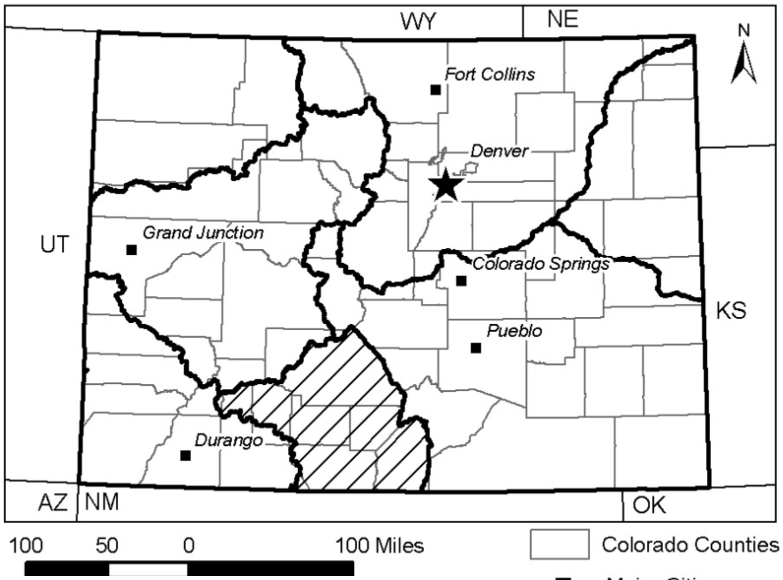
# Chapter 10
# Rio Grande River Basin Plan
## (Regulation 36)

**Exhibit 10-1. Rio Grande River Basin Physical Location**




WQCD 2010a.

**Exhibit 10-2. Rio Grande River Basin Summary Statistics**

| | | | |
|---|---|---|---|
| **Ecoregions (Level IV):**[1] | 21. Southern Rockies (a-j)<br>22. Arizona/New Mexico Plateau (a-c, e) | **Surface Area:**[2]<br>**Stream Length:**[3] | 7,543 square miles<br>6,875 miles |
| **Threatened and Endangered Species (federal and state):**[2] | Threatened: 4<br>Endangered: 6<br>State Species of Concern: 12 | **Major Land Cover:**[2] | Grassland and Forest |
| **Counties:** | Alamosa, Archuleta (portion), Conejos (portion), Costilla (portion), Hinsdale (portion), Mineral (portion), Rio Grande (portion), Saguache (portion), San Juan (portion) | **No. of Assessed Lakes/Reservoirs:**[4,5]<br>**Corresponding Acres:** | 10<br>5,623 |
| **Population:**[6] | 50,000 | **No. of Groundwater Aquifers:**[2] | 2 |
| **Major Population Centers:**[2] | Alamosa and Monte Vista | **Approximate No. of Publicly Owned Treatment Works:**[7] | 28 |
| **Water Quality Planning Regions (in total or in part):**[8] | 8, 9, and 10 | **Known Primary Water Quality Stressors:**[4] | Ammonia, cadmium, copper, dissolved oxygen, *Escherichia coli*, iron, lead, manganese, pH, sediment, selenium, and zinc |

[1] See appendix B for a description of key ecoregional characteristics.
[2] CWCB 2004.
[3] WQCD 2002.
[4] WQCC 2010b; WQCD 2010a.
[5] The number of lakes/reservoirs and the corresponding acres only include the lakes that have been assessed by the Water Quality Control Division and do not reflect all of the lakes/reservoirs present in the basin.
[6] CWCB 2010.
[7] USEPA 2010a, 2010c; WQCD 2010b.
[8] See exhibit 2-2 in chapter 2 for the names of the Water Quality Planning Regions and counties covered.

*This basin chapter and the SWQMP as a whole are primarily water quality documents. They are based on readily available, peer reviewed water quality information, particularly the 2010 Integrated Water Quality Monitoring and Assessment Report (2010 Integrated Report or Clean Water Act (CWA) section 305(b) report).[1] Both the Water Quality Control Commission (WQCC) and the Water Quality Control Division (WQCD) are aware of many other water quality data sources. Organizations and other parties with water quality data are encouraged to get involved in "calls for data" for the biennially completed CWA section 305(b) reports. The data sources that are used in forthcoming CWA section 305(b) reports will subsequently be used in future iterations of the SWQMP. Other key water quality regulations and policies used in the chapter are tabulated in Appendix A.*

# 10.1 System Description

## 10.1.1 Location and Physical Setting

The Rio Grande River Basin encompasses approximately 7,500 square miles, including the San Luis Valley. The river's headwaters are in the San Juan Mountains near the Continental Divide, from which it flows southeasterly. The river's south fork and mainstem join on the west side of the valley at the town of South Fork, Colorado. The river then flows to the east through the town of Del Norte and continues southeasterly across the valley through the cities of Monte Vista and Alamosa, Colorado. At Alamosa, the river turns south and runs nearly 40 miles, passing through a break in the San Luis Hills and then entering a deep canyon above the New Mexico state line (CWCB 2009b).

The San Luis Valley is an open, nearly treeless, intermontane valley. It is the predominant feature of the Rio Grande River Basin (CGS 2003). In size, the San Luis Valley extends approximately 90 miles from north to south and 50 miles from east to west. The valley floor ranges in elevation from 7,512 feet to about 8,000 feet, and it is ringed by mountains between 10,000 feet to 14,390 feet in elevation (CWCB 2009b).

An area known as the Closed Basin occupies the northern part of the San Luis Valley. A low topographic divide and a hydrologic divide separate groundwater in the Closed Basin from that in the rest of the Valley. The divide extends southeast from near Del Norte, Colorado, to a few miles north of Alamosa, Colorado, and then easterly to the east side of the San Luis Valley. The principal tributary to the Rio Grande River in Colorado is the Conejos River. It rises in the southwestern portion of the San Juan Mountains of Colorado, is augmented by the San Antonio and Los Pinos Rivers, and flows northeast to join the Rio Grande at Los Sauces, Colorado. Other major streams in the basin include Sagauche, San Luis, Trinchera, Culebra, and Costilla creeks, along with many dozen lesser streams that contribute to the system (CWCB 2009b). A map of the basin showing the Rio Grande River and its major tributaries is provided as exhibit 10-3 (at end of chapter).

[1] The Integrated Reports are prepared by the WQCD on a biennial basis and are approved by the WQCD as Regulation No. 93: *Colorado's Section 303(d) List of Impaired Waters and Monitoring and Evaluation List,* 5 CCR 1002-93 (WQCC 2010b; WQCD 2010a).

## 10.1.2 Ecology

The boundaries of the Rio Grande River Basin fall within two distinct level III ecoregions (Chapman et al. 2006). Approximately 56% of the basin lies within the Southern Rockies Ecoregion, and the remainder is within the Arizona/New Mexico Plateau Ecoregion (exhibit 10-4 at end of chapter). Key characteristics of these and the more specific level IV ecoregions, such as physical characteristics, elevation, land cover, climate, geology, and soil types, are provided in appendix B.

The Rio Grande River Basin contains several endangered and threatened species and several species of state concern, as summarized in exhibit 10-5 (at end of chapter). There are six federally and/or state-listed endangered species (one fish, two bird, and three mammalian species) and four federally and/or state-listed threatened species (three bird and one mammal species). Finally, Colorado has 12 species of concern in the Rio Grande River Basin (two fish, one amphibian, one reptile, seven birds, and one mammalian species) (CDOW 2010; CWCB 2004).

Exhibit 10-6 (at end of chapter) shows the locations of environmental and recreational uses (i.e., nonconsumptive uses) in the Rio Grande River Basin.[2] The use categories include environmental focus areas, environmental and recreational focus areas, and recreational focus areas (CWCB 2009). The nonconsumptive uses shown are only meant to provide information on environmental and recreational uses in the basin and not to dictate future actions or impact any water rights (CWCB 2009a).

The Colorado Division of Wildlife (CDOW) has designated the reach of the Rio Grande River from the Highway 149 Bridge at South Fork downstream to the Rio Grande Canal diversion structure at Del Norte as a gold medal fishery and considers it an area of high recreational value. Other high value recreational areas in the Rio Grande River Basin include the Great Sand Dunes National Park and the Weminuche Wilderness (CWCB 2004).

