

# *Mora-San Miguel-Guadalupe Regional Water Plan*

**Volume 1: Report Text, Appendices A and B**



*Prepared for:*

**Tierra y Montes Soil and Water  
Conservation District and the  
Mora-San Miguel-Guadalupe Regional  
Water Planning Steering Committee**



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## List of Acronyms

ac-ft/yr	acre-foot per year
AIRFA	American Indian Religious Freedom Act
AMO	Atlantic Multidecadal Oscillation
ASR	aquifer storage and recovery
AWWA	American Water Works Association
BBER	Bureau of Business & Economic Research
bgs	below ground surface
BOD	biological oxygen demand
BTEX	benzene, toluene, ethylbenzene, and xylenes
CAP	Central Arizona Project
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CFRP	Collaborative Forest Restoration Program
cfs	cubic feet per second
CID	Carlsbad Irrigation District
CMA	Critical Management Area
CWA	Clean Water Act
DBS&A	Daniel B. Stephens & Associates, Inc.
EIS	environmental impact statement
ESA	Endangered Species Act
ft <sup>2</sup>	square feet
ft msl	feet above mean sea level
ft/yr	feet per year
GIS	geographic information system
gpcd	gallons per capita per day
gpd	gallons per day
gph	gallons per hour
gpm	gallons per minute
gpm/ft	gallons per minute per foot
IALC	International Arid Lands Consortium
in/yr	inches per year
IPCC	Intergovernmental Panel on Climate Change
ISC	Interstate Stream Commission
km <sup>2</sup>	square kilometer
LEPA	low energy precision application (irrigation system)



## List of Acronyms (Continued)

m <sup>2</sup> /ha	square meters per hectare
mg/L	milligrams per liter
mi <sup>2</sup>	square miles
MMD	Mining and Minerals Division
MOU	memorandum of understanding
MRGAA	Middle Rio Grande Administrative Area
MTBE	methyl tertiary-butyl ether
NCDC	National Climatic Data Center
NEPA	National Environmental Policy Act
NFMA	National Forest Management Act
NHPA	National Historic Preservation Act
NMASS	New Mexico Agricultural Statistics Service
NMDA	New Mexico Department of Agriculture
NMED	New Mexico Environment Department
NMEMNRD	New Mexico Energy, Minerals and Natural Resources Department
NMSA	New Mexico Statutes Annotated
NMSU	New Mexico State University
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List (Superfund)
NMWQCC	New Mexico Water Quality Control Commission
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
OSE	New Mexico Office of the State Engineer
PDO	Pacific Decadal Oscillation
PDOI	Pacific Decadal Oscillation Index
PDSI	Palmer Drought Severity Index
PVC	polyvinyl chloride
SCS	Soil Conservation Service
SNOTEL	snowpack telemetry
SWAPP	New Mexico Source Water Assessment and Protection Program
SWCD	Soil and Water Conservation District
SWE	snow water equivalent
SWPM	Southwest Planning & Marketing
TDS	total dissolved solids
TMDL	total maximum daily load
UIC	underground injection control
USACE	U.S. Army Corps of Engineers
USBR	U.S. Bureau of Reclamation
USDA	U.S. Department of Agriculture
U.S. EPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service



## **List of Acronyms (Continued)**

USFS  
USGS  
UST

U.S. Forest Service  
U.S. Geological Survey  
underground storage tank

WATERS  
WRCC  
WRRI  
WWTP

Water Administration Technical Engineering Resource System Database  
Western Regional Climate Center  
New Mexico Water Resources Research Institute  
wastewater treatment plant



