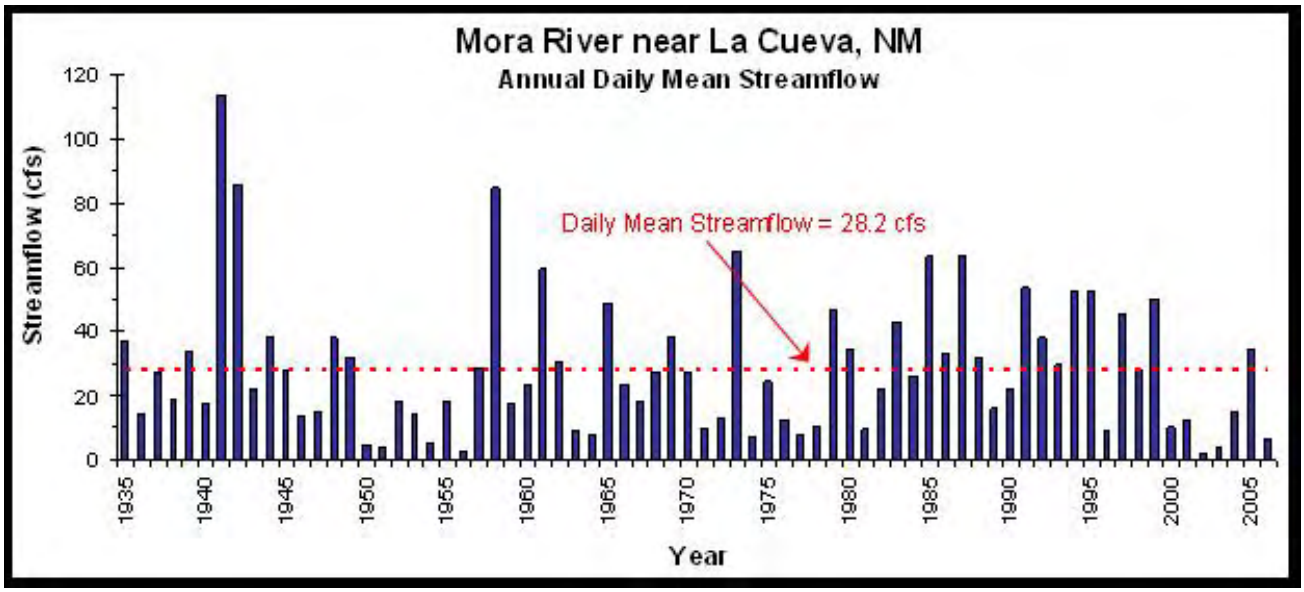

Figure 2.4 Mora River at La Cueva, NM (01 Oct 1996 – 30 Sept 2006)

SWQB also surveyed the Mora River in 1999, 2004 and 2006. Flows in the Mora River (USGS Gage 07215500) during the 1999 survey year were well above normal, with an annual daily mean streamflow of 50.1 cfs, roughly 78% above the "normal" streamflow of 28.2 cfs.

However, streamflow during the 2002, 2004, and 2006 surveys were below "normal" with annual average daily mean streamflows of 2.27 cfs (~95% below average), 14.6 cfs (~48% below average), and 6.64 cfs (~76% below average), respectively.

As stated in the Assessment Protocol (NMED/SWQB 2004b & 2006), data collected during all flow conditions, including low flow conditions (i.e., flows below the 4-day, 3-year low-flow frequency [4Q3]), will be used to determine designated use attainment status during the assessment process. In terms of assessing designated use attainment in ambient surface waters, water quality standards (WQS) apply at all times under all flow conditions.