WATER QUALITY SURVEY SUMMARY

FOR THE

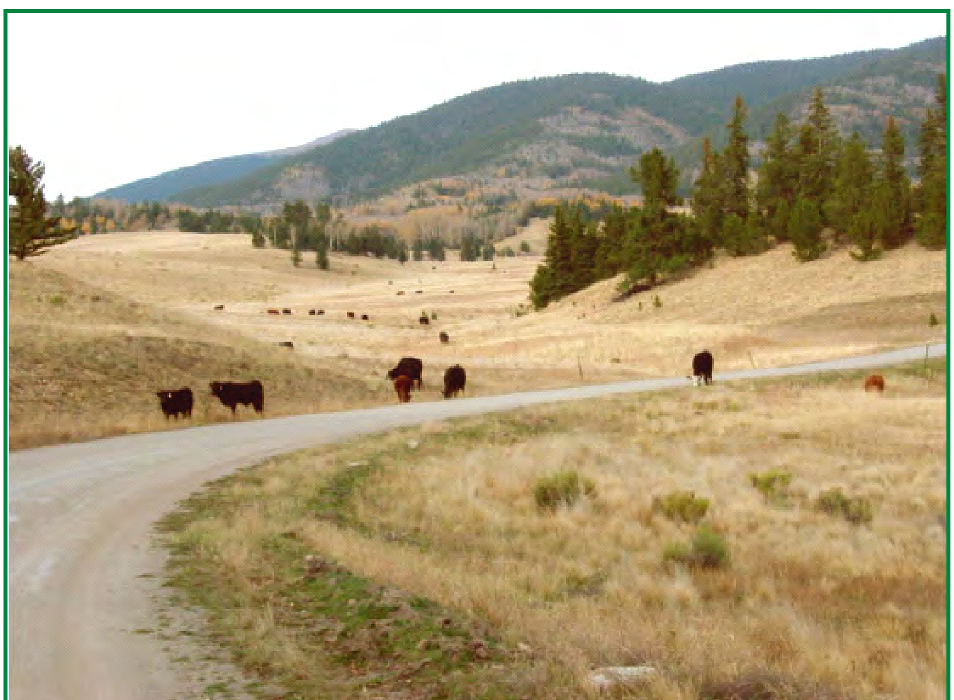
VALLE VIDAL

2006

Prepared by

Surface Water Quality Bureau
New Mexico Environment Department

May 2011



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List of Abbreviations

ADB	Assessment Database
AP	Assessment Protocols: *State of New Mexico Procedures for Assessing Standards Attainment for the Integrated §303(d)/§305(b) Water Quality Monitoring and Assessment Report*
°C	Degrees Celsius
cfs	cubic feet per second
CWA	Clean Water Act
CWAL	Coldwater Aquatic Life
DO	Dissolved Oxygen
EMAP	Environmental Monitoring and Assessment Protocol
FS	Fully Supporting the designated aquatic life use
GIS	Geographic Information Systems
HQCWAL	High Quality Coldwater Aquatic Life
IR	Integrated Report: *State of New Mexico Integrated Clean Water Act §303(d)/305(b) Report*
km^2	square kilometers
mm	millimeter
MAS	Monitoring and Assessment Section
mi^2	square miles
M-SCI	Mountain Stream Condition Index
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NS	Not Supporting the designated aquatic life use
NTU	Nephelometric Turbidity Unit
QAPP	Quality Assurance Project Plan
RGA	Rapid Geomorphic Assessment
RHA	Rapid Habitat Assessment
SOP	Standard Operating Procedures for Data Collection (SWQB - specific)
STORET	*STO*rage and *RET*rieval (USEPA Database)
SU	Standard Units
SWQB	Surface Water Quality Bureau
TMDL	Total Maximum Daily Load
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WPS	Watershed Protection Section
WQS	Water Quality Standards (New Mexico)

EXECUTIVE SUMMARY

The Monitoring and Assessment Section (MAS) of the Surface Water Quality Bureau of the New Mexico Environment Department conducted a water quality survey of the watersheds within the Valle Vidal Unit of the Carson National Forest between April and October, 2006. On the westside of the unit, the survey focused on Costilla Creek and Comanche Creek, including all perennial tributaries. On the eastside of the Unit, the survey included Seally Creek, Greenwood Creek, McCrystal Creek and the North and Middle forks of Ponil Creek. Water quality sampling methods were in accordance with the *Quality Assurance Project Plan* (NMED/SWQB, 2006).

The purpose of this survey was to collect chemical, physical, and biological data to evaluate water quality within the watershed. The data were assessed against New Mexico Water Quality Standards (NMAC, 2007) and impaired waters compiled in the Integrated List portion of the biennial *State of New Mexico Integrated Clean Water Act §303(d)/305(b) Report* (NMED/SWQB, 2008). It is important to note that both the assessment protocols and water quality standards are revised periodically to incorporate new information and refinements. Assessment conclusions presented in this report are based on water quality standards and assessment protocols that existed at the time the report was developed. The U.S. Environmental Protection Agency uses the most recent state-developed assessment protocols and the most recent USEPA-approved water quality standards when deciding whether or not to approve impairment determinations on the biennial *New Mexico Integrated List of Impaired Waters* (NMED/SWQB, 2008). Therefore, the current impairment conclusions in the Integrated List supersede assessment conclusions in this survey report.

Water chemistry sampling occurred at 16 survey stations selected to obtain data on all perennial waterbodies in the Valle Vidal Unit. Samples were collected and analyzed for total nutrients, total and dissolved metals, major anions and cations, radionuclides, semivolatile organic compounds and E. *coli*. Data loggers were deployed at select stations to collect long-term, continuous data sets for temperature, pH, dissolved oxygen and turbidity. Benthic macroinvertebrate and periphyton samples were also collected.

