# 3.0 INDIVIDUAL WATERSHED DESCRIPTIONS

TMDLs were developed for assessment units for which constituent (or pollutant) concentrations measured during the 2002 water quality survey indicated impairment. Because characteristics of each subwatershed, such as geology, land use, and land ownership provide insight into probable sources of impairment, they are presented in this section for the individual subwatersheds within the Canadian River basin. In addition, the 2006-2008 Integrated CWA §303(d)/§305(b) listings within the Canadian River basin are discussed (NMED/SWQB 2007). Assessment units that will have delist letters prepared are discussed in their respective individual subwatershed sections.

## 3.1 Canadian Headwaters Subwatershed

The Canadian Headwaters watershed (US Geological Survey [USGS] Hydrologic Unit Code [HUC] 11080001) is located in northeastern New Mexico (NM) and is bounded by the Sangre de Cristo Mountains to the west and the Great Plains to the east. The Canadian Headwaters watershed from a point southeast of Maxwell, NM to its headwaters drains approximately 2850 square miles ($mi^2$). Elevation ranges from 11,610 feet (ft.) at Vermejo Peak to 5640 ft. at the USGS Gage 07211500 near Taylor Springs, NM.

As presented in Figure 3.1, land uses include 52% forest, 34% grassland; 11% shrubland; 1% agriculture, 1% riparian, and 1% urban. Land ownership is 92% private, 6% State, 1% US Forest Service (USFS), 1% US Fish and Wildlife Service (USFWS), <1% Bureau of Land Management (BLM), and <1% Bureau of Reclamation (BOR) (Figure 3.2). Much of the land ownership adjacent to the river is private with the exceptions of Maxwell National Wildlife Refuge and a small portion of the Valle Vidal in the headwaters of Leandro Creek. According to available Geographic Information System (GIS) coverages, the average annual precipitation in the Colfax County is 16.34 inches. Average annual snowfall in the study area is 72 inches (or 7.2 inches of precipitation).

The geology of the Canadian Headwaters watershed is characterized by sandstone, shale, mudstone, and claystone that are flanked by limestone or calcareous rocks in the west and mafic volcanic rocks in the east (Figure 3.3). Alluvium, basin, and valley fill is generally found in river valleys and eastern basins.

Tributaries to the Canadian Headwaters include: Caliente Canyon Creek, York Canyon Creek, Leandro Creek, Vermejo River, VanBremmer Creek, Raton Creek, Chicorica Creek, Uña de Gato Creek, Blosser Arroyo, and Tinaja Creek.

