INTRODUCTION

In 1891, public concern regarding the issue of having adequate supplies of clean water led to the establishment of federally protected forest reserves in the United States. The importance of water protection was evident in the wording of the Organic Act of 1897, the legislation that founded the USFS, which stated that “no public forest reservation shall be established, except to improve and protect the forest within the reservation, or for the purpose of securing favorable conditions of water flows…”

The protection of water on BLM-administered lands is also emphasized in several acts, most notably the Federal Land Management Policy Act (FLPMA) of 1976, which declares that public lands are to be managed, among other things, for the protection of water and water-related resources. Today, public lands, especially USFS-administered lands, are a large and important source of clean water for this nation. Watersheds throughout the planning area, as administered by both agencies under the management of the SJPLC, provide a multitude of benefits, including for aquatic and riparian habitat, municipal water supplies, flood reduction, low-flow augmentation, recreation opportunities, as well as for providing a continuous supply of clean water for many additional uses.

Water quality within the planning area is typically good (CDPHE 2006a). In the few water bodies having water quality problems, mercury, heavy metals, sediment, and salinity are common pollutants. In some places, mine-related heavy-metals pollution is being cleaned up as a result of the aggressive abandoned mine reclamation program being conducted within the planning area.

Development and depletion of ground-water resources are emerging issues on SJPL, especially in relation to fluid-minerals extraction and private land development. Factors such as high road densities, poor road locations, and inadequate road design/maintenance have caused water quality, floodplain, and channel morphology changes in some watersheds.

Over the past decade, drought has also impacted the planning area. The prolonged drought has resulted in lower water tables in some areas, which has, in turn, resulted in reduced water flow in streams, springs, and seeps. Dry upland conditions have increased grazing pressure on riparian areas. The drought-related increase of large wildfires has impacted many watersheds by resulting in increased flooding, erosion, sedimentation, and damage to private property adjacent to, or near, the boundaries of the planning area. Large and small proposals for new water-development projects have also increased, in part, as a result of long-term drought. Accommodating increasing public needs for water while, at the same time, protecting aquatic ecosystems may be one of the biggest challenges for the management of public lands over the next few decades.

LEGAL AND ADMINISTRATIVE FRAMEWORK

LAWS

- ***The Organic Administration Act of June 4, 1897, as amended***: This act contains the initial, basic authority of watershed management on USFS lands. The purpose for the establishment of national forests, as stated in this act, includes securing favorable conditions of water-flows.
- ***The Multiple-Use Sustained- Yield Act of 1960***: Under this act, "National forests are established and shall be used for outdoor recreation, range, timber, watershed, and wildlife and fish purposes." The Secretary of Agriculture is authorized and directed to develop and administer the renewable surface resources of the national forests for multiple uses and sustained yield, without impairment of the productivity of the land.
- ***The Federal Water Pollution Control Act of July 9, 1956, as amended***: The intent of this act is to enhance the quality and value of the water resource, and to establish a national policy for the prevention, control, and abatement of water pollution. The act was amended by the Federal Water Pollution Control Act/ Amendments of 1961; the Water Quality Act of 1965; the Clean Water Restoration Act of 1966; the Water Quality Improvement Act of 1970; the National Environmental Policy Act of 1969; the Federal Water Pollution Act of 1969; the Federal Water Pollution Control Act Amendments of 1972; and the Clean Water Act of 1977.
- ***The National Environmental Policy Act of January 1, 1970***: This act requires an environmental assessment, including an evaluation of impacts on water resources, for all major Federal actions.
- ***The Colorado River Basin Salinity Control Act of June 24, 1974***: This act directs the U.S. Department of the Interior (USDOI) to undertake research and development projects in order to identify methods designed to improve the water quality of the Colorado River.
- ***The National Forest Management Act of 1976***: This act substantially amends the Forest and Rangeland Renewable Resources Planning Act of 1974. This act strengthens the references pertaining to suitability and compatibility of land areas; stresses the maintenance of productivity, as well as the need to protect and improve the quality, of soil and water resources; and seeks to avoid the permanent impairment of the productive capability of the land.
- ***The Federal Land Policy and Management Act of October 21, 1976***: This act declares that "…the public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values." It also states that "Terms and conditions must minimize damage to scenic and aesthetic values and fish and wildlife habitat and otherwise protect the environment."
- ***The Clean Water Act of 1977***: This act amends the Federal Water Pollution Control Act of 1972. Section 313 of the act stresses that Federal agencies must comply with Federal, State, and local substantive and procedural requirements related to the control and abatement of pollution to the same extent as required of non-governmental entities. Section 404 of the Clean Water Act regulates the discharge of dredged, excavated, and/or fill material in wetlands, streams, rivers, and other U.S. waters. (The U.S. Army Corps of Engineers is the Federal agency authorized to issue Section 404 Permits for certain activities conducted in wetlands or other U.S. waters.) Activities that may be exempt from Section 404 Permits, or that are covered under the general permit, are identified in the legislation (include normal silviculture, forest roads using BMP, and stream-bank erosion control).

- ***The Surface Mining and Control and Reclamation Act of August 3, 1977***: This act may require the BLM to make determinations of "probable hydrologic consequences" in relation to mining and reclamation activities.

EXECUTIVE ORDERS

- ***Executive Order 11288***: his EO requires that Federal agencies develop pollution-abatement plans and preventative measures for the discharge of hazardous waste into waters.
- ***Executive Order 11752***: This EO mandates that Federal agencies provide national leadership in order to protect and enhance the quality of air, water, and land resources through compliance with applicable Federal, State, interstate, and local pollution standards.
- ***Executive Order 11988***: This EO requires that Federal agencies provide leadership and take action to: a) minimize adverse impacts associated with the occupancy and modification of floodplains and reduce risks of flood loss; b) minimize impacts of floods on human safety, health, and welfare; and c) restore and preserve the natural and beneficial values served by floodplains.
- ***Executive Order 11990***: This EO requires Federal agencies take action in order to minimize the destruction, loss, or degradation of wetlands; and to preserve and enhance the natural and beneficial values of wetlands.

REGULATIONS AND POLICIES

- ***FSM 2500 and FSH 2500***: These consolidate USFS regulation, policy, and direction regarding watershed management. These documents also stipulate limitations of resource use in order to protect watershed conditions.
- ***BLM Manual Supplement 7200***: This provides policy and direction regarding water-use management on BLM-administered lands.
- ***BLM Manual Supplement 7240***: This manual provides policy and direction regarding water-quality management on BLM-administered lands.

OTHER AGREEMENTS

- ***Memorandum of Understanding (MOU) between the State of Colorado Department of Natural Resources, the State of Colorado Water Conservation Board, and the BLM, 2005***: This MOU provides a formal cooperative framework between the State of Colorado and the BLM in relation to water management on BLM-administered lands in Colorado.
- ***Memorandum of Understanding between the State of Colorado Department of Natural Resources and USFS, 2004***: This MOU provides a formal cooperative framework between the State of Colorado and the USFS in relation to water management on USFS-administered lands in Colorado.

DESIGN CRITERIA

Management guidelines and design criteria describe the environmental protection measures that would be applied to all of the alternatives at the project level in order to protect, enhance, and, where appropriate, improve resources related to water and water quality. Guidelines and design criteria are presented in Part 3 of Volume II of the DLMP/DEIS.