Primary findings of the surface water quality assessment are as follows:

- **Aluminum:** Data from Comanche Creek, Greenwood Creek, Gold Creek, North Ponil Creek exceeded the chronic aquatic life criterion of 87 μg/L.
- **Nutrients:** Data from Middle Ponil Creek indicated nutrient enrichment.
- **Temperature:** Temperature impairments were documented in Comanche Creek, Gold Creek, Holman Creek, LaBelle Creek and North Ponil Creek,
- **Gross Alpha Radiation:** Data from North Ponil Creek exceeded the gross alpha radiation drinking water supply criteria of 15 pCi/L.
- **Radium 226 + Radium 228:** Data from North Ponil Creek also exceeded the 5 pCi/L drinking water supply criteria for radium (226+228).
- **Turbidity:** Data from Grassy Creek, North Ponil Creek and McCrystal Creek exceeded the 25 NTU threshold.

1.0 INTRODUCTION

The Valle Vidal is a 100,000-acre (400 km^2) area in the Sangre de Cristo Mountains within the Carson National Forest, northwest of Cimarron, New Mexico. Pennzoil donated the Valle Vidal to the American public in 1982. In 2002, El Paso Natural Gas petitioned the Forest Service to lease the eastern 40,000 acres (160 km^2) of the Valle Vidal for coalbed methane development. The proposed natural gas exploration drew strong public protests, and in 2006, President Bush signed legislation prohibiting oil drilling and mining in the Valle Vidal.

The elevation of the Valle Vidal ranges from 7,400 feet at the south end of North Ponil Creek to 12,554 feet at the top of Little Costilla Peak. Whereas much of the land east of the Rock Wall is below 8,500 feet, higher elevations are found to the west. The Valle Vidal proper, a huge meadow/park on the west side, is about 9,500 feet.

Vegetation, as a function of elevation, ranges from mid-elevation forest to sub-alpine to a small alpine section on the top of Little Costilla Peak. Bristlecone pine, Ponderosa pine, Lodgepole pine, Douglas fir, Colorado (blue) spruce, juniper, Engleman spruce and sub-alpine fir can be found in the Unit. The Valle Vidal hosts a number of animal species including elk, black bear, mountain lion, turkey and bobcat. Native Rio Grande cutthroat trout can be found in many of the streams, as well as introduced brook-, brown-, and rainbow trout. The Valle Vidal hosts outfitters, hunting and trekking guides, backpackers, horseback riding, fly-fishing and over 3,000 Boy Scouts a year.

1.1 Geography and Geology

The predominant lithologies within the Valle Vidal are sandstones to the east and volcanic, metamorphic, and alluvium to the west (Figure 1). The Valle Vidal is on the western edge of the Raton Basin, which marks the transition from the Sangre de Cristo Mountains to the Great Plains region. Both coal and gold were historically mined in the area (Chronic, 1987). The Pierre Formation, a Cretaceous shale, form many local slopes and pediments. Distinct Oligocene igneous dikes cut across the basin, forming the Rock Wall that separates the east from the west side of the Valle Vidal. The western side is predominately sandstone of the Poison Canyon Formation and Piedmont alluvial deposits. The eastern side is a mix of lower Miocene and Upper Oligocene volcanic rocks, Lower Proterozoic metamorphic rocks, Upper Oligocene andesites, and the Lower and Middle Santa Fe Group.