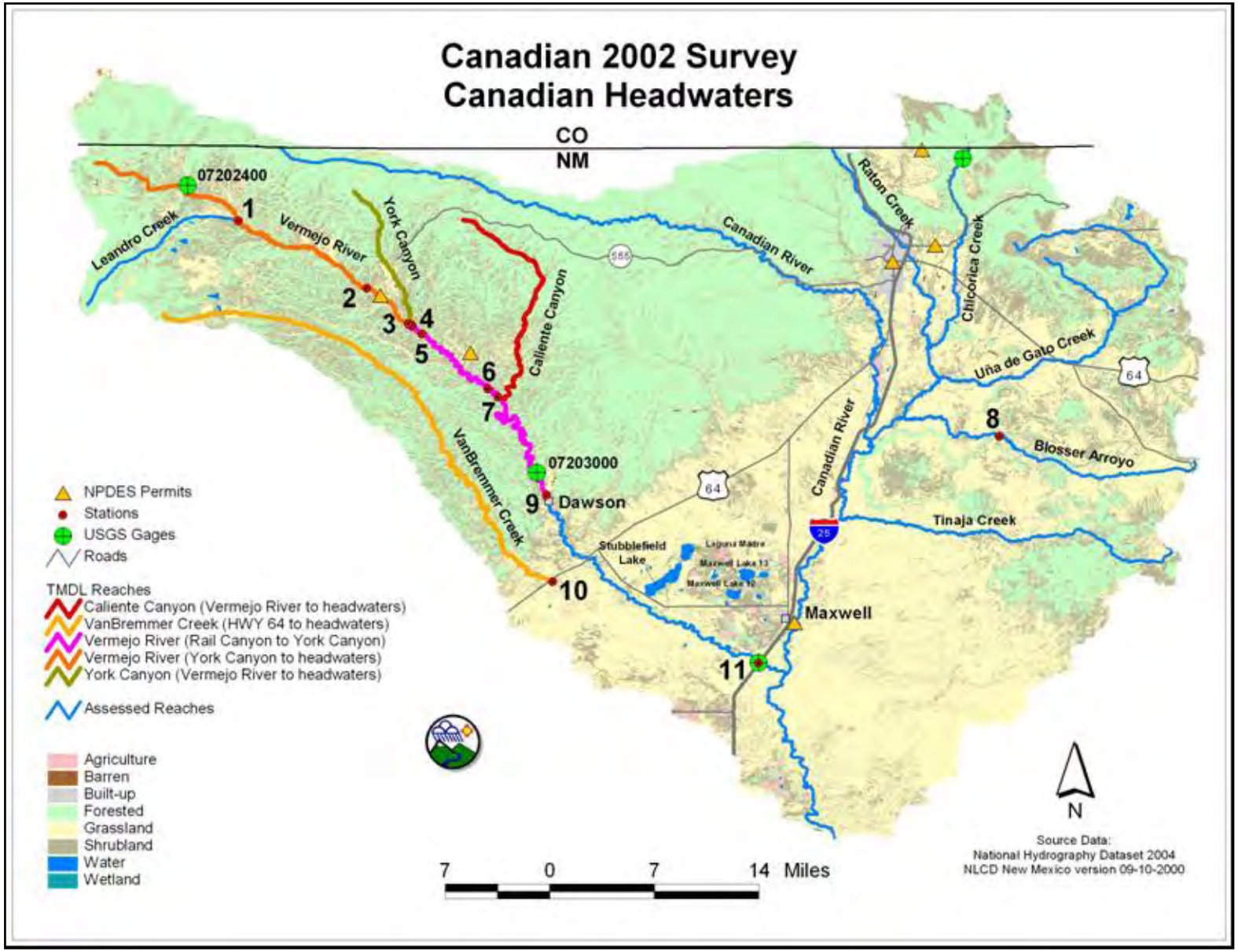


**Figure 3.1 Land Use in the Canadian Headwaters Watershed**

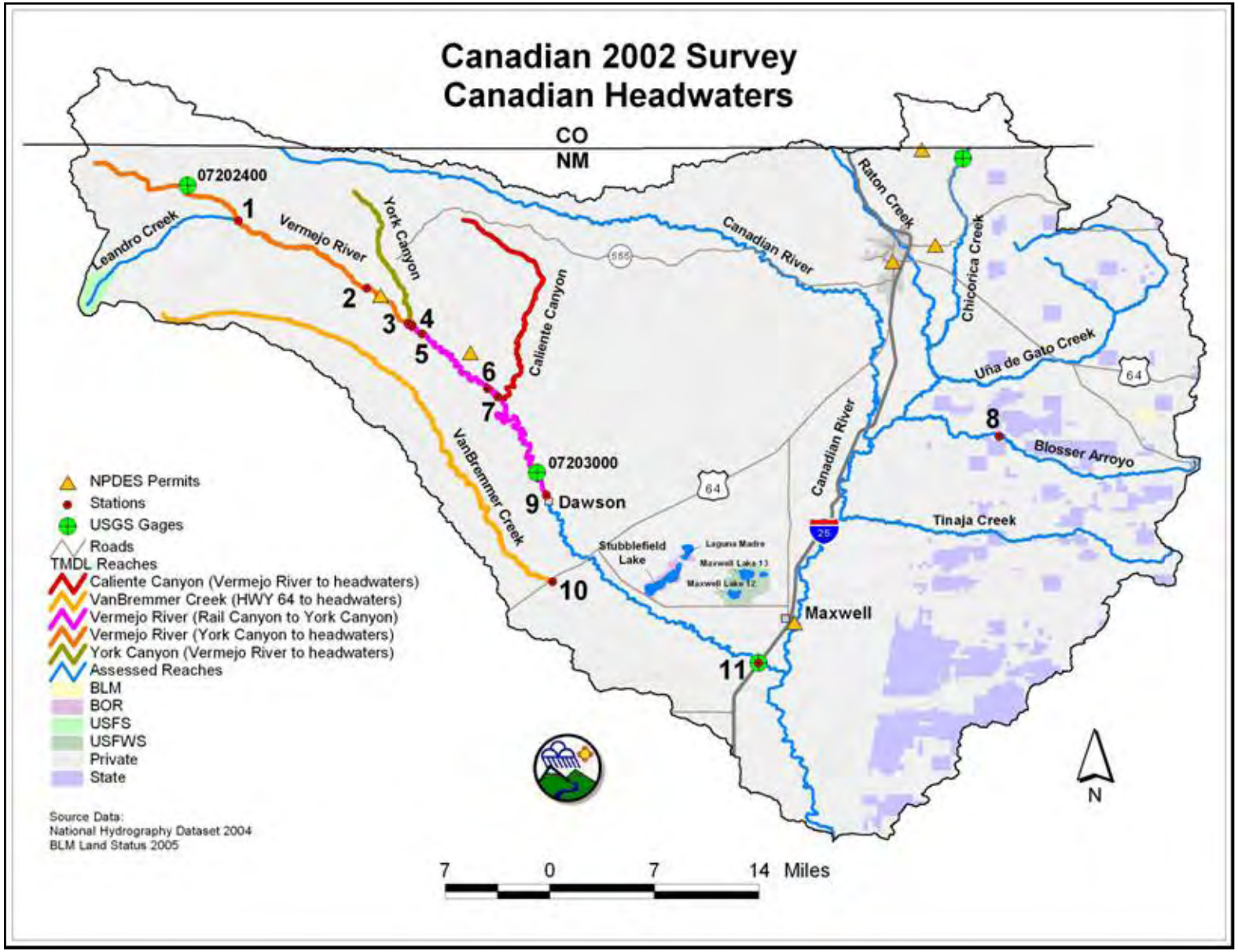


**Figure 3.2 Land Ownership of the Canadian Headwaters Watershed**

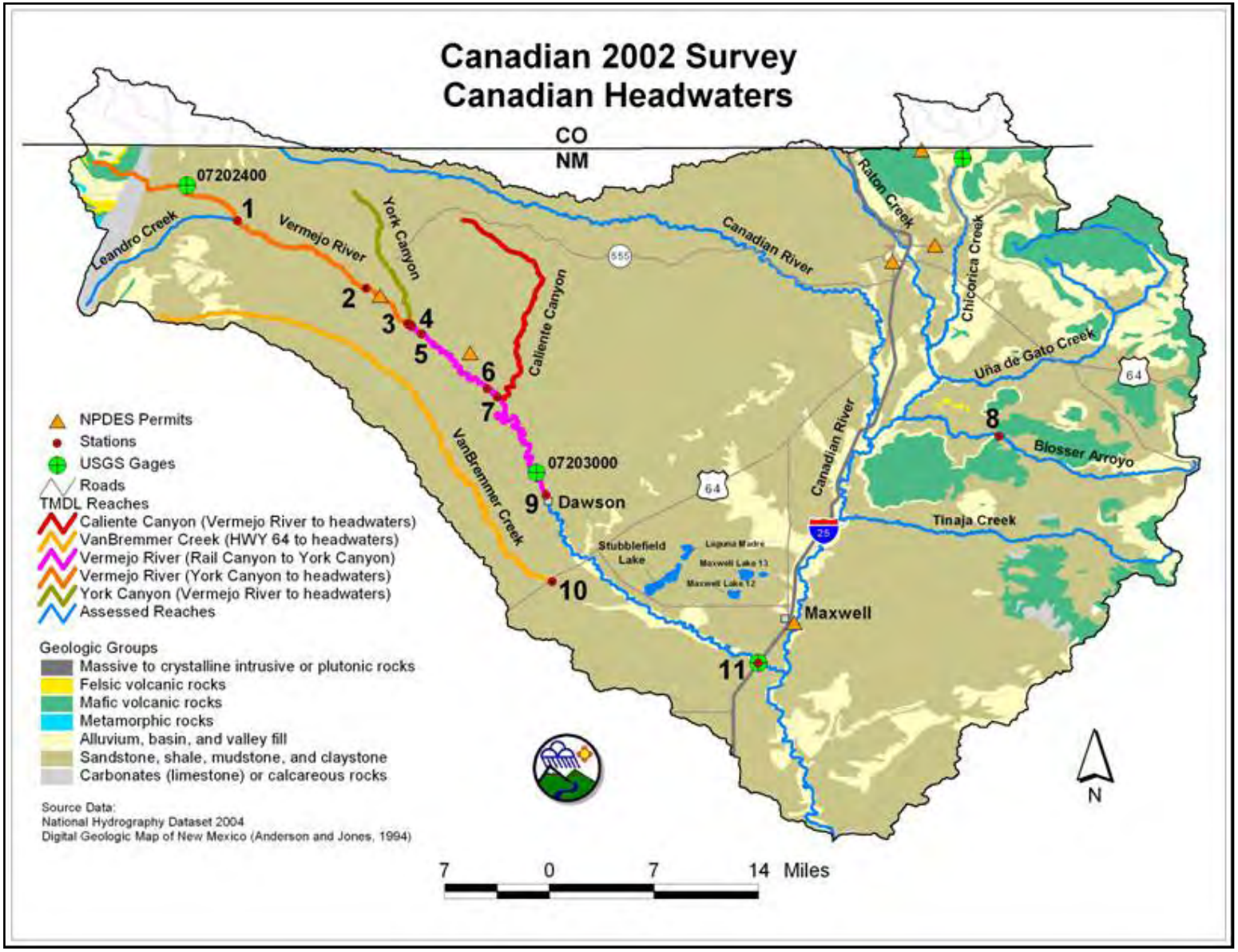


**Figure 3.3 Geology of the Canadian Headwaters Watershed**

Caliente Canyon (Vermejo River to Headwaters) is approximately 17 miles in length. SWQB established one station along this assessment unit during the 2002 intensive survey. Caliente Canyon (Vermejo River to Headwaters) was included on the 2004-2006 Integrated CWA §303(d)/§305(b) list for specific conductance. No TMDLs have previously been established for this assessment unit. Therefore, a TMDL was developed for inclusion in this document for the following assessment unit in the Canadian Headwaters subbasin:

- ***Specific Conductance*:** Caliente Canyon (Vermejo River to Headwaters)

VanBremmer Creek (Hwy 64 to Headwaters) is approximately 41 miles in length. SWQB established one station along this assessment unit during the 2002 intensive survey. VanBremmer Creek (Hwy 64 to Headwaters) was included on the 2004-2006 Integrated CWA §303(d)/§305(b) list for temperature, specific conductance, and turbidity. No thermograph data were available to address the existing temperature impairment on Van Bremmer Creek (Hwy 64 to headwaters). In addition, according to staff observations, VanBremmer Creek should be classified as a coldwater