## 10.1.3 Climate

The San Luis Valley has cool summers and cold winters. Most of the precipitation occurs as scattered summer afternoon showers or winter snow. Exhibit 10-7 (at end of chapter) shows a contour (isohyetal) plot of the average annual precipitation throughout the basin. Average annual precipitation in the central part of the Rio Grande River Basin ranges from 6 to 9 inches. Precipitation in the mountains is considerably greater. For example, Wolf Creek Pass, southwest of South Fork, receives 49 to 56 inches of precipitation annually. Because of low humidity,

[2] In 2005, the Colorado legislature established the Water for the 21st Century Act, which established an Interbasin Compact Process that provides a permanent forum for broad-based water discussions in the state. The law created two new structures: the Interbasin Compact Committee (IBCC) and the Basin Roundtables. As part of the IBCC, the Basin Roundtables are required to complete basin-wide needs assessments; an assessment of consumptive water needs and an assessment of nonconsumptive water needs. In 2009, the Colorado Water Conservation Board released a draft report entitled, *Nonconsumptive Needs Assessment Focus Mapping*. The focus mapping described in the report is part of the Basin Roundtables' assessment of nonconsumptive water needs.

abundant sunshine, and warm temperatures, the average annual evaporation rate often exceeds the rate of precipitation, ranging from 35 to 48 inches per year (CWCB 2004).

## 10.1.4 Land Ownership and Land Cover/Use

The federal government owns 54% of the land in the Rio Grande River Basin. Forty percent of the remaining land is privately owned, while the remaining 6% is owned by the state of Colorado. Exhibit 10-8 (at end of chapter) provides a map of land ownership by basin.

Land cover in the Rio Grande River Basin is shown in exhibit 10-9 (at end of chapter) and summarized in exhibit 10-10. Grassland and forest are the predominant land cover types in the basin, each covering approximately 31% of the basin. The grassland areas are concentrated in the valley of the basin, whereas the forested land is largely located in the mountainous portions of the basin. Most of the San Luis Valley, located in the central portion of the basin, is privately owned with more than 600,000 acres irrigated for use primarily in agricultural operations (CWCB 2004).

**Exhibit 10-10. Rio Grande River Basin Land Cover Data**

| Land Cover | Basin-wide | | Statewide | |
|---|---|---|---|---|
| | Area (sq. miles) | Percent of Total | Area (sq. miles) | Percent of Total |
| Grassland | 2,355 | 31.2% | 41,051 | 39.5% |
| Forest | 2,342 | 31.1% | 29,577 | 28.4% |
| Shrubland | 1,811 | 24.0% | 16,883 | 16.2% |
| Planted/cultivated | 787 | 10.4% | 13,737 | 13.2% |
| Barren | 158 | 2.1% | 1,219 | 1.2% |
| Wetland | 41 | 0.5% | 80 | 0.08% |
| Open water | 35 | 0.5% | 590 | 0.6% |
| Developed | 14 | 0.2% | 923 | 0.9% |
| **TOTAL** | **7,543** | | **104,067** | |

Source: CWCB 2004.

## 10.1.5 Demographic and Socioeconomic Conditions

The general socioeconomic conditions of the Rio Grande River Basin are characterized by increasing populations in most counties between 2008 and 2050, especially in the counties with urban areas, and with increasing employment in all sectors during the same period, although at varying rates of growth.

The population of the Rio Grande River Basin is projected to increase by about 60% between 2008 and 2050 under medium economic development assumptions, or from 50,000 to 80,000. Alamosa County is projected to account for much of the population growth in the basin (CWCB 2010). Population will remain relatively flat in Mineral, Costilla, and Conejos counties, while moderate population increases are expected in Saguache and Rio Grande counties during the same period. Exhibit 10-11 (at end of chapter) shows the population projections for the Rio Grande River Basin.

As shown in exhibit 10-12, agribusiness was the largest basic employment sector in the Rio Grande River Basin in 2007, followed by the household basic sector and regional/national service jobs. By 2050, however, the household basic sector is expected to provide the greatest number of jobs, with agribusiness jobs following closely behind. In terms of total percent growth by sector, mining is expected to see the greatest percent increase at 133%, followed by household basic jobs at 111%. In addition, the percentage of jobs in the basin that are mining-related is expected to increase from 0.30% in 2007 to 0.40% in 2050; the same pattern is anticipated in regional and national service jobs, tourism jobs, and household basic jobs. Total job growth in the basin is expected to increase 56% between 2007 and 2050 (CWCB 2010).

**Exhibit 10-12. 2050 Rio Grande River Basin Employment Projections, Medium-Growth Scenario**

| Sector | 2007 | 2050 |
|---|---|---|
| **Agribusiness Jobs** | 5,400 | 7,700 |
| % of Total Jobs | 22.90% | 20.90% |
| Total % Growth | NA | 43% |
| **Mining Jobs** | 60 | 140 |
| % of Total Jobs | 0.30% | 0.40% |
| Total % Growth | NA | 133% |
| **Manufacturing Jobs** | 190 | 200 |
| % of Total Jobs | 0.80% | 0.50% |
| Total % Growth | NA | 5% |
| **Government Jobs** | 1,800 | 2,300 |
| % of Total Jobs | 7.60% | 6.20% |
| Total % Growth | NA | 28% |
| **Regional/National Service Jobs** | 2,800 | 4,900 |
| % of Total Jobs | 11.90% | 13.30% |
| Total % Growth | NA | 75% |
| **Tourism Jobs** | 1,900 | 3,400 |
| % of Total Jobs | 8.10% | 9.20% |
| Total % Growth | NA | 79% |
| **Household Basic Jobs** | 3,700 | 7,800 |
| % of Total Jobs | 15.70% | 21.10% |
| Total % Growth | NA | 111% |
| **Total Basic Jobs** | 15,900 | 26,500 |
| % of Total Jobs | 67.40% | 71.80% |
| Total % Growth | NA | 67% |
| **Resident Service Jobs** | 7,800 | 10,500 |
| % of Total Jobs | 33.10% | 28.50% |
| Total % Growth | NA | 35% |
| **Total Jobs** | 23,600 | 36,900 |
| % of Total Jobs | 100% | 100% |
| Total % Growth | NA | 56% |

Source: CWCB 2010.

### 10.1.6 Water Withdrawals

The Rio Grande River Basin has many diverse uses in Colorado. Its waters are used for agriculture, water supply, recreation, and aquatic life purposes. According to the Interbasin Compact Committee (IBCC), water in the Rio Grande River Basin is currently over-appropriated and has been since the 1890s (CWCB 2009b). The Rio Grande Compact was established in 1938 to address some of the over-appropriation issues, especially in terms of downstream uses. All the waters of the Rio Grande River and Conejos River and their tributaries are subject to the terms of the Rio Grande Compact. The compact establishes Colorado's obligation to ensure certain deliveries of water at the New Mexico state line and New Mexico's obligation to ensure certain deliveries of water at the Elephant Butte Reservoir in New Mexico, with some allowance for credit and debit accounts by each of the compact parties (CWCB 2009b).

Water quantity and quality issues are intertwined, particularly in arid western states where water can be scarce (CFWE 2003). Water quantity issues tend to be more contentious than quality issues. Water rights are protected under Colorado's constitution and several state statutes, including the Colorado Water Quality Control Act. Colorado water law establishes water use rights for a variety of purposes including farming, drinking, manufacturing, recreation, protection of the environment, and all of the use categories listed in exhibit 10-13 below (CFWE 2003). Public and private entities involved in watershed protection in Colorado have grown to appreciate that the two worlds of water quality and quantity are inexplicably linked and are working together more frequently to combat water quality/quantity problems.

In 2005, the U.S. Geological Survey (USGS), in cooperation with the Colorado Water Conservation Board (CWCB), estimated total surface water and groundwater use in the Rio Grande River Basin to be approximately 2,050.96 million gallons per day (Mgal/d). Use was estimated for the following categories: irrigation for crops, irrigation for golf courses, public supply, domestic, industrial, livestock, mining, and thermoelectric.[3] Exhibit 10-13 shows the total water withdrawals in the basin and the state as a whole for these categories. The predominant uses of water in the basin were for agriculture at 2,042.00 Mgal/d (99.56%), followed by public supply at 5.75 Mgal/d (0.28%), and domestic at 2.67 Mgal/d (0.13%).

