

An Assessment of Water Supply Alternatives in New Mexico

Technical Report



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Glossary

Acre-foot – The conventional unit for measuring large volumes of water in the western US, equivalent to 325,851 gallons.

Brackish Groundwater – Groundwater, typically stored in deep, confined aquifers, having total dissolved solids concentrations of 1,000–10,000 milligrams per liter (mg/L).

Graywater – Wastewater produced from bathroom sinks, showers, bathtubs, clothes washers, and laundry sinks, derived from residential and commercial buildings.

Levelized Cost of Water – The unit cost of supplied or conserved water, calculated as the net present value of life cycle costs and monetary benefits of a water supply alternative, divided by the lifetime volume of water supplied or conserved by that alternative.

Non-Potable Reuse – The reuse of municipal and industrial wastewater or graywater that has been sufficiently treated for non-drinking water quality uses, such as irrigation, toilet flushing, and cooling tower makeup.

Potable Water – Water that has been treated to drinking water quality that is suitable for human consumption, hygiene, and food preparation.

Produced Water – The fluid that is an incidental byproduct from drilling for or the production of oil and gas.

Recycled Water/Reclaimed Water System – A dedicated distribution system for non-potable reuse that delivers treated municipal and industrial wastewater and/or stormwater runoff to meet non-potable water demands (also known as a “purple-pipe” system).

Stormwater Runoff – Runoff generated from precipitation that falls on rooftops, roads, and other impervious surfaces.

Technical Potential – The maximum annual amount of water that can be provided or conserved by a water supply alternative.

Total Dissolved Solids – The concentration of all dissolved solid matter, such as minerals, metals, salts, and contaminants, in a water source, expressed in milligrams per liter (mg/L).

Treated Wastewater – Municipal and industrial wastewater that has been treated to suitable standards to be released to the environment, as defined by the EPA.

Water Conservation – Technologies and practices that reduce the demand for water, either by adjusting behavior to reduce overall water use (e.g., taking shorter showers) or by reducing the amount of water needed for the same use (e.g., installing a high-efficiency showerhead).

Water Supply Alternative – A strategy for water supply that is supplied from sources other than direct diversion/withdrawal from surface water and groundwater bodies.

Abbreviations

AF	Acre-Foot
AFY	Acre-Foot Per Year
CII	Commercial, Industrial, and Institutional
ISC	Interstate Stream Commission
M&I	Municipal and Industrial
NMED	New Mexico Environment Department
NMBGMR	New Mexico Bureau of Geology and Mineral Resource
OSE	New Mexico Office of the State Engineer
PVACD	Pecos Valley Artesian Conservancy District

1. Introduction

New Mexico, like other states in the American Southwest, faces significant long-term water shortages from drought, aging infrastructure, and the increasingly frequent and destructive effects of climate change. A key challenge, identified in the December 2022 [New Mexico Water Policy and Infrastructure Task Force Report](#), is coping with the reality of climate change impacts on already overallocated rivers and aquifers, the sources of “traditional” water supplies like surface water reservoirs and groundwater wells (New Mexico Water Policy and Infrastructure Task Force 2022). To address this challenge, the Task Force recommended evaluating the potential of alternative water supplies, including brackish groundwater desalination and water reuse, as well as promoting water conservation across all sectors.

Despite the recognized need for water supply alternatives, there is limited data and information on their availability and relative cost, hindering efforts to effectively address water risks for New Mexico. The Governor’s [50-Year Water Action Plan](#), released in 2024, offered high-level estimates on the potential impact of greater implementation of agricultural, municipal, and industrial water conservation (660,000 acre-feet per year) and alternative water supplies (150,000 acre-feet per year) (New Mexico Office of the Governor 2024). While these high-level estimates are helpful, further analysis is needed to refine them and provide meaningful life-cycle cost estimates to help understand the true potential of these alternatives. Such an analysis could also provide comparisons to conventional and already planned water supply strategies to determine how best to prioritize new programs and investments.

In this study, we assessed the maximum amount of water that could be obtained or conserved in an average year, hereafter referred to as the technical potential, and the cost effectiveness of six alternative water supply strategies: agricultural water conservation, municipal and industrial water conservation, reuse of municipal and industrial wastewater, reuse of urban stormwater runoff, reuse of produced water, and brackish groundwater desalination. We also discuss the funding and policy implications of these assessments to better characterize the possible role of water supply alternatives in advancing long-term water resilience.

Section 2 of this study describes the methodology used to quantify the technical potential of each water supply alternative and assess its cost-effectiveness. Section 3 presents the results of the technical potential and cost assessments for each alternative and discusses additional considerations for implementation. Section 4 summarizes the key findings and contextualizes them within New Mexico’s water supply planning efforts.

2. Methods

For this study, we estimated the recent technical potential and levelized cost of water supply for six water supply alternatives: agricultural conservation, municipal and industrial conservation, municipal and industrial wastewater reuse, urban stormwater runoff, produced water reuse, and brackish groundwater desalination. For each alternative, we developed scenarios to reflect possible implementation strategies in New Mexico. The estimates presented in this study are first-order approximations based on available data and information on potential volumetric yields and levelized costs given current population and development patterns. Further analysis is needed at finer geographic scales to incorporate local conditions and constraints that are unique to individual basins and/or sub-basins. Such analyses should include considerations for legal and regulatory constraints, downstream flow obligations and/or interstate compact compliance, as well as the interdependencies between groundwater and surface water hydrology.

2.1. Advisory Committee

Throughout the project, we engaged an advisory group consisting of 12 members with relevant expertise and representing diverse stakeholder groups within New Mexico, including water utilities, academia, state legislators, irrigation districts, and environmental health organizations. The advisory group provided input on the analytical approach, key state-level factors that affect the results, interpretation of findings, and final project deliverables. Input was gathered through virtual meetings with the entire advisory group and with individual members.

2.2. Data Sources

We compiled data used for this analysis from a variety of sources, including state and municipal agencies in New Mexico and other states, federal agencies, academic literature, and non-governmental organizations. When possible, we relied on data specific to New Mexico to inform our assumptions and analysis inputs. Much of these data, such as those collected by the New Mexico Office of the State Engineer (OSE) and Interstate Stream Commission (ISC), the New Mexico Environment Department (NMED), New Mexico Bureau of Geology and Mineral Resources (NMBGMR), and the Oil Conservation Division (OCD) of the New Mexico Energy, Minerals, and Natural Resources Department, were available via the [New Mexico Water Data Initiative](#) data catalog (New Mexico Water Data Initiative, n.d.). The spatial scale of data sources ranged from individual communities to the entire state. To reconcile disparities between different datasets, we spatially aggregated analysis inputs from community- and user-level data sources into county totals/averages and disaggregated basin- and state-level inputs into county-level estimates in proportion to population and/or land area. We provide the full list of data sources, organized by water supply alternative and use in the analysis, in Appendix A.

We relied on previously collected measurements and/or estimates for the technical potential assessment and performed additional analysis to resolve disparities between data sources and to fill data gaps. For the cost assessment, we relied on publicly available information for product prices, water and energy costs, and socioeconomic variables such as population, household size, and housing characteristics. We estimated infrastructure costs with capital and operation and maintenance (O&M) cost models developed from academic and federal sources and validated these models with infrastructure cost data from projects in New Mexico when possible.

2.3. Technical Potential Assessment

We assessed the technical potential for each water supply alternative based on the most recent available data of existing demographic, economic, and average climate/weather conditions, representing calendar years 2020–2025.¹ For each alternative, we provide estimates for multiple possible implementation strategies, briefly described in Table 1 and detailed further in this section, that represent the theoretical upper bound of renewable annual yields based on constraints inherent to each alternative. For example, conservation and reuse strategies depend in part on the total available water demand that can be reduced (for conservation) or offset (for reuse), while produced water primarily depends on the level of production in the oil and gas industry. On the other hand, deep brackish aquifers typically receive little to no natural recharge; virtually all extraction of brackish groundwater from these sources is considered non-renewable. For this water supply alternative, we provide the total storage volume estimated from the available literature, though further investigation is needed to better understand the technically feasible volume that can be extracted.

For municipal and industrial water conservation, municipal and industrial wastewater reuse, and stormwater runoff, we derived the technical potential based on the Pacific Institute’s recent and ongoing national assessments (Berhanu et al. 2024, 2025). We adapted state-level results for New Mexico from these assessments and further refined them by incorporating available state and local data. The analysis methods for each national assessment and additional refinements for New Mexico are detailed in Appendix A. For the remaining water supply alternatives, we developed analysis methods informed by available data and literature review specific to New Mexico. In cases where data specific to New Mexico were unavailable or did not exist, we used data from other states in the Southwest U.S. and/or national-level data. The data sources, analysis methods, and key assumptions for these alternatives are also detailed in Appendix A.

¹ Due to data limitations inherent to each water source, the actual historical period used in the analysis is provided separately for each water sources in Section 3 and Appendix B.

Table 1. Description of Analysis Scenarios Used to Assess Technical Potential, by Water Supply Alternative.

Water Supply Alternative	Volumetric Potential Scenario(s)
Agricultural Conservation	• Reduction of irrigation conveyance losses from lining off-farm earthen supply conveyances • Locally led conservation planning and implementation
Municipal and Industrial Conservation	• Improved Conservation Scenario: Adoption of water conservation measures moderately beyond current minimum state requirements and/or typical industry performance. ○ Indoor Residential: Average WaterSense®- and ENERGY STAR®-labeled device performance ○ Outdoor Residential: Equivalent to landscapes with medium-water use plants and efficient irrigation systems ○ Commercial, Industrial, and Institutional (CII): Median reported CII water intensity (gallons per square foot of gross floor area) ○ Utility Water Loss: Median reported infrastructure leakage index (ILI) • Leading Conservation Scenario: Adoption of water conservation measures reflecting leading-edge technology and/or industry-leading performance. ○ Indoor Residential: Most efficient WaterSense- and ENERGY STAR-labeled device performance ○ Outdoor Residential: Equivalent to landscapes with low-water use plants and efficient irrigation ○ CII: Lowest 25th percentile reported CII water intensity (gallons per square foot gross floor area) ○ Utility Water Loss: Lowest 25th percentile reported infrastructure leakage index (ILI)
Municipal and Industrial Wastewater Reuse	• Volume of wastewater available from sewer and septic sources to offset non-potable municipal and industrial water demands, under current regulations^a • Total volume of treated wastewater generated from municipal and industrial sources
Urban Stormwater Runoff	• Volume of stormwater runoff generated in urban areas available to offset non-potable municipal and industrial water demands, under current regulations and guidance^a • Total volume of stormwater runoff generated in urban areas
Produced Water Recycling and Reuse	• Increased recycling within the oil and gas sector to offset freshwater use • Treatment and transport for off-site reuse to offset cooling water demands from power plants • Volume of produced water generated by the oil and gas sector, excluding the volume that is currently already recycled
Brackish Groundwater Desalination	• Total estimated storage volume of brackish groundwater in deep brackish aquifers compiled from previous investigations

^a As described in the NMED Graywater Irrigation Guide and NMED Ground Water Quality Bureau Guidance: Above Ground Use of Reclaimed Domestic Wastewater (New Mexico Environment Department 2003, 2007).

2.4. Levelized Cost Assessment

We estimated the cost-effectiveness of each water supply alternative, represented by the levelized cost of water metric, in 2025 dollars per acre-foot of water (\$/AF). The levelized cost of water is defined as the ratio of the net present value of life cycle costs, less any monetary benefits produced, over the lifetime water volume either saved or supplied (Howe et al. 1999; Macy et al. 1989). The levelized cost concept was originally developed in the field of energy economics and later adapted for use in water resources economics as a standardized metric of the cost-effectiveness of water supply strategies over the useful life of a water supply project (Cooley et al. 2016; Fane et al. 2003; Meier 1982; Short et al. 1995). The levelized cost of water provides a single metric similar to the unit cost of water that can be used to compare multiple water supply strategies while accounting for differences in service life and scale.

We developed multiple scenarios to estimate levelized costs for each water supply alternative, described briefly in Table 2 and further detailed in Appendix A. These scenarios reflect existing strategies that have been implemented at various scales in New Mexico and/or other states in the U.S. and provide a non-exhaustive portfolio of potential implementation options under New Mexico's current regulatory and policy landscape. However, realizing the full technical potential of each alternative investigated in this study may require additional strategies that are not captured in this analysis.

Levelized costs estimated in this study assume a discount rate of 3.0% per guidance provided by the U.S. Bureau of Reclamation and the U.S. Office of Management and Budget for water resources planning (U.S. Bureau of Reclamation 2024; U.S. Office of Management and Budget 2024). The choice of discount rate influences the present value of future cash flows, such as annual O&M expenses and monetary benefits, reflecting the time-value of money from the perspective of the cost-paying entity. Higher discount rates are typically used for private sector investment analysis and result in lower present values of annual cash flow. In cases where annual costs exceed annual monetary benefits, a higher discount rate would result in lower overall levelized costs (and higher levelized costs when annual monetary benefits exceed annual costs).

The levelized costs estimates for municipal and industrial conservation strategies and decentralized strategies for reuse (e.g., household graywater collection and treatment for irrigation) include the monetary savings from avoided customer costs from reduced wastewater and energy bills, representing direct implementation by utility customers. For produced water reuse strategies, levelized cost estimates include monetary savings from avoided produced water disposal costs and represent

direct implementation by oil and gas companies. Estimating the levelized costs of these strategies from a public investment perspective, such as through state-led implementation, requires further investigation that reflects the avoided costs borne by the public. For example, state-led implementation of produced water reuse would not consider avoided disposal fees as a monetary benefit but could account for avoiding other administrative or regulatory costs that are currently borne by the public.

All costs were adjusted to 2025 U.S. dollars, based on the national average Consumer Price Index for consumer product prices and aggregated Producer Price Indexes for major construction and labor inputs, following the procedure developed by El-Khattabi (2025). Beyond inflation, construction costs have increased significantly across the U.S. in recent years, with significant variability between and within states. Future investment decisions should first validate and/or adjust cost inputs presented in this study with recent construction cost data that reflect local conditions in New Mexico communities.

Table 2. Description of Analysis Scenarios Used to Estimate Levelized Cost, by Water Supply Alternative.

Water Supply Alternative	Scenario Description(s)
Agricultural Water Conservation	- Locally led conservation planning and implementation - Concrete lining of earthen supply conveyances for agricultural irrigation
Municipal and Industrial Water Conservation	- Indoor Residential: Immediate replacement of inefficient fixtures and appliances with models that meet minimum and best available WaterSense and ENERGY STAR performance specifications - Outdoor Residential: Turf landscape transformation equivalent to medium-water use and low-water use plants - CII Non-Seasonal: Immediate replacement of inefficient fixtures and appliances and subsector-specific water-using equipment with models that meet minimum and best available WaterSense and ENERGY STAR performance specifications - CII Seasonal: Turf landscape transformation equivalent to medium-water use and low-water use plants. - Utility Water Loss: Implementation of advanced leak detection and pressure management strategies to reduce the Infrastructure Leakage Index to the median and 25th percentiles
Municipal and Industrial Wastewater Reuse	- Centralized Implementation: - Hypothetical 5 million gallon per day (MGD) capacity wastewater reuse facility with advanced treatment - Accompanying storage, pumping, and distribution infrastructure - Decentralized Implementation: - Household laundry-to-landscape system - Building-scale graywater diversion system for irrigation
Urban Stormwater Runoff	- Centralized Implementation: - Directed stormwater infiltration - Managed stormwater recharge - Stormwater aquifer storage and recovery - Decentralized Implementation: - Household rain barrel adoption - Hybrid building-scale rain barrel and graywater diversion system for irrigation
Produced Water	- Recycling of produced water for use within the oil and gas industry sufficient to offset 100% of freshwater use - Treatment of produced water via thermal distillation and transport to the nearest water-cooled power plant to offset freshwater demand
Brackish Groundwater Desalination	Brackish groundwater desalination projects for municipal water supply augmentation based on reported data for similar existing and/or planned projects in the United States

2.5. Key Considerations for Interpreting Results

Estimating the technical potential and levelized cost of each water supply alternative requires several state-level assumptions to capture the variability of analysis inputs across New Mexico, account for interdependencies between alternatives, and avoid double-counting the technical potential. For municipal and industrial conservation, municipal and industrial wastewater reuse, and urban stormwater runoff, we first estimate the technical potential at the county level before aggregating results to the state level. We provide the state-level results in the body of this report and water security planning region-level results in Appendix B. Beyond the state-level assumptions, we also summarize source-specific assumptions used in the technical potential and levelized cost assessment in Section 2 of this study and in Appendix A.