## Glossary

abandoned:	A term used to describe a water right that can no longer be used; for example, when a building is constructed over a previously irrigated field, the water right is considered to be abandoned.
acre-foot:	Volume of water required to cover 1 acre of land (43,560 square feet) to a depth of 1 foot, equivalent to 325,872 gallons.
adjudication:	A legal proceeding in which a court determines the validity, priority, and amount of a water right.
alluvium:	General term for deposits of clay, silt, sand, gravel, or other particulate material deposited by a stream or other body of running water in a streambed, on a floodplain, on a delta, or at the base of a mountain.
anion:	A negatively charged ion.
appropriate (verb):	To take the legal actions necessary to create a right to take water from a natural stream or aquifer for application to beneficial use.
appropriation:	The right to take water from a natural stream or aquifer for beneficial use at a specified rate of flow, either for immediate use or to store for later use. Usually confirmed by a water court decree (see also <i>prior appropriation</i> ).
aquifer:	A geologic formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield significant quantities of water to wells and springs.
artesian water:	Groundwater under sufficient pressure to rise above the level at which the water-bearing bed is reached in a well. The pressure in such an aquifer commonly is called artesian pressure, and the formation containing artesian water is called an artesian aquifer.
artificial recharge:	The addition of water to the groundwater reservoir by human activities, such as through an infiltration gallery or injection well.
base flow:	Sustained or fair-weather runoff—generally that portion of the streamflow derived from discharging groundwater or other delayed sources.
bedrock:	General term for consolidated (solid) rock that underlies soils or other unconsolidated material.
beneficial use:	The use of water by humans for any purpose from which benefits are derived, such as domestic, municipal, irrigation, livestock, industrial, power development, and recreation. Under the New Mexico Constitution, beneficial use is the basis, the measure, and





## Glossary (Continued)

the limit of the right to use water; therefore, beneficial use of public water is an essential element in the development of a water right.

call:	A demand that holders of upstream water rights with more recent (junior) priority dates than the holder of the calling right cease diverting; in "calling" for his or her water rights, a senior water right holder requires junior water right holders to allow water to pass to the senior water right holder.
cation	A positively charged ion.
cone of depression	A depression in the potentiometric surface of a body of groundwater that develops around a well from which water is being withdrawn. It defines the area of influence of a well.
confining bed:	A rock formation that will not readily transmit water and that retards or stops the free movement of water underground. Confining beds have also been called aquicludes, aquitards, or semiconfining beds.
conjunctive water use:	Combined use of groundwater and surface water.
consumptive irrigation requirement (CIR):	The quantity of irrigation water (exclusive of precipitation), stored soil moisture, or groundwater that is required consumptively for crop production.
consumptive use:	The quantity of water that is consumed and not returned to the water system. For example, in irrigation a portion of the water is consumed through plant evapotranspiration or evaporation and is therefore lost to the water system (the remaining portion becomes return flow). See also <i>depletion</i> (synonym).
conveyance loss:	Water that is lost in transit from a canal, conduit, or ditch by leakage or evaporation.
cubic foot per second (cfs):	The rate of discharge representing a volume of 1 cubic foot passing a given point during 1 second. It is equivalent to 7.48 gallons per second, or 448.9 gallons per minute.
declared underground water basin:	An area of the state proclaimed by the State Engineer to be underlain by a groundwater source having reasonably ascertainable boundaries. By such proclamation the State Engineer assumes jurisdiction over the appropriation and use of groundwater from the source.



## Glossary (Continued)

- depletion:** That part of a withdrawal that has been evaporated, transpired, incorporated into crops or products, consumed by man or livestock, or otherwise removed. See also *consumptive use* (synonym).
- discharge:** Rate of flow at a given instant in terms of volume per unit of time; for example, pumping discharge (which equals pumping rate), usually given in gallons per minute (gpm), or stream discharge, usually given in cubic feet per second (cfs). With respect to groundwater, the movement of water out of an aquifer. Discharge may be natural (e.g., from springs or by seepage), or it may be artificial (e.g., through constructed drains or from wells).
- diversion:** A turning aside or alteration of the natural course of a flow of water, normally considered physically to leave the natural channel. In New Mexico this can include consumptive use directly from a stream, such as by livestock watering, as well as such actions as directing water through a canal or conduit.
- domestic water use:** Water for normal household purposes—such as drinking, food preparation, bathing, washing clothes and dishes, flushing toilets, and watering lawns, gardens and livestock—supplied from a domestic source. Also called residential water use. The water can be obtained from a public supply or can be self-supplied.
- domestic well:** A well that provides domestic water. Domestic water rights are also known as “72-12-1” water rights, after the section of the water code that requires the State Engineer to approve all applications for a well to supply a household for domestic uses. A regulation adopted by the State Engineer allows domestic well users to use up to 3 acre-feet per year, except in areas where water rights are administratively restricted by court decree.
- drainage basin:** A part of the surface of the earth that is occupied by a drainage system that consists of a surface stream or body of impounded surface water together with all tributary surface streams and bodies of impounded surface water.
- drawdown (groundwater):** The depression or decline of the water level or potentiometric surface in a pumped well or in nearby wells caused by pumping. At the well, it is the vertical distance between the static and the pumping level.
- drought:** A long period of below-average precipitation.
- environmental impact statement (EIS):** Detailed analysis of the impacts of a project on all aspects of the natural environment, required by the National Environmental Policy Act for federal permitting or use of federal funds.