**Exhibit 10-13. Rio Grande River Basin Total Water Withdrawals in Colorado, 2005**

| Use Category | Withdrawals by Use Category | | |
|---|---|---|---|
| | Withdrawals (Mgal/d) (*percent of total basin withdrawals*) | Total Withdrawals All of Colorado (Mgal/d) | Withdrawals in Rio Grande River Basin as Percent of Total Withdrawals in State |
| Agriculture (crop irrigation & livestock) | 2,042.00 *(99.56%)* | 12,354.91 | 16.53% |
| Irrigation (golf course) | 0.34 *(0.02%)* | 40.64 | 0.84% |
| Public Supply[1] | 5.75 *(0.28%)* | 864.17 | 0.67% |
| Domestic[2] | 2.67 *(0.13%)* | 34.43 | 7.75% |
| Industrial | 0.00 *(0%)* | 142.44 | 0% |
| Mining | 0.20 *(0.01%)* | 21.42 | 0.93% |
| Thermoelectric | 0.00 | 123.21 | 0% |

[3] The term "public supply" refers to "community water systems" as that term is defined under the federal Safe Drinking Water Act. Community water systems (CWSs) are any water system that serves drinking water to at least 25 people for at least 60 days of the calendar year or has at least 15 service connections. In addition to providing water to domestic customers, CWSs also deliver water to commercial, industrial, and thermoelectric power users. The term "domestic" refers to the portion of the population not served by a "public supply" (USGS 2010).

| Use Category | Withdrawals by Use Category | | |
|---|---|---|---|
| | Withdrawals (Mgal/d) (*percent of total basin withdrawals*) | Total Withdrawals All of Colorado (Mgal/d) | Withdrawals in Rio Grande River Basin as Percent of Total Withdrawals in State |
| | *(0%)* | | |
| **Totals** | **2,050.96** *(or 2,299.12 thousand acre-feet per year)* | **13,581.22** *(or 15,224.55 thousand acre-feet per year)* | **15.10%** |

[1] The term "public supply" is water supplied by a publicly or privately owned water system for public distribution, sometimes also known as a "municipal-supply system" or "community water system" (CWS). Any water system that serves drinking water to at least 25 people for at least 60 days of the calendar year or has at least 15 service connections is considered a public supply system. In addition to providing water to domestic customers, CWSs also deliver water to commercial, industrial, and thermoelectric power users (USGS 2010).

[2] The term "domestic" refers to water used for household purposes, such as washing clothes, cleaning dishes, drinking, food preparation, bathing, flushing toilets, and watering lawns and gardens that are not served by public-supply systems (USGS 2010).

Source: USGS 2010.

The CWCB recently completed a projection of municipal and industrial (M&I) surface water use needs to the year 2050 for the state.[4] The projections will provide relevant parties in the state with a basis for discussing and addressing the state's future M&I water needs. In a report, the CWCB estimated M&I water demand in the Rio Grande River Basin under medium growth assumptions with demand reductions for passive conservation to be at 18,000 acre-feet per year (AFY; 16 Mgal/day) in 2008 and at 28,000 AFY (25 Mgal/day) in 2050.[5] The counties with the highest forecasted M&I water demands are Alamosa, Conejos, and Rio Grande. Self-supplied industrial (SSI) water needs are expected to increase during the same period by 1,200 to 2,000 AFY; the growth is expected to be primarily related to solar energy development (CWCB 2010).

## 10.1.7 Hydrography and Hydrology

### 10.1.7.1 Surface Geology

Geology ranging from Precambrian to Tertiary age is exposed in the Rio Grande River Basin. The Sangre de Cristo Mountains are dominated by Precambrian-age crystalline rocks such as granites, gneisses, and schists. Paleozoic-age sedimentary rocks are present and exposed on the north and east sides of the San Luis Valley. These rocks include the Manitou Limestone, Harding Sandstone, Fremont Limestone, Chaffee Formation, Kerber Formation, and Minturn Formation. The remainder of the San Luis Valley is composed of Tertiary-age sedimentary rocks of sand, gravel, and clay derived from the San Juan and Sangre de Cristo mountains. These sediments are nearly 30,000 feet thick and interbedded partially with lava flows (CWCB 2004). It should also

[4] In 2003, the Colorado General Assembly authorized the CWCB to implement the Statewide Water Supply Initiative (SWSI), an 18-month basin-by-basin investigation of the state's existing and future water needs. As part of that effort, the CWCB assembled water users (farmers, ranchers, municipalities, industrial users, recreationalists, and environmentalists) to plan for the future. That effort resulted in the completion of the *Statewide Water Supply Initiative* Phase I Report in November 2004 and a Phase II report in November 2007. Both reports focus on all water uses, not just M&I. Since that time, the CWCB has undertaken another investigation to project M&I surface water use needs to the year 2050 for the state. The result of that investigation is reported in the document *State of Colorado 2050 Municipal and Industrial Water Use Projections*, dated July 2010.

[5] Passive conservation accounts for retrofits of existing housing and commercial construction with high-efficiency toilets, clothes washers, dishwashers, and the like as implementation of the baseline efficiency standards established under the 1992 National Energy Policy Act takes place (CWCB 2010).

be noted that soils derived from the various shallow geologies and deposited materials are a prime consideration in water quality planning.[6]

### 10.1.7.2 Surface Water

The Rio Grande and its tributaries collect the runoff from lands in the western and southern portions of the basin. The headwaters of the Rio Grande River Basin originate just to the east of the Continental Divide, in Hinsdale County in the south-central portion of the state. Streams in the northern portion of the basin flow southeasterly into the Closed Basin, a 2,900-square mile area with no natural surface water outlet.

The Rio Grande River Basin contains approximately 7,500 square miles. The mainstem and its tributaries drain approximately 4,600 square miles of the basin, while the Closed Basin receives drainage from the remaining 2,900 square miles.

To monitor stream flow, numerous USGS stream flow gauges are maintained in the Rio Grande River Basin. Exhibit 10-14 summarizes the mean annual stream flow, period of record, and drainage area for five drainages, all of which were recently selected by the CWCB to summarize historical flows in the basin across a broad spatial scale. As indicated in the exhibit, mean annual flows are highest in the upstream reaches of the Rio Grande near Del Norte, Colorado. The locations of the selected gauges are shown in exhibit 10-15 (at end of chapter); also shown in exhibit 10-15 are major surface water diversions and segments with decreased instream flow.

**Exhibit 10-14. Rio Grande River Basin Summary of Selected USGS Stream Gauges**

| Site Name | USGS Site Number | Mean Annual Stream Flow (AFY) | Mean Annual Stream Flow (cfs)[1] | Period of Record (years) | Drainage (square miles) |
|---|---|---|---|---|---|
| Saguache Creek near Saguache | 08227000 | 43,934 | 61 | 1923-2002 | 595 |
| Rio Grande near Del Norte | 08220000 | 596,901 | 824 | 1890-2002 | 1,320 |
| Alamosa River above Terrace Reservoir | 08236000 | 74,965 | 103 | 1914-2002 | 107 |
| Rio Grande near Lobatos | 08251500 | 408,655 | 564 | 1899-2002 | 7,700 |
| Conejos River near Magote | 08246500 | 217,353 | 300 | 1903-2002 | 282 |

[1] cfs = cubic feet per second.
Source: CWCB 2004.

In addition, it should be noted that mountain snowpack can have significant impacts and can cause variations in surface water quality and quantity on an annual basis. The Natural Resources Conservation Service (NRCS) Snow Survey Program provides mountain snowpack data and stream flow forecasts for the western United States. Common applications of snow survey data include water supply management, flood control, climate modeling, recreation, and conservation planning. Additional information on the NRCS snow survey program can be found at http://www.co.nrcs.usda.gov/snow/.