For water conservation and reuse, we summarize technical potential in terms of the disposition of water use being reduced or offset, either as consumptive or non-consumptive water use.² The disposition of water use is important to consider in the context of subsequent impacts on water availability, which vary across basins and water supply alternatives, and can have implications for existing downstream flow obligations, groundwater depletion, and interstate compact compliance. Some water uses, such as utility water loss and conveyance seepage, can represent both dispositions, depending on local hydrologic conditions and where they occur within a basin. For these uses, water that is lost to evapotranspiration (ET) or stored as soil moisture would represent consumptive use, whereas water that returns to aquifers or surface water would represent non-consumptive use. We discuss these implications for each alternative further in Section 3.

Another issue that intersects with these interdependencies is the potential transfer between groundwater and surface water resources that can occur when water withdrawals are not returned to the same source after use. This transfer can occur for communities that are supplied by surface water but deliver return flows to groundwater aquifers (and vice versa) and can influence the downstream flow impacts of water conservation and reuse strategies. We discuss the implications of these existing transfers in more detail in Section 3.

In most cases, reducing indoor municipal and industrial water demands via water efficiency improvements would reduce both the volume of treated wastewater

² The disposition of water use can either be consumptive or non-consumptive. Consumptive use of water effectively removes water from the hydrological system, such that it cannot be used by others (Bokum et al. 2015). Examples of consumptive water uses include evaporation from reservoirs, ponds, irrigation systems, or cooling systems; evapotranspiration from vegetation including landscapes and crops; and percolation into deep aquifers that cannot be recovered. Non-consumptive use refers to all water use that is returned to the hydrological system for use by others.

available for reuse and the demand that could be offset by non-potable reuse. We captured this interaction by ordering the analysis procedure to first estimate the volumetric savings from municipal and industrial water conservation and then subtract this volume from the total estimated treated wastewater volume and corresponding demand offset potential. We apply a similar process to account for the resulting demand offset potential from municipal and industrial wastewater reuse when estimating the demand offset potential available for urban stormwater runoff.

Beyond these interdependencies, any changes to existing water withdrawals and/or return flows could impact water availability for downstream water users within a river basin and, potentially, interstate compact compliance. In addition to these technical considerations, New Mexico's legal landscape and current allocations of water rights can also constrain the technical potential of these strategies. While a comprehensive basin-level accounting of impacts to water rights and downstream flow obligations is outside the scope of this study, we provide a basin-level summary of technical potential and a narrative description of potential impacts in Appendix A to inform further investigations that should precede any future infrastructure investments and/or policy decisions related to these alternatives.

2.6. Study Limitations

The technical potential and levelized costs presented in this study reflect varying levels of uncertainty, due to the underlying assumptions described throughout this section. The extent of available data to inform the analysis varied widely across water supply alternatives, which limits the applicability of these results to individual communities and implementation outcomes in New Mexico. Therefore, the aggregated estimates presented in this study and appendices require validation and additional refinement with local data before implementation. However, our findings can inform state-level prioritization of investment and policy decisions to enable greater uptake at smaller scales.

This study also does not account for the future impacts of climate change on water availability and demands. Water supplies in New Mexico are projected to become more scarce, driven by increasing frequency, duration, and severity of drought and arid conditions over the next several decades (Dunbar et al. 2022; New Mexico Interstate Stream Commission 2018; Payton et al. 2023). Based on the most recent projections for an intermediate climate change scenario developed for the Fifth National Climate Assessment, New Mexico is projected to experience reductions in annual precipitation, snowpack volume, and summer soil moisture over the next

several decades.³ While climate change impacts will further constrain New Mexico's hydrologic water budget, the water supply alternatives investigated in this study can support water resilience by extending the availability of existing water supplies (for conservation/efficiency and reuse) or by providing supply augmentation (for produced water and brackish groundwater) to accommodate future growth and economic development.

Lower water availability can force demand reductions that could otherwise be achieved by conservation strategies, effectively offsetting their technical potential. Water demand reductions can also translate into lower available supply of wastewater and corresponding demand for non-potable reuse, while decreased precipitation can reduce the volume of urban stormwater runoff available for reuse.

³ The assessment also projects reductions in actual evaporation, though it is unclear if these reductions are limited by lower projected water availability as opposed to reduced evaporative demand. Historically, evaporative demand in this region has increased over the past several decades (Payton et al. 2023).

3. Results

In this section, we provide state-level summaries of the technical potential and levelized costs of water supply alternatives for the scenarios described in Section 2, organized by alternative. We also discuss source-specific caveats for interpreting results and considerations for implementation.

All levelized cost estimates are presented in 2025 U.S. dollars per acre-foot of water saved/generated. These estimates do not account for non-monetary or otherwise unquantifiable costs and/or benefits such as environmental benefits and ecosystem services (Diringer et al. 2020). For each water supply alternative, we describe the costs and benefits considered in the levelized cost calculation and key considerations for potential implementation and investment decision making. The detailed procedure for levelized cost calculations, including example calculations for each alternative, is provided in Appendix A. We also provide additional estimates for Water Security Planning Regions (which roughly correspond to major river basins) in Appendix B.

3.1. Agricultural Conservation

The agricultural sector is the largest water use category in New Mexico, accounting for 78% (or about three million acre-feet per year) of total water withdrawals across the state in calendar year 2020 (Valdez et al. 2024). Roughly 786,000 acres of agricultural land exist across 21,000 farms, with alfalfa, onions, pecans, chiles, and corn providing the greatest economic value in 2023 (Whitcotton et al. 2024). Irrigation water is supplied from both groundwater and surface water sources in roughly equal proportion and predominantly applied via flood and sprinkler irrigation (58% and 40% of total withdrawals, respectively) (Valdez et al. 2024). While a comprehensive assessment of agricultural water use is outside the scope of this study, we provide a state-level summary of irrigated agricultural area and water use for calendar year 2020 by water source in Table 3 for reference purposes.

Opportunities to conserve water in New Mexico agriculture are the subject of much investigation, with strategies including conveyance and irrigation system improvements, deficit irrigation, crop switching and dynamic fallowing, comprehensive monitoring and remote sensing, and soil health management (CK Blueshift, LLC et al. 2024; McCarthy 2022; Udall et al. 2017). Each of these strategies has its own tradeoffs with respect to efficacy in reducing water use, environmental protection, economic impacts, and social equity, such that no single strategy is appropriate for all agricultural water users (Bokum et al. 2015; Fernald et al. 2020; Grafton et al. 2018; Hasenbeck et al. 2025; Samani et al. 2008). Strategies focused on reducing consumptive water use can often represent options for reducing agricultural water use that also minimize negative impacts to communities.

Across New Mexico, irrigators have put water to productive use, in some cases for centuries, adapting to dynamic water availability through creative and resilient methods. Climate change has challenged this historic adaptability, confronting many irrigators with steadily decreasing water availability and increasing pressure to irrigate with less. A key consideration in any discussion of agricultural water conservation potential is the seniority of agricultural water rights. However, across much of the state, the challenge is less about competing demands for existing supplies and more about diminished supplies. Some areas have planned and implemented regionally specific responses to these challenges, increasing local resilience.

Table 3. Summary of Irrigated Agricultural Area and Water Use, by Water Source.

	Surface Water	Groundwater	Total
Irrigated Acreage	261,000	525,000	786,000
Total Withdrawals (AFY)	1,470,000	1,500,000	2,970,000
<i>Measured Withdrawals (AFY)</i>	<i>931,000</i>	<i>582,000</i>	<i>1,510,000</i>
<i>% of Withdrawals That Are Measured</i>	<i>63%</i>	<i>39%</i>	<i>51%</i>
Withdrawal Rate (AF/acre-year)	5.6	2.9	3.8
Conveyance Loss (AFY)	512,000	-	512,000
<i>Conveyance Efficiency (Applied % of Withdrawals)^a</i>	<i>65%</i>	<i>100%</i>	<i>83%</i>
Applied Irrigation (AFY)	956,000	1,500,000	2,460,000
Consumptive Use of Crops (AFY)	565,000	932,000	1,500,000
<i>Irrigation Efficiency (Consumptive % of Applied Irrigation)</i>	<i>62%</i>	<i>67%</i>	<i>65%</i>
Remainder (AFY) ^b	367,000	499,000	866,000

Note: Data compiled from the *New Mexico 2020 Water Use by Categories Report* produced by OSE (Valdez et al. 2024).

^a Groundwater conveyance is assumed to be 100% efficient based on volumes reported by OSE in 2020 (Valdez et al. 2024).

^b This volume represents the portion of applied irrigation that is not accounted for by consumptive use, representing the combination of non-crop consumptive use and return flows that are not included in conveyance loss estimates.

3.1.1. Technical Potential

Agricultural water use in New Mexico is complex and highly interdependent, shaped by competing demands such as downstream flow obligations and water rights. The lack of reliable, high-resolution data on agricultural water use compounds these challenges. We focus here on adapting a model that has demonstrated success in the Pecos Valley to establish a financing and coordination framework that supports locally led conservation planning between farmers and irrigation districts. This

framework, where water availability is quantified at the basin level and used to determine per-acre withdrawal allocations, preserves flexibility for irrigation district-level decision making for bringing total withdrawals in line with available water supplies. Ultimately, determining how this approach is implemented and how water conservation is achieved in each basin depends on institutional support, local knowledge, and acceptance by stakeholders.

We selected these strategies for analysis based on the availability of sufficient data to perform the analysis. We also summarize and discuss the available documentation for additional conservation strategies that have been implemented in New Mexico, though we could not find sufficient data to include these strategies for analysis. The strategies discussed in this section are a non-exhaustive subset of available options; we recommend further investigation to better quantify the water savings benefits and levelized cost of these strategies and other strategies not discussed here (see Hasenbeck et al. 2025 for examples of additional strategies).

For this study, we estimated the technical potential for two strategies aimed at reducing agricultural water use: (1) locally led conservation planning and implementation at the irrigation district level and (2) targeted lining of earthen irrigation supply conveyance infrastructure. Irrigation districts throughout New Mexico recognize that declining water supplies threaten future productivity, but many lack the financial resources to work with their irrigators to plan and implement systemwide conservation measures. The evaluation and subsequent monitoring and enforcement of local water availability per acre provides a framework for conjunctive management of water resources within a district, while preserving flexibility in decision making by farmers to align irrigation volumes with the available water supply. One specific method to help align these volumes is infrastructure improvements. Conveyance lining reduces the volume of water lost to seepage during delivery to farms, allowing for more efficient use of diverted water and/or reductions of water withdrawals while meeting crop irrigation requirements.

The locally led agricultural water conservation planning scenario was modeled after the Pecos Valley Artesian Conservancy District's (PVACD) efforts to measure and manage water use. Confronted by declining water supply, PVACD determined its water availability and withdrawals and took ambitious measures to bring them into balance, including lining conveyances, leveling fields, and purchasing land from willing sellers within the district to reduce total irrigated acreage (New Mexico Interstate Stream Commission 2024). Irrigators within the district recognized the importance of long-term planning and ensuring their water supply's resilience. Each well in PVACD is now monitored, and water withdrawals are limited to 3 AFY per irrigated acre, reflecting the average consumptive irrigation requirement per irrigated acre with additional allowances for conveyance and irrigation system losses for the basin. Other irrigation districts have established agricultural water exchanges, where

irrigators with lower water demands can make water available to other irrigators in the district who may have crops with higher demands (Hadjigeorgalis et al. 2007).

We estimated the technical potential of applying a per-acre limit to farm water withdrawals, with low and high values of 3 and 5 AFY per acre, representing the range of farm water withdrawal limits observed from completed adjudications for the Pecos, Animas, and Lower Rio Grande basins (New Mexico Judicial Branch 2013; New Mexico Office of the State Engineer 2003; Serrano 2020). For basins that are currently unadjudicated or under active adjudication, the appropriate farm water withdrawal limit will vary from basin to basin depending on crop diversity and hydrologic conditions. We estimated the technical potential as the difference between the current rate of withdrawals for each locale estimated by OSE in 2020 and the rate that would be withdrawn if the on-farm diversion were limited to 3 and 5 AFY per acre for the total acres farmed (Valdez et al. 2024).

We estimate that applying a per-acre limit on farm withdrawals for irrigation use could reduce current agricultural water withdrawals by 278,000–676,000 AFY, or 11%–30% of current total withdrawals. Achieving these savings would require financial support for local irrigation districts to develop district-specific plans and implement appropriate monitoring networks, as well as funding to incentivize compliance. Local irrigators would determine their own methods to reduce farm-level withdrawals that account for the priority status of their water rights. Senior water rights holders may also require additional incentives and/or compensation to proactively forego a portion of their water right allotment to adapt to reduced overall water availability. A flexible compliance framework would be necessary to minimize negative impacts to downstream flow availability and existing aquifer recharge and mitigate potential economic and community impacts associated with reduced water use.

One method to reduce farm-level withdrawal rates could be lining irrigation supply conveyances. We define irrigation supply conveyances as canals, feeders, community ditches, channels, ditches, culverts, and laterals as identified by OSE (New Mexico Office of the State Engineer 2020). Conveyance infrastructure categories that do not meet this definition were excluded from analysis on the basis that the addition of lining would not significantly reduce consumptive water use and/or would directly interfere with existing aquifer recharge functions. Irrigation supply conveyances make up roughly 68% of the total length of conveyance infrastructure identified by OSE (Table 4). Due to data limitations for conveyance geometry, we assume uniform seepage rates and an average 75% reduction in conveyance loss, including a 5% allowance for conveyance losses attributed to ET along the conveyance length that

would not be affected by lining (King et al. 2006; Leigh et al. 2023; U.S. Bureau of Reclamation 2001).⁴

Table 4. Summary of Water Supply Conveyance Length, by Conveyance Type.

Conveyance Type	Length (miles)	% of Total Length
Canals	410	7%
Feeders and Community Ditches	46	1%
Channels, Ditches, and Culverts	3,040	52%
Laterals	1,140	20%
Excluded Categories	1,220	20%
Total Conveyance Length	5,860	

Note: The following conveyance types were excluded from analysis: acequias and conveyances administered by acequia associations, diversion structures, drains, and natural waterways. Data compiled from “Irrigation Conveyances” GIS feature layer developed by (New Mexico Office of the State Engineer 2020).

Under these assumptions, we estimate that lining irrigation supply conveyances can reduce subsequent seepage losses by 213,000–264,000 AFY, depending on whether on-farm laterals are included. This estimate does not account for variations in channel width across the types of supply conveyances or cases where conveyance lining is not desirable due to existing incidental aquifer recharge from seepage within a basin. These factors should be considered in future investigations to refine this first-order estimate at the basin scale.

Table 5. Technical Potential of Agricultural Conservation Strategies.

Scenario	Conservation Savings (AFY)
Supply Conveyance Seepage Reduction	213,000–264,000
Locally Led Conservation Planning and Implementation	278,000–676,000

Lining conveyance canals and improving irrigation systems can improve delivery reliability, reduce losses, and support increased crop yields and farm productivity. However, water savings from these strategies depend on how they are implemented within the broader basin context. As discussed in the PVACD example, it is important to combine these strategies with basin-level water management and irrigation application planning to maximize water savings and minimize unintended

⁴ The 5% allowance for the evapotranspiration component of conveyance losses is likely a conservative overestimate, though data to validate this assumption in New Mexico could not be found. In their assessment of canal seepage losses in the Middle Rio Grande Conservancy District, Kinzli et al. (2010) assumed evaporation to be a negligible component of total conveyance loss. Future basin-scale investigations should validate this assumption to further refine the estimates of water savings for this strategy presented in this study.

consequences such as reduced aquifer recharge and increased consumptive use on farms.

