3.9 Environmental Justice

Executive Order 12898, dated February 11, 1994, established the requirement to address environmental justice concerns in the context of federal actions. Federal agencies are required to avoid, minimize, or mitigate disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority and low-income populations.

The entire three-county Project Area has a lower median household income than the State and the nation. The proportion of the population living below the poverty level within the Project Area is slightly higher than in the State. Logan and Grady have the lowest proportions of residents living below poverty level, at 11.1 percent and 12.5 percent, respectively. Tucumcari and Portales have the highest proportion of residents living below poverty level, at 24.8 percent and 24.9 percent, respectively. These proportions are approximately 1.35 times higher than the State average; however, of these residents, the proportion in Portales may be influenced by students at ENMU.

Minority populations vary considerably across the Project Area, from 0 to 55.7 percent. The national average is 30.9 percent, State average is 55.3 percent, and the average for the Project Area is 40.3 percent. The primary minority population is Hispanic. Based on definitions set by Executive Order 12898, Texico and Tucumcari are considered minority communities because minority populations exceed 50 percent; however, these community averages are very close to the State average.

Chapter 4. Effects Analysis

This section is an evaluation of the potential environmental effects of the No Action Alternative and Proposed Action. The *Hydrology* section, which includes surface water, ground water, water quality, and geomorphology, is the primary "driver" for other resource impacts. It may be necessary to refer to the *Hydrology* section for maps, tables, and clarification of concepts.

4.1 Hydrology

In the *Effects* section that follows, the terms "wet," "dry," and "average" are used. These terms were defined for purposes of this analysis by the following method: using the 41-year reservoir period of record, simulated reservoir inflow data were sorted from high to low and were then divided into three parts. The third of the data with the lowest simulated reservoir inflows were classified as dry year, the middle third as average year, and the upper third as wet year. These divisions are intended to provide relative context for discussion and evaluation of potential impacts.

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The hydrology effects analysis for the No Action Alternative assumes that future conditions in Ute Reservoir will be the same as existing conditions. However, in the absence of the Project, NMISC would seek to put Ute Reservoir water to beneficial use (domestic, M&I, and irrigation uses) by pursuing other purchasers.

4.1.1 Surface Water

Potential effects on Ute Reservoir and the Canadian River from the No Action Alternative and Proposed Action are described and compared in the sections below. Potential minor, temporary effects due to Project construction would occur at Running Water Draw and Frio Draw; however, these effects would be minor and are not discussed further.

4.1.1.1 Ute Reservoir

An existing monthly mass balance model for Ute Reservoir was used to estimate the future storage in the reservoir under both the No Action Alterative and the Proposed Action (CH2M HILL 2007; Whipple 1994). The No Action Alternative is an extension of existing conditions (i.e., no Project demands on the reservoir), while the Proposed Action analysis simulates the 16,450 AF annual Project demand under the historical hydrologic conditions. The maximum effect of withdrawing 16,450 AFY is considered in this effects analysis. This approach conservatively estimates a worst-case scenario for effects on reservoir contents.

The model is a mass balance model that uses historical Ute Reservoir contents to estimate historical inflows based on 41 years of historical data from 1966 to 2007. Historical inflows are then used to simulate the No Action Alternative and the Proposed Action. Several types of studies for eastern New Mexico were reviewed to make sure the period of record for the historical reservoir contents was a reasonable representation of potential hydrology for Ute Reservoir. The Project team compared the range of hydrologic conditions in the period of record for historical reservoir contents to the range of hydrologic conditions from several longer term hydrology datasets including precipitation records, Palmer Drought Indices, and tree ring data. The historical simulation period was determined to be reasonably representative of the potential hydrologic variation (MWH 2008).

The effects of two agreements—the Compact and the Management Plan—were included in the analysis. In the model, Compact releases were simulated when Ute Reservoir storage exceeded the Compact maximum. The minimum baseflow of 3 cfs to the Canadian River was assumed to be met by continued leakage from the reservoir at rates similar to those that have occurred

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historically. A sensitivity analysis demonstrated that making dedicated releases to meet baseflow requirements would not significantly affect simulated reservoir levels over the model period.

A summary of Ute Reservoir simulation results is shown in Table 14. Effects on mean simulated reservoir storage, stage, depth, and surface area are summarized. Reservoir storage, stage, and surface area are all lower for the Proposed Action when compared with the No Action Alternative because of the Project diversions. The decrease in reservoir releases/spills of 11,050 AFY for the Proposed Action would be a benefit to the State, because the Proposed Action would utilize that water for M&I demands within the State instead of releasing it to downstream users.

Table 14. Simulated Effects on Ute Reservoir for 1966–2007 Historical Inflows.

	Simulated Value		Effects	
	No Action Alternative	**Proposed Action**	**Magnitude**	**%**
Mean Annual Storage Contents (AF)	174,350	146,130	-28,220	-16
Mean Annual Reservoir Stage (ft)	3,781	3,775	-5	--
Mean Annual Reservoir Depth (ft)	73	67	-5	-7
Mean Annual Reservoir Area (ac)	6,289	5,508	-781	-12
Mean Annual Releases/Spills (AFY)	23,910	12,860	-11,050	-46

Source: MWH 2009b.

Figure 19 shows how the reservoir elevations would be different for the No Action Alternative and the Proposed Action. These elevations are based on changes in reservoir storage over the simulation period. Reservoir contents are lowest during dry periods (e.g., from simulation years 9 through 15 and simulation years 36 through 41), and the difference between reservoir contents for the No Action Alternative and the Proposed Action is greatest during dry periods. Simulated reservoir contents would never be less than the fisheries minimum pool for either the No Action Alternative or the Proposed Action. The largest difference in storage between the No Action Alternative and the Proposed Action would occur during the late spring and early summer months before the late summer rainy season. Releases through the reservoir outlet works were assumed to be made when storage was simulated to exceed the Compact maximum, but the rate of release was limited to the safe discharge rate of the outlet works of about 325 cfs. The limited release rate resulted in storage that would exceed the Compact maximum for periods when releases would continuously be made until storage was reduced within the Compact maximum.