[6] Soil variations occur on a local and regional scale and should be taken into consideration when addressing water quality problems. Information on soil conditions can be found through the Natural Resources Conservation Service (NRCS) Web Soil Survey at http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm. The website can be used to access soil maps and soil descriptions, interpretations, and characteristics. The information can be used at a relatively broad scale as well as on a site-specific basis.

#### 10.1.7.3 Groundwater

Groundwater in the Rio Grande River Basin is predominately located in the San Luis Valley within two aquifers, the Unconfined and Confined aquifers.

Exhibit 10-16 (at end of chapter) shows these two aquifers. Also shown in the exhibit is the location of wells in the Rio Grande River Basin with a permitted or decreed yield of 500 gallons per minute (gpm) or higher (CGS 2003).

Throughout most of the San Luis Valley, the unconfined aquifer extends 5 to 100 feet below the land surface. However, in the southeast portion of the valley, along the outer edges of the valley, and along the streams and rivers, the unconfined aquifer can extend to depths of several hundred feet below ground surface. In a large part of the valley, a confined or artesian aquifer, which lies under an aquitard called blue clay, averages from 150 to 3,000 feet in depth (CWCB 2004).

The average annual supply pumped from the aquifers in the San Luis Valley is 380,000 acre-feet (AF), or about one-third of the total surface water diversions (CWCB 2004). The IBCC also reports that the groundwater resources of the San Luis Valley have been overdrafted (CWCB 2009b).

# 10.2 Water Quality Classifications and Standards

## 10.2.1 Surface Water

### 10.2.1.1 Use Classifications

The Rio Grande River Basin contains a total of 72 stream segments covering approximately 5,642 stream miles (exhibit 10-17 at end of chapter). The WQCC has specified the classified uses for each of these segments in Regulation No. 36: *Classifications and Numeric Standards for the Rio Grande River Basin* (5 CCR 1002-36) (WQCC 2010a). The uses are summarized in exhibits 10-18 and 10-19 (at end of chapter). These last two exhibits show that WQCC has classified the majority of the segments in the Rio Grande River Basin with the uses of agriculture (99%) and existing recreation (97%). These are followed by aquatic life cold water 1 (58%), water supply (50%), aquatic life warm water 2 (15%), aquatic life cold water 2 (15%), not suitable for recreation (3%), and aquatic life warm water 1 (1%). The stream miles associated with these uses are shown in exhibit 10-20.

**Exhibit 10-20. Number of Streams and Stream Miles by Classified Use**

| Classified Uses | Number of Streams | Stream Miles | Percent of Total Stream Miles (*n=5,643 miles*) |
|---|---|---|---|
| Agriculture | 71 | 5,641 | 99.9% |
| Existing Recreational Uses | 70 | 4,798 | 85% |
| Aquatic Life Cold 1 | 42 | 3,630 | 64% |
| Water Supply | 36 | 4,130 | 73% |
| Aquatic Life Warm 2 | 11 | 867 | 15% |
| Not Suitable for Recreation | 2 | 845 | 15% |
| Aquatic Life Cold 2 | 11 | 147 | 3% |
| Aquatic Life Warm 1 | 1 | 65 | 1% |

| | | | |
|---|---|---|---|
| **Total Streams** | **72** | **5,643** | -- |

Source: WQCC 2010b; WQCD 2010a.

In its latest assessment cycle, the WQCD presented information for a total of 10 lakes in the Rio Grande River Basin, covering 5,623 acres.[7] Exhibit 10-21 shows the classified uses for each of these lakes/reservoirs and the corresponding lake acres.

**Exhibit 10-21. Number of Lakes and Lake Acres by Classified Use**

| Classified Uses | Number of Lakes | Lake Acres | Percent of Total Lake Acres (*n=5,623 acres*) |
|---|---|---|---|
| Agriculture | 10 | 5,623 | 100% |
| Existing Recreational Uses | 10 | 5,623 | 100% |
| Aquatic Life Cold 1 | 6 | 3,638 | 65% |
| Water Supply | 4 | 2,180 | 39% |
| Aquatic Life Cold 2 | 3 | 1,965 | 35% |
| Aquatic Life Warm 2 | 1 | 20 | 4% |
| **Total Lakes:** | **10** | **5,623** | -- |

Source: WQCC 2010b; WQCD 2010a.

#### 10.2.1.2 Designations

As further shown in exhibits 10-18 and 10-19 (at end of chapter), the WQCC has designated a total of four waterbody segments as *Outstanding Waters*. The WQCC has designated a total of 23 waterbody segments as *Use Protected*. The meaning of these two designations is provided in section 2.2.3.1 of chapter 2, "Water Quality Planning and Management in Colorado."

#### 10.2.1.3 Standards

Numeric standards for the Rio Grande River Basin are provided in the "Stream Classifications and Water Quality Standards" table attached to Regulation No. 36. Because new standards are often developed and existing standards are periodically revised, the standards are not summarized here. For specific details, readers should consult the actual regulations, which are available at http://www.cdphe.state.co.us/regulations/wqccregs.

### 10.2.2 Lakes

#### 10.2.2.1 Trophic Status

From July 2007 to July 2009, the WQCD monitored a total of 50 lakes and reservoirs across the state to evaluate their trophic status and to assess whether they were attaining their respective water quality standards. Of the 50 lakes and reservoirs assessed, none are in the Rio Grande River Basin. During the period from 2000 to 2006, however, the Division monitored other sets of lakes and reservoirs across the state to assess their trophic status and determine whether water

[7] Lakes are presented in WQCC's surface water quality classifications and standards regulations in several ways. A lake may be present alone as its own segment, as a combination of several lakes grouped into a segment, or as part of a segment that includes streams, lakes, and wetlands. The WQCD presented only those lakes/reservoirs it assessed during its latest monitoring cycle in appendix B of the 2010 Integrated Report. The entire universe of lakes/reservoirs in the state is not explicitly denoted in the WQCC regulations, nor are the lakes/reservoirs fully denoted in WQCD's biennial integrated reports. Each biennial cycle, the WQCD assesses and presents information for only a subset of lakes/reservoirs in the state.

quality standards were being met. Of the total lakes and reservoirs assessed during the period, six are in the Rio Grande River Basin. (See exhibit 10-22.)

The *trophic state* is a means of classifying lakes on the basis of their level of biological productivity (especially algae) and nutrient status. Commonly used indicators of nutrient status and productivity include the amount of algae as measured by chlorophyll *a*, water transparency as measured by Secchi disk depth, and in-lake epilimnetic total phosphorus concentration. The WQCD broadly defines the various trophic states for the purposes of its analyses as follows:

- **Oligotrophic.** Lakes with few available nutrients and a low level of biological productivity. They are characterized by clear water, and they often support cold-water fish species.
- **Mesotrophic.** Lakes with moderate nutrient levels and biological productivity between oligotrophic and eutrophic. These lakes usually support warm-water fish species.
- **Eutrophic.** Lakes with high nutrient levels and a high level of productivity. These lakes typically support only warm-water fish species.
- **Hypereutrophic.** Lakes in an advanced eutrophic state.

**Exhibit 10-22. Rio Grande River Basin Trophic Status of Lakes and Reservoirs as Measured by WQCD During the Period 1999 to 2006**

| Lake | Beaver Creek Reservoir | La Jara Reservoir | Sanchez Reservoir | Smith Reservoir | Platoro Reservoir | San Luis Lake |
|---|---|---|---|---|---|---|
| **Segment ID No.** | CORGRG05 | CORGAL11 | CORGRG30 | CORGRG27 | CORGAL14 | CORGCB6 |
| **Elevation (feet)** | 8,850 | 9,698 | 8,272 | 7,721 | 10,034 | 7,529 |
| **Surface Acres** | 115 | 635 | 2000 | 700 | 700 | 890 |
| **Chlorophyll *a* (micrograms per liter [µg/L])** | 23.5 | 104.8 | 22.8 | 19.4 | 8.1 | 3.7 |
| **Chlorophyll Trophic Status Index[1]** | 62 | 76 | 61 | 60 | 51 | 44 |
| **Secchi Depth (meters)** | NA | NA | NA | NA | NA | 0.4 |
| **Estimated Trophic Status** | Eutrophic | Hypereutrophic | Eutrophic | Eutrophic | Eutrophic | Eutrophic[2] |
| **Year Monitored** | 2005-2006 | 2005-2006 | 2005-2006 | 2005-2006 | 2005-2006 | 2000 |

[1] Chlorophyll Trophic Status Index (TSI) quantifies the relationship between lake clarity measured in terms of Secchi disk transparency and algal biomass measured in terms of chlorophyll a. Lakes with the following TSI values are estimated to have the following trophic status: TSI 0-40, Oligotrophic; TSI 41-50, Mesotrophic; TSI 51-70, Eutrophic; and TSI greater than 70, Hypereutrophic.