AFFECTED ENVIRONMENT

EXISTING CONDITIONS AND TRENDS

Aquatic Resources

The SJPLC-administered lands are located within the upper Colorado River Basin. The principal rivers that drain these lands are the Dolores, Mancos, La Plata, Animas, Florida, Los Pinos, Piedra, and San Juan Rivers. All of these river systems drain into the Colorado River. In general, the headwaters of these rivers originate in the higher-elevation igneous or metamorphic rocks of the southern Rocky Mountains. Upon leaving the mountainous terrain, the rivers often create canyons and valleys of variable size as they flow through the sedimentary rocks of the Colorado Plateau, which is located to the south and west of the mountains.

The higher-elevation headwater areas receive the bulk of annual precipitation as snow, and run-off is snowmelt-dominated. The point of greatest measured precipitation within the planning area (Wolf Creek Pass, at an elevation of 9,440 feet) averages 40.85 inches per year. Per year, this site averages 352 inches of snow. The point of lowest measured precipitation (Uravan, at an elevation of 5,020 feet) averages 12.5 inches per year. Per year, this site averages 9.5 inches of snow (NOAA 2005). As with most of the rivers in the arid West, the mountain headwaters are critical for producing the majority of discharge for all the principal rivers originating within the planning area.

There are approximately 1,960 miles of perennial streams within the planning area, and approximately 3,122 mapped lakes and reservoirs. Only 1.6% of the lakes and reservoirs are greater than 10 acres. The largest natural lake is Emerald Lake (approximately 284 acres), which is located within the Weminuche Wilderness Area. The largest reservoir is McPhee Reservoir (approximately 4,328 acres), which is on the Dolores River.

Within the planning area, water quality varies across the landscape. In general, the water quality of most forested watersheds is good. Table 3.3.1 summarizes the streams within the planning area that have been recognized by the State of Colorado as having water quality impairment problems.

Some rangelands in the western portions of the planning area have large areas of exposed marine-derived Lewis and Mancos shale. In these watersheds, salinity and the delivery of salts to the Colorado River is of national concern. Over the past decade, the BLM has focused a great deal of effort on inventorying, monitoring, and designing erosion-control measures that reduce the salt transport to the Colorado River. Figure 3.3.1 shows the surface locations of the Lewis and Mancos shale formations. The highest priorities for future salinity reduction work would occur in the watersheds where these formations are present over large areas.

Groundwater

There are four major regional aquifers within the planning area, all located primarily in sedimentary rocks of the Colorado Plateau. Local aquifers also exist, and can be found in alluvium along major rivers, as well as in volcanic or fractured crystalline rocks. These aquifers have formed as a result of long-term irrigation practices. Table 3.3.2 summarizes the aquifers and their characteristics.

Table 3.3.1 – Waterbodies Classified as Water Quality Impaired

WATERBODY	POLLUTANT	STATUS
McPhee Reservoir	Mercury	State 303(d) List 2006
Silver Creek (above Rico domestic water diversion)	Cadmium, Zinc	State 303(d) List 2006
Silver Creek	Copper, Zinc	State 303(d) List 2006
East Mancos River	Copper	State 303(d) List 2006
Rio Blanco River (lower Rio Blanco)	Sediment	TMDL List for State 305(b) Report 2006

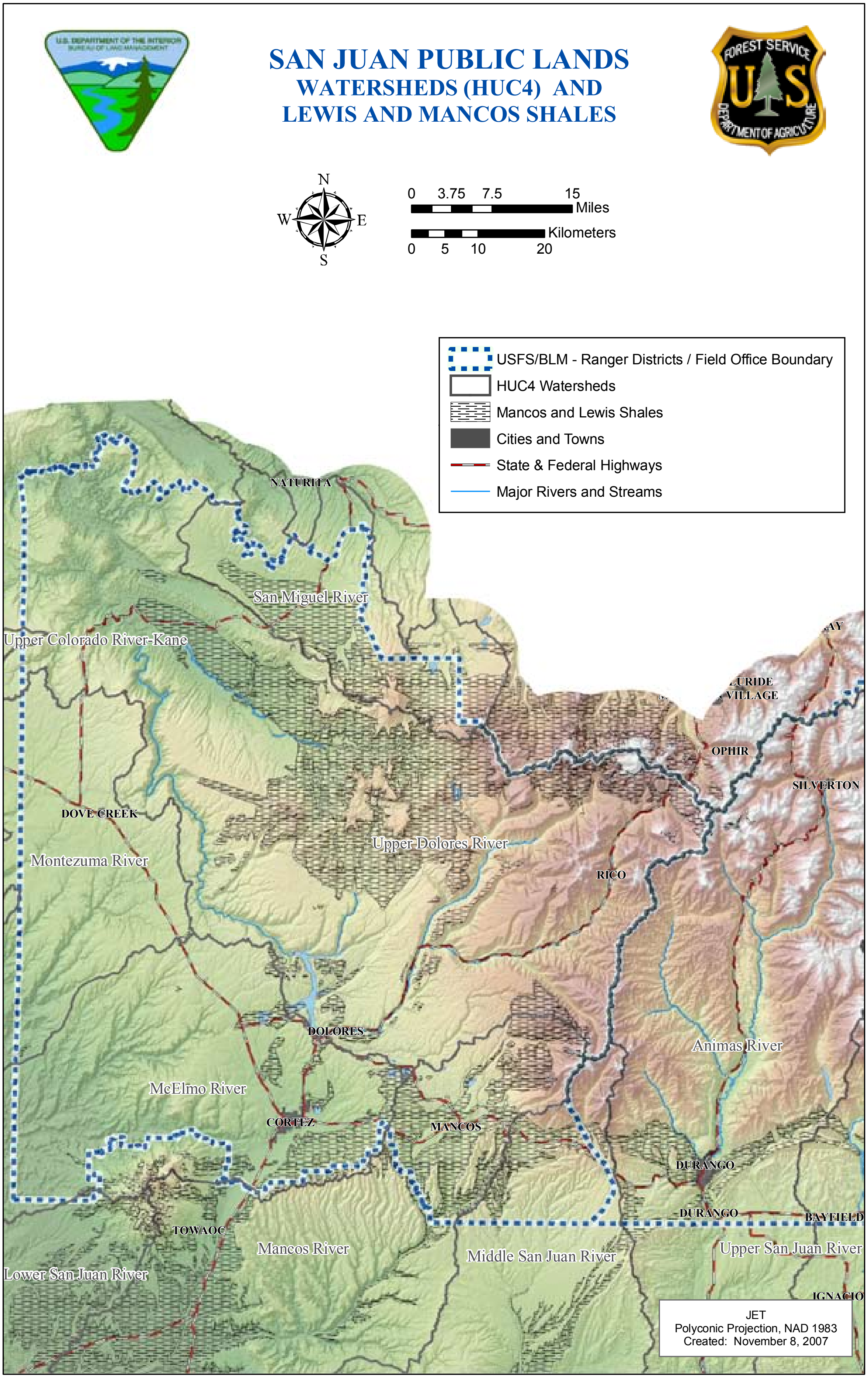
Sources: Colorado Division of Public Health and Environment (CDPHE), 2005; Colorado Water Quality Control Division, 2006.