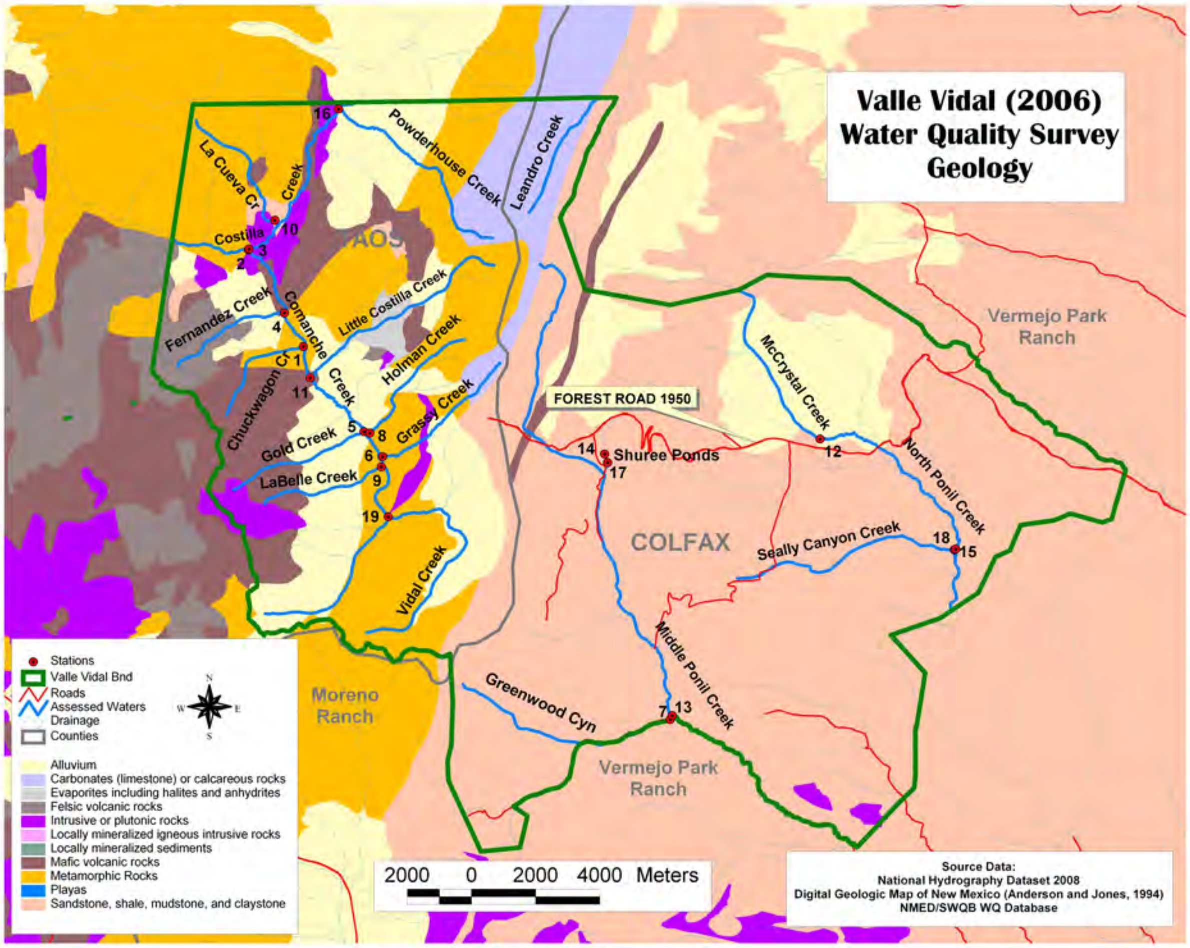

Figure 1. Valle Vidal survey sampling locations. See table 1 for more details.

2.0 NEW MEXICO WATER QUALITY STANDARDS

The water quality standards for the watersheds in the Valle Vidal fall into two segments. For the westside, which drains into the Rio Grande, the following standards apply:

20.6.4.123 RIO GRANDE BASIN - Perennial reaches of the Red river upstream of the mouth of Placer creek, all perennial reaches of tributaries to the Red river, and all other perennial reaches of tributaries to the Rio Grande in Taos and Rio Arriba counties unless included in other segments and excluding waters on Santa Clara, Ohkay Owingeh, Picuris and Taos pueblos.

A. Designated Uses: domestic water supply, high quality coldwater aquatic life, irrigation, livestock watering, wildlife habitat and primary contact; and public water supply on the Rio Pueblo and Rio Fernando de Taos.

B. **Criteria**: the use-specific numeric criteria set forth in 20.6.4.900 NMAC are applicable to the designated uses, except that the following segment-specific criteria apply: specific conductance 400 μS/cm or less (500 μS/cm or less for the Rio Fernando de Taos); the monthly geometric mean of *E. coli* bacteria 126 cfu/100 ml or less, single sample 235 cfu/100 ml or less; and phosphorus (unfiltered sample) less than 0.1 mg/L for the Red river. [20.6.4.123 NMAC – Rp 20 NMAC 6.1.2120, 10-12-00; A, 05-23-05; A, 12-01-10]

The eastside of the Valle Vidal drains into the Canadian River Basin and these standards apply:

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]

3.0 METHODS

All biological, chemical, and geomorphic data were collected in accordance with the procedures set forth in the Surface Water Quality Bureau (SWQB*)* Quality Assurance Project Plan (*QAPP*; NMED/SWQB, 2006) and the *SWQB Standard Operating Procedures for Data Collection* (SOP; NMED/SWQB, 2004). The data collected as part of this study were later combined with all other readily available data that met state quality assurance/quality control requirements to form the basis of designated use attainment determinations. These data were assessed in accordance with protocols established in the *State of New Mexico Procedures for Assessing Standards Attainment for the Integrated §303(d)/§305(b) Water Quality Monitoring and Assessment Report* (AP; NMED/SWQB, 2007).

4.0 SAMPLING SUMMARY

The Monitoring and Assessment Section (MAS) of the Surface Water Quality Bureau (SWQB) conducted a water quality survey of the Valle Vidal between April and October, 2006. This water quality survey included nineteen sampling stations (Table 1). Sampling station locations are determined by the project team based on a targeted monitoring approach. To the extent possible, existing or potential point or nonpoint source pollution sources along the stream are identified through the use of maps, historical data, and information from other agencies and the public. Existing stations are reviewed to determine their relevance. Sampling locations are then added or moved to be as representative of the assessment unit (AU) as possible, maximize the probability of identifying potential pollution sources and to simplify access. Typically only one sampling station is located within each AU and is positioned as far down the AU as is practicable to account for as many natural or anthropogenic inputs from the adjacent region as possible. If a United States Geological Survey (USGS) gaging station is located in the reach under study, it is usually selected as one of the sampling stations since long-term flow and water quality data are generally available for these stations.

Water samples were analyzed for plant nutrients, ions, total and dissolved metals, bacteria, radionuclides, and anthropogenic organic compounds. Parameters such as temperature, dissolved oxygen, pH, turbidity, and specific conductance were measured in the field and are included in the "field data" column. Physical habitat, benthic macroinvertebrate communities, and periphyton were surveyed to determine the impacts of excessive nutrients and settled sediment on aquatic life within a stream.

Table 1. Sampling stations and rationales.