3.1.2. Levelized Cost

The costs of agricultural conservation vary widely depending on several factors, including the strategy chosen and scale of implementation. Some strategies financially incentivize farmers to reduce water use or limit irrigated acreage, such as dynamic fallowing and the purchase/lease of water rights. In New Mexico, these include the Lower Rio Grande Groundwater Conservation Pilot Program administered by the Interstate Stream Commission and the Environmental Water Leasing Program administered by the Middle Rio Grande Conservancy District. These programs each make direct payments to farmers to temporarily remove portions of irrigated acreage from production during the growing season, with an estimated cost of \$150–\$160/AF of water conserved. The water savings from these programs are temporary and contingent on funding availability and willingness to accept payment by farmers.

Strategies to incentivize removal of cropland from production can negatively impact surrounding communities by displacing agricultural workers, decreasing revenue for farm equipment suppliers, and, in some cases, reducing local food availability (Udall et al. 2017). Temporary fallowing can create additional time and labor costs to return cropland into production (Hasenbeck et al. 2025; Udall et al. 2017). The potentially significant adverse impacts of planned, incentivized, voluntary reductions in irrigated acreage should be measured against the potential impacts of unplanned, uncompensated, and mandatory reductions caused by overdrawn aquifers or diminished streamflow. Each of these challenges are surmountable, yet they highlight the need to better understand local conditions before implementation in a community.

Farmers and irrigation districts have implemented crop shifting and soil health management strategies to varying extents across the state. For example, the New Mexico Department of Agriculture has provided roughly \$3 million in grant funding since 2020 across over 150 projects and 14,000 acres, dedicated to advancing healthy cropland soil principles (New Mexico Department of Agriculture, n.d.). While a formal evaluation of water savings for these projects is not available, the U.S. Department of Agriculture estimates that a 1% increase in soil organic matter can retain up to 20,000 gallons of additional water per acre (Sustainable Conservation 2023). Though there is no formal grant program for crop shifting in New Mexico, Hasenbeck et al. (2025) found that agricultural irrigators in the Middle Rio Grande Basin have already implemented crop shifting practices over other innovative water management approaches and expressed a desire for increasing this strategy's

prevalence.⁵ Comprehensive assessments of the cost of implementing crop shifting practices in New Mexico are not available, though Cohen et al (2013) estimated that unit costs of shifting from alfalfa to sorghum or wheat and cotton in California ranged from \$54/AF to \$144/AF in 2025 U.S. dollars.⁶

Conveyance and irrigation improvements, including irrigation scheduling, can reduce agricultural water use by increasing the amount of applied water that reaches and benefits crops. Previous studies of conveyance lining in New Mexico have found unit costs of seepage reduction ranging from \$170/AF up to \$3,400/AF (King et al. 2006; Llewellyn et al. 2021; U.S. Bureau of Reclamation 2001). We could not find any published analyses of the unit cost of irrigation system improvements using measured water savings specific to New Mexico, though previous research by the Pacific Institute estimated that levelized costs for a 25% conversion of flood to sprinkler irrigation systems in the Colorado River Basin could range from \$680/AF to \$2,250/AF (Cohen et al. 2013).

We provide the estimates of levelized cost to implement water withdrawal measurement and ongoing monitoring required to implement the locally led conservation planning approach, as well as the reported costs for individual conservation strategies to reduce farm withdrawal rates summarized from the academic literature on existing implementations in New Mexico (Table 6). Realizing the technical potential of this water supply alternative will depend on farm-level water withdrawal measurement and monitoring as a prerequisite and likely requires a combination of the other conservation strategies listed. The appropriate portfolio of these strategies also depends on the hydrological characteristics and potential impacts to downstream flows for each basin.

⁵ Examples of crop shifting practiced cited in the study include growing spring, fall, or winter crops, substituting alfalfa and specialty crops with drought-resistant grasses and drought-tolerant varieties, and shifting to grain crops consumed by humans.

⁶ Adjusted to 2025 dollars using Producer Price Index for Agricultural Machinery and Equipment data provided by the U.S. Bureau of Labor Statistics (Series ID WPU111).
<https://fred.stlouisfed.org/series/WPU111>

Table 6. Levelized Cost for Agricultural Conservation Strategies.

Scenario	Levelized Cost (\$/AF)
Farm-Level Water Withdrawal Measurement and Ongoing Monitoring ^a	\$6–\$14
Incentivized Fallowing and Water Rights Purchase/Leasing	\$150–\$160
Earthen Supply Conveyance Lining	\$170–\$3,400
Conversion of Flood and Sprinkler Irrigation Systems to Drip Irrigation	\$680–\$2,250

^a Represents installation of withdrawal measurement devices and ongoing monitoring and maintenance, as a prerequisite for the locally led conservation planning and implementation scenario. It does not include the cost of implementing individual conservation strategies to reduce withdrawals to meet scenario per-acre water withdrawal limits.

Monitoring and measuring water use at the basin level requires installation of metering infrastructure for currently unmetered water withdrawals and administrative staff to monitor and validate reported withdrawal volumes, plus any costs of implementing strategies to reduce water use. We estimate the levelized cost of this monitoring to range from \$6/AF to \$14/AF. When added to the levelized cost of implementing one or more of the agricultural conservation strategies discussed in this section, the cost of monitoring and enforcement can constitute about 5% of the total implementation costs. While direct metering of agricultural withdrawals is preferred, researchers have also used satellite-based ET data, such as from OpenET, to approximate farm-level crop ET in New Mexico, with average error rates ranging from 13% to 29% with a slight bias toward underestimating ET (CK Blueshift, LLC et al. 2024; Djaman et al. 2023; Tawalbeh et al. 2024; Volk et al. 2024; Zipper et al. 2024). However, these methods do not explicitly account for total farm withdrawals and have unknown implementation costs as a statewide regulatory policy.

3.1.3. Additional Considerations

The process to implement the locally led conservation planning approach can take years and can face significant local opposition (Buynak et al. 2015; New Mexico Interstate Stream Commission, n.d.). Implementing a resilience-based conservation planning effort would require collaboration with district irrigators to establish the level of risk associated with a business-as-usual approach and earn the support of irrigators, senior water rights holders, and local community members, as well as identifying appropriate and equitable funding mechanisms. Continued aridification and chronic, unplanned reductions in the absence of proactive local efforts will likely expedite the process of acceptance and implementation, especially if state-based financial incentives are sufficiently attractive.

The strategies discussed in this section might not be suitable for statewide adoption across all farms. For example, irrigation efficiency improvements such as conversion

of flood irrigation systems to drip irrigation and lining conveyances could interfere with existing aquifer recharge and return flows; irrigation efficiency improvements can also potentially increase on-farm consumptive use if irrigation application rates are not adjusted accordingly (CK Blueshift, LLC et al. 2024; Fernald et al. 2020; Grafton et al. 2018; Samani et al. 2008). Reductions to surface water return flows could also negatively impact downstream water availability and interstate compact compliance. In surface water-supplied farms, which are likely to face diminishing water supplies into the future, these impacts could be mitigated in part due to the commensurate reductions in surface water withdrawals. Understanding the hydrologic and legal impacts of each of these strategies requires further investigation at the basin scale to better understand the current extent of groundwater to surface water transfers (and vice versa) occurring from conveyance seepage and irrigation return flows. This information can then support collaboration between water users within the basin to identify the acceptable balance of risks to long-term water supply resilience and competing water demands.

3.2. Municipal and Industrial Conservation

Municipal and industrial water conservation includes a variety of technologies and practices for saving water without affecting the benefits and services water provides. Conservation measures include replacing old, inefficient toilets, showerheads, and clothes washers with high-efficiency models; installing regionally appropriate landscapes; improving irrigation methods; and reducing leakage in the water delivery system. Many of these strategies are already being implemented in New Mexico and could be expanded to realize additional water savings (Albuquerque Bernalillo County Water Utility Authority, n.d.; City of Las Cruces, n.d.; City of Rio Rancho, n.d.; City of Santa Fe, n.d.-b; Los Alamos County, n.d.; New Mexico Office of the State Engineer, n.d.; New Mexico Water Conservation Alliance, n.d.). For example, many utilities offer incentives to encourage customers to buy water-efficient devices; New Mexico can enshrine more efficient performance requirements for fixture and appliances in state standards and codes. Likewise, the New Mexico Environment Department (NMED), through its LeakTracer Funding Program, provides funding for leak detection in rural communities, and this program could be expanded. We present opportunities for improving conservation across customer sectors and end uses for two scenarios and provide cost estimates for a variety of water-efficient devices.

3.2.1. Technical Potential

We estimate that recent municipal and industrial water demand in New Mexico is about 390,000 AFY. For this study, “recent water demands” represents the average annual water demand for calendar years 2022 and 2023, adjusted to 30-year

historical average weather conditions.⁷ Increasing uptake of water conservation strategies in New Mexico can reduce water demands by 164,000–196,000 AFY, calculated as the difference between recent municipal and industrial water demands and the estimated water demands after adopting the technologies and practices described in Section 2.3 (Table 7). Water savings opportunities exist across all major sectors; the residential sector accounts for about half of potential savings, ranging from 84,200 to 102,000 AFY, followed by the CII sector (67,900–81,500 AFY), and more distantly by utility water loss (11,900–12,200 AFY). These estimates suggest that adopting conservation strategies that go beyond minimum federal standards and typical non-residential efficiency levels could reduce recent municipal and industrial water demands by 42%–50%.

Table 7. Technical Potential for Municipal and Industrial Water Conservation, by Sector.

Sector	Water Demand (AFY)	Conservation Savings (AFY)	
		Improved Conservation Scenario	Leading Conservation Scenario
Residential Total	246,000	84,200	102,000
<i>Indoor</i>	<i>78,200</i>	<i>33,200</i>	<i>49,100</i>
<i>Outdoor</i>	<i>167,000</i>	<i>51,000</i>	<i>53,000</i>
Commercial, Industrial, Institutional Total	117,000	67,900	81,500
<i>Non-Seasonal</i>	<i>88,900</i>	<i>51,700</i>	<i>62,100</i>
<i>Seasonal</i>	<i>27,800</i>	<i>16,200</i>	<i>19,400</i>
Utility Water Loss	27,800	11,900	12,200
Total Municipal and Industrial	390,000	164,000	196,000

Note: Conservation scenario descriptions are detailed in Section 2.3.

Of the 390,000 AFY in total demand, consumptive uses are approximately 195,000 AFY, or 57% (Table 8). We estimate that water conservation measures can reduce consumptive water use by 79,100–84,600 AFY. Consumptive water savings are largest for the residential sector (51,000–53,000 AFY), followed by the CII sector (16,200–19,400 AFY), and utility water loss (11,900–12,200 AFY). While reductions in consumptive use are important, there are also compelling reasons to reduce non-

⁷ To control for the effects of annual weather variability, we analyzed the impact of historical precipitation and temperature on monthly per capita demands and estimated “weather-normalized” water demands assuming 30-year average weather conditions. See Berhanu et al. (2025) for a detailed description of how average weather adjustments were performed.

consumptive uses. In particular, any reduction in demand lessens the amount of water taken from rivers, reservoirs, and aquifers and can defer or avoid the need for investment in new infrastructure to capture, store, treat, and distribute that water. For communities reliant on surface water, this can also reduce vulnerability to drought, provide greater flexibility in managing water deliveries, and improve the timing and maximize the amount of water left in the natural environment while providing benefits to downstream water quality, the environment, and recreation.

Table 8. Technical Potential of Municipal and Industrial Conservation and Efficiency, by Water Use Disposition.

Water Use Disposition	Description	Recent Demand (AFY)	Technical Potential as Conservation Savings (AFY)	
			Improved Conservation	Leading Conservation
Consumptive	Outdoor (Residential) and Seasonal (CII)	195,000	67,100	72,500
Non-Consumptive	Indoor (Residential) and Non-Seasonal (CII)	167,000	85,000	111,000
Other	Utility Water Loss ^a	27,800	11,900	12,200
Total		390,000	164,000	196,000

^a Utility Water Loss can represent both consumptive and non-consumptive uses (see discussion in Section 2.5).

Reducing water demands also helps mitigate the impacts of diminishing supplies that are increasingly constraining efforts to prioritize water uses within a basin. Under these conditions, conservation can still support population growth and economic development. However, for communities where existing withdrawals and return flows create a net transfer of groundwater to surface water, reducing nonconsumptive use could result in a net reduction of return flows that would affect downstream users. We recommend further analyses at the utility and basin levels to better characterize the impacts of reducing non-consumptive water use across the state.

3.2.2. Levelized Cost

Municipal and industrial conservation, like agricultural conservation, can help reduce water use, with varying levelized associated costs that depend on the implemented strategy and can be impacted by a number of factors. The key components for the levelized cost of conservation strategies are the cost of the water-conserving device

plus any installation costs, O&M costs (or savings from reduced O&M), monetary savings from reduced wastewater and energy use, and lifetime water savings.⁸

For the residential and CII sectors, we estimated levelized costs of indoor water savings for individual fixtures and appliances that do not meet current minimum WaterSense and ENERGY STAR specifications (improved conservation scenario) or best available technology performance (leading conservation scenario). We assume outdoor water savings are generated from turf landscape transformation equivalent to medium- and low-water use plants for the improved conservation and leading conservation technical potential scenarios, respectively. For utility water loss, we estimated the levelized cost of advanced leak detection and distribution system pressure management strategies, derived from compiled water loss management program cost data and literature (Cooley et al. 2016; Rupiper et al. 2022).

We find that the levelized cost of water conservation strategies ranges from \$-4,000/AF to \$8,520/AF, depending on the strategy enacted and corresponding water savings (Table 9). A negative levelized cost value indicates that the total cost of adoption is outweighed by the present value of monetary savings generated over the service lives of these strategies when considered as a whole, with lower negative costs reflecting larger monetary savings. Residential showerheads, lavatory faucets, low-flow leak reductions, and clothes washers, as well as indoor fixtures/appliances in the CII sector, all produce net monetary benefits over their service lives, across technical potential scenarios. These strategies represent least-cost options for investment and/or subsidy to adapt to reductions in water availability. When weighed by volume of water savings per strategy, the net monetary savings generated by these strategies also offset strategies with the net costs (1.6 gallons per flush [gpf] toilets, dishwashers, outdoor landscape transformation, and utility-side leakage reduction).

⁸ Because water rates typically include water supply costs, we do not include the monetary savings from reduced water bills. We assumed that wastewater and energy rates reflect the cost of service ultimately borne by ratepayers. The estimates provided in this study can be further refined by including monetary savings from reduced water treatment costs (i.e., avoided utility O&M cost).

Table 9. Levelized Cost for Water Conservation and Efficiency Technologies/Practices.

Sector	End Use	Levelized Cost (\$/AF)
Residential Indoor	Showerhead	\$-4,000–\$-1,660
	Faucet	\$-4,830–\$-4,790
	1.6-gpf Toilet	\$3,540–\$8,520
	3.5-gpf Toilet	\$355–\$371
	Clothes Washer	\$-2,060–\$-1,610
	Dishwasher	\$670–\$2,500
	Leaks	\$-520–\$-300
CII Indoor ^a	Indoor	\$-2,500–\$-2,180
Outdoor Landscape Transformation	Outdoor	\$1,000–\$1,610
Advanced Leak Detection and Pressure Management ^b	Utility Water Loss	\$350–\$510

^a Adapted from Cooley et al. (2016)

^b Adapted from Rupiper et al. (2022)

These estimates do not account for other co-benefits that can come from reduced water demands, such as greenhouse gas emission reductions from reduced energy use for water heating and water/wastewater treatment, extended service life of distribution system assets, and environmental health improvements (Berhanu et al. 2025; Diringier et al. 2020). At the same time, water demand reduction can reduce utility revenue and create operational challenges for wastewater treatment due to increased concentration of solid material in wastewater collection systems and treatment facilities, though these challenges can be mitigated in part by adjustments to utility financial planning and wastewater treatment process operations and design criteria (Berhanu et al. 2025).