Table 3.3.2 – SJPL Regional and Local Aquifers

AQUIFER	CHARACTERISTICS	WATER QUALITY
Uinta-Animas	Important regional aquifer of the San Juan Structural Basin.[2] Locally, it is found within the Nacimento and Animas formations and is discontinuous with very slow recharge rates.[1]	Fresh to saline. Fresh water usually located close to recharge areas.[2]
Mesa Verde	Aquifer of the San Juan Basin that is confined by the Mancos shale. Primary recharge from higher-elevation areas in north and central New Mexico.[2]	Highly variable.
Coconino-DeChelly	Located in north and central portions of SJPL.[2]	No detailed water quality data is available.
Dakota-Glen Canyon	Located within several formations, including the Dakota and Morrison Formations.[2]	Locally, good quality water may be present where it is close to the surface. Where it is located at great depths, highly dissolved solids limit its potential use.[2]
Fruitland-Pictured Cliffs	Aquifer of the San Juan Basin. Recharge areas exist within the planning area in La Plata and Archuleta Counties.[4, 5]	Water quality varies from good (in recharge areas) to highly saline (near the San Juan River in New Mexico[4],). [5]
Florida Mesa	Local aquifer located in southeast La Plata County. Recharge from historic and current irrigation.[1]	No detailed water quality data is available.
Major Alluvial Aquifers	Largest quaternary alluvial aquifers are located along the La Plata, Animas, Florida, and Los Pinos Rivers. Most wells completed in these aquifers are less than 170 feet.[3]	Water quality is typically good, but highly variable. Headwater aquifers of the Animas and La Plata Rivers contain high concentrations of heavy metals and are acidic.[3]

[1] La Plata County , 2005.
[2] Ground Water Atlas of the United States (Robson and Blanta 1995).
[3] Tropper et al. (2003). Ground Water Atlas of Colorado.
[4] USDI BLM and USFS (2006). Northern San Juan Basin Project.
[5] Cox et al. (2001). Ground Water-Surface Water Interactions between Fruitland Coalbed Methane Development and Rivers.

Figure 3.3.1 – Lewis and Mancos Shale in HUC 4 Watersheds



Human Activities and Management Activities

Over time, human activity within the planning area has resulted in widespread and varied alterations to hydrologic systems. Stream-system alterations include changes in flow regime, sediment transport, riparian vegetation, stream stability, floodplain function, and aquatic ecosystems. The majority of these changes are associated primarily with land management activities, including road construction, livestock grazing, vegetation management, recreation use, aquatic species management, water diversion/regulation, and mineral development.

Roads

The construction and maintenance of roads has long been recognized as a potential and major source of sediment in forested watersheds (Megahan and Kidd 1972; Reid and Dunne 1984). Roads can change natural run-off patterns by increasing the amount of impervious surface in a watershed, and/or by intercepting overland flow or shallow subsurface run-off. The network of road drainages often routes this water, and the associated sediment, directly into streams (MacDonald and Stednick 2003). Sediment is the major pollutant associated with roads on public lands. Sedimentation in streams impacts water quality, which can, in turn, impact aquatic life. Sediment can also alter channel morphology, which can, in turn, impact aquatic habitat (CDPHE 2002). Road construction and maintenance activities can result in physical changes to streams, including floodplain and riparian habitat modifications, channel degradation, and fish passage reduction. When roads and streams interact, there can also be economic impacts, including higher road maintenance and stabilization costs, and higher water treatment costs for public water supplies. It can also lead to rapid sedimentation, filling in water storage reservoirs and ponds. Ecological impacts commonly associated with stream/road interactions include aquatic, riparian, and wetland habitat degradation (USFS 2005a).

There are an estimated 7,000 miles of road within the planning area. Most roads on the San Juan National Forest (SJNF) were initially built to facilitate timber harvesting. Some of these roads now serve multiple uses as part of the managed road system. Many roads persist on the landscape in an unmanaged state because they were never decommissioned after use. Most roads on BLM-administered lands were built primarily for minerals development and/or exploration, or oil and gas development (and associated seismic exploration activities). Many areas within the planning area exhibit road-related watershed impacts. In relation to roads, most of these watersheds were developed prior to current-day road construction standards and mitigation measures. The lack of funding for adequate road maintenance continues to be a serious problem on much of the 3,000 miles of authorized roads within the planning area. The thousands of miles of unauthorized or unmanaged roads are also problematic. Unauthorized roads have few plans in place or funds authorized to correct erosion/drainage/public use problems that are causing chronic impacts to some watersheds. It is anticipated that degraded watershed conditions will persist until funds and/or priorities address road problems on a watershed-wide basis.

Road densities across the planning area vary from undeveloped Wilderness Areas (such as Middle Vallecito Creek, with no roads) to road densities of more than 7 miles per square mile (such as in the Naturita Creek and McElmo/Crow Canyon watersheds). The average road density across the planning area is 2 miles per square mile. Watersheds with very high authorized and unauthorized road densities often show the greatest road-related impacts. Watersheds with the highest overall road densities within the planning area are summarized in Table 3.3.3.

Table 3.3.3 – Watersheds with the Highest Road Densities within SJPL (Data Includes Authorized and Unauthorized Roads)

WATERSHED	ROAD DENSITY (mi/mi2)	AGENCY	WATERSHED ID (HUC 6)
Naturita Creek	7.4	USFS/BLM	140300036101
McElmo Creek – Crow Canyon*	7.4	BLM	140802020107
Lower Florida River – Cottonwood Gulch*	6.7	BLM	140801040902
Upper Lost Canyon	6.4	USFS	140300020401
East Fork Hermosa Creek	6.3	USFS	140801040402
Lower Alkali Canyon-Narraguinnep Canyon*	6.1	USFS	140802020106
House Creek	5.5	USFS	140300020407
Mud Creek - McElmo Creek	5.5	BLM	140802020301
Spruce Water Canyon	5.4	USFS	140300020402
Upper Cat Creek*	5.3	USFS	140801010604
East Paradox Creek*	5.2	BLM	140300021103
Dolores Canyon - Cabin Creek	5.1	USFS/BLM	140300020603
Hartman Canyon*	5.1	BLM	140802020103
Upper Beaver Creek	5.1	USFS	140801011601

*Watersheds with less than 1,000 acres in Federal ownership

Livestock Grazing

Grazing practices that favor good range and riparian conditions typically have good water-quality outcomes. Within the planning area, grazing has impacted riparian health, stream-channel conditions, upland infiltration and erosion, and water quality. The most common livestock-caused impacts include fecal/bacterial contamination, sedimentation, and increased temperatures. Livestock grazing activities with the highest potential for direct and indirect impacts to water resources include long-term concentrated grazing in riparian areas, and trampling/trailing near water sources. Direct bank damage may add large amounts of sediment directly into streams, especially in wet meadow streams or erosive topography that is prone to gully formation (USFS 2005). Unrestricted livestock use of water features (including streams, springs, seeps, and ponds) can also lead to water-quality contamination (e.g., fecal and microbial).

Concentrated livestock grazing in riparian areas and wetland ecosystems may occur anywhere within the planning area; however, the lower-elevation drier rangelands tend to show more riparian grazing impacts when compared to higher-elevation forested watersheds. Long-term heavy grazing can shift native woody and herbaceous riparian vegetation into riparian areas dominated by non-native grasses and other vegetation, and result in a great reduction in native woody plants (USFS 2005). This can, in turn, lead to the destabilization of streams and to aquatic-habitat degradation.

Over time, there has been a shift from a predominance of sheep grazing on public lands to a current predominance of cattle grazing, with lower overall stocking rates. For example, in the 1930s, approximately 216,684 sheep and 41,968 cattle were permitted on the San Juan National Forest (SJNF). In 2005, approximately 11,905 sheep and 22,382 cattle were permitted. Decreasing livestock numbers has, in turn, reduced watershed-wide impacts from overgrazing; however, localized problems still exist.