STATION NAME	STATION ID*	SAMPLING RATIONALE
Chuckwagon Creek abv Comanche Creek	1	only station in AU
Comanche Creek abv Costilla Creek	2	only staton in AU
Costilla Creek abv Comanche Creek	3	only station in AU
Fernandez Creek abv Comanche Creek	4	only station in AU
Gold Creek abv Comanche Creek	5	only station in AU
Grassy Creek abv Comanche Creek	6	only station in AU
Greenwood Creek abv Middle Ponil Creek	7	only station in AU
Holman Creek abv Comanche Creek	8	only station in AU
La Belle Creek abv Comanche Creek	9	only station in AU
La Cueva Creek abv Costilla Creek	10	only station in AU
Little Costilla Creek abv Comanche Creek	11	only station in AU

McCrystal Creek at USFS Campground	12	only station in AU
Middle Ponil Creek abv Greenwood Creek	13	only station in AU
North Shuree Pond Deep	14	only station in pond
North Ponil Creek abv Seally Creek	15	only station in AU
Powderhouse Creek abv Costilla Creek	16	only station in AU
South Shuree Pond Deep	17	only station in pond
Seally Creek abv N Ponil Creek	18	only station in AU
Vidal Creek abv Comanche Creek	19	only station in AU

* Numbers refer to stations shown in Figure 1.

The number of times data for each parameter (or suite of parameters) was collected is summarized below (Table 2). The type and number of samples collected at a given station was based on previous survey findings and proximity to potential sources. Monitoring these sites allowed an assessment of the cumulative influence of the physical habitat, water sources, and land management activities upstream from the sites.

5.0 WATER QUALITY IMPAIRMENTS

For many water quality parameters, the State of New Mexico maintains numeric standards, whereas standards for some parameters such as plant nutrients and stream bottom deposits are narrative.). Final designated use impairment determinations are housed in the Assessment Database (ADB) and were reported in the biennial *2008-2010 State of New Mexico CWA §303(d)/§305(b) Integrated Report* (IR; NMED/SWQB, 2008). Due to the large volume of data collected during this survey, it is not included in this report. To acquire data, contact the SWQB or search United States Environmental Protection Agency's (USEPA) *Storage and Retrieval* (STORET) database.

Table 2. Sampling summary.

Assessment Unit / Station	**Field Data**	***E. coli***	**TSS/TDS/Ions**	**Nutrients**	**Periphyton**	**Dissolved Metals**	**Total Metals**	**Radionuclides**	**Organics**	**Discharge**	**Habitat**	**Macro-invertebrates**	**Thermograph**	**Sonde Deployment**
Chuckwagon Creek (Comanche Creek to headwaters)														
Chuckwagon Creek abv Comanche Creek	Dry all year – no data collected													
Comanche Creek (Costilla Creek to headwaters)														
Comanche Creek abv Costilla Creek	6	4	5	5	1	5	5	1	1	5	1	1	1	1
Costilla Creek (Comanche Creek to Costilla Dam)														
Costilla Creek abv Comanche Creek	6	4	5	5	1	5	5	1	1	5	1	1	1	1
Fernandez Creek (Comanche Creek to headwaters)														
Fernandez Creek abv Comanche Creek	5	5	5	5	-	5	5	-	-	5	-	-	1	-
Gold Creek (Comanche Creek to headwaters)														
Gold Creek abv Comanche Creek	4	4	4	4	-	4	4	-	-	4	1	-	1	-
Grassy Creek (Comanche Creek to headwaters)														
Grassy Creek abv Comanche Creek	4	4	4	4	-	4	4	-	-	4	-	-	1	-
Greenwood Creek (Comanche Creek to headwaters)														
Greenwood Creek abv Comanche Creek	5	4	4	4	-	4	4	-	-	4	1	-	1	-
Holman Creek (Comanche Creek to headwaters)														
Holman Creek abv Comanche Creek)	4	4	4	4	-	4	4	-	-	4	1	-	1	-
LaBelle Creek (Comanche Creek to headwaters)														
LaBelle Creek abv Comanche Creek	4	4	4	4	-	4	4	-	-	4	-	-	1	-
La Cueva Creek (Comanche Creek to headwaters)														
La Cueva Creek abv Comanche Creek	4	4	4	4	-	4	4	-	-	4	-	-	1	-
Little Costilla Creek (Comanche Creek to headwaters)														
Little Costilla Creek abv Comanche Creek)	4	4	4	4	-	4	4	-	-	4	-	-	1	-
McCrystal Creek (North Ponil to headwaters)														
McCrystal Creek at USFS Campground	5	3	3	3	-	3	3	1	1	3	1	-	1	-
Middle Ponil Creek (Greenwood														

Assessment Unit / Station	**Field Data**	***E. coli***	**TSS/TDS/Ions**	**Nutrients**	**Periphyton**	**Dissolved Metals**	**Total Metals**	**Radionuclides**	**Organics**	**Discharge**	**Habitat**	**Macro-invertebrates**	**Thermograph**	**Sonde Deployment**
Creek to headwaters)														
Middle Ponil Creek abv Greenwood Creek)	5	3	4	4	-	4	4	1	1	4	1	-	1	1
North Shuree Pond														
North Shuree Pond Deep	2	2	2	2	-	2	2	2	2	2	-	-	-	-
North Ponil Creek (Seally Canyon to headwaters)														
North Ponil Creek abv Seally Creek	5	3	4	4	1	4	4	1	1	4	1	-	1	1
Powderhouse Creek (Comanche Creek to headwaters)														
Powderhouse Creek abv Costilla Creek	4	4	4	4	-	4	4	1	-	4	-	-	1	-
South Shuree Pond														
South Shuree Pond Deep	2	2	2	2	-	2	2	2	2	2	-	-	1	-
Seally Creek (North Ponil Creek to headwaters)														
Seally Creek abv North Ponil Creek	1	1	1	1	-	1	1	1	1	1	-	-	1	-
Vidal Creek (Comanche Creek to headwaters)														
Vidal Creek abv Comanche Creek)	4	4	4	4	-	4	4	1	4	4	-	-	1	-

5.1 Water Quality Impairments For Numeric Criteria

5.1.1 Physicochemical Data

Results from the water quality data assessment indicated designated use impairments due to chronic aluminum and turbidity. A summary of the physicochemical assessment conclusions is given below (Table 3).