3.2.3. Additional Considerations

We find that the majority of volumetric savings potential is generated from reductions in consumptive water uses (49%–54% of total technical potential, or 67,100–72,500 AFY), which are mostly comprised of landscape irrigation and water-based cooling.⁹ For communities that rely on surface water to any extent, reducing consumptive water use can support additional surface water availability for downstream users. At the state level, the technical potential from reducing

⁹ As described in Section 2.5, utility-side leakage can represent consumptive and/or non-consumptive use, depending on local conditions. For this study, we do not include utility water loss in either disposition, though this volume should be accounted for in future investigations for individual service areas.

consumptive water demands in communities reliant on surface water roughly translates to 20,000–27,000 AFY of water left in-stream, assuming the same ratio of groundwater to surface water withdrawals as reported by OSE for calendar year 2020 (Valdez et al. 2024). However, the actual impacts to surface water availability will depend on the specific hydrologic characteristics, interdependencies between groundwater and surface water bodies, and changes to water use in other sectors that are specific to each river basin. Additional investigation is therefore required to characterize the basin-level impacts to surface and groundwater availability across New Mexico.

For communities reliant on groundwater sources, reducing consumptive use can help mitigate groundwater depletion and promote sustainable aquifer withdrawal rates (Valdez et al. 2024).¹⁰ The impacts of reducing non-consumptive water use, however, depend not only on the source of water supply, but also on the discharge location of treated wastewater. We discuss the downstream impacts of reducing non-consumptive water use in the context of wastewater and stormwater reuse in Section 3.3.

Beyond the issues of water rights, downstream flow obligations, and compact compliance implications, water conservation can also improve water quality, reduce energy use, and support water and wastewater bill affordability (Berhanu et al. 2025; Diringer et al. 2020). At the same time, reducing water demands can decrease utility revenues and increase the contaminant and solids concentrations in wastewater flows entering wastewater treatment facilities, potentially causing challenges for funding ongoing infrastructure maintenance and wastewater treatment operations, respectively. However, as existing water supplies become more constrained and new water supplies are infeasible and/or unavailable, reducing water demands can create long-term cost savings by reducing O&M expenditures and avoiding costs of additional water supply. The financial risks imposed by near-term revenue reductions can also be mitigated in part by adopting practices designed to improve utility revenue resilience (see Hughes et al. 2014 for a detailed discussion and examples of available strategies). These tradeoffs must be considered on a case-by-case basis for New Mexico communities to provide a holistic view of the costs and benefits of water demand reductions into the future.

3.3. Municipal and Industrial Wastewater Reuse

For this study, we define municipal and industrial wastewater reuse as intentionally collecting, treating, and reusing wastewater from municipal and industrial sources for beneficial purposes. We estimated the technical potential of wastewater reuse

¹⁰ According to the New Mexico Office of the State Engineer, approximately 76% of water withdrawals for municipal and industrial sources in calendar year 2020 were from groundwater sources.

for two scenarios, as the volume of treated wastewater that can be used to offset non-potable water demands under existing state regulations for non-potable reuse and as the total volume of treated wastewater discharged from centralized wastewater treatment facilities and septic systems. In both scenarios, the volume of treated wastewater primarily originates from indoor water uses with additional contributions from the unintended entry of stormwater and groundwater into sanitary sewers via inflow and infiltration. Due to the lack of comprehensive data for non-potable reuse throughout the state, these estimates include the volume of wastewater from existing non-potable reuse systems. In Albuquerque and Santa Fe, for example, recent estimates of non-potable reuse total 2,000 and 1,300 AFY, or 4% and 2% of treated wastewater effluent, respectively (Albuquerque Bernalillo County Water Utility Authority 2016; City of Santa Fe, n.d.-a; Eastern Research Group, Inc. 2023). Additional investigation to refine these estimates should identify and estimate existing non-potable reuse in other communities in the state.

3.3.1. Technical Potential

An estimated 196,000 AFY of treated wastewater effluent is discharged to surface water and groundwater bodies in New Mexico, with 169,000 AFY (86% of total volume) generated from centralized wastewater treatment facilities and 27,500 AFY generated from septic systems¹¹ (Table 10). The water conservation improvements identified in this study, if fully implemented, would reduce the amount of wastewater generated to 130,000–151,000 AFY.

Table 10. Summary of Treated Wastewater Volumes, by Population Type and Receiving Water.

Treatment Method	Discharge Location	Treated Wastewater (AFY)	
		Existing	After Conservation
Sewer	All	169,000	119,000–135,000
	<i>Surface Water</i>	<i>154,000</i>	<i>107,000–121,000</i>
	<i>Groundwater</i>	<i>14,800</i>	<i>12,800–13,400</i>
Septic	Groundwater ^a	27,500	10,400–16,000
Total	All	196,000	130,000–151,000

^a Groundwater assumed for septic system discharge disposition, though some volume might be discharged to surface water via subsurface flow or evaporated, depending on system design.

Under current New Mexico regulations and depending on the quality of treated wastewater, non-potable reuse is allowed for landscape and crop irrigation, toilet flushing, construction activities, and recreational uses such as snow making and

¹¹ For this study, we only consider the graywater portion of septic wastewater that can be recycled on-site under current regulations.

impoundments (New Mexico Environment Department 2007). New Mexico residents are also permitted to recycle graywater, or wastewater from clothes washers, lavatory faucets, and showers/bathtubs that does not contain significant organic matter or pathogens, at the building scale (New Mexico Environment Department 2003).

Based on these regulations, we estimate that the potential for non-potable reuse in New Mexico is constrained by non-potable demands, which we estimate are approximately 103,000–122,000 AFY, primarily for outdoor consumptive uses (Table 11). This represents roughly 80% of the total wastewater generated and points to an opportunity for expanding allowable non-potable uses of treated wastewater, including for industrial end uses such as process water and cooling tower makeup.

Table 11. Technical Potential for Municipal and Industrial Wastewater Reuse, by Reuse Scenario.

Scenario	Demand Offset Description	Demand Offset (AFY)
Non-Potable Reuse	Consumptive use (irrigation, cooling tower makeup, industrial processes)	98,400–112,000
	Non-consumptive use (toilet flushing, clothes washing)	4,880–10,200
	Total Available Non-Potable Demand	103,000–122,000
Total Wastewater Generated	Reuse of Total Available Treated Wastewater Volume ^a	130,000–151,000

^a Scenario can include one or more of: non-potable reuse, managed aquifer recharge, aquifer storage and recovery, direct/indirect potable reuse, and graywater recycling).

3.3.2. Levelized Cost

We examined multiple implementation strategies for wastewater reuse that capture the diversity of approaches using blackwater and graywater, listed in Table 12 by non-potable water source, scale, and non-potable end use. These estimates reflect the most common implementation methods for non-potable reuse and are not an exhaustive list of available strategies. Since the proportions of water demands that can be offset by wastewater reuse ultimately depend on the implementation strategy and end use(s) supplied, we provide levelized costs for multiple implementation methods allowed under current state regulations for reuse (via New Mexico Administrative Code Section Title 20 Chapter 6 Part 8 – Supplemental Requirements for Water Reuse).

Table 12. Levelized Cost for Non-Potable Reuse Systems Using Wastewater.

Scenario	Non-Potable Water Source	Scale	End Use(s)	Levelized Cost (\$/AF)
5 MGD Wastewater Reuse System	Wastewater	Centralized	Irrigation, Cooling Tower Makeup, Industrial, Toilet Flushing	\$2,330–\$32,600
<i>Additional Treatment Facility</i>				<i>\$2,330</i>
<i>Additional New Pumping, Storage, and Distribution Infrastructure</i>				<i>\$2,260–\$30,300</i>
Laundry-to-Landscape	Graywater	Decentralized	Irrigation	\$1,610–\$6,300
Household Graywater Diversion	Graywater	Decentralized	Irrigation	\$2,890–\$4,790

Centralized reuse of wastewater for non-potable reuse often requires additional treatment beyond traditional wastewater treatment, usually in the form of advanced filtration and disinfection, and might require additional pumping, storage, and distribution infrastructure if it does not exist in the utility service area. For this study, we estimated the levelized cost of a hypothetical new wastewater reuse facility with 5 MGD capacity to produce non-potable water for reuse to an existing service area is \$2,330/AF.

The cost of adding new pumping, storage, and distribution infrastructure to provide non-potable water for reuse to customers can range from \$2,260/AF to \$30,300/AF, depending on the characteristics of the service area (e.g., connection density, number of pressure zones, storage, design criteria for sizing capacity) and the proportion of utility customers receiving non-potable water service. The lower end of the range of costs reported in Table 12 reflects a scale of implementation similar to other existing systems in New Mexico (i.e., a subset of customers with large non-potable water demands), while the higher end of the range represents a maximum-use implementation approach in which non-potable water is supplied to all customers within a service area. However, these systems more often align with the low end of the cost range, depending on non-potable water demand, service area, and regulations for allowable use. Other implementation approaches could have lower levelized costs than presented in this study, depending on how close or dense the non-potable water demand source within a service area is located to the treatment facility.

Under existing New Mexico regulations, there are several decentralized strategies available for non-potable reuse of graywater and/or rainwater from roof runoff at the building scale. Laundry-to-landscape systems, where graywater generated from clothes washing is diverted to outdoor landscapes for gravity-fed irrigation, range from \$1,610/AF to \$6,310/AF, depending on the available graywater volume within a household. More complex systems that also divert graywater from lavatory faucets and showers/bathtubs have lower levelized costs that range from \$2,890/AF to \$4,790/AF. The lower levelized costs of these systems suggest that the monetary savings from diverting additional graywater from the sewer outweighs the cost of treating and storing this additional volume.

At the same time, each of the strategies considered in this study depend on existing water demands to offset potential and available supply, except for cases where rainwater/stormwater are used as the sole supply. Future reductions in demand from conservation can therefore reduce the technical potential and increase the levelized cost of implementation by reducing the amount of available demand and required supply. This tradeoff should be considered when planning for investments in non-potable reuse in the long term to avoid overinvestment and stranded capacity.

3.3.3. Additional Considerations

Over 90% of water demand for consumptive uses could theoretically be offset via non-potable reuse, at a cost that varies depending on the implementation strategy. Surface water-supplied communities wishing to implement non-potable reuse strategies could prioritize offsetting consumptive uses as the “least regrets” option that minimizes downstream flow impacts.

We estimate that approximately 80% of the existing volume of treated wastewater is currently discharged to surface water, with the remainder discharged to land or subsurface. Based on OSE’s reported proportions of municipal and industrial water withdrawals from groundwater, the treated wastewater generated by communities that rely on groundwater represents an existing net transfer of about 128,000 AFY from groundwater to surface water across the state. This transfer includes approximately 130,000 AFY moving from groundwater to surface water, offset by about 2,000 AFY moving from surface water to groundwater through municipal and industrial water use, in the aggregate.

For groundwater-supplied communities, however, the existing net transfer of groundwater to surface water combined with the net reductions to downstream flows can limit the opportunity for non-potable reuse. These communities, and the aquifers from which they withdraw water, face a potential tradeoff between longevity of groundwater supply and disruptions to surface water availability due to their existing net transfer between groundwater and surface water sources. These

impacts should be considered in the context of existing groundwater-to-surface water transfers discussed previously in Section 2.5 and in this section.

For communities supplied by and discharging to the same water body, wastewater reuse presents no net change to return flows for the water body (though some net reduction could occur for surface water-supplied communities discharging to groundwater and vice versa). However, the locations of diversions and discharges can still create localized impacts that can affect nearby water users and ecosystems. These communities might consider prioritizing wastewater reuse strategies that offset consumptive uses to minimize net impacts.

For groundwater-supplied communities discharging to surface water, however, wastewater reuse would represent a net reduction in return flows to the receiving water body. For surface water-supplied communities discharging to surface water, wastewater reuse to offset consumptive uses produces no net change to downstream flow availability because it would commensurately reduce surface water withdrawals. Accounting for the interactions between water supply sources, existing groundwater-to-surface water transfers, and impacts of wastewater reuse requires careful consideration and planning on a case-by-case basis for communities and basins.

Communities that divert surface water downstream from treated wastewater discharges already practice “de facto” or “indirect” reuse because part of their supply consists of treated wastewater discharged by upstream communities. These communities may oppose upstream communities’ direct wastewater reuse strategies due to impacts on their own water supply. However, many communities face current and/or future challenges from diminishing surface water supplies and would benefit from offsetting their water withdrawals to avoid future supply disruptions and increasingly expensive infrastructure to obtain water supply from sources outside of their basin or from unconventional sources.

3.4. Urban Stormwater Runoff

Urban stormwater runoff is generated when precipitation falls on rooftops, roads, and other impervious surfaces in urbanized areas. While long considered a nuisance, urban stormwater is increasingly viewed as an asset in water-scarce areas. Stormwater capture and use can augment water supplies while also supporting flood control, water quality protection, and other environmental and community benefits (Diringer et al. 2020; Smith et al. 2022). Reusing stormwater may require less intensive treatment methods than wastewater reuse and can be more easily implemented at the building scale through the adoption of household rain barrels to provide landscape irrigation. This flexibility encourages a multifaceted approach to capturing and using stormwater runoff across scales and uses. In this study, we

investigated the technical potential of urban stormwater runoff on an average annual basis and do not account for the impacts of the timing and magnitude of large storm events that can produce “pulse flows” that support ecosystems and habitats. Additional investigation is needed to understand the impacts that stormwater capture strategies discussed in this section can have on the environmental benefits that stormwater currently provides.

3.4.1. Technical Potential

When used as a standalone water supply, urban stormwater runoff can be captured at various scales, ranging from household rain barrels and neighborhood-scale detention ponds to centralized collection and infiltration or storage and recovery strategies, while combined use of stormwater and recycled graywater is most likely to occur on-site at the building-scale. The technical potential in each of these cases is ultimately limited by the available non-potable demand that can be offset through non-potable reuse. Implementing additional forms of reuse, such as managed aquifer recharge and direct/indirect potable reuse, either in conjunction with or instead of non-potable reuse, would be needed to realize the full technical potential of urban stormwater runoff. We estimate that the annual average volume of urban stormwater runoff generated in New Mexico is 61,300 AFY (Berhanu et al. 2024) and the technical potential of urban stormwater runoff under existing regulations is 59,800 AFY (Table 13).

Table 13. Technical Potential for Stormwater Runoff and Combined Wastewater/Stormwater Reuse Scenarios, by Water Use Disposition and Water Demand Offset.

Scenario	Demand Offset Description	Demand Offset (AFY)	
		Existing	After Conservation
Centralized Non-Potable Reuse of Stormwater	Consumptive use (irrigation, cooling tower makeup, industrial processes)	59,800	54,200–54,600
	Non-consumptive use (toilet flushing, clothes washing)	1,080	1,290–1,860
	Total Available Non-Potable Demand	60,900	55,500–56,500
On-Site Non-Potable Reuse of Stormwater and Graywater	Consumptive use (irrigation, cooling tower makeup water, industrial processes)	122,000	72,000–83,000
	Non-consumptive use (toilet flushing, clothes washing)	3,960	2,340–3,600
	Total Available Non-Potable Demand	126,000	74,300–86,600

Note: The volumetric offset potential for consumptive uses is limited by available non-potable demand, and reducing these demands leaves more stormwater available to offset non-consumptive uses and results in a higher demand offset volume of these uses when conservation savings are applied.

3.4.2. Levelized Cost

There are a variety of ways to prioritize the development and implementation of alternative water supplies. Beyond understanding the technical potential of capturing urban stormwater runoff, it is important to understand the source of the stormwater, the extent to which it may be impaired, and the end use for which its quality may be the right fit. Like other water supply alternatives, the levelized cost is highly dependent on the implementation strategy.

Stormwater runoff can require less treatment than wastewater and can often be implemented at the neighborhood/district or sub-basin scale using existing stormwater management infrastructure and/or watercourses like arroyos and acequias, depending on the intended use. We examined implementation of decentralized capture and use of stormwater runoff via building-scale rain barrel system adoption and centralized capture and use of stormwater runoff for directed aquifer recharge and for aquifer storage and recovery for addition to drinking water distribution systems (Table 14).