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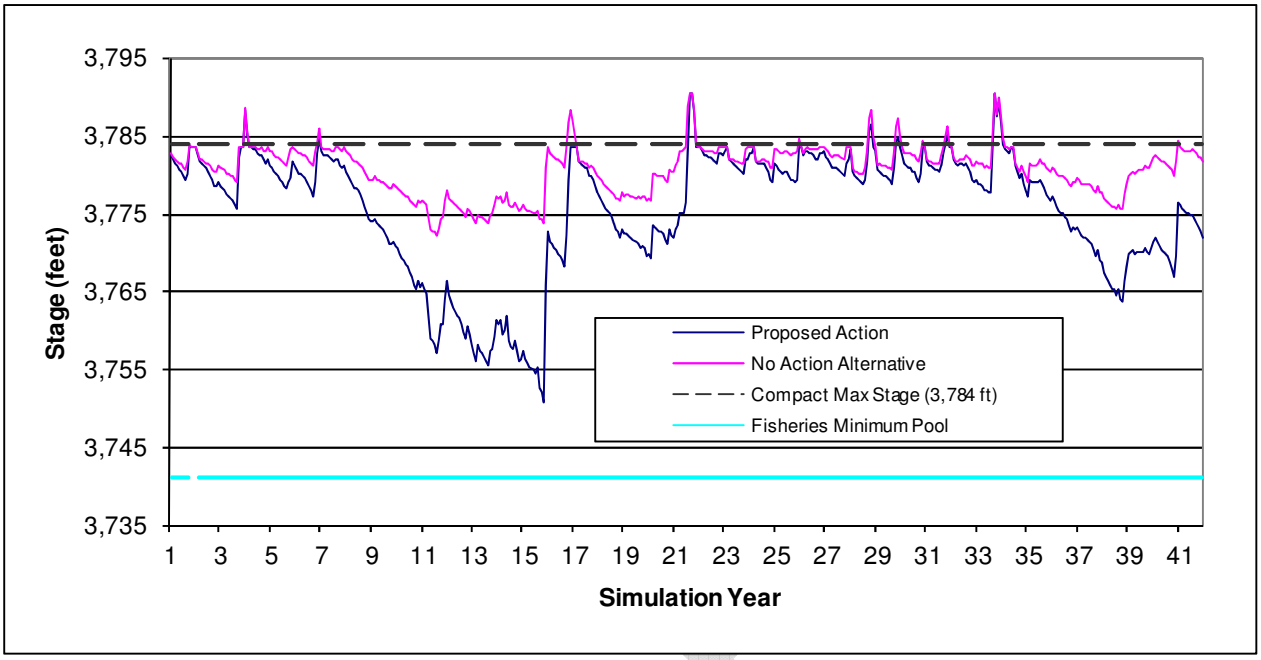
Figure 19. Simulated Ute Reservoir Elevation (Stage) Time Series.

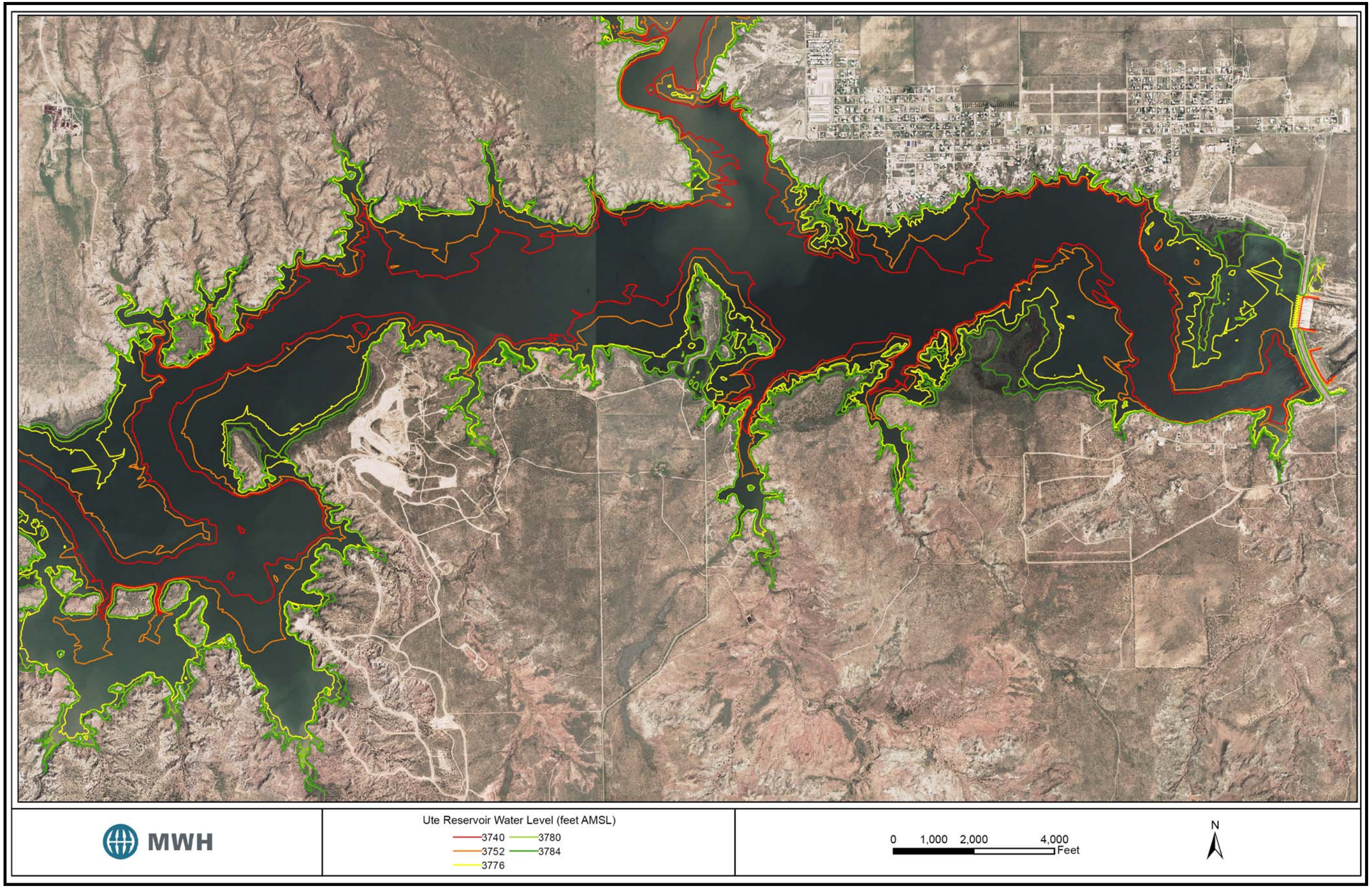


Source: MWH 2009b.

Ute Reservoir footprints are shown for a range of elevations from 3,740 to 3,784 feet asl in Figure 20, representative of the range of elevations from the fisheries minimum pool elevation (3,742 feet) to the current Compact maximum pool elevation (3,784 feet). Ute Reservoir surface area contours were based on available bathymetry data, which include contours at intervals of 4 feet. As a result, the closest matching contour to modeled reservoir elevations is shown in Figure 20. In addition to the fisheries minimum pool elevation and maximum spillway elevation, the following simulated reservoir footprints are shown in the figure:

- Average simulated reservoir stage over the 41-year simulation period for the Proposed Action (3,775 ft; closest available elevation footprint is 3,776 ft)
- Average simulated reservoir stage over the 41-year simulation period for the No Action Alternative (3,781 ft; closest available elevation footprint is 3,780 ft)
- Reservoir stage for the driest period simulated (i.e., winter of simulation year 15) for the Proposed Action (3,751 ft; closest available elevation footprint is 3,752 ft)
- Reservoir stage for the driest period simulated (i.e., winter of simulation year 15) for the No Action Alternative (3,772 ft; closest available elevation footprint is 3,776 ft)

Figure 20. Simulated Ute Reservoir Footprints.



4.1.1.2 Canadian River

Because the Canadian River baseflows were assumed to be maintained as specified in the Management Plan, the largest effect on flows in the river would be from changes in Compact releases and spills from the reservoir. The NMISC outlet structure capacity for releases is about 325 cfs. With the new water supply demands on the reservoir, there would be fewer time periods when storage in the reservoir is greater than the Compact maximum and spills are required (Table 15).

Table 15. Simulated Ute Reservoir Releases/Spills.

	Simulated Value		Effects	
	No Action Alternative	Proposed Action	Magnitude	%
Average annual releases/spills (AFY)	23,940	12,860	-11,050	-46
Maximum monthly releases/spills (AF/mo)	76,031	59,493	-16,538	-22
# Months Compact releases/spills	69	40	-29	-42

Source: MWH 2009b.