Livestock tend to follow predictable patterns of distribution on the landscape. In general, forested rangelands are not areas where widespread livestock impacts to water occur. Livestock use is often concentrated in high-preference sites, including riparian areas and meadows. During the planning process, high-preference grazing areas were mapped for the planning area. Some watersheds have a high proportion of cattle preference areas located in valley floors where floodplains, streams, and riparian areas exist. These areas would most likely show more direct and indirect impacts to streams and riparian areas from historic and current livestock grazing (USFS 2005b).

Table 3.3.4 – Watershed Percent of Valley Floor in High Cattle Preference Grazing Areas

HYDROLOGIC UNIT BASIN	WATERSHED	PERCENTAGE (%) OF VALLEY FLOOR IN HIGH CATTLE PREFERENCE AREAS
140300020305	Beaver Creek - Trail Canyon	68.1
140300020601	Dolores River - Salter Canyon	60.1
140300020306	McPhee Reservoir - Beaver Creek Inlet	56.0
140300020602	Narraguinnep Canyon Natural Area	55.8
140300030407	House Creek	55.2
140801040801	Florida River Headwaters	52.3
140300020403	Middle Lost Canyon	49.3
140300020509	Pine Arroyo	48.7
140300020507	Dawson Draw	48.1
140801020103	Williams Creek	46.5
140801010404	Middle Rio Blanco	46.1

Within the planning area, vegetation management is expected to comply with policies and management techniques, as developed during last 5 years. Range condition should continue on the same trend as the last decade; however, the protection and improvement f riparian areas and wetland ecosystems would likely receive additional emphasis.

Vegetation Management

Hydrology, water quality, riparian areas and wetland ecosystems health and function, as well as channel and biotic conditions, may all be adversely impacted by large-scale vegetation management (Chamberlin et al. 1991). The primary vegetation management tools used within the planning area include timber harvesting, timber stand improvements (TSIs), range management treatments, and fuels reduction. Table 3.3.5 shows the approximate total acreage within the planning area that had different types of vegetation management treatments over the past 30 years.

Range treatments on USFS-administered lands include seeding, planting, and piling slash. Timber activities occur almost exclusively on the USFS-administered lands within the planning area, and include activities such as site preparation (burning and mechanical), harvesting (regeneration cuts, intermediate cuts, and salvage), and slash treatment.

Table 3.3.5 – Vegetation Treatments on SJPL

TREATMENT TYPE	ACRES SINCE 1976	AGENCY	LAND BASE ON SJPL
Range Improvement	40	USFS	0.01%
Timber Activities	227,300	USFS	12%
Range and Other Vegetation Treatments	49,600	BLM	7%

Timber harvesting on USFS-administered land has been concentrated in some watersheds, while no harvesting has occurred in other watersheds. Watersheds that have the highest level of harvest, in relation to the clear-cutting method, are summarized in Table 3.3.6.

Table 3.3.6 – Greatest Clear-Cut Harvest Areas on SJPL

WATERSHED	PERCENTAGE (%) WATERSHED HARVESTED BY CLEAR-CUTTING	PERCENTAGE (%) RIVER VALLEY FLOOR HARVESTED BY CLEAR-CUTTING	HUC 6 ID
Roaring Forks Creek	11.26%	0.62%	140300020205
Upper Lost Canyon	10.61%	2.36%	140300020401
Upper Beaver Creek	10.52%	1.40%	140801011601
Hermosa Creek Headwaters	7.76%	0.40%	140801040401

Some watersheds have been affected (impacted) by large areas of clear-cut harvesting; however, only a small amount of activity has occurred within river valley floors. When all harvesting methods over the past 40 years are considered, approximately 204,700 acres have been harvested in uplands, and approximately 44,700 acres have been harvested within river valley floors.

Harvesting large areas of timber, especially stand conversion timber harvesting, can result in changes in soil water content and water yield; and may create localized site-stability issues. The watersheds identified in Table 3.3.6 may be the most at-risk watersheds for these types of impacts. However, the cumulative impacts of physically harvesting, skidding, building roads, transporting logs, disposing of slash, and preparing sites have a much greater impact on watersheds, when compared to the changes made to vegetation alone. Some watersheds are highly sensitive to disturbances, including to timber harvesting activities (see Appendix J, Volume 3, Sensitive Watersheds on NFS Lands). Watersheds with a large amount of suitable timber lands can be compared to watersheds that are likely to be scheduled for harvesting to determine watershed sensitivity.

Water Uses

Development of water for human use has long been a common occurrence in southwestern Colorado. Limited irrigation occurred as far back as the Pueblo III period (between A.D. 1150 and A.D. 1300). Around Dolores, Mancos, Dove Creek, and Cortez, springs and seeps were developed in order to irrigate small terraces of usually less than 5 acres (Arrington 2006). Along with the earliest European settlements, diversion of water was a common occurrence and included irrigation and mining activities.

Today, there are approximately 1,500 water rights that divert water from streams and springs located within the planning area. A majority of these water rights are owned by non-Federal entities. The size of private water developments, and well as the related amount of water diverted, varies greatly. Small developments for individual families often use less than 15 gallons/minute, while larger irrigation or hydroelectric diversions can be 50 cfs or more. McPhee Reservoir, the largest on-channel reservoir within the planning area, has a total storage capacity of approximately 381,195 acre-feet (BOR 2006).

There are also hundreds of water impoundments located throughout the planning area. Water impoundments and water diversion projects have resulted in numerous direct and cumulative impacts to stream channels, floodplains, aquatic, and riparian area and wetlands ecosystems. Ditch failures and maintenance activities often introduce large quantities of sediment into waterways. Diverting water from streams into ditches can result in major alterations to stream-transport processes. This practice can also reduce or eliminate flow, which, in turn, can affect aquatic ecosystems and habitat. Dam regulation can change stream-flow timing and quantity, and disrupt sediment routing, which, in turn, can affect ecosystems and physical stream characteristics.

There are many examples of developments for water storage and diversion affecting water-dependent resources within the planning area. One example is the McPhee Reservoir. This project affects almost 100 miles of the Dolores River within the planning area. Since the construction of the reservoir, native and desired non-native fisheries have declined, and recreational boating has been curtailed. Riparian areas and wetland ecosystems, river channels, and floodplains have also been greatly modified. Several grassroots efforts have focused on possible solutions designed to improve conditions on the lower Dolores River.

The Blanco Tunnel diverts water from the Blanco River into an underground tunnel for delivery to New Mexico reservoirs. Approximately 8 miles of the Blanco River within the planning area below the Blanco Tunnel are impacted by the greatly reduced flows. Sedimentation problems exist, in part, due to these reduced-flow and diversion operations. Due to sediment-related water quality problems, this river is on the State of Colorado Monitoring and Evaluation List (CDPHE 2006a).

At times, Cascade Creek is completely dewatered below a diversion that has eliminated and/or greatly reduced flows. Loss of flow has impacted fisheries and aquatic ecosystems.

Although one large diversion or impoundment may result in large aquatic resource impacts, many small diversions may also cumulatively impact streams. Watersheds identified in Table 3.3.7 have the greatest number of diversions found within the planning area, and are, as a result, most likely to exhibit cumulative impacts from water-development activities.