[2] In 2002 the determination of trophic status was based on an average TSI score for chlorophyll a, total phosphorus and Secchi depth. Since 2006 trophic status is based only on the chlorophyll a TSI, and therefore San Luis Lake would be classified as mesotrophic.

Source: WQCD 2002, 2008a.

As presented in exhibit 10-22, five of the assessed lakes and reservoirs in the Rio Grande River Basin were identified as being in a eutrophic state while one reservoir was noted as being hypereutrophic.

### 10.2.2.2 Fish Tissue Studies

As part of its overall monitoring efforts, the WQCD also investigates fish tissues for the presence of contaminants that can be harmful to humans if ingested. WQCD uses the monitoring data to issue fish consumption advisories (FCAs) to the public as warranted. During the period July 2007 to July 2009, the WQCD evaluated fish tissues from more than 112 waterbodies. Of this number, two were assessed in the Rio Grande River Basin for mercury, selenium, and arsenic. No FCAs were issued for either of the two lakes included in this assessment effort. Exhibit 10-23 lists the lakes/reservoirs and fish species evaluated in the Rio Grande River Basin.

**Exhibit 10-23. Rio Grande River Basin Lakes and Reservoirs Assessed for Mercury, Selenium, and Arsenic During the Period 2007 to 2009**

| Lake (Segment ID No.) | Species Tested |
|---|---|
| Rio Grande Reservoir (CORGRG03) | Brook trout, brown trout, rainbow trout, and splake |
| Smith Reservoir (CORGRG27) | Rainbow trout |

Source: WQCC 2010b; WQCD 2010a.

WQCD chose to test for the presence of mercury, selenium, and arsenic in fish tissue because of the harmful human health effects that may occur if these parameters are ingested. In particular, mercury adversely affects wildlife and humans, especially children and women of childbearing age. It is also the leading cause of impairment in the nation’s estuaries and lakes. Mercury was cited in nearly 80% of FCAs reported by the states in the 2000 National Listing of Fish and Wildlife Advisories. Although arsenic generally bio-accumulates in fish in its less toxic organic form, human exposure is still harmful. The U.S. Department of Health and Human Services (DHHS) has determined that arsenic is a known carcinogen, and human exposure can occur by ingesting water, soil, or air contaminated by the substance. Selenium is an essential dietary element that prevents damage to tissues by oxygen. When consumed in amounts higher than the recommended daily allowance, however, it is toxic to both humans and animals, and excessive ingestion or exposure should be minimized (WQCD 2005).

Any waterbody that is issued an FCA is listed on the state’s CWA section 303(d) list of impaired waters with aquatic life impairment. Total maximum daily loads (TMDLs) must be completed for all impairments. The last issued FCA in the Rio Grande River Basin was in 2006 when the WQCD issued an FCA for mercury in northern pike and walleye fish species in the Sanchez Reservoir (WQCD 2006b). WQCD completed a TMDL for the Sanchez Reservoir in 2008 (WQCC 2010b and WQCD 2010a).

### 10.2.3 Wetlands

The Rio Grande River Basin lies within an area supported by the CDOW’s San Luis Valley Focus Area Committee.[8] The CDOW has identified the following wetland types within the San

[8] The CDOW created the Wetlands Wildlife Conservation Program (WWCP) to focus on preserving, restoring, enhancing, and creating wetlands throughout the state. This program focuses on (1) protecting the role of wetlands in Colorado as important feeding, breeding, migratory, and brooding habitat for water birds, and (2) providing recreational uses, such as hunting, fishing, and bird watching, through wetlands (CDOW 2008). The CDOW has created 11 focus area committees under the WWCP. The committees provide a mechanism through which

Luis Valley Focus Area: emergent marsh, wet meadows, playa (mudflats), and open water. These wetland types are generally distinguished by water table, vegetation, and soil types (San Luis Valley Wetlands Committee 2000).

Large portions of wetlands within the San Luis Valley Focus Area fall within state or federal protection areas, including the Alamosa National Wildlife Refuge (NWR), Blanca Wildlife Habitat Area, Monte Vista NWR, Rio Grande State Wildlife Area, Russell Lakes State Wildlife Area, and San Luis Lakes State Wildlife Area. Descriptions of these important wetland areas are included in exhibit 10-24.

**Exhibit 10-24. Wetlands of Importance to the CDOW San Luis Valley Focus Area Committee**

| Wetland Area | Wetland Acreage | Description |
|---|---|---|
| Alamosa NWR | 8,000 | Wetland areas consist of open water with extensive cattail stands and baltic rush/wet meadows. The Alamosa NWR provides important year-round habitat and breeding and migratory habitat for waterfowl, water birds, nongame birds, raptors, and Canada geese, some of which are listed as endangered species at the federal or state level. |
| Blanca Wildlife Habitat Area (Blanca Wetlands Area (BWA)) | 2,500 | Wetlands in the BWA include freshwater ponds, marshes, and meadows; alkali ponds, marshes, and meadows; and playa lakes. The total potential development for the BWA is 4,700 acres of wetlands. |
| Monte Vista NWR | 8,000 | Monte Vista NWR wetland habitat primarily consists of baltic rush/wet meadow communities and open water interspersed with cattail and bulrush stands. Because the Monte Vista NWR is an important seasonal waterbird habitat, approximately 26,500 acre-feet of water is applied annually through numerous artesian wells and pumps, and canal water is diverted from the Rio Grande River. The Monte Vista NWR represents one of the most productive waterfowl refuges in North America because of successful habitat management practices. |
| Rio Grande State Wildlife Area | 870 | The Rio Grande Wildlife Area lies at an elevation of 7,600 feet and consists of cottonwood groves and marshes. The CDOW purchased this area in l95l to provide habitat for nesting waterfowl, upland game, and wintering birds. |
| Russell Lakes State Wildlife Area | [1] | Acquisition of land for the Russell Lakes State Wildlife Area began in 1967; total land acreage was at 4,560 acres as of 2000. As part of an agreement between the CDOW and the Bureau of Reclamation signed in l989, the primary management goal of the Russell Lakes State Wildlife Area is to provide nesting and brood rearing habitat for waterfowl and shorebirds. A secondary goal is to provide public use of the area for hunting, trapping, and nonconsumptive use of the wildlife resources. |
| San Luis Lakes State Wildlife Area | 400 | The San Luis Lakes Wildlife Area includes San Luis and Head Lakes, as well as other water areas, including intermittent sloughs and small ponds that develop during the spring runoff. The San Luis Lakes State Wildlife Area is made up of sand dunes vegetated with salt, rabbit, and greasewood. There are also grassy meadows that are usually flooded during the spring runoff. |

[1] Wetland acreage is unavailable.

Source: San Luis Valley Wetlands Committee 2000.

In general, all of these wetland areas have conservation goals aimed at protecting wetland habitat important to nesting, migration, and brood rearing for waterfowl, water birds, and other birds. Other conservation goals include recreational uses (San Luis Valley Wetlands Committee 2000).

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conservationists can share information on local wetlands, discuss wetland needs, and generate ideas for wetland protection and restoration projects.

A map of Rio Grande River Basin wetlands is included as exhibit 10-25 (at end of chapter). The wetlands are those included in the U.S. Fish and Wildlife Service's (USFWS's) National Wetlands Inventory, the database the USFWS uses to periodically report to Congress on the status and trends of the nation's wetlands. Colorado's Natural Heritage Program and other entities are involved in more fully identifying and characterizing Colorado's wetlands. This information will be added when completed to future iterations of the SWQMP.