Table 3. Summary of physicochemical impairments.

Assessment Unit	Station	IR Category*	Impairments
Comanche Creek (Costilla Creek to headwaters)	Comanche Creek abv Costilla Creek	4A	temperature
Gold Creek (Comanche Creek to headwaters	Gold Creek abv Comanche Creek	4A	temperature, aluminum
Grassy Creek (Comanche Creek to headwaters)	Grassy Creek abv Comanche Creek	4A	turbidity
LaBelle Creek (Comanche Creek to headwaters)	LaBelle Creek abv Comanche Creek	4A	temperature
Greenwood Creek (Middle Ponil to headwaters)	Greenwood Creek abv Middle Ponil Creek	5/5A	aluminum
McCrystal Creek(North Ponil Creek to headwaters)	McCrystal Creek at USFS Campground	5/5C	temperature, turbidity
Middle Ponil Creek (Greenwood Creek to headwaters)	Middle Ponil abv Greenwood Creek	5/5C	nutrient/ eutrophication, biological indicators
North Ponil Creek (Seally Canyon to headwaters)	North Ponil Creek abv Seally Creek	5/5C	aluminum, adjusted gross alpha, radium-226, radium-228, temperature, turbidity

Table 4. Summary of physicochemical assessments.

Assessment Unit / Station	**Aluminum**	**Turbidity**	**Temperature**	**Gross Alpha Radiation**	**Nutrients**
Chuckwagon Creek (Comanche Creek to headwaters)					
Chuckwagon Creek abv Comanche Creek	Not assessed – dry all year				
Comanche Creek (Costilla Creek to headwaters)					
Comanche Creek abv Costilla Creek	FS	FS	**NS**	NA[1]	FS
Costilla Creek (Comanche Creek to Costilla Dam)					
Costilla Creek abv Comanche Creek	FS	FS	FS	NA	FS
Fernandez Creek (Comanche Creek to headwaters)					
Fernandez Creek abv Comanche Creek	FS	FS	FS	NA	FS
Gold Creek (Comanche Creek to headwaters)					
Gold Creek abv Comanche Creek	**NS**	FS	**NS**	NA	FS
Grassy Creek (Comanche Creek to headwaters)					
Grassy Creek abv Comanche Creek	FS	**NS**	FS	NA	FS
Greenwood Creek (Middle Ponil Creek to headwaters)					
Greenwood Creek abv Middle Ponil Creek	**NS**	FS	FS	NA	FS
Holman Creek (Comanche Creek to headwaters)					
Holman Creek abv Comanche Creek)	FS	FS	FS	NA	FS
LaBelle Creek (Comanche Creek to headwaters)					
LaBelle Creek abv Comanche Creek	FS	FS	NS	NA	FS
La Cueva Creek (Comanche Creek to headwaters)					
La Cueva Creek abv Comanche Creek	FS	FS	FS	NA	FS
Little Costilla Creek (Comanche Creek to headwaters)					
Little Costilla Creek abv Comanche Creek)	FS	FS	FS	NA	FS
McCrystal Creek (North Ponil to headwaters)					
McCrystal Creek at USFS Campground	FS	**NS**	**NS**	NA	FS
Middle Ponil Creek (Greenwood Creek to headwaters)					
Middle Ponil Creek abv Greenwood Creek)	FS	FS	FS	NA	**NS**
North Shuree Pond Deep					
North Shuree Pond Deep	FS	FS	FS	FS	FS
North Ponil Creek (Seally Canyon to headwaters)					
North Ponil Creek abv Seally Creek	**NS**	**NS**	**NS**	**NS**	FS
Powderhouse Creek (Comanche Creek to headwaters)					
Powderhouse Creek abv Costilla Creek	FS	FS	FS	NA	FS
South Shuree Pond Deep					
South Shuree Pond Deep	FS	FS	FS	FS	FS
Seally Creek (North Ponil Creek to headwaters)					
Seally Creek abv North Ponil Creek	NA[2]	NA[2]	NA[2]	NA[2]	NA[2]

Assessment Unit / Station	**Aluminum**	**Turbidity**	**Temperature**	**Gross Alpha Radiation**	**Nutrients**
Vidal Creek (Comanche Creek to headwaters)					
Vidal Creek abv Comanche Creek)	FS	FS	FS	NA	FS

NS Not supporting designated aquatic life use; FS, fully supporting designated aquatic life use; and
NA Not assessed.

[1] Only one gross-alpha sample was collected at each station. According to the 2008 AP, a single exceedence of the 15 pCi/L criterion results in a determination of NS, while a single sample is not sufficient to attain FS status when there is no exceedence.

[2] Seally Creek was flowing during only one visit and insufficient data was collected for assessment.

5.1.2 Data from Continuous Monitoring Devices

Temperature data loggers (thermographs) were deployed at selected stations (Table 2) within the study area. Multi-parameter sondes were also deployed at selected stations (Table 2) to acquire long-term pH and dissolved oxygen (DO) datasets. Thermographs and sondes were programmed to record temperature, DO, and/or pH once per hour over the deployment period.