While these averages provide some useful information to compare the alternatives, they do not give a clear picture of when effects would be greatest. Differences in average annual Compact releases/spills from Ute Reservoir (Figure 21) would be greatest during wet years (about 24,000 AFY less for the Proposed Action), less for average years (about 4,900 AFY less for the Proposed Action), and the least for dry years (about 3,700 AFY less for the Proposed Action). Each of the years in the 41-year simulation period was classified as dry, average, or wet by ranking the simulated reservoir inflow for the years and dividing them into the lower third (dry years), middle third (average years), and upper third (wet years). As described above in Section 4.1.1.1, the simulation period was reasonably representative of long-term hydrological variability for Ute Reservoir. As a result, division of the 41-year simulation period based on a ranking of simulated inflow was assumed to be a reasonable approximation of identifying hydrological conditions for the simulation period (Figure 22).

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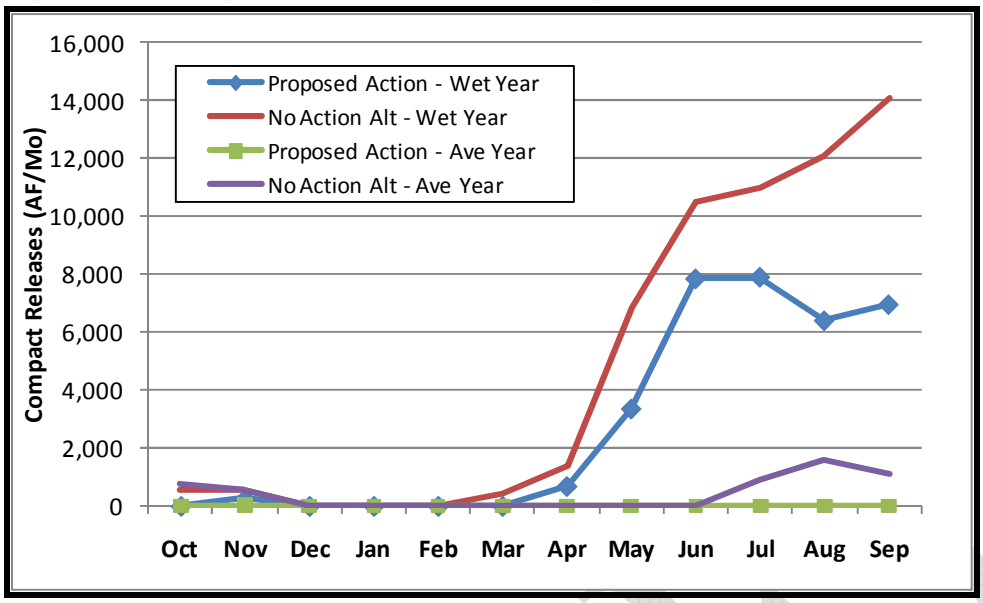
Figure 21. Average Annual Releases for Average, Wet, and Dry Years.



Source: MWH 2009b.

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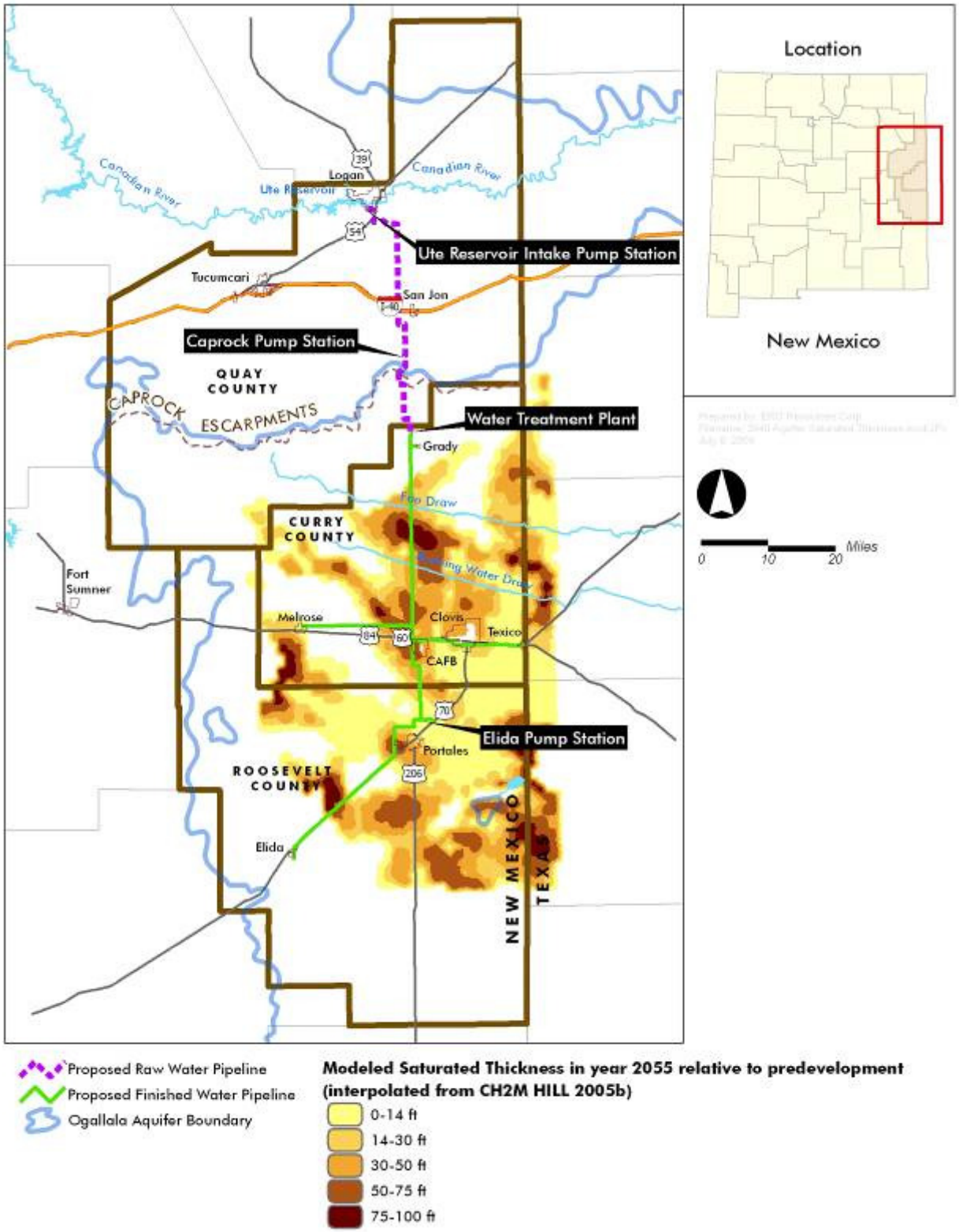
Figure 22. Declines in Saturated Thickness for the No Action Alternative.



Source: CH2M HILL 2005b.

The average change in flow at the state line was estimated using the available gage information and an estimated transit loss of 0.16 percent per stream mile (5.8 percent total loss between Logan gage and the state line) based on existing transit loss models. Transit loss per stream mile was calculated based on estimates of transit losses between the Canadian River at the Logan gage and Canadian River at Amarillo stream gages reported in previous studies (Reclamation 1960; HDR 1987; Parkhill et al. 1992). The volume of releases/spills reaching the state line would be less than the volume at Ute Reservoir for the No Action Alternative and the Proposed Action as a result of transit losses. The magnitude of effects would be less at the state line (decrease of 10,410 AFY) than at Ute Dam (decrease of 11,050 AFY), but the effects under the Proposed Action as a percentage of No Action Alternative conditions would be the same for the two locations (46 percent decrease in releases/spills; Table 16).