Table 14. Levelized Cost for Non-Potable Reuse Systems Using Stormwater Runoff.

Scenario	Non-Potable Water Source	Scale	End Use(s)	Levelized Cost (\$/AF)
Managed Aquifer Recharge	Stormwater	Centralized	Recharge	\$1,910
Aquifer Storage and Recovery	Stormwater	Centralized	Potable Water	\$2,460
Rain Barrels	Rainwater	Decentralized	Irrigation	\$630
Rain Barrels + On-Site Graywater Recycling	Rainwater, Graywater	Decentralized	Irrigation	\$2,130–\$2,880

We find that the least-cost strategy among the implementation options is household rain barrels for gravity-fed landscape irrigation, at \$630/AF. Integrating building-scale rainwater collection and graywater recycling is even more cost-effective than the other systems that only use graywater discussed in Section 3.3.2, with costs ranging from \$2,130 to \$2,880, though they are still more expensive than rain barrel systems alone. However, we estimate that hybrid rainwater-graywater systems can offset up to 60% of non-potable demands while rain barrel systems alone can offset up to 26% of non-potable demands.

The aquifer storage and recovery strategy requires the same infrastructure as managed aquifer recharge plus additional costs for subsequent pumping and treatment. We estimate that the levelized cost of these strategies is \$1,910/AF for managed aquifer recharge, including conveyance to recharge areas, and increases to \$2,460 when including subsequent pumping and treatment for raw water supply augmentation.

3.4.3. Additional Considerations

Similar to treated wastewater, urban stormwater runoff plays a significant role in New Mexico’s surface water budget, particularly for intermittent flows and ephemeral streams. According to the state constitution, stormwater is classified as “public waters of the state” and its impoundment is allowed, provided the detained volume is released within 96 hours of collection; however, the OSE discourages stormwater management practices that promote evaporative losses (Holcomb et al. 2017). Under these conditions, there are still several opportunities for the capture and subsequent use of stormwater runoff to offset potable water demands, recharge aquifers, and support water quality and environmental protection.

For surface water-supplied communities, stormwater capture would represent no net change to downstream surface water availability when used to offset consumptive water use. When offsetting non-consumptive uses, stormwater capture

can potentially provide a net increase in surface water availability by reducing surface water withdrawals and providing additional return flows via treated wastewater discharge.¹² In groundwater-supplied communities, reusing stormwater could reduce downstream surface water availability when it offsets consumptive use or replaces non-consumptive use in communities that discharge to land or subsurface; no impact is expected from non-consumptive use where treated wastewater is discharged to surface water (Albuquerque Bernalillo County Water Utility Authority 2016). However, capturing stormwater runoff during high-flow periods can potentially interfere with the timing of “pulse” flows that can provide benefits to ecosystems and habitats.

3.5. Produced Water

New Mexico is the second largest producer of oil and gas in the United States and has seen a dramatic increase in production since 2010 due in part to technological advances in horizontal drilling and hydraulic fracturing (Thomson 2025). The expansion of oil and gas activity has raised concerns about proper disposal of waste byproducts, including produced water generated during the well completion and extraction processes. The NMED defines produced water as “fluid that is an incidental byproduct from drilling for or the production of oil and gas” (New Mexico Environment Department, n.d.). This water typically has a much higher dissolved solids content than seawater, ranging anywhere from 20,000 milligrams per liter (mg/L) in the San Juan Basin to greater than 300,000 mg/L in the Permian Basin, and contains many other contaminants regulated under federal and state standards (Cooper et al. 2022; New Mexico Environment Department et al. 2024).

Beginning in 2020, the New Mexico legislature and NMED began requiring oil and gas producers to report their water use volume by source (fresh, brackish, saline, and produced) (Produced Water Act 2019). Recent data for annual production and produced water generation from 2020 through 2024 indicate that roughly 255,000 AFY of produced water is generated across the state on average, predominantly in the San Juan and Permian oil and gas basins, while the oil and gas industry uses roughly 25,000 AFY of fresh, brackish, and saline water per year (New Mexico Oil Conservation Division, n.d.). In general, the water use and produced water volumes reported for 2024 are higher than the annual average, due to the increasing trend in oil and gas development activity in recent years. While this trend suggests that water use and produced water generation will increase in future years, their future availability is highly uncertain and contingent on continued development of the

¹² A net increase in downstream surface water availability is only applicable to cases where stormwater runoff is not infiltrated and treated wastewater is discharged to surface water bodies.

remaining oil and gas resources in New Mexico. Due to this uncertainty, produced water should be considered a non-renewable water supply alternative.

Table 15. Summary of Annual Produced Water Generation and Water Use in the Oil and Gas Sector for Years 2020–2024, by Energy Resource.

	2020–2024 Average			2024 Only		
	Oil	Gas	Total	Oil	Gas	Total
Wells Spudded Per Year	780	280	1,100	860	310	1,200
Total Water Use (AFY)	37,000	13,000	49,000	48,000	14,000	62,000
<i>Fresh</i>	<i>2,500</i>	<i>730</i>	<i>3,200</i>	<i>1,100</i>	<i>620</i>	<i>1,700</i>
<i>Brackish</i>	<i>8,900</i>	<i>3,200</i>	<i>12,000</i>	<i>10,000</i>	<i>2,800</i>	<i>13,000</i>
<i>Saline</i>	<i>2,200</i>	<i>2,800</i>	<i>5,000</i>	<i>5,200</i>	<i>5,000</i>	<i>10,000</i>
<i>Produced Water</i>	<i>23,000</i>	<i>6,100</i>	<i>29,000</i>	<i>32,000</i>	<i>5,900</i>	<i>38,000</i>
Gross Produced Water Generated (AFY)	190,000	66,000	260,000	240,000	82,000	320,000
<i>Recycled On-Site or Reinjectd (AFY)</i>	<i>30,000</i>	<i>8,300</i>	<i>38,000</i>	<i>38,000</i>	<i>8,200</i>	<i>46,000</i>
<i>Disposed Via Injection Well (AFY)</i>	<i>160,000</i>	<i>58,000</i>	<i>220,000</i>	<i>200,000</i>	<i>74,000</i>	<i>280,000</i>

Oil wells produce the largest volume of produced water, despite the roughly equal number of oil and gas wells over the historical analysis period, though the produced water is recycled at a higher rate in gas wells, in terms of the proportion of volume generated. At the same time, the hydraulic fracturing process consumes up to 50,000 AFY of water of varying quality. While freshwater remains a relatively small portion of total water use, the New Mexico legislature and NMED currently require reporting of water use for oil and gas development by water source (fresh, brackish, saline, and produced) and have begun updating existing regulations to both further reduce freshwater use and allow for treatment and reuse of produced water as a water supply alternative (N.M. Admin. Code § 20.6.8 2025; Produced Water Act 2019).

3.5.1. Technical Potential

We estimated the technical potential of produced water recycling and reuse for two scenarios: increased on-site recycling of produced water to offset freshwater use, and broader treatment and reuse of produced water for use outside of the oil and gas sector (Table 16). Produced water recycling and reuse represents a “new” water supply not reflected in New Mexico’s current water budget. However, the risks posed

by insufficient treatment can threaten public and environmental health and safety. While produced water recycling within the oil and gas industry is a common practice, the only full-scale examples of active reuse in other sectors are for agricultural use in Kern County, California, and as part of an aquifer storage and recovery effort in Wellington, Colorado (Allison et al. 2018; Hejase et al. 2022; National Research Council 2010).¹³ The produced water used in these examples contains much lower TDS, ranging from 200 to 22,500 mg/L, than that found in the Permian Basin, which generates over 90% of produced water in New Mexico (Healy et al. 2011; Lester et al. 2015; Thebo et al. 2023). This disparity suggests that full-scale produced water reuse in New Mexico would require significant additional treatment, and costs cannot be directly compared to existing examples in the U.S.

We find that reuse of produced water at existing oil and gas wells can fully offset current freshwater use, estimated as 3,200 AFY on average for 2020–2024 (1,700 AFY in 2024). Off-site reuse opportunities for produced water to meet other beneficial uses are larger, at 110,000 AFY. This volume represents the amount of produced water available after treatment assuming a 50% recovery factor for existing technologies, as discussed further in Section 3.5.2. Gas wells provide the bulk of produced water available for the off-site treatment and reuse scenario, while oil wells provide a larger opportunity for on-site recycling via enhanced oil recovery. This difference is important to consider for potential implementation, as future production trends in the San Juan and Permian basins will directly influence the subsequent availability of produced water from each resource (see Thomson [2025] for a detailed discussion of these trends in each basin).

¹³ The produced water generated in these areas is of significantly lower dissolved solids content than that found in the Permian Basin in New Mexico, where the vast majority of produced water is generated.

Table 16. Technical Potential of Produced Water Recycling and Reuse, by Energy Source.

Scenario	Technical Potential (AFY)		
	Gas	Oil	Total
Increased On-Site Recycling	700	2,500	3,200
Treatment and Transport for Off-Site Reuse in Nearby Power Plants ^a	-	-	11,300
Total Treated Produced Water Volume Available for Off-Site Reuse ^b	79,600	29,000	109,000

^a Represents the average annual cooling water demand for power plants in New Mexico. The proportions of this volume provided by gas wells versus oil wells will depend on how this strategy is implemented.

^b Reflects the total available volume of produced water after treatment with assumed 50% recovery ratio.

3.5.2. Levelized Cost

There is strong opposition against using treated produced water as a water supply because it contains hazardous materials and chemical additives that could threaten public and environmental health if not adequately treated (Thomson 2025). These additives include proprietary fracturing and completion fluids with unknown chemical compositions that make it difficult to define appropriate post-treatment water quality standards and can reduce treatment efficacy (Cooper et al. 2022). While oil and gas development generates a significant amount of produced water, the treatment and transport of produced water presents additional questions about public and environmental safety and cost-effectiveness.

We found several examples of pilot-scale studies for treatment of produced water using various advanced treatment technologies. In a review of produced water treatment systems, Bhojwani et al. (2019) investigated several thermal distillation and membrane treatment processes and estimated their capital and life-cycle operating costs, noting that membrane-based treatment (such as reverse osmosis) is much less cost-effective than thermal distillation for treating high-salinity produced water. They further note that membrane-based treatment is not technically feasible for water with TDS much greater than 30,000 mg/L, such as that found in the Permian Basin in southeastern New Mexico, which represents over 95% of the state's total produced water volume. They estimate that annual unit product costs (including capital and O&M costs) for thermal distillation facilities with 1 MGD (about 1,100 AFY) capacity range from \$2,400/AF to \$5,000/AF, though they did not indicate the TDS of produced water being treated, which can drive increases in O&M costs. Other researchers have estimated the cost of treating produced water with similar TDS to that in the Permian Basin for multiple applications to range from \$8,700/AF to \$126,000/AF, for thermal distillation processes alone as well as hybrid systems using both membrane and thermal distillation processes (Cooper et al.

2022; New Mexico Environment Department et al. 2024; Tavakkoli et al. 2017; U.S. Environmental Protection Agency 2018). This wide range of estimates points to the significant uncertainty in treatment costs that depend on produced water quality, treatment technology, and appropriate treatment standards for the intended use. However, some monetary savings can occur from avoiding disposal costs for the portion of produced water that is delivered off-site rather than injected or evaporated.

For this study, we investigated two scenarios: (1) increased recycling of produced water within the oil and gas industry to offset freshwater use, and (2) treatment via thermal distillation and off-site transport to offset nearby freshwater demands, specifically nearby water-cooled power plants in the Permian Basin. These scenarios reflect optimistic beneficial use cases, due to relative proximity to oil and gas wells for on-site recycling and multiple water-cooled power plants averaging 25–45 miles from the nearest oil and gas well in the Permian and San Juan basins, respectively. However, the total freshwater demand from power plants in the Permian Basin represents only 9% of the total produced water generated in this region. Additional investigations into treatment and off-site reuse in other sectors would provide a more comprehensive assessment of levelized cost for the full technical potential of produced water.

We estimate that the levelized cost for increased on-site recycling is \$-1,700 for the Permian Basin and \$-950 in the San Juan Basin (Table 17). The negative levelized cost for this scenario indicates that the monetary benefits of avoided produced water disposal costs offset the cost of increasing on-site recycling.¹⁴ For the treatment and transport of produced water to nearby water-cooled thermal power plants, we estimate that the levelized cost ranges from \$52,000/AF to \$209,000/AF, indicating that the cost of treatment and transport far outweighs the monetary savings from reduced disposal costs (Table 17).

¹⁴ We assume that the marginal cost of additional on-site recycling is zero in this study, as produced water disposal already requires pre-treatment for disposal injection that would also be necessary for on-site recycling. The avoided disposal cost therefore represents the transportation component of total disposal costs.

Table 17. Levelized Cost for Produced Water Recycling and Reuse Scenarios.

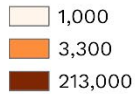
Scenario	Levelized Cost (\$/AF)
Increased On-Site Recycling	\$-1,710–\$-950
Treatment and Transport for Off-Site Reuse in Nearby Power Plants	\$51,900–\$209,000 (Median: \$60,900–\$86,400)
Treatment Cost	\$8,760–\$138,000 (Median: \$14,900)
Transport Cost	\$43,400–\$72,700
Residuals Management Cost	\$3,950–\$11,500
Avoided Disposal Cost	-\$6,050

Note: Cost subtotal ranges for the off-site reuse scenario reflect variability of each cost component and do not correspond to the range of total costs.

In the off-site reuse scenario, we find that transport costs have significant influence regardless of region, ranging from 23%–84% of total cost in the Permian Basin, and 35%–90% in the San Juan Basin (see Figure 1 for locations of power plants and oil and gas production regions). The Permian Basin represents 85% of the technical potential for off-site reuse, with roughly half the average distance between oil and gas wells and the nearest power plant than in the San Juan Basin (25 and 45 miles, respectively). These factors contribute to the lower overall range of costs compared to the San Juan Basin, (\$51,900–\$187,000 and \$81,200–\$209,000, respectively).

Legend

Net Produced Water Generation
2020 - 2024 Average (AFY)



Thermal Power Plant Water Demand
2024 Water Withdrawals (AFY)

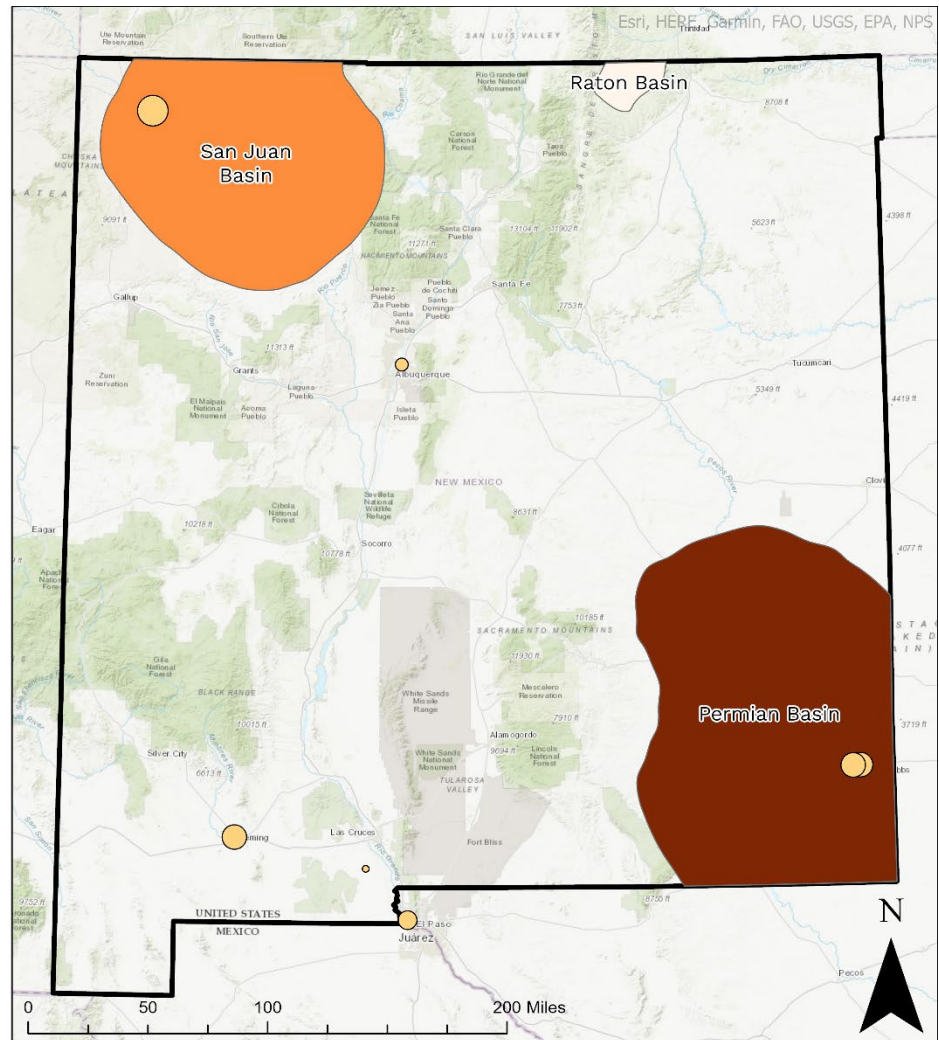
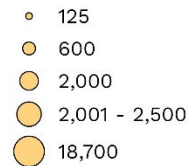


Figure 1. Average Annual Produced Water Generation (by OCD Production Area) and Locations and Scale of Thermal Power Plant Water Demands.