Table 3.3.7 – Watersheds with the Most Water Diversions

HUC 6	HUC	NUMBER OF DIVERSIONS
140801070205	Upper Navajo Canyon	39
140801070204	Mancos River-Soda Canyon	33
140801070203	Morfield Canyon	24
140801040101	Animas River above Howardsville	21
140801040102	Cement Creek	18
140801011404	Vallecito Reservoir	18
140801070302	Navajo Wash-Cottonwood Wash	16
140801040103	Mineral Creek	14
140801050102	Mayday Valley	13
140801040601	Junction Creek	12
140801040803	Lemon Reservoir	12
140300020408	McPhee Reservoir - Dolores River	12
140802020301	Mud Creek-McElmo Creek	12
140801010403	Rio Blanco River - Blanco Basin	12
140802020210	Bridge Canyon - Yellow Jacket Canyon	11
140801040502	Elbert Creek	11
140801010302	Fourmile Creek	11
140801010404	Middle Rio Blanco	11
140801020503	Piedra River - Navajo Reservoir Inlet	11
140802020102	Stinking Springs Canyon	11

This data shown above reflects ditches and pipelines with water rights diverted from streams. The demand for water development from public lands will continue to increase over time. Projections show that populations could increase by approximately 89% throughout the Dolores, San Juan, and San Miguel basins over the next 30 years (Colorado Water Conservation Board 2004). The current drought cycles being experienced throughout the Southwest will add to water development pressure. New water-storage projects are continually proposed on public lands. After the 2002 drought, the number of water rights filings within the planning area greatly increased. The drought also caused the State of Colorado to comprehensively study water-shortage issues up to the year 2030, and created a process to help solve predicted shortages. It is expected that some local solutions from the Statewide Basin Roundtable process would include new water development within the planning area.

During the creation of this DLMP/DEIS, desired future conditions for water dependent resources were developed. The emphasis would be placed on protecting aquatic ecosystems, and maintaining streams, floodplains, and watersheds that function well. Maintaining or restoring functioning watersheds and stream systems would ensure that water quality and habitat are protected, as required by Federal and State laws, regulations, and policies. However, demand for new water projects, as well as for proposals to change existing water facilities, may occur. For large water projects, it would be a challenge to provide for large increases in water use while, at the same time, minimizing potential adverse impacts to the environment.

Table 3.3.8 – Largest Reservoirs on SJPL

RESERVOIR	WATER SOURCE	USE
Electra Lake	Cascade Elbert Creeks	Hydroelectric power generation; irrigation
Jackson Gulch Jackson Gulch Reservoir	Mancos River System	Irrigation and domestic use in Mancos Valley; hydroelectric
Lemon Reservoir	Florida River	Irrigation for Florida Mesa, La Plata County; hydroelectric
McPhee Reservoir	Dolores River	Irrigation and domestic in Cortez, Dove Creek, Ute Mountain Ute Tribe, and other irrigated lands; hydroelectric
Summit Lake	Lost Canyon	Irrigation for lands in Montezuma County
Vallecito Reservoir	Los Pinos River	Irrigation for Southern Ute Tribe and other irrigated lands; hydroelectric
Williams Creek Reservoir	Piedra River System	Wildlife, Colorado Division of Wildlife

Sources: Southwestern Water Conservancy District; BOR; Colorado Division of Water Resources, Colorado Water Conservation Board

Wells and other Groundwater Developments

Previous resource management plans related to the planning area did not, for the most part, address groundwater resources. Over the last 5 years, proposals to develop large quantities of groundwater for consumptive use have been steadily increasing. It was recently recognized that the large volumes of groundwater produced during fluid-minerals extraction could impact aquifers as well as the connected surface-water features. A comprehensive groundwater policy has not yet been adopted for USFS-administered lands. For these reasons, direction for groundwater management was developed during the planning process for the DLMP/DEIS. There are approximately 437 water wells located within the planning area. Table 3.3.9 summarizes basic information about existing wells.

Over the past 30 years, 23,000 oil and gas production wells have been drilled in the San Juan Basin. In order to recover methane gas, many of these wells require pumping of groundwater from the Fruitland and Pictured Cliffs Formations. An estimated 25,000 barrels of water per day is produced from the San Juan Basin as a result of coalbed methane (CBM) development. To date, a typical CBM well in this basin has produced 250,000 barrels of water. Almost all of this water is disposed of through reinjection into deep aquifers of poor water quality (BLM and USFS 2006).

Table 3.3.9 – Wells on SJPL

PRIMARY USE	USFS	BLM
Commercial	25	2
Municipal	7	4
Domestic	211	44
Livestock	1	7
Industrial	2	4
Geothermal	3	0
Monitoring	17	47
Recreation	3	1
Irrigation	11	4
Storage	6	0
Other	26	12
Total	312	125

Data includes wells decreed and permitted by the State of Colorado (Colorado Division of Water Resources 2006)

According to a body of evidence drawn by researchers studying the issue of groundwater surface water interaction in the San Juan Basin, groundwater pumping from the Fruitland Formation has the potential to impact surface water quality. As the dewatering of the Fruitland Formation continues, there may be widespread reduction in water quantity to streams, springs, seeps, and riparian areas and wetland ecosystem.

Groundwater pumping also occurs in conjunction with CO2 development in the Leadville Limestone on BLM-administered lands in the western portions of the planning area. Quantities of water vary from 1,000 to 2,166 barrels per day, and the water is of poor quality with high total dissolved solids and salt (Kinder Morgan 2005). Within the planning area, large-scale energy development would continue to result in changes within the Fruitland Formation aquifer. Pumping produced water would continue as existing wells, and a projected 11,000 new wells, are drilled within the San Juan Basin (including in New Mexico) over the next 10 years. At some point, the Fruitland Formation aquifer would be effectively dewatered. Some projections show that it would take several centuries to recharge this aquifer (Cox et al. 2001). Dewatering of this aquifer may cause some springs, seeps, streams, and wetlands located on the Fruitland Formation outcrop to run dry (BLM and USFS 2006).

Mining and Mineral Development

The mountains surrounding Silverton, Rico, Mancos, and La Plata City have historically been areas of intensive mining. Early placer and hydraulic mining resulted in impacts to floodplains and water quality in the La Plata, Dolores, and Mancos Rivers. Hard-rock mine drainage and tailings have increased the natural geologic background of metals and acidity, and have further impacted the water quality of several rivers and aquifers in the Animas River (near Silverton), the La Plata River, the East Fork Mancos River, the Dolores River (near Rico), and the West Fork Dolores River (near Dunton).

Water-quality trends vary across the planning area. Some streams and rivers within the upper Animas River watershed were determined to be impaired by the State of Colorado due to heavy metals pollution. The SJPLC has an active abandoned mine and lands clean-up program. Current clean-up efforts have focused primarily on the upper Animas River watershed. Clean-up work in the upper Animas River, and other polluted watersheds, is anticipated to continue over the next 15 years.

Coalbed methane and CO2 extraction processes may impact groundwater resources, while the infrastructure necessary for fluid-minerals development and transport (e.g., roads, well pads, pipelines, and compressor stations) may result in large impacts to SJPLC-managed watersheds. Where well densities are high, the impacts of infrastructure may be more pronounced. Sedimentation and altered run-off patterns are perhaps the largest contributing factors to surface watershed degradation associated with this type of energy development (BLM and USFS 2006). Even with widespread mitigation, the cumulative impacts associated with building roads, pipelines, well pads, and other infrastructure have been large in some areas. For example, mitigation measures would be implemented in order to reduce sediment delivery to surface water sources; however, high road, pipeline, and well-pad densities may continue to cumulatively impact water resources.