Table 16. Canadian River Streamflow Effects Associated with Releases/Spills over 41-Year Simulation Period.

	Total # Releases/Spills Ute Reservoir and State Line[1]	Streamflow from Releases/Spills (AFY)	
		Canadian River below Ute Reservoir	Canadian River at State Line[2]
No Action Alternative	69	23,910	22,520
Proposed Action	40	12,860	12,110
Effects (magnitude)[3]	-29	-11,050	-10,410
Effects (percent)[4]	-42%	-46%	-46%

[1] Total number of releases/spills over the 41-year simulation period.
[2] Assumed transit loss of 0.16 percent per stream mile (5.8 percent total loss between Logan gage and state line).
[3] Effects (magnitude) calculated as (Proposed Action – No Action Alternative).
[4] Effects (percent) calculated as (Proposed Action – No Action Alternative) / No Action Alternative.
Source: MWH 2009b.

4.1.2 Ground Water

Results from previous ground water studies were used to determine the potential effects of the No Action Alternative and Proposed Action on ground water resources in the Project Area. Modeling estimated the effects of changes in ground water use on saturated thickness (the difference between the water level in the aquifer and the "bottom," or bedrock level) in the aquifer.

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4.1.2.1 Ogallala Aquifer

No Action Alternative Assumptions

Under the No Action Alternative, the existing trends of water use from the Ogallala aquifer would continue. Modeling completed for the No Action Alternative assumed that the agricultural and M&I uses would remain the same. The Ogallala aquifer would continue to be drawn down. As the saturated thickness continues to decrease, wells would produce less and more wells would have to be drilled to keep up with demand.

Proposed Action Assumptions

To determine ground water effects for the Proposed Action, M&I demands on the aquifer were assumed to decline, and agricultural demands were assumed to remain the same. The assumption also was made that the existing ratio of ground water use (i.e., 96 percent agricultural uses and 3 percent for M&I uses) would be reduced due to the Proposed Action. Supply from the Proposed Action would provide about 86 percent of the water demands in the Project Area, so that about 2,345 AFY of ground water supplies would still be needed for M&I uses in about 2060. Interpretations of previous ground water modeling results were developed for each model node where the Proposed Action would change M&I ground water withdrawals. Results were then averaged for each of the Participant areas. Although the decline in ground water levels and saturated thickness associated with M&I demands would be less for the Proposed Action, the dominating influence of agricultural demand would result in continued declines in water levels under both alternatives.

Effects of the Alternatives

The effects of the No Action Alternative and Proposed Action on fresh ground water supplies in the Ogallala aquifer would be similar due to the relatively small amount of demand for M&I supply compared to agricultural demand. Declines in saturated thickness for the Proposed Action would be slightly less than those for the No Action Alternative because of the small reduction in overall pumping as a result of the lack of M&I pumping, providing a small beneficial effect on water levels. Aquifer levels are expected to continue to decline throughout the Project Area. The severity of decline in saturated thickness varies due to differences in agricultural uses and natural variability in aquifer conditions. Table 17 shows the simulated results.

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Table 17. Simulated Results for Declines in Ogallala Aquifer Saturated Thickness.

Community	2005 Saturated Thickness (ft)	Average Change in Saturated Thickness (ft)	
		No Action Alternative	Proposed Action
Clovis	69	-42	-41
Melrose	11	+2	+2
Portales	69	-41	-40
Texico	100	-97	-95
CAFB	89	-54	-52

Note: Elida and Grady saturated thickness declines were not simulated.
Source: MWH 2008.

In addition to a decrease in saturated thickness, declining ground water levels under both the No Action Alternative and the Proposed Action would continue to correspond to a decrease in well yields. Lower water levels likely would cause the aquifer formation to compress, resulting in further yield decreases. Deeper wells and additional wells would continue to be required, which would increase the cost of using ground water for M&I supply.

4.1.2.2 Other Regional Aquifers and Brackish Aquifers

The northern portion of Quay County would not be served by the Proposed Action since the towns and developments rely on fresh ground water supplies that appear to be stable. Given that there would not be changes in recharge and discharge attributable to the Project, it was assumed that there would be no ground water effects for Quay County.

The two brackish ground water formations that underlie the Ogallala aquifer would not be used for water supply under the No Action Alternative or the Proposed Action. The formations are not a feasible potable water supply due to the high costs of pumping and treatment. There would be no effects to these aquifers.

4.1.3 Water Quality

Effects to water quality in Ute Reservoir and the Canadian River are described below. As described in the previous section, there would be minimal differences in Ogallala aquifer ground water levels for the No Action Alternative and the Proposed Action. As a result, effects on Ogallala aquifer ground water quality would be similar for both alternatives and are not discussed further. Effects on brackish ground water aquifers would not occur because neither alternative would change water levels in brackish aquifers.

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4.1.3.1 Ute Reservoir

The *Surface Water Hydrology Effects* section described the results of 40 years of simulated reservoir operations. In some years, the No Action Alternative and Proposed Action have similar storage levels in Ute Reservoir, as well as similar average surface area, pool elevation, and reservoir depth. The following years of the simulation period would result in different degrees of reservoir drawdown (and different storage levels) for the Proposed Action when compared to the No Action Alternative: years 10 to 15, years 18 to 21, and years 35 to 41 (further detail on simulated storage is provided in the *Surface Water Effects* section). The differences in reservoir storage in the drawdown years are likely to result in differences in reservoir stratification.

For the No Action Alternative, reservoir stage would rarely drop below levels observed in 2001 and 2006 when the reservoir was stratified (see the stratification discussion in the *Affected Environment* section). As a result, the reservoir would likely remain strongly seasonally stratified in most years for the No Action Alternative. For the Proposed Action, there would be more months when simulated reservoir depth would be less than the historical stratification depth (approximately 25 feet). This could lead to less Ute Reservoir stratification for the Proposed Action when compared to the No Action Alternative.

For the Proposed Action, during the drawdown periods, the reservoir would be 5 to 15 feet shallower than for the No Action Alternative. Consequently, more of the reservoir volume would be located near the water surface where it could be mixed by wind. In addition, the pipeline withdrawals would extract water from the reservoir's bottom and middle layer through outlets at 3,735 or 3,759 feet (about 27 or 51 feet above the reservoir bottom). Summer pipeline withdrawals would be about 1,800 AF per month, representing 1 to 3 percent of total reservoir storage during drawdown periods. In particular, withdrawals made from the lower pipeline outlet would reduce the volume of the bottom layer near the outlet, leaving more water that is completely mixed in the upper layer and partially mixed in the middle layer. Therefore, stratification may be stronger and of longer duration for the No Action Alternative than the Proposed Action.

The reduced stratification likely for the Proposed Action could have water quality benefits and drawbacks. Reduced stratification would likely result in fewer and shorter duration low dissolved oxygen events in the bottom layer compared to the No Action Alternative because oxygenated water near the surface would more often mix with water near the reservoir bottom. Fewer occurrences of low dissolved oxygen could mean there would be less release of phosphorus from reservoir sediments. Less release of phosphorus would likely result in less algae growth after the

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reservoir mixes each fall. However, weakened stratification could make what little phosphorus that would be released from bottom sediments available to algae near the surface earlier in the fall, while warm temperatures favor rapid algae growth. Therefore, differences in stratification may or may not result in differences in algae growth in Ute Reservoir.