## 10.2.4 Groundwater

### 10.2.4.1 Interim Narrative Standard

The Interim Narrative Standard found in section 41.5(C)(6)(b)(i) of Regulation 41: *The Basic Standards for Groundwater* (5 CCR 1002-41) (WQCC 2009) is applicable to all groundwater for which the WQCC has not already assigned standards, with the exception of those groundwaters where the total dissolved solids are equal to or exceed 10,000 milligrams per liter (mg/L). The Interim Narrative Standard is independent of and in addition to the statewide groundwater standards for radioactive materials and organic pollutants.

Until such time as use classifications and numeric standards are adopted for groundwater on a site-specific basis, the following standards apply for each parameter at whichever of the following levels is the least restrictive:

- Existing ambient quality as of January 31, 1994, or
- That quality which meets the most stringent criteria set forth in tables 1 through 4 of Regulation No. 41: *The Basic Standards for Groundwater.*

The four tables from Regulation 41: *Basic Standards for Groundwater* can be viewed online at http://www.cdphe.state.co.us/regulations/wqccregs for the following classified uses: Table 1: Domestic Water Supply - Human Health Standards; Table 2: Domestic Water Supply - Drinking Water Standards; Table 3: Agricultural Standards; and Table 4: Total Dissolved Solids Water Quality Standards.

### 10.2.4.2 Site-Specific Classifications and Standards

The WQCC has established two site-specific groundwater classifications for the Rio Grande River Basin, as summarized in exhibit 10-26. Exhibits 10-27 and 10-28[9] (at end of chapter) illustrate the classified areas. These exhibits are cross-referenced in exhibit 10-26.

**Exhibit 10-26. Rio Grande River Basin Site-Specific Groundwater Classifications and Standards**

| Site | Specified Area[1, 2] | Classifications for Confined and Unconfined Groundwater | Are Groundwater Quality Standards in Tables 1–4 Applicable?[3] |
|---|---|---|---|
| City of Alamosa Wellfield, Alamosa County | See exhibit 10-27 | Domestic Use Quality and Agricultural Use Quality | Yes |
| San Luis Water and Sanitation District Wellfield, Costilla County | See exhibit 10-28 | Domestic Use Quality and Agricultural Use Quality | Yes |

[1] Specified areas pertain to confined and unconfined groundwaters within the saturated zones.

[9] Maps displayed in these exhibits are pulled directly from Regulation No. 42: *Site-Specific Water Quality Classification and Standards for Ground Water* (WQCC 2006).

[2] Maps displayed in these exhibits are pulled directly from Regulation No. 42: *Site-Specific Water Quality Classification and Standards for Ground Water* (WQCC 2006).
[3] The groundwater quality standards included in tables 1 to 4 of Regulation No. 41: *The Basic Standards for Groundwater* are assigned to all confined and unconfined groundwater in the specified area.
Source: WQCC 2006.

#### 10.2.4.3 Groundwater Quality

Surface water is the primary water source in the Rio Grande River Basin, but compared to the rest of Colorado, groundwater withdrawals in the basin are some of the highest in the state. Groundwater use in the San Luis Valley dates back to the 1880s, when groundwater was starting to be used for agricultural purposes in the area. Today, a combination of both surface water and groundwater is used for irrigation purposes. Groundwater quality varies across the basin. CGS reported in 2003 that some portions of the Closed Basin have poor quality due to high total dissolved solids concentrations, whereas areas around the edges of the valley generally have good groundwater quality. CGS further noted that salinity can be an issue in the unconfined portion of the aquifer due to leaching of salts and the recirculation of irrigation water. Water in the confined aquifer tends to have lower dissolved solids and nitrogen than that in the unconfined aquifer (CGS 2003).

## 10.3 Surface Water Quality Stressors and Sources

This section of the Rio Grande River Basin Plan summarizes data provided in the 2010 Integrated Report developed by the WQCD and approved by the WQCC. It is important to note that the data on water quality impairments and pollutant sources, as well as segments listed for further monitoring and evaluation, are based on information that is available to WQCD today. Moreover, the data are limited to those parameters for which assessments are performed.

### 10.3.1 Impairments

Exhibits 10-29 and 10-30 (at end of chapter) provide a summary of the impairments for stream and lake/reservoir segments, respectively, in the Rio Grande River Basin. A map of these impairments is provided as exhibit 10-31 (at end of chapter).

As shown in exhibit 10-29, the WQCD identified 13 impairments in stream segments in the Rio Grande River Basin during its latest monitoring cycle, which represents 18% of the total 72 segments in the basin. Overall, the impaired stream segments constitute approximately 3% of total stream miles in the basin. Copper, iron, and pH are causing impairments in two segments each. Cadmium, dissolved oxygen, *Escherichia coli* (*E. coli*), and zinc are causing impairments in one segment each. Each of the impairments noted in exhibit 10-29 requires completion of a TMDL. The exhibit shows the priority status the WQCD has assigned to TMDL development. For further information on the segments impaired, see exhibit 10-32 (at end of chapter).

As shown in exhibit 10-30 (at end of chapter), WQCD has identified four lake/reservoir segments as impaired, which represents 40% of the total assessed lakes/reservoirs. The total lake acres impaired is 2,127, which represents 38% of the total assessed lake acres. Dissolved oxygen and iron are causing impairments in two segments each, while ammonia is causing impairment in only one segment. Each of the impairments in exhibit 10-30 requires completion of a TMDL.

The exhibit shows the priority status the WQCD has assigned to TMDL development. For further information on the lake segment impairments, see exhibit 10-33 (at end of chapter).

## 10.3.2 Segments Listed for Further Monitoring and Evaluation

During each monitoring cycle, the WQCD typically identifies parameters with elevated concentrations in some segments within a basin. The sample results or other factors are such that the Division is unable to make a determination as to whether the classified uses of the segments in question are being attained. These segments are subsequently placed on the state's Monitoring and Evaluation (M&E) List. In its latest monitoring cycle, WQCD identified 13 (18%) of the 72 segments in the Rio Grande River Basin with elevated concentrations of one parameter or more. WQCD identified pH, iron, selenium, copper, cadmium, manganese, zinc, and dissolved oxygen in more than one segment, while it identified lead and sediment in only one segment each. See exhibit 10-34 (at end of chapter) for details.

## 10.3.3 Known Sources of Stressors

Exhibit 10-35 provides a synopsis of the identified sources of stressors to the Rio Grande River Basin based on parameters causing impairments per the 2010 Integrated Report. Note that similar but even more detailed information is provided in exhibits 10-32 to 10-33 (at end of chapter). The Rio Grande River Basin has a total of 15 impaired waterbody segments that require development of a TMDL. Iron and dissolved oxygen account for greatest number of impaired segments with four and three segments, respectively.

**Exhibit 10-35. Rio Grande River Basin, Summary of Stressors for Impaired Waterbodies[1]**

| Sub-Basin and Watershed | Number of Impaired Segments | Impairment | Number of Affected Segments | Source of Pollutants | Number of Affected Segments | Number of Affected Segments by TMDL Priority Development Status | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Low | Med | High |
| Mainstem and tributaries | 4 | Copper | 1 | Mining | 1 | 0 | 0 | 1 |
| | | pH | 1 | Mining | 1 | 0 | 0 | 1 |
| | | *E. coli* | 1 | Unknown | 1 | 0 | 0 | 1 |
| | | Dissolved oxygen | 1 | Unknown | 1 | 0 | 0 | 1 |
| | | **Subtotal** | **4** | **Total No. TMDLs** | **4** | **0** | **0** | **4** |
| Alamosa River/La Jara Creek/Conejos Creek | 8 | Copper | 1 | Unknown | 1 | 0 | 0 | 1 |
| | | pH | 1 | Unknown | 1 | 0 | 0 | 1 |
| | | Zinc | 1 | Unknown | 1 | 0 | 0 | 1 |
| | | Iron | 3[2] | Unknown | 1 | 0 | 0 | 1 |
| | | | | Natural Sources | 2 | 0 | 1 | 1 |
| | | | | Mining | 1 | 0 | 1 | 0 |
| | | Cadmium | 1 | Mining | 1 | 0 | 0 | 1 |
| | | Dissolved oxygen | 2 | Natural Sources | 1 | 0 | 0 | 1 |
| | | | | Unknown | 1 | 0 | 0 | 1 |
| | | **Subtotal** | **9** | **Total No. TMDLs** | **10** | **0** | **2** | **8** |
| Closed Basin/San Luis Valley | 3 | Iron | 1 | Unknown | 1 | 0 | 0 | 1 |
| | | Ammonia | 1 | Unknown | 1 | 0 | 0 | 1 |
| | | **Subtotal** | **20** | **Total No. TMDLs** | **2** | **0** | **0** | **2** |
| **Basin-wide Totals** | | | | | | | | |
| **Rio Grande River Basin** | **15** | Iron | 4[2] | Unknown | 2 | 0 | 0 | 2 |
| | | | | Natural Sources | 2 | 0 | 1 | 1 |