3.5.3. Additional Considerations

These estimates are based on current levels of oil and gas production. While recent industry trends suggest that oil and gas production is likely to continue, long-term projections are highly uncertain due to variable global market conditions and energy demands. The volume of produced water that can sustainably be generated is entirely dependent on oil and gas production activity, and any significant market downturns would reduce the available volume. For example, the cost estimates presented in this study assume a 20-year service life of treatment and transport infrastructure. Reducing the service life to 5 years, representing a potential market downturn or truncated production, would increase costs by roughly 11%–33%, and would require additional costs of decommissioning the constructed treatment facility and site remediation. This dependency on production highlights the non-renewable nature of produced water as a water supply alternative.

Beyond market-driven disruptions to production, the environmental and public health risks, operational complexity, and challenges to cost-effectiveness have all caused premature shutdown of produced water treatment facilities. For example, in the Marcellus Shale formation spanning parts of New York, Ohio, Pennsylvania, and West Virginia, multiple facilities constructed to treat and discharge produced water from hydraulic fracturing activities were shut down within 5-10 years of operation due to environmental and public health violations and lack of produced water influent (Hess 2024; Nobel 2023; Partsch 2024; U.S. Environmental Protection Agency, n.d.). Further, insufficient treatment and/or disposal of treatment byproducts can also threaten public and environmental health and safety (Thebo et al. 2023).

The costs of treatment facility decommissioning and site remediation, as well as who bears these costs, is highly location-specific and should be accounted for when evaluating potential projects implementing this strategy. The question of who bears the costs and benefits of this water supply alternative can also influence the levelized cost estimated in this study. As described in Section 2.4, these cost estimates represent direct implementation by oil and gas companies and do not include the potential administrative costs to the public such as regulatory compliance monitoring and program administration. Publicly funded implementation would not realize the monetary savings from reduced disposal fees, resulting in an additional \$6,050/AF of additional cost.

Full-scale implementation of produced water treatment for reuse outside of the oil and gas industry is not common practice in the U.S., with only a few existing examples identified at the time of this study's publication. Ongoing research on suitable treatment technologies has yet to identify a robust and cost-effective option beyond pilot-scale studies; authors often suggest that unit costs for full-scale implementation will likely be higher than observed in these pilots, and the cost-effectiveness of these technologies in the future heavily depends on the cost savings from avoided disposal (Hightower et al. 2022; New Mexico Environment Department et al. 2024; Scanlon et al. 2020; Texas Produced Water Consortium 2022). Beyond the cost of treatment, the locations where produced water is generated can limit the amount of demand for which oil and gas producers would consider treatment and transport for reuse more cost-effective than conventional disposal methods (Texas Produced Water Consortium 2022; Xu 2023a; Thomson 2025).

The volume of produced water that will be generated and available in the future will also depend on global market trends that influence oil and gas production levels in New Mexico. The relatively high cost of treatment and transport, coupled with the uncertainty of future produced water availability, creates the risk of overinvestment and stranded infrastructure assets that can limit the extent to which produced water can be considered a renewable water supply. The estimated volumes and

costs reported in this study must be considered within the context of these risks when evaluating produced water reuse as a potential water supply strategy.

3.6. Brackish Groundwater Desalination

Brackish groundwater, or water stored in deep and often confined aquifers with dissolved solids concentration ranging from 1,000 to 10,000 mg/L, is perhaps the least characterized among the water supply alternatives investigated in this study, in terms of technical potential. Several studies have attempted to quantify the volume of water across New Mexico brackish aquifers (Figure 2) and are thoroughly detailed by Land (2016) and Timmons et al. (2025), and summarized by Eastern Research Group and NMED (2024) and Thomson (2025).

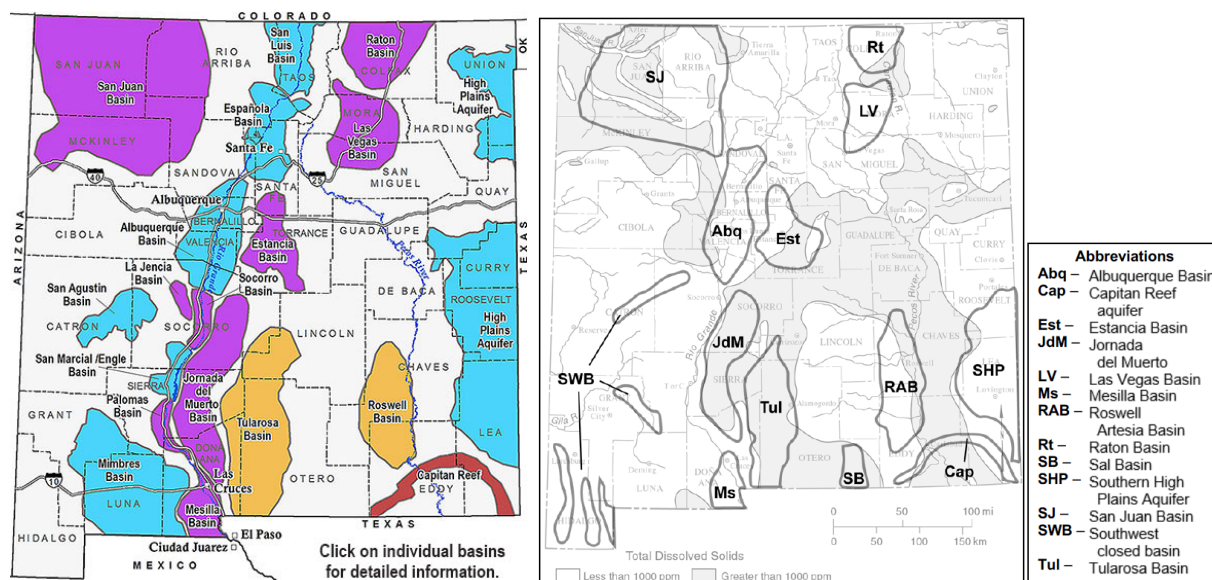


Figure 2. Left: Brackish Groundwater Basins (Land et al. 2016) and Right: Corresponding Sedimentary Basins With Dissolved Solids Indication (Thomson 2025).

3.6.1. Technical Potential

Estimates of stored brackish groundwater volume for these aquifers are sparse, with only a few studies available in the literature (summarized in Table 18 by groundwater basin and aquifer/formation). Further, these estimates are highly uncertain and range from first-order calculations based on limited point measurements to dedicated engineering studies. Additional details for each of the analyses are available in the corresponding references. Across published estimates, the storage volume of brackish groundwater totals 486–878 million AF.

Table 18. Summary of Brackish Groundwater Storage Volumes for Select Aquifers in New Mexico, by Groundwater Basin.

Basin	Aquifer/Formation	Storage Volume (AF)	Average TDS (mg/L)	Reference(s)
Albuquerque	Rio Puerco	576,000	12,000–12,400	(Universal Asset Management et al. 2011)
	Santa Fe Group	300,000,000	1,000–3,000	(Huff 2004)
Mesilla		60,000,000	230–30,800	(New Mexico Environment Department et al. 2024)
Salt		31,000,000	-	(Huff 2004)
San Juan	San Jose/Nacimiento	1,200,000–83,000,000	3,000–10,000	(Kelley et al. 2014)
	Other Confined Aquifers, <2,500' Depth	3,250,000	2,000–12,000	(Kelley et al. 2014)
Tularosa		90,000,000–400,000,000	35,000	(Huff 2004)
Total		486,000,000–878,000,000		

Despite the relatively large storage volume, there are several factors that influence the amount of water that could be sustainably or feasibly extracted. Overall, these deep aquifers receive little to no annual recharge. As a result, these aquifers represent non-renewable supply sources and the sustainable rate of extraction is zero. For other aquifers that have not yet been characterized, the sustainable rate of extraction to be considered as renewable supply must be equal to or less than the rate of recharge. This limitation suggests that brackish groundwater would be more appropriate as an emergency supply or one-time supply augmentation strategy.

Moreover, translating the storage volume to annual yields as a non-renewable supply requires significant additional analysis that is beyond the scope of this study. This includes better characterizing aquifer properties, including transmissivity and storage, validating storage volume estimates, accounting for current and future recharge rates and existing pumping activities, and modeling new pumping activities and subsequent aquifer drawdown over time. Moreover, it would be infeasible to extract the entire storage volume in any of these basins, and the recoverable volume would depend on the required well depth and flow rate to reach sustainable pumping levels. The locations and types of demand relative to brackish groundwater sources would also inform technical potential and cost.

3.6.2. Levelized Cost

The typical costs for brackish groundwater desalination include the construction and operation of deep wells for brackish groundwater pumping, desalination treatment processes such as reverse osmosis, subsequent delivery to nearby public water users or directly to agricultural or industrial users, and disposal of concentrated brine from treatment (Thomson 2025).

Due to the lack of sufficient data for brackish groundwater aquifers in New Mexico to estimate levelized costs, we provide a summary of estimated levelized costs from previous research and pilot studies in New Mexico in Section 3.6.3.

Reported levelized costs range from \$521/AF to \$2,880/AF, with the highest costs belonging to two feasibility study estimates for conceptual facilities in New Mexico. The reasons for the variability in costs are difficult to quantify due to limited available data for cost component details for each project, though the higher TDS of brackish groundwater investigated in these studies, as well as potential economies of scale for the larger facilities, might explain some of this variability across these projects. The mineral content and salinity of brackish water, presence of radioactive or hazardous constituents, production well depth, treatment recovery ratio, waste concentrate disposal method, and transport distance to and from well fields and sources of demand all contribute to the levelized costs.

3.6.3. Additional Considerations

One of the first steps the New Mexico legislature has taken to implement the 50-Year Water Action Plan was to propose the Strategic Water Supply — an initiative to help New Mexico develop alternative water sources for economic opportunities. The Legislature passed the Strategic Water Supply Act (HB137) in 2025 to begin appropriating funds via grants and contracts, totaling \$40 million in FY2026 and an additional \$35 million in FY27, for projects involving brackish water that enhance the state's freshwater resources (Strategic Water Supply Act 2026). These proactive efforts have spurred interest in developing brackish groundwater resources and highlight the existing gaps in essential information to better understand the opportunity of this water supply alternative. Evaluating the actual technical potential of brackish groundwater requires significant additional data collection to characterize pumping activities, aquifer properties, and hydrologic connectivity to surrounding and overlying aquifers. Much of this data collection effort is currently under the purview of NMBGMR through its Aquifer Mapping and Monitoring Program, which began in 2006 to map and characterize the hydrogeologic and water quality characteristics of New Mexico's aquifers (New Mexico Bureau of Geology and Mineral Resources, n.d.).

Table 19. Summary of Levelized Cost Estimates for Brackish Groundwater Desalination Pilot Studies in New Mexico and Nearby States.

Project	Capacity (MGD)	Treatment Process	Waste Disposal Method	Average TDS (mg/L)	Levelized Cost (\$/AF)	Reference
Alamogordo Desalination Plant, NM	1	Brackish Water Reverse Osmosis	Evaporation Ponds	2,330	\$950	(Xu 2023a)
Sandoval County Desalination Treatment Facility Feasibility Study	5	Brackish Water Reverse Osmosis	Injection Well	12,000	\$2,880	(Universal Asset Management et al. 2011)
Santa Teresa Conceptual Feasibility Study	5	Brackish Water Reverse Osmosis	Evaporation Ponds	<5,000	\$2,830	(Xu 2023b)
Irwin Water Works Desalination Plant, CA	6	Electrodialysis Reversal	Evaporation Ponds	300–690	\$1,860	(Xu 2023a)
Eastern Municipal Water District Desalters, CA	12.2	Brackish Water Reverse Osmosis	Ocean Discharge	2,300	\$978–\$1,240	(Xu 2023a)
Kay Bailey Hutchison Desalination Plant, TX	27.5	Brackish Water Reverse Osmosis	Injection Well	2,000–3,600	\$521–\$684	(Xu 2023a)

Deep brackish aquifers in New Mexico typically receive little to no recharge and represent a non-renewable water supply across most of New Mexico's brackish aquifers. The OSE currently requires a groundwater pumping permit for wells less than 2,500 feet deep, as well as for wells greater than 2,500 feet in deep aquifers containing only non-potable water (i.e., TDS higher than 1,000 mg/L), to determine the potential risk of induced leakage from overlying freshwater aquifers (Declaration of Basin - Nonpotable Deep Aquifers. 2009; N.M. Admin. Code § 19.27.4 2017). The interactions between deep and shallow aquifers are highly variable across the state and require more comprehensive characterization, likely through NMBGMR's Aquifer Mapping and Monitoring Program, before implementing this strategy at scale.

4. Summary of Key Findings

New Mexico faces significant challenges from drought, aging infrastructure, and the increasingly frequent and destructive impacts of climate change that strain the state's already overallocated rivers and aquifers. Securing sustainable water supplies over the long term will require significant investment to extend the useful life of current water supplies and potentially develop the water supply alternatives investigated in this study. The state has identified each of these alternatives as part of its recent 50-Year Water Action Plan, though implementation requires a comprehensive understanding of the available opportunity for these strategies. In this study, we investigate each of these water supply alternatives to provide a first-order assessment of their technical potential and levelized cost. This assessment serves as a first step toward identifying and prioritizing existing opportunities for implementation and areas where further investigation is needed.

Significant opportunity exists to build on past progress in reducing water demands by building on existing best practices and through additional conservation measures and technologies that exist today. New Mexico's agricultural sector uses about 78% of the state's developed water. Some groundwater-dependent irrigators have reversed unsustainable use patterns by limiting water use per acre, at the district level. New Mexico could establish a financing framework that supports local conservation planning, preserving flexibility for irrigation district-level decision making. Extrapolating from existing efforts suggests such practices could reduce agricultural water use by 262,000–613,000 AFY, at a cost of about \$6/AF–\$14/AF to fully measure water withdrawals and perform ongoing monitoring and an additional \$150/AF–\$3,400/AF to implement water conservation strategies. The potentially significant adverse impacts of planned, incentivized, voluntary reductions in irrigated acreage should be measured against the potential impacts of unplanned, uncompensated, and mandatory reductions caused by overdrawn aquifers or diminished streamflow. One water conservation practice — lining earthen conveyances to reduce unintended seepage — could reduce water use by as much as 269,000 acre-feet per year at a cost of \$170/AF–\$3,400/AF, depending on conveyance type and characteristics.