Theoretical residence time (see discussion on page 42) would be substantially decreased for the Proposed Action compared to the No Action Alternative. The average study period residence time for the Proposed Action would be 31 months compared to 37 months for the No Action Alternative, a reduction of 18 percent. Shorter residence times tend to result in less algae growth as nutrients are flushed out of the reservoir at a faster rate. The potential reduction in algae growth and organic carbon for the Proposed Action, as a result of reduced residence time, would have a beneficial effect on Ute Reservoir water quality compared to the No Action Alternative. Differences in residence time also have implications for evapoconcentration, where water evaporates from the reservoir surface, concentrating dissolved constituents in the reservoir water. The shorter residence time for the Proposed Action would also result in lower concentrations of dissolved constituents in Ute Reservoir when compared to the No Action Alternative.

4.1.3.2 Canadian River

As discussed in the *Hydrology* section, the Proposed Action would result in fewer releases/spills, an average difference in volume of about 11,050 AFY, compared to the No Action Alternative. Consequently, under the Proposed Action there would be fewer days when the Canadian River would have relatively high flow and relatively low salinity, compared to the No Action Alternative (i.e., 29 fewer months of releases/spills for the Proposed Action over the 41-year simulation period). As a result of fewer infrequent releases for the Proposed Action, there would be less dilution flow on the Canadian River for these 29 months of the 41-year simulation period. However, baseflow would be the same for both alternatives, resulting in minimal changes to TDS for the majority of the time. The No Action Alternative and Proposed Action are not likely to affect attainment of water quality standards.

As shown in Table 18, the Proposed Action would result in fewer releases/spills resulting in about 9,800 tons per year less salt loading.

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Table 18. Canadian River at Logan Gage – Estimated Salt Loading.

	Salt Loading (Tons/Year)			Streamflow at Logan Gage[3] (AFY)
	Baseflow[1]	Releases/ Spills[2]	Total	
No Action Alternative	13,600	21,200	34,800	26,110
Proposed Action	13,600	11,400	25,000	15,060
Effects (magnitude)[4]	0	-9,800	-9,800	-11,050
Effects (percent)[4]	0	-46%	-28%	-44%

[1] Based on a constant baseflow of 3 cfs and TDS equal to historical median of 4,530 mg/L.
[2] Based on simulated Compact releases and TDS equal to Ute Reservoir historical median of 650 mg/L.
[3] Streamflow at Logan gage estimated as simulated Compact releases plus 3 cfs constant baseflow.
[4] Magnitude of effects are calculated as (Proposed Action - No Action Alternative). Effects (%) are calculated as (magnitude of effects/No Action Alternative).
Source: MWH 2009c.

Differences in average annual TDS between the No Action Alternative and Proposed Action would vary depending on hydrologic conditions. The average annual TDS would be associated with differences in the makeup of Canadian River streamflow. Because TDS concentrations at the Logan gage are a weighted average of TDS from baseflow (4,530 mg/L historical TDS) and releases/spills (650 mg/L historical TDS), average TDS concentrations would be higher for periods of low streamflow when there are few releases/spills. The range of TDS concentrations occurring in any given year would be about the same.

4.1.4 Fluvial Geomorphology

No Action Alternative

Under the No Action Alternative, the Canadian River would continue to be in a state of equilibrium, with some minor channelization upstream of the Revuelto Creek confluence continuing as a result of low sediment concentrations in streamflow downstream of Ute Dam.

Proposed Action

The Canadian River from Ute Dam to the state line is predominantly in geomorphic equilibrium, with minor channelization that is occurring upstream of Revuelto Creek as a result of low sediment concentrations in the streamflow (MWH 2008). Streamflow effects for the Proposed Action would be a decrease in the duration and frequency of Compact releases and Reservoir spills. A decrease in Compact releases and Reservoir spills would likely lead to the following geomorphic effects:

- **Decreased removal of sediment associated with high flows, which would decrease the hydraulic capacity of the river to convey flood flows and releases/spills from Ute Reservoir.** Flood flows are small in magnitude and infrequent for the Canadian River

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downstream of Ute Dam because of dam operations (MWH 2008). However, the decrease in hydraulic capacity would have a minor adverse effect on the ability of NMISC to make releases from Ute Dam associated with the Compact requirements without causing erosion or floodplain inundation.

- **Increased growth of riparian vegetation along the streambank as a result of decreased scouring flows.** The increase in riparian vegetation would cause an increase in hydraulic roughness in the overbank zone, which would decrease the hydraulic capacity of the river to convey flood flows and high flow releases/spills from Ute Reservoir. Similar to the effects described in the previous paragraph, the increase in riparian vegetation would have a minor adverse effect on the conveyance of Ute Reservoir releases/spills.

Geomorphic effects for the Canadian River downstream of the confluence with Revuelto Creek would be similar, but would be smaller in magnitude than effects upstream of the confluence. Revuelto Creek would continue to supply the flood flows that maintain the existing stream geomorphology, and, as a result,geomorphic effects would be expected to be negligible downstream of Revuelto Creek.

4.2 Recreation

The No Action Alternative and the Proposed Action would have potential adverse and beneficial effects on recreation that vary throughout the Project Area. Because potential recreation effects for Curry and Roosevelt counties would be similar, they are discussed together; Quay County effects are discussed separately.

4.2.1 Curry and Roosevelt Counties

No Action Alternative

Under the No Action Alternative, recreation resources in Curry and Roosevelt counties could be adversely affected by future water shortages. Reductions in “discretionary” uses, such as irrigation of public parks and golf courses, could occur when ground water declines become more severe. For example, the City of Clovis Drought Management Plan calls for limiting outdoor landscape watering for parks and closing public pools when demand increases to certain levels relative to available supplies (City of Clovis 2007). The extent of these impacts depends on many factors, including the rate of future aquifer declines and the volume of future demands. However, in general, the No Action Alternative would have an adverse effect on recreation resources in Curry and Roosevelt counties within the Project planning horizon.

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Proposed Action

Under the Proposed Action, recreation resources in Curry and Roosevelt counties would remain the same or improve. The Proposed Action would provide a sustainable water supply for all uses, including recreation facilities in the two-county area.

4.2.2 Quay County

No Action Alternative

Under the No Action Alternative, recreation resources in Quay County would generally be similar to existing conditions in the short term. Ute Reservoir levels would remain at approximately the same levels as in the past. Under both existing conditions and the No Action Alternative, Ute Reservoir water levels periodically decrease below the 3,777 foot level where visitor use of facilities may begin to be affected. This is predicted to happen about once every 5 years (22 percent of the time) under the No Action Alternative.

While there would be no difference in lake levels between the No Action Alternative and existing conditions in the short term, NMISC is determined to ensure that the 24,000 AF of Ute Reservoir supply allocated to M&I use is ultimately used for those purposes. If the ENMRWA is unable to use this water, NMISC will look for other ways to use Ute Reservoir water for M&I demands.

In the long term, other indirect effects to Quay County recreation could occur because economic effects in Curry and Roosevelt counties may affect the number of visitors to ULSP. These effects are difficult to calculate because of the lack of historic information about ULSP visitors.