ENVIRONMENTAL CONSEQUENCES

DIRECT AND INDIRECT IMPACTS

Impacts Related to Watershed, Riparian, and Aquatic Habitat Improvement Projects

As a result of the cumulative impacts of previous management activities, many watersheds located within the planning area exhibit poor conditions. Maintaining healthy stream-channel function would be a central focus under all of the alternatives, with the goal being that streams effectively transport discharge, sediment and periodic flooding; and provide aquatic and riparian habitat, as well as a broad spectrum of recreational opportunities. Under all of the alternatives, benefits to pollutant reduction on State 303(d) listed streams, saline soil watersheds, or watersheds identified as having the highest level of cumulative impacts or high sensitivity to management activities would be priorities for SJPLC watershed-restoration programs.

DLMP/DEIS Alternatives: Each of the DLMP/DEIS alternatives would propose annual watershed restoration projects (including erosion control, stream restoration, riparian/lake/fen treatments, road decommissioning, and/or fish habitat improvement). However, Alternatives C and D would propose the greatest number of treatments per year, and may, therefore, result in the greatest benefits overall.

Impacts Related to Roads and Road Densities

Utilizing current direction or guidance for the management of roads may greatly reduce impacts to water-dependent resources. Direction can be found in the Water Conservation Practices Handbook (Rocky Mountain Region Forest Service 2006) and the Surface Operating Standards for Oil and Gas Development (USDOI 1989). Effective measures would include locating roads away from streams, riparian areas, steep slopes, landslide-hazard areas, and high erosion areas. Providing adequate drainage, enforcing seasonal road closures, preserving sediment-filtration buffers, and constructing perpendicular road crossings may also serve as effective mitigation measures.

Current standards and guidelines do not address limiting road densities in order to protect watersheds. Under all of the action alternatives, new guidelines would focus efforts on reducing road miles, as well as road densities in high priority areas. New guidelines would also suggest upper limits for road densities in MA 3s, 5s, and 7s (where most road-related issues are expected). New guidelines would emphasize road decommissioning for unauthorized roads, and would direct focus to watersheds sensitive to disturbance, watersheds with high existing road densities, and watersheds with salinity concerns. These guidelines may result in positive trends in some areas; however, progress is expected to be slow due to limited resources and to the large numbers of unauthorized roads that currently exist.

DLMP/DEIS Alternatives: All of the alternatives would propose some road decommissioning; however, Alternatives C and D would propose the greatest number of miles and may, therefore, have the greatest watershed benefit.

Impacts Related to New Road Construction and Reconstruction

The amount of new road construction and reconstruction occurring within the planning area would vary primarily with the amount of timber harvesting and oil and gas development proposed under each alternative. The majority of the road-related potential impacts to watersheds would be associated with new oil and gas activities. Under all of the alternatives except the no lease alternative which would result in no new road construction , new oil and gas leasing may result in 70 miles of new road construction. If the reasonable foreseeable development (RFD) for oil and gas development is fully realized, many of the new oil and gas roads could be constructed in watersheds with high existing road densities, watersheds with salinity concerns, or within watersheds extremely sensitive to disturbance. With the exception of the upper Disappointment Valley watershed, all watersheds within the potential new lease areas are of concern. This is due to salinity issues, high road densities, and/or sensitivity to disturbance (Table 3.3.10). Specifically, the Dolores Canyon-Cabin Creek watershed has very high existing road densities (5.1 miles per square mile), and has been determined to be very sensitive to disturbance (USFS 2006b). This watershed is within a lease area that may require more road construction for oil and gas development, which could further intensify the potential for watershed degradation. Even with the implementation of guidelines and mitigation measures designed to reduce sediment, the construction of new roads may result in watershed impacts. Mitigation measures would reduce, but would not eliminate, sediment delivery. Roads interrupt and concentrate overland flow, contribute to erosion, and, in some areas, add to existing high road densities, which may add cumulative watershed impacts. Increased delivery of salt and sediment to the upper Colorado River, and increased impacts to streams and aquatic habitat may occur under all of the alternatives. However, the direct, indirect, and cumulative impacts of oil and gas development are speculative. This is because more precise impacts cannot be determined until the timing, location, and exact design of the projects are authorized.

DLMP/DEIS Alternatives: Plans for future timber harvesting may require new road construction and reconstruction. At this time, the size, timing, and/or location of future timber harvesting is not known; therefore, road impacts can only be discussed in a general sense. As a result of timber harvesting, Alternatives A and D may result in higher total road construction needs. These alternatives may also have the highest potential for watershed impacts because road construction associated with timber harvesting in forested watersheds is typically the largest source of sediment (Reid and Dunne 1984; Megahan and Kidd 1972).

Smaller amounts of new road construction may also be associated with recreation development, minerals development, Special Use Permits, and other activities. Although the amount of road construction necessary for these activities is unknown until projects are proposed, the impacts of these activities are not expected to vary by alternative.

Impacts Related to Livestock Grazing

Excessive or unrestricted grazing by permitted livestock and big game may result in widespread impacts on watershed health and water resources. On drier BLM-administered lands it is common for livestock to concentrate within valley/canyon floors, and in riparian areas. This results in water quality (including in riparian areas and wetland ecosystems) and rangeland degradation. Cattle favor the easy access to water and the better forage found in lower-elevation riparian areas. For the majority of USFS watersheds within the planning area, grazing over the last decade has had moderate to low direct and indirect impacts on watershed or stream health (USFS 2005a). Long-term chronic grazing problems that impact water resources occur in localized areas across the planning area. Areas commonly impacted by livestock grazing include mountain grasslands, riparian areas and wetland ecosystems, alpine vegetation, semi-desert grasslands, as well as places where livestock concentrate directly on or near water sources.

Table 3.3.10 – Watersheds Potentially Affected by Oil and Gas Development as a Result of New Leasing Decisions

HUC 6	WATERSHED	WATER-SHED ACRES	NUMBER (#) OF WELLS PER WATERSHED	MILES OF NEW ROAD	TOTAL ACRES OF DISTURBANCE*
140300020406	Upper Dolores River - Italian Creek	13,217	2	1	8
140300020509	Pine Arroyo	10,944	29	14.5	116
140300020507	Dawson Draw	18,108	22	11	88
140300020604	Dolores Canyon - Lake Canyon	45,632	4	2	16
140300020404	Stapleton Valley	12,070	8	4	32
140300020504	Ryman Creek	15,937	5	2.5	20
140300020505	Upper Disappointment Creek	26,104	19	9.5	76
140300020602	Narraguinnep Canyon Natural Area	24,900	9	4.5	36
140300020603	Dolores Canyon - Cabin Creek	21,823	14	7	56
140300020601	Dolores River - Salter Canyon	14,672	26	13	104
140300020510	Upper Disappointment Valley	11,953	1	0.5	4
140300020306	McPhee Reservoir - Beaver Creek Inlet	11,686	1	0.5	4
	TOTAL	227,046	140	70	560

*Approximately 4 acres of disturbance per well, including new roads.

Watersheds with salinity concerns.

Watersheds with high existing road densities that are sensitive to disturbance.

No shading indicates watersheds sensitive to disturbance.
This is the reasonably foreseeable development (RFD) scenario.