| Sub-Basin and Watershed | Number of Impaired Segments | Impairment | Number of Affected Segments | Source of Pollutants | Number of Affected Segments | Number of Affected Segments by TMDL Priority Development Status | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Low | Med | High |
| | | | | Mining | 1 | 0 | 1 | 0 |
| | | Dissolved oxygen | 3 | Natural Sources | 1 | 0 | 0 | 1 |
| | | | | Unknown | 2 | 0 | 0 | 2 |
| | | Copper | 2 | Mining | 1 | 0 | 0 | 1 |
| | | | | Unknown | 1 | 0 | 0 | 1 |
| | | pH | 2 | Mining | 1 | 0 | 0 | 1 |
| | | | | Unknown | 1 | 0 | 0 | 1 |
| | | *E. coli* | 1 | Unknown | 1 | 0 | 0 | 1 |
| | | Zinc | 1 | Unknown | 1 | 0 | 0 | 1 |
| | | Cadmium | 1 | Mining | 1 | 0 | 0 | 1 |
| | | Ammonia | 1 | Unknown | 1 | 0 | 0 | 1 |
| | | **Total[3]** | **15** | **Total No. TMDLs[3]** | **16** | **0** | **2** | **14** |

[1] The term "waterbodies" is used because the regulations identify some segments as containing streams, lakes, wetlands, or some combination thereof. In other instances, the regulations identify some segments as "lake-only." In this exhibit, all relevant segments are shown.
[2] One segment lists both mining and natural sources as the source of the impairment.
[3] The total number of affected segments and the total number of TMDLs do not match because several segments have more than one source of pollutants. These situations are footnoted individually in this table.
Sources: WQCC 2010b; WQCD 2010a, appendices A to D.

# 10.4 TMDLs as Water Protection Strategies

## 10.4.1 TMDL Basics

As noted previously in chapter 2, "Water Quality Management and Planning in Colorado," CWA section 303(d) requires states to periodically submit to EPA a list of waterbodies that are impaired, meaning that the segment is not meeting the standards for its assigned use classification. The list of impaired waterbodies is referred to as the CWA section 303(d) list. The WQCD prepares the list in conjunction with its biennial Integrated Reports. The WQCC approves and adopts the list as Regulation No. 93: *Colorado's Section 303(d) List of Impaired Waters and Monitoring and Evaluation List* (5 CCR 1002-93) (WQCC 2010b).

**TMDL Equation**

**TMDL = WLA + LA + MOS**

TMDLs must be developed for waterbodies on the CWA section 303(d) list. A TMDL is the maximum amount of a pollutant that a waterbody can receive and still maintain water quality standards. The TMDL is the sum of the waste load allocation (WLA), which is the load from point source discharges; the load allocation (LA), which is the load attributed to natural background and/or nonpoint sources; and a margin of safety (MOS).

An important aspect of the TMDL development process includes the identification of the sources of pollutants causing impairments in the waterbody. Both point sources and nonpoint sources are identified.

## 10.4.2 TMDLs Required to Be Developed

Exhibit 10-36 summarizes the number of TMDLs that must be developed based on the waterbodies (streams and lake-only segments) included on the 2010 CWA section 303(d) list, which is also encompassed in the 2010 Integrated Report. The first section of the exhibit shows that a total of 15 impairments occurred in 17 distinct waterbody segments for the basin as a whole. Iron requires the greatest number of TMDLs to be developed (four total). The WQCD has assigned a high priority to developing 14 of the 15 TMDLs (93%). The remaining TMDL is listed in the medium priority category.

**Exhibit 10-36. Rio Grande River Basin Summary of Impairments, Affected Waterbody Segments and TMDL Priority Development Status**

| | Total Number of Distinct Segments Impaired[1] | Affected Stream Segments | | Affected Lake-Only Segments | | Impairment | Number of Impaired Segments by Pollutant[1] | Number of Affected Segments and TMDL Priority Status by Pollutant | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | No. *(n=72)* | Miles *(n=5,643)* | No. *(n=10)* | Acres *(n=5,624)* | | | Low | Medium | High |
| Basin-wide | 17 | 13 | 188 | 4 | 2,127 | Iron | 4 | 0 | 1 | 3 |
| | | | | | | Dissolved oxygen | 3 | 0 | 0 | 3 |
| | | | | | | Copper | 2 | 0 | 0 | 2 |
| | | | | | | pH | 2 | 0 | 0 | 2 |
| | | | | | | Cadmium | 1 | 0 | 0 | 1 |
| | | | | | | *E. coli* | 1 | 0 | 0 | 1 |
| | | | | | | Zinc | 1 | 0 | 0 | 1 |
| | | | | | | Ammonia | 1 | 0 | 0 | 1 |
| | | | | | | **Total No. TMDLs to Be Developed** | **15** | **0** | **1** | **14** |
| **Impaired Segments as Percent of Total Segments and Miles/Acres in Basin** | | **18%** | **3%** | **40%** | **38%** | **Affected Segments as Percent of TMDL Priority Status** | | **0%** | **7%** | **93%** |

[1] When the total number of TMDLs to be developed is greater than the total number of distinct segments impaired, it typically means that one or more of the impaired individual segment s is impaired by more than one pollutant. When the total number of TMDLs to be developed is less than the total number of distinct segments impaired, it typically means that one or more individual segments were identified as impaired in a previous CWA section 303(d) listing cycle. However, in the latest monitoring cycle the segments showed that they are not meeting the standard(s) for one or more assigned use classifications.

Sources: WQCC 2010b; WQCD 2010a, appendices A to D.

## 10.4.3 TMDLs Completed to Date

During any given assessment cycle, segments for which a TMDL has already been developed are likely to be identified as impaired. This indicates that the TMDL has not yet been implemented or the benefits of TMDL implementation have yet to be realized. The previous exhibit identifies segments in these circumstances and the applicable pollutant(s), while also showing newly identified impaired segments.

To date, the WQCD has had TMDLs approved for 11waterbody segments in the basin to address impairments identified during previous assessment cycles (exhibit 10-37).

**Exhibit 10-37. Rio Grande River Basin Completed and Approved TMDLs**

| Segment Data | | Was use attained in the latest WQCD assessment? | Parameter |
|---|---|---|---|
| Segment | Description of Affected Segment Portion[1] | | |
| CORGRG04 | Rio Grande River below Willow Creek | No | Cadmium |
| | | No | Zinc |
| CORGRG30 | Sanchez Reservoir | No | Mercury |
| CORGAL03a | Alamosa River, Alum Creek to Wrightman Fork | No | Aluminum |
| | | No | Copper |

| Segment Data | | Was use attained in the latest WQCD assessment? | Parameter |
|---|---|---|---|
| Segment | Description of Affected Segment Portion[1] | | |
| | | No | Lead |
| | | No | Zinc |
| CORGAL03b | Alamosa River, Wrightman Fork to Fern Creek | No | pH |
| | | No | Aluminum |
| | | No | Copper |
| | | No | Zinc |
| CORGAL03c | Alamosa River, Fern Creek to Ranger Creek | No | pH |
| | | No | Aluminum |
| | | No | Copper |
| | | No | Zinc |
| CORGAL03d | Alamosa River, Ranger Creek to inlet of Terrace Reservoir | No | pH |
| | | No | Copper |
| | | No | Zinc |
| CORGAL05 | Wightman Fork above Summitville | No | pH |
| CORGAL08 | Terrace Reservoir | No | Copper |
| CORGAL09 | Alamosa River, Terrace Reservoir to Highway 15 | No | Copper |
| CORGCB09a | Kerber Creek above Brewery Creek | Yes[2] | pH |
| | | Yes[2] | Silver |
| | | No | Cadmium |
| | | Yes[2] | Lead |
| CORGCB09b | Kerber Creek, Brewery Creek to San Luis Creek | Yes[2] | Cadmium |
| | | No | Copper |
| | | Yes[2] | Zinc |

[1] Some segment descriptions might not precisely match the descriptions in Regulation No. 36 because segment descriptions and portions can change during subsequent reviews of the regulation, resulting in the addition of a segment or the splitting of a segment into multiple segments. The description was taken from the TMDL.
[2] Parameter is not listed in appendix A of the 2010 Integrated Report as a cause for the use not being attained.
Sources: WQCD 2002, 2006b, 2008a, 2008b, 2008c, and 2010a.