aquatic life (CWAL) use instead of a high quality coldwater aquatic life (HQCWAL) use. A Use Attainability Analysis (UAA) will be developed to correct the classification of VanBremmer Creek. Since CWAL does not have a specific conductance criterion, the specific conductance listing will be removed once the UAA is approved. Furthermore, the 2002 New Mexico WQS segment-specific turbidity criterion (20.6.4.309 NMAC) was used to assess the 2002 Canadian River Watershed water quality results. However, all numeric segment-specific turbidity criteria were removed as part of the 2005 WQS rule amendment and replaced with a general turbidity criterion that reads:

> *20.6.4.13(J) NMAC: Turbidity attributable to other than natural causes shall not reduce light transmission to the point that the normal growth, function or reproduction of aquatic life is impaired or that will cause substantial visible contrast with the natural appearance of the water. Turbidity shall not exceed 10 NTU over background turbidity when the background turbidity is 50 NTU or less, or increase more than 20 percent when the background turbidity is more than 50 NTU. Background turbidity shall be measured at a point immediately upstream of the turbidity causing activity…*

The SWQB is currently evaluating how to implement this provision. Options include developing a protocol to determine background turbidity in order to use the general criterion in future assessments. New assessment methods to determine turbidity impairment based on this new language are not yet available. SWQB will retain historic turbidity listings in the interim. Because of the reasons presented above, no TMDLs were written for this assessment unit.

Vermejo River (Rail Canyon to York Canyon) is approximately 24 miles in length. SWQB established two stations along this assessment unit and deployed one thermograph during the 2002 intensive survey. Vermejo River (Rail Canyon to York Canyon) was included on the 2004-2006 Integrated CWA §303(d)/§305(b) list for specific conductance and temperature. No TMDLs have previously been established for this assessment unit. Therefore, TMDLs were

developed for inclusion in this document for the following assessment unit in the Canadian Headwaters subbasin:

- ***Specific Conductance*:** Vermejo River (Rail Canyon to York Canyon)
- ***Temperature*:** Vermejo River (Rail Canyon to York Canyon)

Vermejo River (York Canyon to Headwaters) is approximately 25 miles in length. SWQB established three stations along this assessment unit and deployed one thermograph during the 2002 intensive survey. Vermejo River (Rail Canyon to York Canyon) was included on the 2004-2006 Integrated CWA §303(d)/§305(b) list for temperature. No TMDLs have previously been established for this assessment unit. Therefore, a TMDL was developed for inclusion in this document for the following assessment unit in the Canadian Headwaters subbasin:

- ***Temperature*:** Vermejo River (York Canyon to Headwaters)

York Canyon Creek (Vermejo River to Headwaters) is approximately 11 miles in length. SWQB established one station along this assessment unit and deployed one thermograph during the 2002 intensive survey. York Canyon Creek (Vermejo River to Headwaters) was included on the 2004-2006 Integrated CWA §303(d)/§305(b) list for specific conductance and turbidity. However, the 2002 New Mexico WQS segment-specific turbidity criterion (20.6.4.309 NMAC) was used to assess the 2002 Canadian River Watershed water quality results. All numeric segment-specific turbidity criteria were removed as part of the 2005 WQS rule amendment and replaced with a general turbidity criterion that reads:

> *20.6.4.13(J) NMAC: Turbidity attributable to other than natural causes shall not reduce light transmission to the point that the normal growth, function or reproduction of aquatic life is impaired or that will cause substantial visible contrast with the natural appearance of the water. Turbidity shall not exceed 10 NTU over background turbidity when the background turbidity is 50 NTU or less, or increase more than 20 percent when the background turbidity is more than 50 NTU. Background turbidity shall be measured at a point immediately upstream of the turbidity causing activity…*

The SWQB is currently evaluating how to implement this provision. Options include developing a protocol to determine background turbidity in order to use the general criterion in future assessments. New assessment methods to determine turbidity impairment based on this new language are not yet available. SWQB will retain historic turbidity listings in the interim. No TMDLs have previously been established for this assessment unit. Therefore, a TMDL was developed for inclusion in this document for the following assessment unit in the Canadian Headwaters subbasin:

- ***Specific Conductance*:** York Canyon Creek (Vermejo River to Headwaters)

## 3.2 Mora Subwatershed

The Mora watershed (US Geological Survey [USGS] Hydrologic Unit Code [HUC] 11080004) is located in northeastern New Mexico (NM) and is bounded by the Sangre de Cristo Mountains to the west and the Canadian River and Great Plains to the east. The Mora River watershed from Shoemaker, NM (just east of I-25) to its headwaters drains approximately 1104 square miles ($mi^2$). Elevation ranges from 13,102 feet (ft.) at South Truchas Peak to 6145 ft. at the USGS Gage 07221000 near Shoemaker.

There are three main land uses in the Mora River watershed, as presented in Figure 3.4. They include forest (spruce-fir-pine-aspen in higher elevations and piñon-juniper in lower elevations) in the western mountainous region, rangeland characterized by gramma grass in association with other species in the eastern plains, and agriculture, which is located primarily along narrow, alluvial valleys and river corridors. Land ownership is 91% private, 6% USFS, 3% State, <1% National Park Service (NPS), and <1% BLM (Figure 3.5). Much of the land ownership adjacent to the river is private with the exceptions of Fort Union National Monument on Wolf Creek and Coyote Creek State Park and USFS land in the headwaters.

The average annual precipitation in Mora County ranges from 16 inches in the eastern plains to 25 inches in the mountain valleys. Over forty inches can accumulate in the highest western mountains (Tuan et. al 1973). Average annual snowfall in the study area ranges from about 30 inches to well over 100 inches at the higher elevations.

The geology of the Mora River watershed (Figure 3.6) is characterized by broad, elevated, north-trending belts of crystalline rocks that are generally flanked by steeply dipping sedimentary rocks in the west and high mesas and extensive dissected plateaus in the east. The core of the Sangre de Cristo Mountains to the west consists of metamorphic and igneous rocks overlain by the Pennsylvanian Magdalena Group. This thick sequence of rocks includes the Sandia Formation (carbonaceous shales and sandstones) and the Madera Limestone (limestone with interbedded shales). Shales, silts, mudstones, and sandstones overlay the Magdalena Group. The Permian Yeso formation consisting of argillaceous sandstone with lenses of silty sandstone overlies the shales, silts, mudstones, and sandstones. The Yeso is overlain by the Glorieta Sandstone, which is exposed near Mora and Ocate, NM. In addition, volcanic rocks are exposed over a large part of Mora County (Glorieta Geoscience, Inc. 1990).

Both the geologic and the bedrock hydrologic system are complex. The Mora River and its tributaries originate in the Sangre de Cristo Mountains. Luna and Lujan Creeks form the headwaters of the Mora River. After their confluence just north of Chacón, the Mora River flows southeast through the villages of Holman, Cleveland, Mora, Buena Vista, and Watrous. The river turns east near Watrous and begins to entrench into the plains as it travels towards the Canadian River.