## Glossary (Continued)

ephemeral stream:	A stream or portion of a stream that flows only in direct response to precipitation. Such flow is usually of short duration. Most of the dry washes of the region may be classified as ephemeral streams.
evaporation:	Process by which water is changed from the liquid state to the vapor state.
evaporation, net reservoir:	The evaporative water loss from a reservoir after making allowance for precipitation on the reservoir. Net reservoir evaporation equals the total evaporation minus the precipitation on the reservoir surface.
evapotranspiration:	The combined processes of simple evaporation and plant transpiration by which water is converted to vapor and lost to the system.
fallow:	Cropland, either tilled or untilled, that is allowed to lie idle during all or most of the growing season.
forfeiture	If a water right is not used for a four-year period and for one additional year after notification, the right is forfeited. Water rights not used prior to 1965 do not require a one-year period of non-use after notification.
freshwater:	Water that contains less than 1,000 milligrams per liter (mg/L) of dissolved solids; generally, more than 500 mg/L is considered undesirable for drinking and many industrial uses.
gaging station:	A particular site on a stream, canal, lake, or reservoir where systematic observations of water level, flow, or discharge are made.
gaining stream:	A river, or reach of a stream or river, that gains flow from groundwater seepage or from springs in or alongside the channel.
graywater	Domestic wastewater that has not come in contact with human or animal wastes and does not contain pathogens; typically water from showers and washing machines.
groundwater:	Generally, all subsurface water as distinct from surface water, specifically, that part of the subsurface water in the saturated zone (a zone in which all voids, large and small, ideally are filled with water under pressure equal to or greater than atmospheric).
groundwater mining:	The condition that exists when the withdrawal of water from an aquifer exceeds the recharge, causing a decline in the groundwater level.



## **Glossary (Continued)**

groundwater recharge:	The addition of water to the zone of saturation. Infiltration of precipitation and its movement to the water table is one form of natural recharge.
hydraulic conductivity	A constant of proportionality describing the rate at which water can move through a permeable medium. The density and kinematic viscosity of the water must be considered in determining hydraulic conductivity (Fetter, 1988, p. 571).
hydraulic gradient (groundwater):	The gradient or slope of the water table or potentiometric surface in a specific direction.
hydrograph:	A graph showing the stage, flow, velocity, or other property of water with respect to the passage of time. Hydrographs of wells show the changes in water levels during the period of observation.
hydrologic cycle:	The movement of water from the atmosphere to the earth and back again to the atmosphere. The three stages are precipitation, runoff or infiltration, and evaporation.
impairment:	The diminishing quantity or quality of the water supply of an existing user by a new use or change in an existing use.
impermeable:	Not capable of transmitting fluids or gases in appreciable quantities. Few rocks are completely impermeable, but some—such as unweathered granite, dense basalt, welded tuff, dense limestone, and well cemented conglomerate—may be considered so for practical purposes.
instream flow:	Water in a stream or river for fish, wildlife, recreation, watershed or other purposes.
intermittent stream:	A stream that flows for only a part of the time. Flow generally occurs for several weeks or months in response to seasonal precipitation, due to groundwater discharge, in contrast to an ephemeral stream that flows for just a few hours or days following a single storm.
interstate compact:	An agreement between two or more states that has been approved by the U.S. Congress and allocates the water in the rivers and streams flowing through those states.
irrigated area:	The gross area upon which water is artificially applied.
irrigation:	Generally, the controlled application of water to arable lands to supply water requirements of crops not satisfied by rainfall.