We estimate that the total water savings potential for municipal and industrial water users could be as high as 164,000–196,000 AFY, including 79,100–84,600 AFY of consumptive water savings, primarily in the residential sector. Implementing the full suite of indoor and outdoor conservation strategies could, in the aggregate, generate enough monetary savings to offset the cost of adoption. These findings suggest that increased conservation can provide a “least regrets” strategy to adapt to reductions in water supply from an implementation cost perspective.

Table 20. Technical Potential and Levelized Cost of Investigated Water Supply Alternatives.

Water Supply Alternative	Technical Potential (AFY)	Levelized Cost (\$/AF)	Key Considerations
Agricultural Conservation	213,000–676,000	\$160–\$3,400	• Extends use of existing supplies • Requires comprehensive withdrawal metering and ongoing monitoring • Water rights implications • Administrative and monitoring challenges • Potential third-party impacts
Municipal and Industrial Conservation	164,000–196,000	\$-4,830–\$8,520	• Extends use of existing supplies • Non-consumptive use savings may reduce downstream flows and return flow credits • Consumptive use savings typically have a higher cost than nonconsumptive use savings, though often less than new supply alternatives
Wastewater Reuse (Non-Potable Reuse)	103,000–122,000	<u>Centralized Treatment Facility:</u> \$2,330–\$32,600 <i>Treatment: \$2,330</i> <i>Distribution: \$2,260–\$30,300</i> <u>Graywater Recycling:</u> \$1,610–\$4,790	• May reduce downstream return flows and return flow credits • Cost of centralized reuse infrastructure varies with scale of implementation • Could require additional implementation methods (indirect/direct potable reuse, managed aquifer recharge, aquifer storage and recovery) to realize full technical potential.
Stormwater Capture	55,500–56,500	\$790–\$2,500	• May reduce downstream return flows and return flow credits • Diminishes downstream indirect reuse potential • Could require legal changes to realize full technical potential
Produced Water Reuse	<u>On-Site Recycling:</u> 3,210 <u>Off-Site Reuse:</u> 28,900–109,000	<u>On-Site Recycling:</u> \$-1,710–\$-950 <u>Off-Site Reuse:</u> \$51,900–\$209,000 <i>Median: \$60,900–\$86,400</i>	• Public and environmental safety concerns • Supplies are rarely in areas with significant local water demands, wide cost range driven by high transport costs to align supply with demand • Not a renewable resource, annual availability depends on oil and gas industry activity and global market trends
Brackish Groundwater Desalination	One-time extraction potential is high, but not a renewable resource	\$521–\$2,880	• Not a renewable resource but could offer an emergency supply option • Groundwater overdraft can cause land subsidence and degrade adjacent freshwater aquifers and ecosystems

Note: Negative levelized costs indicate cases where monetary savings generated from avoided costs (reduced wastewater and energy bills for municipal and industrial conservation and avoided disposal costs for produced water) over time outweigh the upfront cost of adoption.

The total potential of treated wastewater for non-potable reuse can provide an additional 103,000–151,000 AFY, with costs ranging from \$2,330/AF to \$32,600/AF for centralized systems and \$1,610/AF–\$6,310/AF for decentralized systems, depending on additional storage, pumping, and distribution infrastructure for the proportion of utility customers that would receive non-potable water service. Realizing the full potential of wastewater reuse would likely require additional strategies such as direct or indirect potable reuse, managed aquifer recharge, and/or aquifer storage and recovery. The total potential urban stormwater runoff can provide an additional 55,500–56,500 AFY, with costs ranging from \$1,910/AF to \$2,460/AF for centralized systems and \$790/AF–\$2,460/AF for decentralized systems.

Depending on the disposition of water demands being offset and whether withdrawals come from groundwater or surface water, non-potable reuse and stormwater capture could impact existing transfers of groundwater to surface water and downstream flow availability for other users. These impacts can constrain the potential of these sources to offset non-consumptive use (for surface water-supplied communities) or the potential of these sources as a whole (for groundwater-supplied communities). However, communities must consider these impacts within the broader context of diminishing water supplies that could otherwise create future water supply disruptions.

Produced water represents a substantial volume of water, roughly 217,000 AFY on average, that is currently recycled within the oil and gas industry or sequestered underground in saltwater disposal wells. Increasing rates of on-site produced water recycling can result in net monetary savings for oil and gas producers, while the cost of treatment and transport for off-site uses in water-cooled power plants varies from \$51,900/AF to \$209,000/AF. However, the feasibility of using this water supply alternative outside of the oil and gas industry is highly uncertain. Public and environmental health concerns, availability of cost-effective treatment methods, large transport distances required to deliver treated produced water to prospective users, and future availability driven by global oil and gas market trends all raise significant challenges to implementation. These challenges require a combination of community acceptance, additional research and pilot testing, and favorable economic conditions to build the necessary confidence to be considered a reliable and cost-effective water supply.

Brackish groundwater from deep aquifers represents a non-renewable water supply alternative that could provide emergency water supply or support interstate compact compliance. However, the technical potential is highly uncertain and requires further investigation. The cost to pump, treat, and deliver brackish groundwater for water supply augmentation varies from \$521/AF to \$2,880/AF per year, based on actual and estimated costs from other brackish groundwater desalination projects in the Southwest.

Ultimately, the appropriate implementation for each of these sources will depend on community- and basin-level conditions and the advantages and disadvantages of each source must be considered in the context of broader water supply constraints. This study provides an initial assessment that state agencies and communities can use to perform further data collection and investigation and inform investment and policy decisions that help secure a sustainable and resilient water future for New Mexico.

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Appendix A – Supporting Information

This appendix provides detailed descriptions of the data sources, analysis scenarios, assumptions, and methods used to perform the assessments of technical potential (Appendix A.1) and levelized cost (Appendix A.2) of the water supply alternatives investigated in this study. The sub-appendices are provided by water supply alternative and are complementary to the information provided in the accompanying technical report. Relevant data inputs used in the analysis are organized by data source and reflect additional data inputs not already referenced in the technical report.

A.1. Technical Potential Assessment

A.1.1. Agricultural Water Conservation

Data Sources

1. 2020 New Mexico Water Use by Categories Report (Valdez et al. 2024)
 - a. Irrigated acreage
 - b. Total water withdrawals (by source)
 - c. Measured water withdrawals (by source)
 - d. Estimated conveyance efficiency
 - e. Applied irrigation volume
 - f. Consumptive irrigation requirement
 - g. Estimated irrigation efficiency.
2. Irrigation Conveyances GIS Feature Layer (New Mexico Office of the State Engineer 2020).
 - a. Conveyance infrastructure length and location, by type and construction material
3. Points of Diversion GIS Feature Layer (New Mexico Office of the State Engineer 2025)
 - a. Agricultural Irrigation Points of Diversion

Analysis Scenarios

Supply Conveyance Seepage Reduction:

Reduction of irrigation conveyance seepage losses via lining of earthen supply conveyances (canals, feeders, community ditches, channels, ditches, culverts, and laterals).

Locally Led Conservation Planning and Implementation:

Reduction of agricultural water withdrawals via limits to farm water withdrawal rates to 3 and 5 acre-feet per year (AFY) per acre, coupled with installation of farm withdrawal metering and ongoing monitoring.

- Example: Pecos Valley Artesian Conservancy District
 - Pecos River Basin was adjudicated in 1956, establishing water withdrawal allocations per water user. Full metering was implemented by 1972.
 - Withdrawal allocation set to 3 AFY per acre, plus 0.5 AFY per acre allotment for conveyance losses (14.3% average loss).
 - Additional allocation allowed for Carlsbad, due to the need for blending to dilute salts.
 - Allocations enforced by a 2x cost multiplier for exceeded volume.
 - Allocation system allows for flexibility in strategies enacted to manage withdrawals.
 - Includes purchase of downstream water rights, irrigation and conveyance efficiency improvements, etc.
 - Nearly 20,000 acres have been removed from production to date.
 - Mitigation of aquifer recharge impacts are the responsibility of the irrigation district, which has authority to purchase water rights and is funded by a district-administered tax.
 - Some issues with selling land attached to water rights, which can delay purchase.

Assumptions

Supply Conveyance Seepage Reduction:

Conveyance efficiency lining of all earthen primary irrigation supply conveyances (i.e., canals, channels, ditches, and feeders).

- Supply conveyances make up approximately 73% of total conveyance length (60% when excluding on-farm laterals).¹
- Equal seepage/loss rates across conveyances. Implementation will require a more comprehensive understanding of seepage rate variability across the conveyance types and across New Mexico.
- Conveyance lining activities result in a 75% reduction to overall conveyance loss (including a 5% allowance for the evapotranspiration component of total conveyance losses that cannot be reduced via lining).

Locally Led Conservation Planning and Implementation:

- Farm withdrawal metering and monitoring and implementation of agricultural conservation strategies to reduce farm withdrawal rates to 5 AFY per acre (low savings estimate) and 3 AFY per acre (high savings estimate).

¹ Estimated from New Mexico Irrigation Conveyances GIS shapefile developed by NM Office of State Engineer
(https://gis.ose.state.nm.us/arcgis/rest/services/Conveyances/OSE_Conveyances/MapServer/0).

- Farm withdrawal rate limits applied by OSE-identified locale only where estimated withdrawal rate exceeds scenario withdrawal rate limit (5 or 3 AFY per acre).

A.1.2. Municipal and Industrial Water Conservation

Municipal and Industrial Conservation is defined in this study from a water demand management context, as technologies and strategies that reduce municipal and industrial water demands by either reducing excess water use (conservation) or improving water use performance while maintaining the existing level of service (efficiency).

- Water savings are estimated as the difference between recent water demand estimates and conservation scenario water demand estimates; see Berhanu et al. (2025) for a detailed description of the data sources and analysis methods used to develop these estimates.
- Additional adjustments performed to downscale state-level estimates of recent water demand developed by the Pacific Institute to the county scale and calibrate per capita water use estimates to those estimated by Valdez et al. (2024).
 - Calibration adjustments applied to total GPCD and then applied to sectors, assuming no change to the proportional share of total water demands held by each sector by county.

Data Sources

1. 2020 New Mexico Water Use by Categories Report (Valdez et al. 2024)
 - a. County-level water withdrawals (by source) for public water supply, self-supplied domestic, commercial, and industrial categories.
 - b. County-level population.
2. Municipal and Industrial Water Demands and Conservation Savings Potential, previously developed by the Pacific Institute (Berhanu et al. 2025).
 - a. “Recent year” (calendar years 2022–2023) water demands and per capita water use for residential (single-family and multi-family), commercial, industrial, and institutional (CII), and utility water loss sectors.
 - i. Residential demands disaggregated to end-use (e.g., shower) level.
 - ii. CII demands disaggregated to seasonal and non-seasonal levels.
 - b. Conservation savings potential estimates (corresponding to analysis scenarios described in this section).
 - c. Population and employment estimates and housing stock characteristics (lot area, building footprint area) derived from U.S. Census Bureau datasets (U.S. Census Bureau 2022a; 2023; 2024a)

Analysis Scenarios

Improved Conservation:

Adoption of water conservation measures moderately beyond current minimum state requirements and/or typical industry performance.

- Indoor Residential: Average WaterSense- and ENERGY STAR-labeled device performance.
- Outdoor Residential: Equivalent to a landscape with medium water use plants and an efficient irrigation system.
- Commercial, Industrial, and Institutional (CII): Median reported CII water intensity (gallons per square foot of gross floor area).
- Utility Water Loss: Median reported infrastructure leakage index (ILI).

Leading Conservation:

Adoption of water conservation measures reflecting leading-edge technology and/or industry-leading performance.

- Indoor Residential: Most efficient WaterSense- and ENERGY STAR-labeled device performance.
- Outdoor Residential: Equivalent to a landscape with low water use plants and efficient irrigation.
- CII: Lowest 25th percentile reported CII water intensity (gallons per square foot of gross floor area).
- Utility Water Loss: Lowest 25th percentile reported infrastructure leakage index (ILI).

Assumptions

- Implementation reflects 100% uptake of efficient technologies and practices.
- Seasonal water demands for both residential and CII sectors predominantly represent irrigation and/or cooling tower makeup, i.e., consumptive water use.

A.1.3. Municipal and Industrial Wastewater Reuse

Data Sources

1. 2023 National Pollution Discharge Elimination System (NPDES) Discharge Monitoring Reports (DMR) (U.S. Environmental Protection Agency 2023)
 - a. Monthly treated and discharged wastewater from publicly owned treatment works facilities for FY 2023.
2. Groundwater Discharge Permit GIS Feature Layer (New Mexico Environment Department 2023a).
 - a. Locations and permitted capacities for state-permitted wastewater treatment facilities discharging to groundwater.
3. Onsite Wastewater Compliance GIS Feature Layer (New Mexico Environment Department 2023b).
 - a. Locations of active permitted septic tanks in New Mexico.

Analysis Scenarios

Non-Potable Reuse:

Volume of wastewater from sewer and septic sources available to offset non-potable municipal and industrial water demands, under current regulations and guidance.²

Total Wastewater Generated:

Total volume of treated wastewater generated from municipal and industrial sources. Implementation can occur via one or more of the following: centralized and building-scale non-potable reuse, direct/indirect non-potable reuse, managed aquifer recharge, and aquifer storage and recovery.

Assumptions

- Considering all treated wastewater from surface water discharges (via the NPDES database), groundwater discharge (via the NMED Groundwater Discharge Permit Program), as well as septic systems (identified via OSE data).
- Possible uses include those currently allowed under NMED regulation and/or guidance (irrigation, toilet flushing, cooling tower makeup).
- Technical potential taken as the lesser of non-potable demand offset potential or available treated wastewater volume by county.
- Technical potential estimates include the volume of wastewater that is currently recycled. Additional data collection for the existing volume of reuse is required to refine these estimates.
- Technical potential range reflects the existing volume of available treated wastewater and the potential volume after implementing conservation strategies investigated in this study.
- The total Wastewater Generated scenario represents adoption of one or more of the following strategies to maximize wastewater reuse: non-potable reuse (centralized and building-scale), indirect/direct potable reuse, managed aquifer recharge, and aquifer storage and recovery.

A.1.4. Urban Stormwater Runoff

Urban stormwater runoff refers to average annual runoff from impervious surfaces such as rooftops, parking lots, and streets and highways for the 32 U.S. Census Bureau-designated Urban Areas in New Mexico (U.S. Census Bureau 2022b). These areas represent the majority of stormwater runoff sources throughout the state and include communities with populations ranging from 5,000 to 770,000 (total population of 1.55 million, or 73% of New Mexico's population in calendar year 2020).

Technical potential estimates were derived from the Pacific Institute's previous report "Untapped Potential: An Assessment of Urban Stormwater Runoff in the United States," which estimates average annual urban stormwater runoff using the

² As described in the NMED Graywater Irrigation Guide and NMED Ground Water Quality Bureau Guidance: Above Ground Use of Reclaimed Domestic Wastewater (New Mexico Environment Department 2003; 2007).

2019 National Land Cover Dataset average annual rainfall statistics for the period 1980–2018 (Berhanu et al. 2024).

Runoff estimates were generated at a 30-meter spatial resolution and aggregated to Urban Area geographies to provide community-level runoff volumes.

Data Sources

1. Average annual stormwater runoff estimates for U.S. Census-defined Urban Areas in New Mexico for calendar year 2020, previously developed by the Pacific Institute, (Berhanu et al. 2024)

Analysis Scenarios

Centralized Non-Potable Reuse of Stormwater:

Volume of stormwater runoff from centralized storm sewer sources to offset non-potable municipal and industrial water demands, under current regulations and guidance.³

On-Site Non-Potable Reuse of Stormwater and Graywater:

Volume of stormwater runoff and graywater generated from private property to offset non-potable municipal and industrial water demands via rainwater capture, under current regulations and guidance.⁴

Total Stormwater Generated:

Total volume of stormwater runoff generated in urban areas.