Temperature and pH Assessments are tied to the criteria in the *State of New Mexico Standards for Interstate and Intrastate Surface Waters* (NMAC, 2007). Dissolved oxygen assessment criteria are linked to the presence of sensitive aquatic organisms, *e.g.* early life stages, and designated use, *e.g.* marginal coldwater aquatic life use. The AP provides details of large dataset assessment procedures (appendices E and F). Assessment conclusions from thermograph and sonde data are summarized below (Table 5).

Turbidity assessments were not done on datasets from multi-parameter sondes. Turbidity values from discrete measurements made during chemical sampling events showed impairments at several locations (Table 4).

Table 5. Summary of thermograph and sonde assessments.

Assessment Unit	Designated Use	Temperature Criterion (°C)	Temperature Assessment	pH Criterion (SU)	pH Assessment	DO Criterion (mg/L)	DO Assessment
Comanche Creek (Costilla Creek to headwaters)	HQCWAL	≤ 20.0	**NS**	6.6 – 8.8	FS	≥ 6.0	FS
Costilla Creek (Comanche Creek to Costilla Dam)	HQCWAL	≤ 20.0	**NS**	6.6 – 8.8	FS	≥ 6.0	FS
Fernandez Creek (Comanche Creek to headwaters)	HQCWAL	≤ 20.0	FS	6.6 – 8.8	NA	≥ 6.0	NA
Gold Creek (Comanche Creek to headwaters)	HQCWAL	≤ 20.0	FS	6.6 – 8.8	NA	≥ 6.0	NA
Grassy Creek (Comanche Creek to headwaters)	HQCWAL	≤ 20.0	FS	6.6 – 8.8	NA	≥ 6.0	NA
Greenwood Canyon (Middle Ponil to headwaters)	HQCWAL	≤ 20.0	FS	6.6 – 8.8	NA	≥ 6.0	NA
Holman Creek (Comanche Creek to headwaters)	HQCWAL	≤ 20.0	FS	6.6 – 8.8	NA	≥ 6.0	NA
LaBelle Creek (Comanche Creek to headwaters)	HQCWAL	≤ 20.0	**NS**	6.6 – 8.8	NA	≥ 6.0	NA
La Cueva Creek (Costilla Creek to headwaters)	HQCWAL	≤ 20.0	FS	6.6 – 8.8	NA	≥ 6.0	NA
Little Costilla Creek (Comanche Creek to headwaters)	HQCWAL	≤ 20.0	**NS**	6.6 – 8.8	NA	≥ 6.0	NA
Middle Ponil Creek (South Ponil to headwaters)	HQCWAL	≤ 20.0	**NS**	6.6 – 8.8	FS	≥ 6.0	FS
North Ponil Creek (South Ponil Creek to McCrystal Creek)	HQCWAL	≤ 20.0	**NS**	6.6 – 8.8	FS	≥ 6.0	FS
Powderhouse Creek (Costilla Creek to headwaters)	HQCWAL	≤ 20.0	**NS**	6.6 – 8.8	NA	≥ 6.0	NA
Vidal Creek (Comanche Creek to headwaters)	HQCWAL	≤ 20.0	**NS**	6.6 – 8.8	NA	≥ 6.0	NA

NS, not supporting; FS, fully supporting; HQCWAL, high quality coldwater aquatic life; CWAL, coldwater aquatic life; NA, not assessed; SU, standard units.

5.2 Water Quality Impairments for Narrative Criteria

5.2.1 Physical Habitat

Stream physical habitat is characterized in order to relate stream biological condition to land use impacts and potential anthropogenic disturbances. The physical characteristics most directly impacting aquatic communities are the stream geomorphology (physical structure), the riparian corridor that supports and protects aquatic life, and the composition of the substrate where the aquatic communities live. Streams in similar landscapes display similar traits and can be compared to a reference site within that group. A reference site is a stream reach that has been exposed to minimal human disturbance within a particular ecoregion.

Environmental Monitoring and Assessment Program (EMAP; Peck et al., 2006) surveys were conducted to collect data for sedimentation/siltation impairment determinations at Costilla Creek and Comanche Creek. Data for Rapid Geomorphic Assessment (RGA; Simon, 1989) was collected on other streams. Watershed size, elevation, and the ecoregion of stations where surveys were conducted appear below (Table 6).

Substrate Composition

The size of sediment particles in a stream system is one of the most important physical attributes affecting the health of aquatic communities. There are two components to sediment load that impact aquatic life: suspended load and bed load. Suspended load is quantified through the measurement of a surrogate parameter (turbidity) and total suspended solids. Bed load describes the particles that settle to, or roll along, the bottom (saltation) of the channel. Larger bed load particles provide increased interstitial space between particles, thus allowing for different aquatic communities than those found among small particles with little or no space. The size of sediment within a stream has a natural progression from coarse, large particles in sections at high elevation with smaller watershed size gradually decreasing to sand in low elevation streams with large watersheds. Therefore, to determine whether a stream exhibits an unnaturally fine bed load, knowledge of the location of the stream segment within the watershed is necessary. Particles smaller than 2 mm are considered “fines”, and percent fines values are assessed against New Mexico’s narrative sediment standard (see 20.6.4.13(A) NMAC). Percent fine values are calculated by adding the percent sand and percent silt-clay fractions (Table 7). Another useful metric is the mean embeddedness, which is the number of particles surrounded by fines.

Table 6. Watershed characteristics of physical habitat study sites.