### 10.4.4 TMDL Implementation Strategies

Exhibit 10-38 at end of chapter summarizes information in the TMDL reports completed to date.[10] Specifically, it summarizes current and potential future strategies identified in the TMDL reports. The discussion should not be considered to be complete or exhaustive in the sense of strategies that could or should be undertaken in the basin. Moreover, the WQCD recognizes that many other entities have undertaken or are planning activities that will contribute to improvements in water quality in the basin. Finally, WQCD appreciates that the development and implementation of strategies is best undertaken in partnership with local and other stakeholders in the watersheds and basins of issue. Readers interested in understanding the array of potential strategies that could be employed in a watershed should consult chapter 4 of this document, "*Strategies for Addressing Water Quality Problems*" and appendix E.

## 10.5 Planned Point Source Treatment Upgrades

[10] Time and resource constraints prohibited a review of TMDLs beyond those available on WQCD's website at http://www.cdphe.state.co.us/wq/assessment/TMDL/TMDLs.html.

As shown in exhibit 10-39, there are a total of 28 public and private point source dischargers in the Rio Grande River Basin[11]. The point source dischargers are located in six counties. The counties with the greatest number of point source dischargers are Conejos and Saguache with six each (21% each); Alamosa, Costilla, and Rio Grande with five each (18% each); and Mineral with one (4%).

**Exhibit 10-39. Summary of Point Sources in Rio Grande River Basin by County**

| Applicable Counties | Number of Point Sources by County |
|---|---|
| Alamosa | 5 |
| Archuleta | 0 |
| Conejos | 6 |
| Costilla | 5 |
| Hinsdale | 0 |
| Mineral | 1 |
| Rio Grande | 5 |
| Saguache | 6 |
| San Juan | 0 |
| **6** | **28** |

Sources: USEPA 2010a and 2010d; WQCD 2010b.

Congress authorized the Clean Water State Revolving Fund (CWSRF; called the Water Pollution Control Revolving Fund, or WPCRF, in Colorado) when amending the CWA in 1987. The purpose of the CWSRF is to help provide financial assistance to governmental agencies for the construction of projects that are listed in the state's annual Intended Use Plans (IUPs). The Project Eligibility List included in the IUPs is made up of projects for construction of publicly owned treatment works and projects/activities eligible for assistance under CWA sections 319 and 320. The Colorado IUP Project Eligibility List is comprised of the following six categories: (1) Category 1 includes those projects that improve or benefit public health or that will remediate a public health hazard; (2) Category 2 includes those projects that enable an entity to achieve permit compliance; (3) Category 3 includes those projects that contribute to the prevention of a public health hazard, enable an entity to maintain permit compliance, or enables an entity to address a possible future effluent limit or emerging issue; (4) Category 4 includes those projects that implement a watershed/nonpoint source management plan; (5) Category 5 includes those projects that implement a source water protection plan; and (6) Category 6 includes those projects that sought funding only under the American Recovery and Reinvestment Act of 2009 and that were not already on the state's Project Eligibility List as of January 1, 2009.
For the purposes of the SWQMP, projects in categories 1through 3 were labeled as wastewater treatment facility projects; projects in category 4 were labeled as nonpoint source projects or stormwater projects; and projects in category 5 were labeled as source water protection projects. Finally, projects in category 6 were labeled as wastewater treatment facility, nonpoint source, stormwater, or source water protection depending on the nature of the project (WQCD 2010b).

[11] Point source dischargers only include those reported in the Clean Watershed Needs Survey 2008 database (USEPA 2010a), the USEPA ECHO database accessed June 24, 2010 (USEPA 2010d), and the Water Pollution Control Revolving Fund annual Intended Use Plan (WQCD 2010b).

A total of 22 planned treatment projects were identified for point source facilities in the Rio Grande River Basin[12]. Exhibit 10-40 provides a summary of the project types and includes the number of projects, the estimated costs of the project, and the population expected to benefit. The three project types are (1) wastewater treatment facility, (2) stormwater, and (3) source water protection. Wastewater treatment facility projects lead the list in terms of the greatest number of scheduled projects (18 of 22, or 82%); stormwater projects follow with a total of 3 (14%).

**Exhibit *10-40.* Rio Grande River Basin Summary of Scheduled Point Source Improvements**

| Project Type | Number of Projects | Estimated Cost of Projects[1] | Population Expected to Benefit from Projects | Number of Projects Reporting Population Data |
|---|---|---|---|---|
| **Wastewater Treatment Facility** | 18 | $24,706,468 | 23,007 | 100% |
| **Stormwater** | 3 | $13,808,000 | 5,679 | 100% |
| **Source Water Protection** | 1 | $52,000 | 130 | 100% |
| **Total All Projects** | **22** | **$38,566,468** | **28,816** | |

[1] Dollar amounts listed are those reported in WPCRF project applications only, as reported in the IUP. They likely are not inclusive of all projects that may be occurring in the basin.

Sources: USEPA 2010a and 2010c; WQCD 2010b.

The total estimated cost of the 22 projects in the Rio Grande River Basin is $38,566,468. Wastewater treatment facility improvement projects constitute 64% of the total cost, or $24,706,468. These are followed by stormwater projects at $13,808,000 and source water protection projects at $52,000 (36% and 0.1%, respectively, of total estimated project costs). Exhibit 10-41 (at end of chapter) provides additional details. It should be noted that funding gaps exist nationwide in the CWSRF for wastewater treatment projects.[13] Total funding has also not increased significantly under section 319 in spite of nonpoint sources being the leading source of water pollution nationwide.

## 10.6 Nonpoint Source Management

Exhibit 10-42 (at end of chapter) summarizes CWA section 319 nonpoint source grant projects in the Rio Grande River Basin for the past 5 years. A total of four such projects were identified. In two of the four projects, the principal focus was to develop watershed plans. The objective of the third project was to perform watershed modeling, and the objective of the fourth project is best management practice design and implementation. Only two of the four grant projects reported

[12] Projects identified include only those on the state's IUP. Therefore, the list is not likely inclusive of all projects that may be occurring in the basin.

[13] It is well recognized that the nation's infrastructure is aging and that the funds to replace this infrastructure are severely lacking. EPA recently completed its 2008 Report to Congress summarizing the results of its Clean Watersheds Needs Survey. The report presents a comprehensive analysis of capital investments necessary to meet the nation's wastewater and stormwater treatment and collection needs over the next 20 years. The report documents a total need of $299.1 billion as of January 1, 2008. This total includes capital needs for publicly owned wastewater treatment pipes and treatment facilities ($192.2 billion), combined sewer overflow correction ($63.6 billion), and stormwater management ($42.3 billion) (USEPA 2010b).

budgets, and these totaled $537,791. Approximately 41% of this amount ($222,723) was provided through section 319 grant funds; the remaining funds were from other sources and represent the grant recipients' cost-share agreement with the WQCD.

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## Map References

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### Exhibit 10-15. Rio Grande River Basin Key Diversions and Streamflow Gauges

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### Exhibit 10-16. Rio Grande River Basin Wells and Aquifers

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### Exhibit 10-17. Rio Grande River Basin Classified Waterbody Segments

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