Proposed Action

Recreation opportunities in Quay County—specifically at Ute Reservoir—could be affected by changes to reservoir levels under the Proposed Action. These effects could take the form of decreased visitation due to decreased accessibility to recreation facilities, or decreases due to reduced desirability of the recreation resources at lower lake levels.

During interviews with Ute Reservoir private boat dock owners, several concerns were expressed related to the Proposed Action including potential impacts to recreation due to changes in the aesthetics of the Reservoir, operation of private boat docks, and quality of recreation.

Changes to lake levels could have an effect on the accessibility and usability of the recreation facilities around Ute Reservoir, including the marina and boat ramps. Based on existing information, it appears that at about 8 feet below “full’ conditions (about 3,777 feet), some of the public facilities around Ute Reservoir would begin to be affected. Over the next 40 years, this condition would occur about once every 2 years (about 51 percent of the time) under the

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Proposed Action. However, it is likely that a series of drier years would lead to several years in a row with lower lake levels, rather than every other year or every third year. Additional information about lake levels is discussed in the *Hydrology* section.

Table 19 shows projected visitation at ULSP under the No Action Alternative and the Proposed Action. The effects of lake levels on visitation are very difficult to predict because other factors are involved. Factors that affect how many visitors come to ULSP include general economic conditions in the State and water levels at other water-based recreation areas in the State or nearby areas. For example, low water levels at Brantley Lake and Conchas Lake could encourage visitors to use Ute Reservoir.

The relationships between lake levels and visitation at three other regional reservoirs that have experienced greater variability in lake levels than Ute Reservoir in recent years (Conchas Lake, Elephant Butte Reservoir, and Lake Meredith) were examined. Based on those evaluations, it was estimated that there would be little or no effect on visitation from lower levels at Ute Reservoir up to an 8-foot decline below full conditions. Beyond an 8-foot decline, visitation could decrease by about 1 percent for every 2 percent further decrease in storage contents (during May through September only). Applying these assumptions to the projected hydrology of Ute Reservoir under the Proposed Action, the average annual visitation at ULSP was projected to be about 6 percent lower under the Proposed Action than under the No Action Alternative or existing conditions. In the driest year, there would be a larger impact on visitation. Table 19 summarizes these results.

Table 19. Projected Annual ULSP Visitation (+/- 50%).

	No Action Alternative	Proposed Action
% of years with potential low water conditions	22%	51%
Projected average annual visitation*	318,000	299,000
Proposed Action percent reduction in visitation compared to the No Action Alternative*	NA	-6%
Minimum visitation in driest year*	306,000	230,000

*This estimate has an approximate uncertainty of +/- 50%.
Source: BBC 2009.

4.3 Socioeconomics

The No Action Alternative and the Proposed Action would have potential adverse and beneficial effects to social and economic conditions that vary throughout the Project Area. Because potential effects for Curry and Roosevelt counties would be similar, they are discussed together; Quay County effects are discussed separately.

4.3.1 Curry and Roosevelt Counties

No Action Alternative

Under the No Action Alternative, Curry and Roosevelt counties would continue to rely on ground water. As this nonsustainable resource is depleted, the following effects may occur:

- Water supply costs for municipalities and NMAW would increase, with rate increases for customers;
- Economic development likely would decline due to water supply problems for existing and new business and residents;
- Growth in construction would slow or cease due to potential "tap moratoriums";
- Water use restrictions would increase;
- Residents and businesses may migrate out of the area; and
- Purchases of agricultural lands for M&I water supply would accelerate retirement of those lands and diminish the economic contribution from agriculture.

A comparative evaluation performed for the ENMRWA of the costs of continuing to rely on ground water resources (e.g., the No Action Alternative) estimated the present worth costs of this approach at about $500 million over the next 25 years (CH2MHILL 2005a).

Proposed Action

Under the Proposed Action, the Participating Communities would incur costs to construct and maintain a new sustainable water supply from Ute Reservoir. Short-term benefits during construction would include the addition of about 313 new jobs over the 5-year construction period. This assumes that local labor is used for construction, and represents an increase in regional employment of less than 1 percent. Long-term costs of a portion of the construction expenditures and all of the operation and maintenance requirements of the water supply system would be paid by the Participating Communities. The costs were assumed to be spread across the Participating Communities based on their apportionment in the NMISC and UWC contract. These costs would result in increased water fees for residents and businesses in the Project Area, relative to existing conditions. The total expected construction costs for the Participating Communities is about $37 million. Annual operations and maintenance costs depend on the amount of water used by the Participating Communities in a given year. For example, the total operation and maintenance costs in 2012 were estimated to be about $5.5 million—assuming all M&I water comes from Ute Reservoir (i.e., no ground water use). This estimate is based on population projections and assumes average annual water use per-connection remains constant. The cost to customers (on a per-connection basis) is anticipated to increase average annual water costs by about $164 to $404 during the early years of the planning horizon (about 2017) and

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would decrease to about $138 to $302 annually by the end of the planning horizon (about 2043). Tap fees for new connections are anticipated to increase as well, with a range for the Participating Communities from about $928 to $5,566.

In the short term, these increases to water rates and tap fees are likely to exceed any increases adopted under the No Action Alternative. However, in the long term, these costs are anticipated to be lower than the financial and economic costs to the Participating Communities under the No Action Alternative. The comparative cost evaluation performed by CH2M HILL for the ENMRWA in 2005 estimated the net present worth costs of the Proposed Action to be about 7 percent lower than the costs of relying on ground water supplies over the next 25 years. The Proposed Action also offers much greater sustainability than relying on ground water (CH2M HILL 2005a).

4.3.2 Quay County

No Action Alternative

In the short term, Ute Reservoir hydrology would represent a continuation of existing conditions under the No Action Alternative. There would be no direct effects from the No Action Alternative on Quay County socioeconomic conditions. In the long term, declining socioeconomic conditions in Curry and Roosevelt counties would likely have adverse effects on the region as a whole. In addition, NMISC is determined to ensure that the 24,000 AF of Ute Reservoir supply allocated to M&I use is ultimately used for those purposes. If the ENMRWA is unable to use this water, NMISC will look for other ways to use Ute Reservoir water for M&I demands.

Proposed Action

Anticipated effects of the Proposed Action on the socioeconomic conditions in Quay County include short-term economic benefits from construction and changes to the recreation-based economy and property values around Ute Reservoir. During interviews with Ute Reservoir private boat dock owners, several concerns were expressed related to the Proposed Action including potential impacts to the local economy (Quay County) and quality of life in the Logan area. Boat dock owners also expressed concerns about construction costs and the annual operation and maintenance costs of the Proposed Action.

Some of the economic benefits from Project construction would likely occur in Quay County. About 40 jobs during the 5-year construction period are anticipated, an employment increase of about 1 percent. Annual economic benefits to Quay County from construction activities are projected to be about $4 million, including labor income from the jobs created.

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The Proposed Action would result in changes to Ute Reservoir water levels, which could affect tourism and the recreation-based portion of Quay County's economy. It is important to note that there is considerable uncertainty in these estimates due to the uncertainty of projected changes to annual visits to Quay County and ULSP. The estimates have a level of uncertainty of at least +/- 50 percent. The 6 percent average decrease in annual visitation would result in an annual average decrease of about $1 million to the Quay County economy. About 19 jobs throughout Quay County could be affected by the decrease in visits due to lower lake levels.[1] With the uncertainty in these estimates, there could be a potential range of effects in decreased gross receipts for Quay County of $500,000 to $1.5 million and a decrease in jobs from 9 to 28.