## Glossary (Continued)

irrigation conveyance loss:	The loss of water in transit from a reservoir, point of diversion, or groundwater pump to the point of use, whether in natural channels or in artificial ones, such as canals, ditches, and laterals.
irrigation efficiency:	The percentage of the irrigation water diverted from a water source that is consumed.
irrigation return flow:	That part of irrigation water that is not consumed by evapotranspiration and that drains from the irrigated area to an aquifer or surface water body.
junior rights:	Water rights that were obtained more recently and therefore are junior in priority to older or more senior rights. (see <i>priority date</i> )
karst:	A type of topography that is formed on limestone, dolomite, gypsum beds, and other rocks by dissolution and is characterized by closed depressions, sinkholes, caves, and underground drainage.
National Pollution Discharge Elimination System (NPDES) permit:	A permit required under Section 401 of the Clean Water Act regulating discharge of pollutants into the nation's waterways.
National Environmental Policy Act (NEPA):	The federal law enacted to ensure the integration of natural and social sciences and environmental design in planning and in decision making that may impact the quality of the human environment.
nonpoint source:	The source of pollution discharged over a wide land area, as opposed to from one specific area, that finds its way into streams, lakes and oceans; examples of nonpoint source pollution are runoff from streets, parking lots, lawns, agricultural land, individual septic systems, and construction sites.
nonpotable water:	Water not suitable for drinking.
outflow (from sub-basin):	Groundwater discharge across sub-basin boundaries.
per capita use:	The average amount of water used per person during a standard time period, generally one day.
perennial stream:	A stream that normally has water in its channel at all times.
phreatophyte:	A plant that habitually obtains its water supply from the zone of saturation.
playa:	Flat-floored bottom of an undrained desert plains basin.



## Glossary (Continued)

point source:	The source of pollution discharged from any identifiable point, including ditches, channels, sewers, tunnels, and containers of various types.
porosity:	The ratio of the total volume of pore space (voids) in a rock or soil to its total volume, usually stated as a percentage. Effective porosity is the ratio of the volume of interconnected voids to the total volume. Unconnected voids contribute to total porosity but are ineffective in transmitting water through the rock.
potable water:	Water that is safe and palatable for human consumption.
potentiometric surface:	An imaginary surface representing the static head of groundwater in tightly cased wells that tap a water-bearing rock unit (aquifer) or, in the case of unconfined aquifers, the water table.
precipitation:	Includes atmospheric hail, mist, rain, sleet, and snow that descends upon the earth; the quantity of water accumulated from the above events.
prior appropriation:	The water law doctrine that confers priority to use water from natural streams based upon when the water rights were acquired. In New Mexico and most other western states, holders of senior rights have first claim to withdraw water over holders who have filed later claims (see also <i>water right, priority date, appropriation</i> ).
priority date:	The date indicating when the water right was first exercised or applied for. The priority date determines the seniority of the water right. Senior water rights holders are entitled to receive their full water right before junior water rights holders receive any water.
recharge:	The addition of water to an aquifer by infiltration, either directly into the aquifer or indirectly by way of another rock formation. Recharge may be natural, as when precipitation infiltrates to the water table, or artificial, as when water is injected through wells or spread over permeable surfaces for the purpose of recharging an aquifer.
recoverable groundwater:	The amount of water that may be physically and economically withdrawn from the groundwater reservoir.
reservoir:	A body of water used to collect and store water.
return flow:	The part of a diverted flow that is not consumptively used and that returns to a water body.
reuse:	To use again, recycle; to intercept, either directly or by exchange, water that would otherwise return to the stream system for subsequent beneficial use.