Tributaries to the Mora River include: La Jara Creek, Coyote Creek, Little Coyote Creek, Rio la Casa, Santiago Creek, Rito Morphy, Rito Cebolla, Rito de Gascon, Rito San Jose, Manuelitas Creek, Sapello River, and Wolf Creek. All of the perennial streams in Mora County are diverted for irrigation.

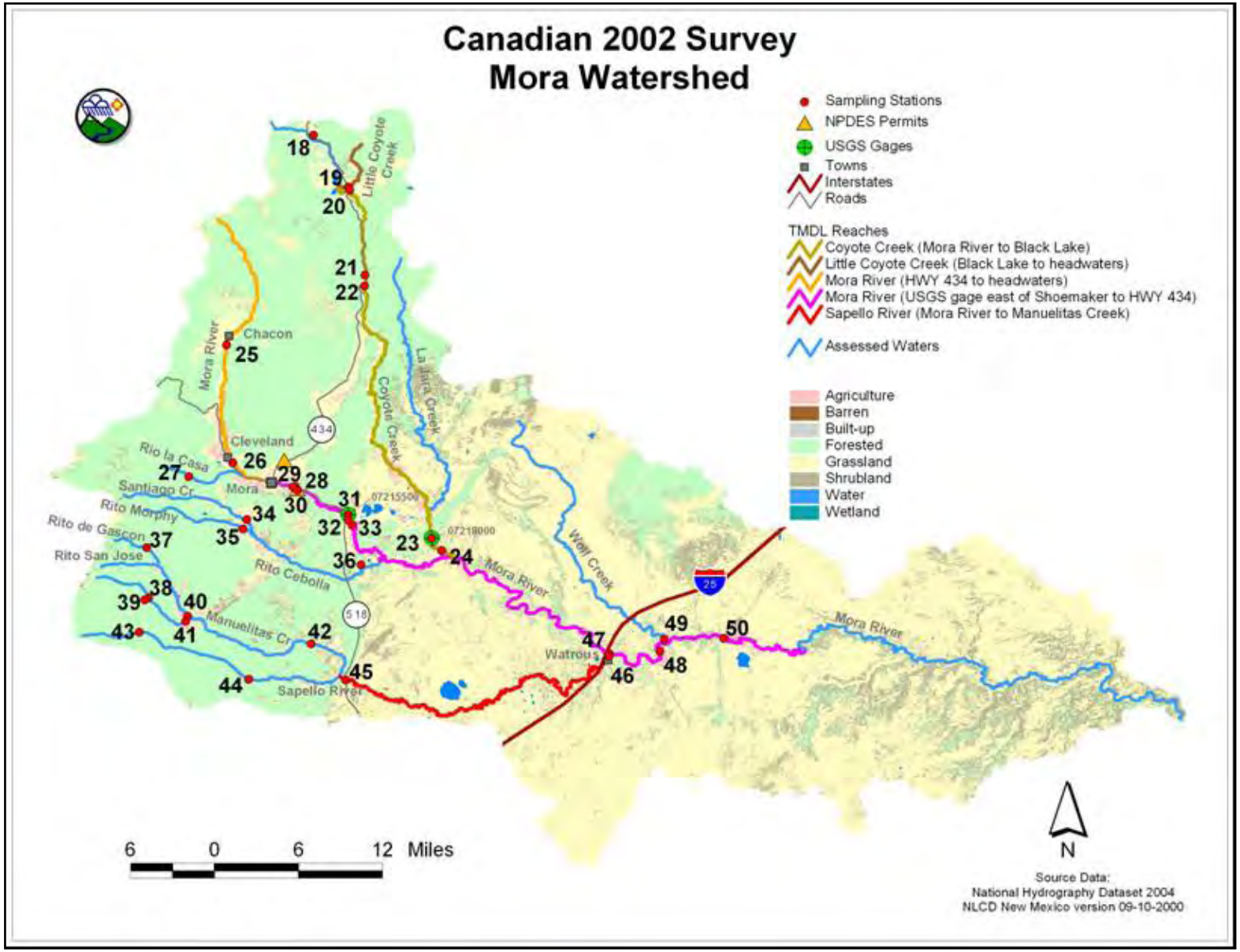


**Figure 3.4 Land Use/Land Cover of the Mora River Watershed**

**Figure 3.5 Land Ownership of the Mora River Watershed**

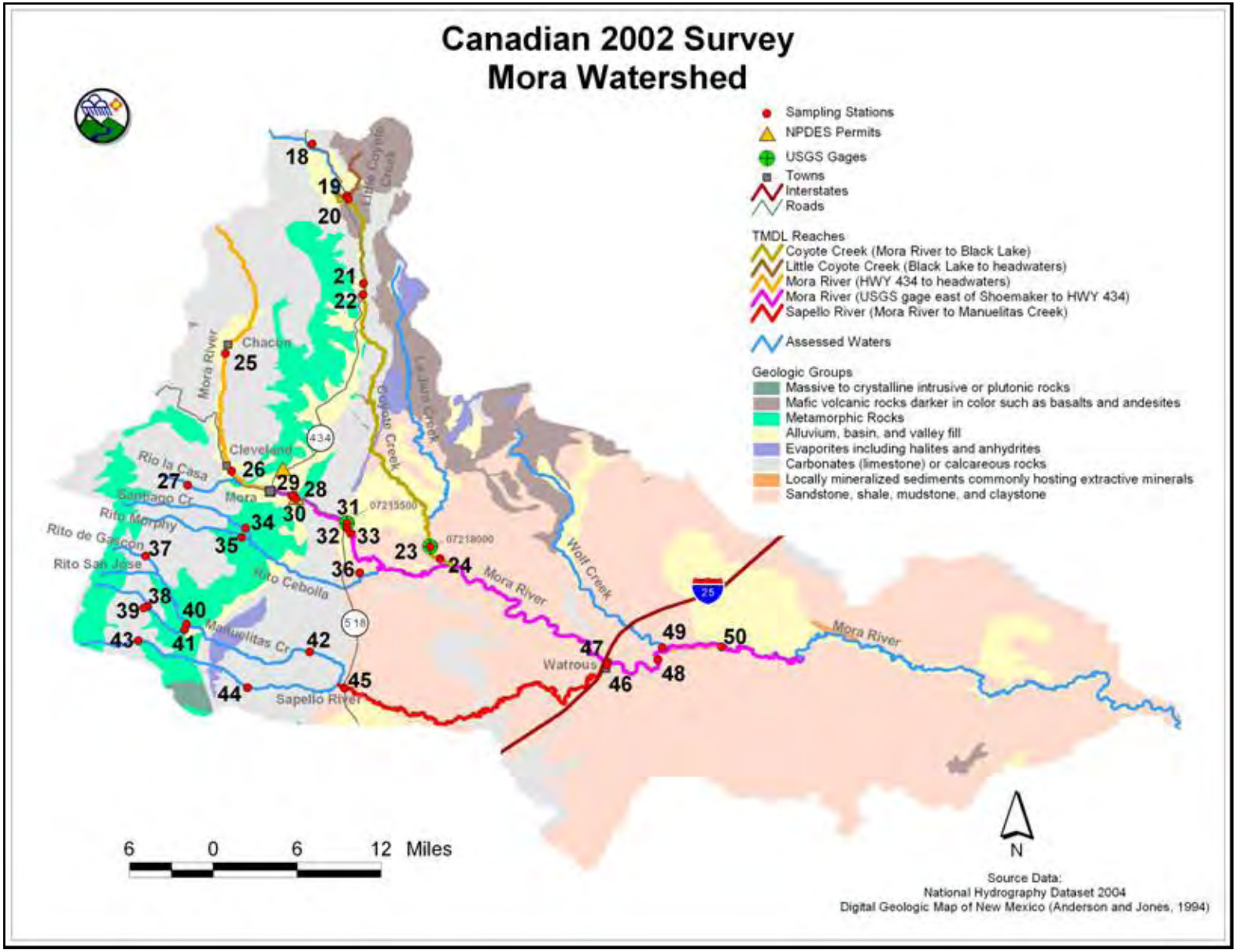


**Figure 3.6 Geology of the Mora River Watershed**

Coyote Creek (Mora River to Black Lake) is approximately 37 miles in length. SWQB established five stations along this assessment unit and deployed two thermographs during the 2002 intensive survey. Coyote Creek (Mora River to Black Lake) was included on the 2004-2006 Integrated CWA §303(d)/§305(b) list for specific conductance and temperature. No TMDLs have previously been established for this assessment unit. Therefore, TMDLs were developed for inclusion in this document for the following assessment unit in the Mora River subbasin:

- ***Specific Conductance*:** Coyote Creek (Mora River to Black Lake)
- ***Temperature*:** Coyote Creek (Mora River to Black Lake)

Little Coyote Creek (Black Lake to headwaters) is approximately 2 miles in length. SWQB established one station along this assessment unit and deployed one thermograph during the 2002 intensive survey. Little Coyote Creek (Black Lake to headwaters) was included on the 2004-2006 Integrated CWA §303(d)/§305(b) list for nutrient/eutrophication biological indicators, pH, and temperature. In preparing the 2006-2008 Integrated CWA §303(d)/§305(b) list, SWQB staff reevalauted the thermograph data from the 2002 Canadian Part 1 survey and discovered that the thermograph was unknowingly placed downstream of a diversion and most of the streamflow was diverted during the summer, which contributed to the temperature exceedences. According to Paragraph (2) of Subsection I of 20.6.4.11 NMAC, numeric criteria for temperature adopted under the Water Quality Act do not apply when changes in temperature in a surface water of the state are attributable to the reasonable operation of irrigation and flood control facilities that are not subject to federal or state water pollution control permitting. Based on the exception to the applicability of water quality standards noted above, temperature was removed from the 2006-2008 Integrated CWA §303(d)/§305(b) list as a cause of non-support in the reach Little Coyote Creek (Black Lake to headwaters). No TMDLs have previously been established for this assessment unit. Therefore, TMDLs and de-list letters were developed for the following assessment unit in the Mora River subbasin:

- ***Plant Nutrients*:** Little Coyote Creek (Black Lake to headwaters)
- **DE-LIST for *Temperature*:** Little Coyote Creek (Black Lake to headwaters)

Mora River (Canadian River to USGS gage east of Shoemaker) is approximately 50 miles in length. SWQB established one station along this assessment unit and deployed one thermograph during the 2002 intensive survey. Mora River (Canadian River to USGS gage east of Shoemaker) was included on the 2004-2006 Integrated CWA §303(d)/§305(b) list for dissolved oxygen (DO) based on grab data and categorized as 5C indicating that a sonde would be deployed to verify the DO listing. A sonde was deployed in 2006 to record DO every hour for a 10-day period. This resulted in 240 data points being generated. Based on the application of these data to current assessment protocols (NMED/SWQB 2006), DO was removed from the 2006-2008 Integrated CWA §303(d)/§305(b) list as a cause of non-support in the reach Mora River (Canadian River to USGS gage east of Shoemaker). Therefore, a delist letter was developed for the following assessment unit in the Mora River subbasin:

- **DE-LIST for *Dissolved Oxygen*:** Mora River (Canadian River to USGS gage east of Shoemaker)

Mora River (USGS gage east of Shoemaker to Hwy 434) is approximately 52 miles in length. SWQB established eight stations along this assessment unit and deployed one thermograph during the 2002 intensive survey. Mora River (USGS gage east of Shoemaker to Hwy 434) was included on the 2004-2006 Integrated CWA §303(d)/§305(b) list for nutrient/eutrophication biological indicators. No TMDLs have previously been established for this assessment unit. Therefore, a TMDL was developed for inclusion in this document for the following assessment unit in the Mora River subbasin:

- ***Plant Nutrients*:** Mora River (USGS gage east of Shoemaker to Hwy 434)

Mora River (Hwy 434 to headwaters) is approximately 18 miles in length. SWQB established two stations along this assessment unit and deployed one thermograph during the 2002 intensive survey. Mora River (Hwy 434 to headwaters) was included on the 2004-2006 Integrated CWA §303(d)/§305(b) list for sedimentation/siltation and specific conductance. No TMDLs have previously been established for this assessment unit. Therefore, TMDLs were developed for inclusion in this document for the following assessment unit in the Mora River subbasin:

- ***Specific Conductance*:** Mora River (Hwy 434 to headwaters)
- ***Sedimentation/Siltation*:** Mora River (Hwy 434 to headwaters)

Sapello River (Mora River to Manuelitas Creek) is approximately 27 miles in length. SWQB established two stations along this assessment unit and deployed one thermograph during the 2002 intensive survey. Sapello River (Mora River to Manuelitas Creek) was included on the 2004-2006 Integrated CWA §303(d)/§305(b) list for sedimentation/siltation. No TMDLs have previously been established for this assessment unit. Therefore, a TMDL was developed for inclusion in this document for the following assessment unit in the Mora River subbasin:

- ***Sedimentation/Siltation*:** Sapello River (Mora River to Manuelitas Creek)