Station Name	Watershed area above station (mi^2)	Elevation (ft)	Omernick Ecoregion
Comanche Creek above Rio Costilla	42.18	8930	21b crystalline subalpine forest
Middle Ponil Creek above Greenwood Creek	18.43	8248	21f sedimentary midlevel forest
Costilla Creek above Comanche Creek	69.61	8937	21b crystalline subalpine forest
Holman Creek above Comanche Creek	1.89	9212	21j grassland parks
Gold Creek above Comanche Creek	2.21	9199	21j grassland parks
Greenwood Creek above Middle Ponil Creek	NA	8268	21f sedimentary midlevel forest
McCrystal Creek @USFS Campground	10.3	8130	21f sedimentary midlevel forest
North Ponil above Seally Creek	36.8	7854	21f sedimentary midlevel forest

Geomorphology

Quantifying the structure of a stream channel allows the amount and variability of habitat available for aquatic communities to be determined. A natural, undisturbed stream system maintains equilibrium with the amount of water and sediment that it transports, allowing that system to remain stable. Human impacts may alter the equilibrium of a stream, causing the stream to actively attempt to restore this balance. As the stream attempts to restore equilibrium, it may cause damage to the adjacent riparian habitat or the aquatic communities within the channel. Detailed geomorphic surveys following the USEPA EMAP data collection methods (Peck et. al., 2007) were conducted at two sites: Comanche Creek above Rio Costilla and Costilla Creek above Comanche Creek. Other sites were surveyed using the less extensive rapid Geomorphic Assessment (RGA; Simon, 1989). Components of habitat data were used to assess attainment of sedimentation and temperature criteria.

Table 7. Substrate composition data.

Station Name	% Fines* (>2 mm)	Mean % Embeddedness
Comanche Creek above Rio Costilla	3	38.5
Middle Ponil Creek above Greenwood Creek	14	31.1
Costilla Creek above Comanche Creek	12	22.6
Holman Creek above Comanche Creek	13.9	35.8
Gold Creek above Comanche Creek	7	46.3
Greenwood Creek above Middle Ponil Creek	3	2.27

* Pebble counts were conducted in targeted riffles.

Riparian Health

The riparian area is the corridor of vegetation surrounding the stream that provides many beneficial functions to the stream channel. Although there are many benefits to a diverse and healthy riparian area, the most direct effects are shade, soil stability, and organic inputs providing food for the aquatic communities. Qualitative riparian assessments were performed to provide general information on the health of the habitat and structure of the stream using the Rapid Habitat Assessment (RHA; Barbour, et al., 1999). These assessments combined with the quantitative canopy measurements (Table 8) provide an indication of riparian health.

5.2.2 Macroinvertebrate Community and Sedimentation Data

By collecting data on the macroinvertebrate communities, changes in community composition that indicate water quality or habitat impairment can be identified. All stations in this survey were in ecoregion 21 and were assessed with the Mountain Stream Condition Index (M-SCI; Jacobi et al., 2006) as described in the AP (NMED/SWQB, 2007). The M-SCI score is a percentage comparison of the sum of selected metric scores derived from the macroinvertebrate communities and used to compare the study site to the selected reference site or reference condition in order to determine the degree of impairment. For example, when the macroinvertebrate community at a study site in ecoregion 21 has an M-SCI score less than 37.2, it can be concluded that the community is impaired and the assessment unit (AU) would be deemed not supporting of its aquatic life use (Table 9). Macroinvertebrate samples were collected at two sites and M-SCI index scores were all within the full support range for both (Table 10).

Table 8. Riparian cover and qualitative riparian scores.

Station Name	% Riparian Canopy Cover	RGA[1] Stability Score	RHA[2] Habitat Score
Comanche Creek above Rio Costilla	88	12.5	137
Middle Ponil Creek above Greenwood Creek	63	15	143
Costilla Creek above Comanche Creek	76	9.5	161
Holman Creek above Comanche Creek	63	14	137
Gold Creek above Comanche Creek	88	10.5	170
Greenwood Creek above Middle Ponil Creek	63	12	159
McCrystal Creek @USFS Campground	18	25	NA
North Ponil above Seally Creek	63	19	NA

1 The Rapid Geomorphic Assessment is used to identify stable reaches and the destabilizing processes that are active in the reach. A channel stability score is determined by observing a number of channel characteristics and the stage of channel evolution based on the National Sedimentation Lab empirical model (Simon 1989). Lower scores indicate a more stable channel. Scores range from 0 to 36.

2 The Rapid Habitat Assessment (Barbour, *et al.* 1999) provides a qualitative aquatic habitat score that is based primarily on observation of the quality and diversity of in stream habitats. Higher scores indicate better habitat quality. Scores range from 0 to 200.

In order to assess for excess sedimentation, the biological index score and the percent fines in the stream reach are assessed independently for their support of the aquatic life use. Reference sites are currently used to determine the amount of fines appropriate for each stream reach. If a low biological index score coincides with percent fines greater than 20% and this value exceeds a 28% increase from the associated reference site, excess fine sediment is indicated as a cause of impairment. If only the biological index score is low, excess fine sediment is not indicated as a cause of impairment.

Macroinvertebrate and sediment data were assessed at two sites. According to Appendix D of the Assessment Protocol (NMED/SWQB, 2007), raw percent values for percent fines of ≤ 20% at a study site should be evaluated as “Full Support” for sedimentation/siltation. Both sites evaluated for sedimentation/siltation in this survey met this condition (Table 11).

Table 9. Biological integrity attainment using M-SCI[1] for ecoregion 21.

M-SCI Index[1]	Aquatic Life Use Support Determination
>56.7	Full Support
≤56.7	Not Supporting

[1]M-SCI Index and percentages based on Jacobi, *et al.* (2006).