## Glossary (Continued)

- reverse osmosis: A water treatment technique that forces water through a dense membrane to remove impurities.
- riparian: The habitat and life forms along streams, lakes, and wetlands.
- runoff: Water that is not absorbed by the soil or landscape to which it is applied. The part of the precipitation that appears in surface streams. Runoff occurs when water is applied quickly (application rate exceeds infiltration rate), particularly if there is a severe slope. Stormwater runoff is created by natural precipitation rather than human-caused or applied water use.
- saline water: Water that contains more than 1,000 milligrams per liter of dissolved solids. It generally is considered unsuitable for human consumption and less desirable for irrigation because of its high content of dissolved solids. Salinity generally is expressed as milligrams per liter (mg/L) of dissolved solids, with 35,000 mg/L defined as seawater. A general salinity scale is:

Salinity	Dissolved Solids (mg/L)
Slight	1,000-3,000
Moderate	3,000-10,000
Very	10,000-35,000
Brine	more than 35,000

- secondary treatment: Treatment of wastewater to a nonpotable level so that it may be returned to the stream (see also *tertiary treatment, nonpotable water*).
- specific capacity: In groundwater hydrology, the yield of a well after a period of sustained pumping, usually expressed in gallons per minute per foot of drawdown.
- specific yield: The quantity of water that a unit volume of aquifer will yield by gravity after it is saturated, expressed as either a ratio or a percentage of the aquifer volume; specific yield is a measure of the water available to wells.
- storage: Water held in a reservoir for later use.
- streamflow: The discharge that occurs in a natural channel of a surface stream course.
- stream gain: The amount of water that flows into a stream from springs or seeps from an aquifer
- stream loss: The amount of water that seeps out of a stream and recharges the aquifer.



## Glossary (Continued)

surface water:	An open body of water, such as a stream or a lake.
surface water inflow:	The amount of water that annually enters an area as surface runoff.
suspended sediment:	Sediment that is transported in suspension by a stream. Fragmental material, both mineral and organic, that is maintained in suspension in water by the upward components of turbulence and currents and/or by colloidal suspension.
sustainability:	A decision-making concept describing development that meets the needs of the present without compromising the ability of future generations to meet their own needs.
tertiary treatment:	Treatment of wastewater to a level beyond secondary treatment but below potable (see also <i>secondary treatment, nonpotable water, potable water</i> ).
total dissolved solids (TDS):	An aggregate of carbonates, bicarbonates, chlorides, sulfates, phosphates, nitrates, etc., of calcium, magnesium, manganese, sodium, potassium, and other cations that form salts. High TDS concentrations exert varying degrees of osmotic pressure and often become lethal to the biological inhabitants of an aquatic environment. The common and synonymously used term for TDS is "salt."
total maximum daily load (TMDL):	Described as a watershed or basin-wide budget for pollutant influx to a watercourse.
transmissivity:	The rate at which water of a prevailing density and viscosity is transmitted through a unit width of an aquifer or confining bed under a unit hydraulic gradient. It is a function of the properties of the liquid, the porous media, and the thickness of the porous media.
transpiration:	The process by which water is absorbed by plants, usually through the roots. The residual water vapor is emitted into the atmosphere from the plant surface.
tributary:	A stream or river that flows into a larger one.
tributary drainage:	The area from which water drains by gravity into a water course.
tributary groundwater:	Water below the earth's surface that is physically or hydrologically connected to natural stream water so as to affect its flow, whether in movement to or from that stream.
turbidity:	The opaqueness or reduced clarity of a fluid due to the presence of suspended matter.





## Glossary (Continued)

unaccounted-for water:	The difference between the total amount of water leaving treatment facilities and the total amount of water measured at customers' meters. Besides system losses, it also includes beneficial uses such as unmetered fire fighting and water used in system maintenance, along with meter under-registration.
wastewater:	Water that contains dissolved or suspended solids as a result of human use.
water budget:	An accounting of the inflow to, outflow from, and storage changes of water in a hydrologic unit.
water right:	Legal right to use a specific quantity of water, on a specific time schedule, at a specific place, and for a specific purpose.
watershed:	An area from which water drains and contributes to a given point on a stream or river.
water table:	The upper surface of zone of saturation (see also <i>potentiometric surface</i> ).
withdrawal:	Water removed from the ground or diverted from a surface water source for use.
xeriscape:	Landscaping concept that incorporates vegetation that is suited to local soils and climate, typically requiring less water. The term is derived from the Greek word <i>xeros</i> , meaning dry.
yield (water):	The supply of water produced by a given stream or water development; average annual yield is the amount of water given over a period of 12 months.



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