The impacts related to livestock grazing on water resources in the planning area may include increased grazing pressure on areas that are sensitive to impacts (such as to riparian areas and wetlands ecosystems, and to wet meadows). Increased grazing pressure in these sensitive areas may degrade aquatic and riparian conditions through the direct, physical removal of vegetation and trampling; or through the indirect changes to vegetation species composition, decreased shading/increased water temperatures, and changes in water chemistry (USFS 2005a). The protection and improvement of riparian areas and wetland ecosystems would receive emphasis under in all of the alternatives; however, the degree of success would depend largely upon individual grazing permittees.

DLMP/DEIS Alternatives: Permitted livestock grazing, as well as the acres of land suitable for livestock grazing, would vary moderately by alternative. Alternative D may result in the highest potential impacts to watersheds and water resources because, out of all of the alternatives, it would propose the largest amount of suitable acreage for livestock grazing, as well as the largest amount of projected AUMs for both sheep and cattle. Alternative C would have the fewest acres of land suitable for livestock grazing and lowest potential AUMs; therefore, it may have the lowest potential watershed impacts. Alternative A and B would propose the same number of suitable livestock grazing acres; therefore, the potential impacts to watershed resources may be similar to alternative C (which proposes only slightly fewer acres). The direct, indirect, and cumulative impacts of domestic livestock grazing may increase under Alternative D.

Impacts Related to Timber Harvesting and Fuels Treatment

Water-Yield Impacts - Timber harvesting and fuels treatments are vegetation management activities that have the potential to impact watersheds and stream health. Major reductions in forest canopy can increase water-yield in forested watersheds. These increases can be large in some regions (including in drier areas, such as lower-elevation forests); however, the reductions are typically represent such a small increment of total water-yield that they can rarely be measured in larger watersheds. Annual climate variations are much more important (Rocky Mountain Region Forest Service 2006). Flow increases occur mostly during spring run-off and during the summer; they are not significant until about 25% of the basal area of a forested watershed is cut (USFS 1980). Large openings can suffer snow scour that can reduce site moisture and water yield (Rocky Mountain Region Forest Service 2006).

Timber harvesting acres would be spread throughout many forested watersheds within the planning area; however, their exact amount and location would not be known until specific projects are proposed. It is not expected that watersheds would receive timber harvesting treatments that would exceed 25% basal area removal over the life of the final approved LMP; therefore, detectable changes in water-yield would, generally, not be a concern. On a site-specific basis, certain sensitive watersheds can have water-yield concerns. Some watersheds are prone to mass failure and may be especially sensitive to small changes in water-yield. Other watersheds have experienced large amounts of disturbance (including as a result of past management activities, severe climatic events, and/or large wildfires) and may have water yield-issues. Those watersheds would be analyzed on a project-by-project basis in order to evaluate if water-yield concerns exist. Then the appropriate guidelines and design criteria would be applied to such projects, as needed, in order to reduce water-yield concerns. The volume of timber harvesting is anticipated to be lower than predicted in the current LMP, and would be largely limited to existing roaded areas. The large-scale road construction that occurred over the past two decades is not anticipated to occur during the next planning period, because most of the infrastructure is already in place within the planning area.

DLMP/DEIS Alternatives: In terms of timber harvesting, the volume of timber harvesting under all of the alternatives is anticipated to be lower than predicted in the current LMP, and largely limited to existing roaded areas. The large-scale road construction that occurred over the past 2 decades is not anticipated to occur during the next planning period (because most of the infrastructure is already in place within the planning area). In terms of fuels treatments, there is no meaningful variation between the alternatives; therefore, the potential impacts to watersheds may be identical under all of the alternatives. In general, fuels treatments would not be expected to result in measurable impacts to water-yield because such treatments (including mechanical treatments and prescribed burns) primarily target the understory and small-diameter trees; therefore, they may not measurably alter basal area (except in dry, pinyon-juniper vegetation types). Wildland fire use (WFU), on the other hand, may have the potential to result in large changes in basal area and, consequently, may increase water-yield, depending upon the individual fire. The potential for increased water-yield is greatest if WFU occurs in spruce-fir and cool-moist mixed-conifer stands that exist in the wettest areas within the planning area. Water-Quality Impacts - Sediment is the primary pollutant associated with timber harvesting. With regard to all timber harvesting activities, implementation of Water Conservation Practices, BMPs, guidelines, and proper design criteria are typically effective in preventing or reducing sediment delivery to water bodies.

Road construction associated with timber harvesting has a higher potential to impact water quality. New road construction has the greatest potential for direct or indirect watershed impacts associated with timber harvesting (Megahan and Kidd 1972; Reid and Dunne 1984). Reconstruction on stabilized roads that are covered with vegetation can generate increased sediment (Swift 1984), just as new road construction is a large source of sediment to forested watershed streams.

Vegetation management activities within the planning area are expected to comply with the policies and management techniques developed over the last 5 years. The reduction of wildfire risk through fuels treatment would continue to be emphasized on public lands. In the long term, reducing the risk of uncharacteristic wildfires may be a benefit to watersheds, and may support the desired conditions for overall water quality (including stream channels, floodplains, groundwater, and watersheds).

DLMP/DEIS Alternatives: In terms of water-quality impacts, Alternatives A and D may have the highest level of objectives for timber harvesting and may, therefore, have the highest potential for sedimentation impacts (although the impacts from harvesting vegetation are expected to be small). In terms of timber production, the impacts resulting from the implementation of either Alternatives B or C may have fewer overall watershed impacts, when compared to Alternatives A and D. This is because the proposed volume of timber harvesting, as well as the magnitude of associated harvesting activities, under Alternatives B and C are lower than that proposed for Alternatives A and D. Most of the infrastructure necessary in order to support timber harvesting already exists. The amount of road reconstruction (on a per-decade basis) is: Alternatives D, 8.2 miles; Alternative B, 7.6 miles; and Alternative, 7.2 miles. No new road construction would be necessary for timber harvesting under Alternatives B and C; however, 3 miles of new road construction would be proposed under Alternatives A and D (annually, over the next decade). In terms of fuels treatments, there are no meaningful differences between alternatives, even though Alternative D would propose a slightly higher treatment acreage for 4 cover types.

Impacts Related to Water-Development Projects

Depending upon the size and type of project, the development of water for uses within the planning area (as well for adjacent private properties), may result in a range of potential impacts to stream channels, aquatic habitat, and riparian vegetation. However, the direct, indirect, and cumulative impacts of water development are speculative at this point because the number of proponent-driven projects projected within the time frame of this DLMP/DEIS are unknown.

Most water uses within the planning area are primarily for livestock and wildlife watering, recreation (campgrounds), and administrative sites. There are also a small number of irrigation and fish pond (piscatorial) water uses. With the exception of irrigation and piscatorial uses, the amount of water for planning area uses tends to be small (usually less than 5 gallons per minute, or 0.01 cfs for a source of water). Each year, for the next 10 years, it is expected that there could be an average of 2 new livestock developments within the planning area. The total quantity of water used by livestock and wildlife would not change much over the next planning period. Most livestock and wildlife developments would be built in order to move the use from the actual source of water to a site that protects an area from trampling and contamination, or to facilitate better grazing distribution (which may benefit water quality and riparian habitat). Development of water may also occur if new campgrounds are built, or if/when existing campground water use shifts from surface sources to wells to protect public health. The number of new water developments for uses within the planning area is not expected to vary by alternative.