Table 10. Benthic macroinvertebrate evaluations.

Station Name	Ecoregion	Elevation (m)	Watershed Area (km^2)	M-SCI Score	Benthic Macroinvertebrate Assessment
Costilla Creek above Comanche Creek	21b	2732	180	75	FS
Comanche Creek above Costilla Creek	21b	2732	117	59	FS

FS, fully supporting the designated aquatic life use.

Table 11. Sediment evaluations for Comanche and Costilla Creeks.

Station	M-SCI Score	% Fine Sediment*	Sediment Assessment
Comanche Creek above Costilla Creek	75	3%	FS
Costilla Creek above Comanche Creek	59	12%	FS

FS, fully supporting the designated aquatic life use.
* Raw percent values of ≤20% fines at a study site are evaluated as FS.

5.2.3 Nutrient Assessment

A level 1 nutrient survey is typically performed in each AU to screen for excess nutrients and to prioritize data collection efforts for the survey. If results from the level 1 assessment indicate nutrient enrichment, a level 2 nutrient survey is conducted to obtain additional data necessary to confirm impairment status (NMED/SWQB, 2007).

Due to limited resources, level 1 nutrient surveys were not conducted for most of the Valle Vidal stations. Preliminary analyses showed high nutrient concentrations throughout the region and several stations also had at least one DO grab sample that exceeded the 120% saturation threshold used in nutrient assessment.

Because these high DO readings occurred on the same day or during the same sampling trip, a DO probe malfunction is suspected as the cause of the elevated values. A low DO charge value was also recorded during these sampling events, which also indicates equipment malfunction.

Level 2 Nutrient Assessments

Level 2 nutrient assessments were conducted in four AUs. These assessments evaluate data collected for a number of parameters including total phosphorus, total nitrogen, dissolved oxygen, pH, and periphyton chlorophyll *a*, a measure of algal biomass which is the cause of most problems associated with nutrient impairment. Values for these parameters are compared to the applicable criterion or threshold value to generate an exceedence ratio, or the number of exceedences divided by the total number of measurements (Table 12). For total phosphorus, total nitrogen, and chlorophyll *a*, the threshold values are specific for each ecoregion and designated aquatic life use.

Table 12. Level 2 nutrient assessments.

Assessment Unit	**Ecoregion – Aquatic Life Use**	**DO & pH – long term datasets**	**DO %Sat. – grab** (# and % of exceedences)	**DO conc – grab** (# and % of exceedences)	**pH – grab** (# and % of exceedences)	**Total Nitrogen** (# and % of exceedences)	**Total Phosphorus** (# and % of exceedences)	**Chlorophyll a exceedence?**	**Nutrient Assessment**
Comanche Creek (Costilla Creek to headwaters)	21b-HQCWAL	supports HQCWAL	1/10 (10%)	0/6 (0%)	1/14 (7%)	**3/8 (38%)**	**6/8 (75%)**	no	FS
Costilla Creek (Comanche Creek to headwaters)	21b-HQCWAL	supports HQCWAL	1/10 (10%)	0/14 (0%)	1/14 (7%)	**9/13 (77%)**	**7/13 (54%)**	no	FS
Middle Ponil (South Ponil to headwaters)	21f-HQCWAL	**DO - NS** pH - FS	0/5 (0%)	0/5 (0%)	0/5 (0%)	**4/4 (100%)**	**3/4 (75%)**	no	**NS**
North Ponil (South Ponil to McCrystal Creek)	21f-HQCWAL	supports HQCWAL	0/5 (0%)	0/5 (0%)	0/5 (0%)	**3/4 (75%)**	**3/4 (75%)**	no	FS

HQCWAL, high quality coldwater aquatic life; FS, fully supporting designated aquatic life use; NS, not supporting designated aquatic life use.

6.0 DISCUSSION

Due to the large volume of data collected during this survey, it will not be included in this report. To acquire specific data, contact the SWQB or search the USEPA STORET database. All monitoring conducted by SWQB is summarized in Table 2. Those parameters that exceeded the State's Water Quality Criteria are shown in Tables 4 and 5 as well as Tables 10, 11 and 12. Data collected as part of this study were assessed for water quality impairment and the assessment results were included in the 2008-2010 IR .

The chief impairments in the Valle Vidal streams found during this survey were due to temperature, probably, resulting from lack of riparian cover and channelization, followed by aluminum and gross-alpha radiation, which are elevated because natural levels are high in the survey area.

Individual field measurements of turbidity showed no exceedences of the interim threshold value of 25 NTU. Long-term turbidity datasets, however, contained turbidity values exceeding 284 NTU from Comanche Creek, 523 NTU from Middle Ponil Creek and 836 NTU from North Ponil Creek. The only long-term turbidity dataset without exceedences of the 25 NTU turbidity criteria was obtained from Costilla Creek below Costilla Reservoir, where suspended sediments have the opportunity to settle out before water is released from Costilla Dam. These datasets may be assessed using a recently developed protocol for turbidity for the 2012 IR.

Nitrogen and phosphorus levels exceeded the ecoregion threshold in the vast majority of samples collected during this survey; however impairment of the narrative plant nutrient criterion was only documented on Middle Ponil Creek. Level 1 nutrient assessments should be conducted on all streams in the Valle Vidal, followed by level 2 nutrient surveys (where indicated), which include multi-day sonde deployments and collection of periphyton and chlorophyll *a* data to verify support status conclusions from this survey For more information on this process refer to the Nutrient Assessment Protocol for Wadeable, Perennial Streams (NMED/SWQB, 2011).

7.0 REFERENCES

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