These best estimates based are on the projected effects of the Proposed Action on Ute Reservoir levels and storage contents, and the water level condition of other reservoirs in the region with variable lake levels (e.g., Brantley and Conchas reservoirs). However, given the historically consistent reservoir levels at Ute Reservoir, and the lack of detailed surveys of Ute Reservoir visitors, these estimates are only approximations of how variation in lake levels may affect local economic conditions.

Under the Proposed Action, water levels are expected to generally decrease compared to the historical water levels observed at Ute Reservoir. Under some conditions, the decreased water levels could have negative effects on water access, aesthetics, and crowding. These effects could result in declines in property values adjacent to the reservoir. Lakefront homes and lakeview homes could potentially be affected. The topography of Ute Reservoir varies along the shoreline, with some steep, cliff-like areas where the shoreline does not vary with water level, and some shallow areas where the shoreline is variable at different water levels. The different areas can be seen in Figure 20. Most areas along the reservoir have little variation in shoreline down to an elevation of about 3,772 feet. At water levels of about 3,760 to 3,772, some developed residential areas would be several hundred feet from the shoreline, while some areas would change little. At these water levels, there would be wider areas of exposed shoreline near the lakefront properties in west Logan Village and near the southern portions of Ute Lake Ranch.

The concept of "locational premiums" is discussed in Section 3.2.2.2 on page 52. To estimate the potential effects on property values for lakeview and lakefront properties, the following simplified assumptions were made:

- Locational premiums would be about 25 to 50 percent less when the lake levels are between 3,772 and 3,760 feet in elevation; and

[1] Based on data provided in Table 7 and Table 19.

- Lakefront and lakeview premiums would be about 50 to 100 percent less when the lake is below 3,760 feet.

These are broad generalizations; homes near steep shorelines would not be affected as much as homes near shallow (flat) shorelines.

Based on the lake level analysis, reservoir levels would be between 3,772 and 3,760 feet about 21 percent of the time under the Proposed Action and would be below 3,760 feet about 8 percent of the time. Using the hydrology analysis combined with the assumptions in the bulleted list above, the Proposed Action is anticipated to reduce the locational premium for lakefront and lakeview properties by about 9 to 18 percent over the 40-year forecast period. This calculation is shown below:

25% to 50% reduction about 21% of the time, plus 50% to 100% reduction about 8% of the time:
(25% *21%)+(50%*8%) = 9.25% to
(50% *21%)+(100%*8%) = 18.5%

To illustrate this concept by example, assume that a lakefront property worth $500,000 has an estimated locational premium of $250,000 when the lake is near-full. The property's estimated premium would be reduced to $204,000 to $227,000 under the Proposed Action, reducing the total property value to about $454,000 to $477,000. A lakeview property that is worth $375,000 has an estimated locational premium of $125,000 when the lake is near-full. The property's estimated premium would be reduced to about $102,000 to $113,000 under the Proposed Action, reducing the total property value to $352,000 to $363,000.

These anticipated impacts are general, order of magnitude estimates. They represent average effects on property values over the 40-year hydrology modeling period. Effects on some properties would be more and some would be less. Also, effects on property values would be greater during extended periods of low reservoir levels (during drought periods), and there would be less effect during extended wet periods when the reservoir would be full under both the No Action Alternative and the Proposed Action.

4.4 Threatened and Endangered Species

4.4.1 Interior Least Tern

A model simulation of Ute Reservoir levels suggest that reservoir levels would be lower under the Project (MWH 2009b). Lower reservoir pool levels at Ute Reservoir would potentially expose additional shoreline and could create new interior least tern habitat. Based on a review of

current conditions and bathymetry, it does not appear that large expanses of unvegetated rocky or sandy substrate would be exposed at lower lake levels. Annual vegetation establishes quickly in flatter topography, and many areas of the reservoir shoreline are steep and would preclude interior least tern nesting.

In addition, if interior least terns nest along the reservoir shoreline in suitable habitat exposed during low reservoir levels, there are no operational components of the Project that would result in rapid lake rise and inundation of nests.

4.4.2 Lesser Prairie-Chicken

Pipeline construction could temporarily affect lesser prairie-chicken habitat in the area between the Caprock and the City of Clovis. The ENMRWA would coordinate closely with the NMDGF to develop avoidance measures to eliminate or minimize impacts to this species. Those mitigation measures may include:

- Completing lesser prairie-chicken surveys annually during construction of the Project;
- Avoiding or minimizing construction activities during leking and nesting season when active leks or nests are near the Project Area;
- Completing clearing and construction during nonactive seasons; and
- Coordinating with NMDGF regarding revegetation seed mixes and measures to benefit the lesser prairie-chicken.

4.4.3 Arkansas River Shiner

Modeled changes to releases/spills from the Project could potentially affect downstream habitat for the shiner. Table 20 is a summary of important habitat components for the shiner, and the potential effects from the Project. Additional details are included in the BA for the Project.

Table 20. Habitat Components and Potential Effects to the Arkansas River Shiner.

Habitat Component	Potential Effect of the Project
Baseflow	Improved release strategy due to adaptive management plan; maintenance of baseflow (3 to 5 cfs) is a Management Plan requirement.
Fluvial geomorphology	Decreased average flows from Ute Reservoir releases/spills (Ute Dam release flows approximately 325 cfs) upstream of Revuelto Creek confluence; Revuelto Creek flows provide scouring downstream of confluence.
Riparian vegetation	Potential for increased growth of riparian vegetation along the streambank as a result of decreased scouring flows (upstream of Revuelto Creek confluence); minimal effects downstream of confluence. Control of riparian vegetation is a Management Plan requirement.
Flood flows	No change from existing conditions; Revuelto Creek provides flood flows to trigger spawning.

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Habitat Component	Potential Effect of the Project
Water quality	Changes in Ute Reservoir releases/spills would change the annual average TDS concentration in the Canadian River, but would not change the normal range of concentrations.

In summary, the Project would not result in a significant change to habitat components from existing conditions. The Management Plan requires maintenance of existing base flow. The Project would change the duration and frequency of releases due to Compact compliance, but would not change flood flows in Revuelto Creek that maintain downstream habitat geomorphology, manage riparian vegetation, and trigger spawning. The range of TDS concentration would not change as a result of the Project.

4.5 Vegetation and Wetlands

No Action Alternative

There would be no direct impacts to vegetation and wetlands under the No Action Alternative. Indirect effects of the No Action Alternative include continued conversion of irrigated agriculture to dryland or nonagricultural uses as agricultural water rights are purchased for M&I uses.

Proposed Action

The Proposed Action would result in both permanent and temporary effects to vegetation resources in the Project Area from placement of facilities (Table 21). There is a slight potential for changes to vegetation along the Canadian River due to changes in releases/spills from Ute Dam.

About 43.6 acres of permanent impacts would occur as a result of the Proposed Action, most of which would occur in shortgrass prairie. These impacts would be from construction of facilities such as the intake structure, WTP, and pump stations. There would be approximately 2,210.4 acres of temporary impacts from pipeline construction, assuming the entire temporary construction easement is affected. Actual construction impacts likely would be less.