Diversions reduce or eliminate downstream flows, which may, in turn, affect channel size and limit habitat for aquatic and riparian species. Dams alter flow regimes by storing water during run-off (for later release). Dams and diversions can impose substantial barriers to migration of aquatic species, and can dewater streams during certain time periods, which can, in turn, fragment aquatic ecosystems (USFS 2005a). In some cases, altered flow regimes prolong periods of run-off and can enhance riparian vegetation communities. Water wells can reduce the amount of water in connected streams, springs, and seeps, which, in turn, can have similar impacts to structural water diversions.

Dams impact stream channels in different ways, depending upon their operation. Reservoirs store sediment and release sediment-free water below the dam. Water storage reduces peak flows, which, in turn, can reduce the frequency and magnitude of flushing flows. The result can be the reduction of channel capacity, alteration of aquatic habitat, as well as changes in temperature and other factors that can affect spawning and reproductive success of aquatic species.

It is estimated that new water-development projects would continue to be proposed for the planning area in order to meet private water-supply needs. The Statewide Water Supply Initiative Basin Roundtables may propose several new water-development projects for the planning area. On-going drought, as well as population growth, may also be factors that lead to increased water development applications for the planning area. The SJPLC has the responsibility to ensure that permits are consistent with the revised LMP, as well as with all other applicable laws and regulations. As permits are amended, renewed, or issued, the water projects would be analyzed for environmental impacts, as well as to determine what terms and conditions are necessary.

DLMP/DEIS Alternatives: Some projects may result in major impacts to water resources; however, these impacts are not expected to vary between the alternatives. This is because demand for water-use authorizations is driven by proponents, rather than by SJPLC programs or budgets.

Impacts Related to Mining, Oil and Gas Development, and Mining Reclamation

Mining activities conducted within the planning area may include gravel operations, landscape rock, hard-rock mining, and uranium mining. New mining operations for locatable minerals are expected to be small, and limited in quantity. Increases in mining activity are not anticipated; however, to a certain extent, this cannot be predicted. Federal authority over mining activities allows for the setting of terms and conditions in operating plans in order to minimize impacts to public lands. Mining activities may impact water quality and water quantity. Impacts to aquatic resource are assumed to be proportional to the amount of land available for locatable minerals.

The abandoned mines reclamation occurring within the planning area is an intensive program. This is due to the high number of abandoned historic mines in the San Juan Mountains. As work is completed, the number of sites reclaimed is expected to remain steady, or to slowly decrease over the next decade. Mine reclamation work is not expected to vary by alternative. The primary objectives of this program include improving water quality and watershed condition. This work is expected to have a net positive impact on water resources under all of the alternatives.

Fluid-minerals development (e.g., oil, methane gas, and CO2) may result in a broad spectrum of watershed impacts. Construction of new roads, well pads, pipelines, compressor stations, and other site disturbances would be necessary in order to develop fluid-minerals resources. Long-term ground disturbance increases the risk of erosion and sediment transport to surface water. (The impacts related to roads are discussed above in more detail.) The majority of fluid-mineral wells within the planning area produce water of variable, but usually poor, quality that must be disposed of. Dewatering target formations can lead to a connected dewatering of surface seeps, springs, and streams, which may, in turn, impact riparian, wetland, wildlife, and aquatic habitat, as well as human water supplies. Dense pipeline infrastructure increases the risk of spills from pipeline failure, and may contaminate surface and ground water. Well construction in watersheds containing erosive saline soils can produce saline run-off, which may, in turn, increase salt loads in the upper Colorado River.

The infrastructure necessary to support energy development would continue to increase the density of roads, pipelines, and other ground-disturbing activities within the San Juan Basin, Dry Creek Basin, and Disappointment Valley areas.

Large-scale energy development is an agent of change within the Fruitland Formation aquifer. Pumping-produced water would continue as existing wells, and a projected 11,000 new wells, are drilled within the San Juan Basin (including in New Mexico) over the next 10 years. At some point, the Fruitland Formation aquifer will be effectively dewatered. Some projections show that it would take several centuries to recharge this aquifer (Cox et al. 2001). Dewatering of this aquifer would likely cause some springs, seeps, streams, and wetlands located on the Fruitland Formation outcrop to run dry (BLM and USFS 2006).

DLMP/DEIS Alternatives: With the exception of the no lease alternative, there are only minor differences proposed under alternatives A, B and D. This is because these alternatives would propose slightly different amounts of ground-disturbing activities, would propose approximately the same availability as acreages for new fluid-minerals leasing, and approximately the same number of new road construction miles. Alternative C would propose the fewest acres available for leasing, and would project slightly fewer wells; therefore, it may result in slightly lower levels of potential watershed impacts. Within the 2,000,135 to 2,097,278 acres made available for leasing under alternatives A, B and D, as many as 167 new wells may be drilled on currently unleased lands; 70 miles of associated new road may be constructed; and additional disturbances (i.e., well pads) could result. NSO and CSU stipulations would avoid impacts on slopes greater than 40%, on landslide-prone areas, and on water-influence zones. Watershed BMPs would apply to all fluid-minerals development, and would reduce some potential impacts. Of all activities that could occur within the planning area over the next planning period, water-development projects, new large water development projects, and fluid-minerals development may have the highest potential to adversely impact water resources. The no lease alternative would essentially result in no change from existing conditions related to current oil and gas development activities, and would have the lowest level of potential watershed impacts.

CUMULATIVE IMPACTS

Unless specified differently, the cumulative impacts analysis described herein is for the period of expected LMP implementation (which is 10 to 15 years), and is bounded by the 5th level hydrologic unit code boundaries (5th -level HUC). (An example of the size of a 5th-level HUC would be roughly the size of Hermosa Creek or the Piedra River watersheds.)

Looking past the boundaries of the planning area in order to consider how the direct and indirect impacts of management activities would cumulatively add to downstream water quality, the most important consideration is that the headwaters of streams and rivers are located on public lands. With the exception of some lands in the upper Animas River watershed and in the northwest portions of the planning area, there are no water courses that originate on private lands that flow into the planning area. The direct and indirect impacts analysis shows that SJPLC management activities may impact downstream water; however, overall water quality as it leaves the planning area is good in most places, as documented by the Colorado Division of Water Quality. However, there are several planned activities that may have major cumulative impacts on water quality.

It is likely that there would be cumulative impacts resulting from the 2,200 new wells proposed to be drilled on or adjacent to the planning area over the next planning period. In addition to an estimated 170 new wells that may be drilled on new leases (discussed under direct and indirect impacts), there could be as many as 450 new and in-fill wells drilled in the northern San Juan Basin; approximately 1,000 new wells drilled on the Southern Ute lands adjacent to the planning area; and 240 new wells on previously leased land in the Paradox Basin. Development of the RFD projected wells would require new roads, pipelines, and associated disturbance for well construction. Consequently, oil and gas development may have the greatest potential to have major cumulative impacts, when compared to all other activities that affect the planning area. The magnitude of new road/pipeline construction and other disturbances would not vary by alternative.

Areas where the greatest impacts may be expected are the Lower Piedra and Lower Pine watersheds (below the planning area), and the Dolores River below Disappointment Creek. Saline contributions to the upper Colorado River, and to its tributaries, may increase with the cumulative impacts of oil and gas activities from new leases in the Paradox Basin.

WFU and other fuel treatments would be implemented in order to reduce the long-term potential for large uncontrollable fires. The effect of any cumulative changes in water yield due to WFU may be considered small, in comparison to large wildfires that may burn with high intensity and high severity over entire watersheds.