Indirect impacts to vegetation could occur along the Ute Reservoir shoreline. As reservoir levels increase and decrease, annual wetland and vegetation likely would shift to remain closer to the water level. About 123 acres of wetland fringes occur along the shoreline of Ute Reservoir, and these fringes appear to persist as water levels rise and fall in the existing elevation range. Many wetland pockets and fringes occur near drainage inlets, and these wetlands are likely to persist due to normal rainfall. Other wetland areas occur on shallowly inundated islands and peninsulas, and these areas are likely to expand and contract based on the surface area exposed to water. If

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reservoir levels remain lower than historic levels, semipermanent shifts in vegetation communities along the shoreline may occur and the health of wetland and other vegetation communities may decline as they lose supportive hydrology. It is likely that the approximate acreage of wetland fringe along the shoreline would remain constant at about 123 acres.

Table 21. Permanent and Temporary Direct Impacts to Vegetation Communities.

Vegetative Community	Permanent Impacts (ac)	Temporary Impacts (ac)
Agriculture		309.6
Closed conifer woodlands		3.5
Disturbed and fallow		248.7
Mesic mixed grasslands		2.1
Midgrass prairie		320.8
Mesquite midgrass prairie	2.8	22.2
Mesquite shortgrass prairie	3.7	328.5
Mixed shrub steppe		177.3
Open juniper woodlands		11.5
Playa		0.4
Shortgrass prairie	37.0	445.7
Rock outcrops		0.4
Riparian woodland		0.9
Urban		338.3
Wetland		0.5
Total	**43.5**	**2210.4**

Ground-disturbing activities may result in an increase in noxious weeds. Best management practices (BMPs) for weed control would be implemented to prevent permanent degradation of vegetation communities in the Project Area.

4.6 Wildlife Resources

No Action Alternative

The No Action Alternative would result in no change in existing conditions and would have no effect on wildlife resources in the Project Area.

Proposed Action

Permanent and temporary impacts to vegetation communities listed in Table 21 would affect the wildlife species associated with each habitat type. Most impacts would be temporary because the pipeline corridor would be revegetated following construction. Habitat value and use likely would be restored within 1 to 10 years following construction, depending on habitat type.

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Vegetation communities with large shrubs and trees would require a longer time to return to predisturbance conditions. It is likely that most species would temporarily avoid the pipeline alignment and facility locations while construction activities are underway because of noise and human activity. Any clearing that takes place prior to facility installation could potentially disturb birds during nesting season. Take of migratory bird nests is prohibited by the Migratory Bird Treaty Act; therefore, all clearing should be conducted during nonnesting season (normally September through April 1), or nest surveys should be completed prior to ground-disturbing activities. During periods when the reservoir is drawn down, wildlife likely would have to migrate further to water.

The Proposed Action would not result in water levels below the fisheries minimum pool, which was designated by the NMISC and NMGFD to protect the Ute Reservoir fishery. The white bass is the only desirable game species known to have high natural reproductive success in Ute Reservoir. Other species are known to reproduce in the reservoir; however, those species do not maintain levels needed for recreational fishing and, therefore, are stocked annually. Therefore, the Proposed Action is not anticipated to impact the fishery at Ute Reservoir.

4.7 Geology, Climate, Soils, and Air Quality

No Action Alternative

The No Action Alternative would result in additional drilling in the Ogallala aquifer for water supply wells. Minor changes to existing conditions would occur, and would have little effect on geology, climate, soils, or air quality.

Proposed Action.

Impacts to geology resources within the pipeline corridor and proposed facility locations would occur. The impacts would be limited to the pipeline and facility easements and footprints, totaling about 45 acres of permanent impacts and 2,200 acres of temporary impacts.

Limited temporary impacts to soils categorized as “Prime Farmland if Irrigated” and “Farmland of Statewide Importance” would occur. No permanent impacts to any areas classified as “agricultural” would occur, and about 310 acres of temporary impacts would occur. Construction disturbance would increase the possibility of increasing both wind and water erosion of soils in the Project Area; however, no soils categorized as “highly erodible” occur in the Project Area.

Construction activities associated with the Proposed Action have the potential to increase airborne dust matter (PM10) and other pollutants due to truck traffic and construction-related fugitive dust and diesel exhaust emissions. A primary source of fugitive (airborne) dust is

earthmoving equipment associated with trench excavation and filling. Dust could also be generated from truck traffic using haul roads and work areas. Soils that are cleared and destabilized would likely become a source of wind-blown dust until stabilization efforts are implemented. These impacts would be temporary and localized, and no soils classified as "highly erodible" occur in the Project Area. Mitigation strategies and BMPs that would decrease potential impacts to air quality include:

- Use standard dust abatement practices during construction;
- Maintain adequate soil moisture on unpaved roads, staging areas, and other cleared areas;
- Halt earth-moving activities during high winds; and
- Stabilize and reseed disturbed areas as quickly as feasible.

4.8 Cultural Resources

No Action Alternative

The No Action Alternative would result in no change in existing conditions and would have no effect on cultural resources.

Proposed Action

Reclamation is in the process of consulting with the SHPO on the Project. The Proposed Action may affect cultural resources that are eligible for listing in the NRHP. Any eligible sites would be monitored during construction, and would be mitigated per the Programmatic Agreement (PA) that is being implemented between Reclamation, the SHPO, and the NMISC with regard to resolving adverse effects on historical resources along the entire length of the pipeline on both private and federal lands. Reclamation is preparing and implementing a PA to follow the normal regulatory process as described by the Advisory Council on Historic Preservation in 36 CFR 800.5 and 36 CFR 800.11. A mitigation strategy and data recovery plan will be developed as part of the PA, and may include construction monitoring in some parts of the Project Area. Additional information will be provided as the cultural resource consultation proceeds.

4.9 Indian Trust Assets

No ITAs have been identified in the Project Area. No impacts to ITAs are anticipated from either the No Action Alternative or the Proposed Action.

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4.10 Environmental Justice

No Action Alternative

Under the No Action Alternative, adverse socioeconomic impacts from diminishing water supplies on the residents of Portales could be considered an environmental justice concern, based on the relatively high incidence of households living below poverty levels in that community.

Proposed Action

Under the Proposed Action, the largest adverse economic effects would not be expected to occur in low-income or minority communities; therefore, these effects are not an environmental justice issue.

4.11 Irreversible and Irretrievable Commitment of Resources

Irreversible and irretrievable resource commitments involve the use of nonrenewable resources and the effects of use on future generations. Irreversible effects primarily result from the use or destruction of specific resources that cannot be replaced within a reasonable time frame, such as energy and minerals. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action, such as extinction of a threatened or endangered species or the disturbance of a cultural resource. Neither the Proposed Action nor the No Action Alternative would result in a large commitment of nonrenewable resources.

Project construction would require the irretrievable commitment of fossil fuels (diesel and gasoline), oils, and lubricants used by construction equipment and vehicles. The Proposed Action would result in unavoidable harm or harassment of some wildlife, including special status species. The Project would not jeopardize the continued existence of any species.

Chapter 5. Cumulative Impacts

Cumulative effects are the direct and indirect effects of a proposed project alternative's incremental effects when they are added to other past, present, and reasonably foreseeable actions, regardless of who carries out the action (40 CFR, Part 1508.7). NEPA recommends that federal agencies identify the temporal and geographic boundaries of the potential cumulative effects of a proposed action (CEQ 1997). For purposes of this EA, the temporal boundary of analysis is from approximately 2010 to 2060, which represents the project planning horizon. However, forecasting potential cumulative effects 50 years in advance is difficult, and most of the cumulative effects analysis is general and qualitative in nature.

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