Assumptions

- Considering all stormwater runoff occurring in U.S. Census-defined Urban Areas (including roof runoff), derived from Pacific Institute’s National Assessment of Urban Stormwater Runoff in the United State study.⁵
- Technical potential taken as the lesser of non-potable demand offset potential or available stormwater runoff, by county.
- Possible uses include those currently allowed under NMED regulation and/or guidance (irrigation, toilet flushing, cooling tower makeup).
- Technical potential estimates include the volume of stormwater that is currently reused. Additional data collection for existing volume of reuse is required to refine these estimates.

³ As described in NMED Graywater Irrigation Guide and NMED Ground Water Quality Bureau Guidance: Above Ground Use of Reclaimed Domestic Wastewater (New Mexico Environment Department 2003; 2007).

⁴ As described in NMED Graywater Irrigation Guide and NMED Ground Water Quality Bureau Guidance: Above Ground Use of Reclaimed Domestic Wastewater (New Mexico Environment Department 2003; 2007).

⁵ Berhanu et al. 2024. *Untapped Potential: An Assessment of Urban Stormwater Runoff Potential in the United States*. https://pacinst.org/wp-content/uploads/2024/02/StormwaterCapture_FullReport.pdf.

- Technical potential range reflects the existing non-potable demand volume and potential non-potable demand volume after implementing conservation strategies investigated in this study.
- The total Stormwater Generated scenario represents adoption of one or more of the following strategies to maximize reuse: non-potable reuse (centralized and building-scale), indirect/direct potable reuse, managed aquifer recharge, and aquifer storage and recovery.

A.1.5. Produced Water

Data Sources

1. New Mexico Oil Conservation Division Statistics (New Mexico Oil Conservation Division, n.d.).
 - a. Annual oil and gas production, produced water generation volume, oil and gas industry water use (by source), and produced water disposal volume (by method).
2. New Mexico Oil Conservation Division Oil and Gas Well GIS Feature Layer (New Mexico Oil Conservation Division 2025).
 - a. Location, type, activity period, and oil and gas production region for active oil and gas wells in New Mexico.
3. Thermal Power Plants in the US GIS Feature Layer (U.S. Energy Information Administration 2025).
 - a. Location, fuel source, and primary mover for power plants in the United States, filtered to New Mexico.
4. EIA Form 923, Calendar Year 2024 – Monthly Generation and Fuel Consumption Time Series (U.S. Energy Information Administration 2024b).
 - a. Monthly electricity generation for thermal power plants in New Mexico, aggregated to 2024 Total
5. U.S. EIA Water Cooling by Generator and Boiler Report (U.S. Energy Information Administration 2024c).
 - a. Annual water withdrawals and consumption for thermal power plants in New Mexico.

Analysis Scenarios

Increased On-Site Recycling:

Volume of produced water needed or available to offset freshwater withdrawals via additional recycling within the oil and gas industry.

Treatment and Transport for Off-Site Reuse in Nearby Power Plants:

Total recoverable volume of produced water needed or available to offset water withdrawals from nearest water-cooled thermal power plants, after advanced treatment and transport.

Assumptions

- Current freshwater demands for the oil and gas industry provide the upper limit of technical potential for the Increased On-Site Recycling scenario.
- Technical potential estimates for off-site reuse represent the average annual production and produced generation volumes for years 2020–2024, accounting for the recoverable volume available for off-site reuse after treatment.

A.2. Levelized Cost Assessment

A.2.1. Agricultural Water Conservation

Assumptions

Supply Conveyance Seepage Reduction:

- Equal seepage rates and widths across conveyance types.
- Equal width across conveyance, to be refined in future basin-scale investigations.
- O&M cost included in current conveyance maintenance activities (i.e., no marginal O&M cost).

Water Inputs:

Input	Value	Units	Reference(s)
Annual Conveyance Losses	512,000	AFY	(Valdez et al. 2024)
Total Conveyance Length	5,860	miles	(New Mexico Office of the State Engineer 2020)
<i>Canals</i>	<i>410</i>		
<i>Feeders and Community Ditches</i>	<i>46</i>		
<i>Channels, Ditches, and Culverts</i>	<i>3,000</i>		
<i>Laterals</i>	<i>1,100</i>		
<i>Excluded Categories</i>	<i>1,200</i>		
Percentage Seepage Reduction from Conveyance Lining (by Linear Foot)	75%	-	Assumed

Monetary Inputs:

Input	Value	Units	Reference(s)
Unit Capital Cost of Lining – Canals, Feeders, Community Ditches	385	USD	(King et al. 2006)
Unit Capital Cost of Lining – Channels, Ditches, Culverts, Laterals	37	USD	(King et al. 2006)

Other Inputs:

Input	Value	Units	Reference(s)
Scenario Planning Horizon	30	years	Assumed

Locally Led Conservation Planning and Implementation:

- Monitoring and enforcement costs included within existing program administration costs for New Mexico Office of the State Engineer district offices.
- One new FTE per irrigation district to collect withdrawal measurement data and monitor compliance with farm water withdrawal rate limits, with salary equivalent to the midpoint of EE pay band from NM OSE FY25 Salary Schedule for Engineer, Surveyor, Water Resources, Engineering Technician position class (\$95,045.00 per FTE per year).

Water Inputs:

Input	Value	Units	Reference(s)
Total Irrigated Acreage	786,000	acres	(Valdez et al. 2024)
Surface Water Irrigated Acreage	261,000		
Groundwater Irrigated Acreage	525,000		
Current Total Withdrawal Rate	3.77	AF per acre-year	Modeled
Surface Water Withdrawal Rate	5.61		
Groundwater Withdrawal Rate	2.86		
Scenario Withdrawal Rate Allocation	3	AF per acre-year	Assumed

Monetary Inputs:

Input	Value	Units	Reference(s)
Unit Capital Cost of Withdrawal Monitoring Equipment (including installation)	19,850	USD	(California State Water Resources Control Board 2025)
Annual Cost of Monitoring Equipment O&M ^a	2,977.5	USD	
Annual Cost of Compliance Monitoring	170,000	USD	(New Mexico State Personnel Office 2024)

^aAssumed 15% of capital cost, per cost reference guidance.

Other Inputs:

Input	Value	Units	Reference(s)
Existing Number of Irrigation Diversion Points	2,024	each	(New Mexico Office of the State Engineer 2025)
Current Measured Proportion of Agricultural Water Withdrawals	48	%	(Valdez et al. 2024)
Scenario Planning Horizon	30	years	Assumed

Example Levelized Cost Calculation: Installation of Farm-Level Water Withdrawal Measurement Equipment and Ongoing Maintenance and Monitoring.

Present Value Interest Factor (PVIF):

$$\left(\frac{\left(1 - \left(\frac{1}{(1 + 0.030)^{30}} \right) \right)}{0.030} \right) = 25.7$$

Lifetime Water Savings:

$$\begin{aligned} & \text{Annual Water Savings} * \text{Service Life} = \\ & \left(\frac{3.77 \text{ AF} - 3 \text{ AF}}{\text{acre} - \text{year}} \right) * (786,000 \text{ acres}) * 15 \text{ years} = \\ & \mathbf{9,080,000 \text{ AF}} \end{aligned}$$

Capital Cost:

$$\begin{aligned} & \text{Unit Capital Cost of Equipment} * \text{Number of Diversion Points} \\ & * \text{Proportion of Unmeasured Withdrawals} = \end{aligned}$$

$$\frac{\$19,850}{\text{device}} * 2,024 \text{ Irrigation Diversion Points} * 0.52 =$$

$$\mathbf{\$20,900,000}$$

Lifetime O&M Cost:

$$(Annual\ Equipment\ O\&M\ Cost + Annual\ Compliance\ Monitoring\ Cost) * PVIF =$$

$$\left(\left(\frac{\$19,850 * 0.15}{device} * 1,052\ devices \right) + \left(\frac{\$95,045}{FTE - Irrigation\ District} * 15\ Irrigation\ Districts \right) \right) * 25.7 =$$

\$117,000,000

Levelized Cost:

$$\frac{Capital\ Cost + Lifetime\ O\&M\ Cost}{Lifetime\ Water\ Savings} =$$

$$\frac{\$20.9M + \$117M}{9.08M\ AF} = \frac{\$138M}{9.08M\ AF} =$$

$$\frac{\$15.2}{AF}$$

Note: Example levelized cost calculation represents state-level scale of analysis for demonstration purposes. The project technical report will include district-level analyses, aggregated to the state level to account for withdrawal rate variability across irrigation districts.

A.2.2. Municipal and Industrial Water Conservation

Assumptions

- Monetary savings generated from avoided wastewater and energy customer costs, reflecting the cost-of-service provision, including utility O&M and production costs borne by the resource provider.
- Where applicable, unit capital costs of technology adoption include installation cost.
- Levelized costs estimated per device, where applicable.

Water Inputs:

Device	Existing Performance	Scenario Performance ^a	Units	References
Showerhead	2.5	2.0 / 1.0	gallons per minute	(Berhanu et al. 2025)
Bathroom Faucet	2.2	1.5 / 0.8	gallons per minute	
Toilet	1.6–3.5	1.28 / 0.79	gallons per flush	
Clothes Washer	25	16.7 / 13.8	gallons per cycle	
Dishwasher	5	3.3 / 2.9	gallons per cycle	
Leaks	11.3	9.6 / 8.3	gallons per day	
Outdoor Landscape Transformation	-	34.5	gallons saved per square foot transformed	
CII Indoor Water Use	43.3	16.8 / 11.0	gallons per square foot per year	Modeled
Utility Water Loss Infrastructure Leakage Index	4.3	2.6 / 1.6	-	(Berhanu et al. 2025)

^aImproved Conservation and Leading Conservation Scenarios, respectively.

Device	Duration (minutes/use) ^a	Frequency (uses/day) ^a	Devices per Household ^{b,c}	Service Life ^{c-g}
Showerhead	6.3	0.8	1.9	10.0
Bathroom Faucet	0.2	36	2.1	10.0
Toilet	-	6.4	2.1	20.0
Clothes Washer	-	0.48	0.91	13.4
Dishwasher	-	0.49	0.78	15.2
Leaks			-	15.0
Outdoor Landscape Transformation			750	25.0

^a (Flume Data Labs 2024)

^b (U.S. Energy Information Administration 2024a)

^c (Berhanu et al. 2025)

^d (Schein et al. 2019)

^e (Guidehouse Consulting, Inc. et al. 2024b)

^f (Guidehouse Consulting, Inc. et al. 2024a)

^g (Rosenberg et al. 2011)

Cost Inputs:

Device	Unit Capital Cost, Device (\$) ^a	Unit Capital Cost, Installation (\$) ^{b-e}
Showerhead	28.3–40.0	6.5
Bathroom Faucet	6.50	113
Toilet	230–340	300
Clothes Washer	630–750	180
Dishwasher	500	170
Household Water Use Monitoring Device	57–70	-
Outdoor Landscape Transformation	-	4.40

^a Retail device price data for scenario-compliant device models obtained from Home Depot, Lowe's, Walmart, and Target retail websites. Accessed November 14, 2025.

^b <https://www.homedepot.com/services/c/shower-head-replacement/678ceba2e>.

^c <https://www.homedepot.com/services/c/cost-install-toilet/55af3b94a>.

^d (Guidehouse Consulting, Inc. et al. 2024b).

^e (Guidehouse Consulting, Inc. et al. 2024a).

Levelized Cost (\$/AF)	Value	References
CII – Indoor Water Use	-\$2,500 to -\$2,200	(Cooley et al. 2016)
Utility Water Loss – Advanced Leak Detection	\$320–\$870	(Rupiper et al. 2022)
Utility Water Loss – Pressure Management	\$350–\$510	(Rupiper et al. 2022)

Input	Value	Units	References
Unit Cost of Water	.00379	USD per 1,000 gallons	(Albuquerque Bernalillo County Water Utility Authority 2025; Las Cruces Utilities 2021; City of Rio Rancho 2025; City of Roswell 2025; City of Santa Fe 2025)
Unit Cost of Wastewater	.00413	USD per 1,000 gallons	(Albuquerque Bernalillo County Water Utility Authority 2025; Las Cruces Utilities 2020; City of Rio Rancho 2025; City of Roswell 2025; City of Santa Fe 2025)
Unit Cost of Natural Gas	2.68	USD per dekatherm	(Las Cruces Utilities 2022; New Mexico Gas Company, n.d.)
Unit Cost of Electricity	0.1627	USD per kWh	(U.S. Energy Information Administration, n.d.)
Unit Cost of Technology Adoption	112.5	USD	Assumed

Other Inputs:

Input	Value	Units	References
Number of People per Household	2.55	each	(U.S. Census Bureau 2020)
Portion of Households With Electric Water Heating	20%	-	(U.S. Energy Information Administration 2023)
Electric Energy Intensity of Residential Hot Water	0.165	kWh per gallon	(U.S. Environmental Protection Agency 2020)
Natural Gas Energy Intensity of Residential Hot Water	0.0087	dekatherm per gallon	(U.S. Environmental Protection Agency 2020)
Service Life	10	years	(GMP Research 2019)

Example Levelized Cost Calculation: Residential Showerheads

Present Value Interest Factor (PVIF):

$$\left(\frac{\left(1 - \left(\frac{1}{(1 + 0.030)^{10}} \right) \right)}{0.030} \right) = 8.53$$

Lifetime Water Savings:

*Annual Water Savings * Service Life =*

$$\left(\left(2.5 \frac{\text{gallons}}{\text{minute}} - 2.0 \frac{\text{gallons}}{\text{minute}} \right) * \frac{6.3 \text{ minutes}}{\text{shower}} * \frac{0.8 \text{ showers}}{\text{person} - \text{day}} * \frac{2.55 \text{ people}}{\text{household}} * \frac{1 \text{ household}}{1.87 \text{ devices}} \right) * \left(\frac{365 \text{ days}}{\text{year}} \right) * \frac{1 \text{ acre} - \text{foot}}{325,851 \text{ gallons}} * 12.5 \text{ years} =$$

$$\frac{1,250 \text{ gallons}}{\text{device} - \text{year}} * \left(\frac{1 \text{ acre} - \text{foot}}{325,851 \text{ gallons}} \right) * 10 \text{ years} =$$

$$\frac{0.0385 \text{ AF}}{\text{device}}$$

Capital Cost:

$$\text{Unit Cost} * \frac{\text{Units Per Household}}{\text{Persons Per Household}} =$$

$$\frac{\$28.27}{\text{unit}} + \frac{\$112.5}{\text{installation}}$$

$$\frac{\$140.77}{\text{device}}$$

Lifetime Monetary Savings:

$$(\text{Annual Water Monetary Savings} + \text{Annual Wastewater Monetary Savings} + \text{Annual Energy Monetary Savings}) * PVIF =$$

$$\left(\frac{\$0.00413}{\text{gallon wastewater}} + 0.2 * \left(\frac{\$0.1627}{\text{kWh}} * \frac{0.165 \text{ kWh}}{\text{gallon}} \right) + 0.8 * \left(\frac{\$2.68}{\text{dekatherm}} * \frac{0.0087 \text{ dekatherm}}{\text{gallon}} \right) \right) * \frac{1,254 \text{ gallons}}{\text{device} - \text{year}} * 8.53 =$$

$$\frac{\$0.0191}{\text{gallon}} * \frac{1,254 \text{ gallons}}{\text{device} - \text{year}} * 8.53 =$$

$$\frac{\$204.82}{\text{device} - \text{year}}$$

Levelized Cost:

$$\frac{(\text{Capital Cost} - \text{Lifetime Monetary Savings})}{\text{Lifetime Water Savings}} =$$

$$\frac{(\$140.77 - \$204.82)}{0.0385 \text{ AF}} =$$

$$- \frac{\$1,660}{\text{AF}}$$

In this example, a negative levelized cost indicates that life-cycle monetary benefits exceed the life-cycle costs of adoption, and the magnitude of the levelized cost indicates the magnitude of benefits produced per gallon of water saved.

A.2.3. Municipal and Industrial Wastewater Reuse

Analysis Scenarios

- Construction of a hypothetical centralized reclaimed water system providing non-potable water supply to offset potable water demands.
 - For communities with existing reclaimed system infrastructure:
 - Upgraded treatment capacity for additional reclaimed water production and additional storage, pumping, and distribution in proportion to additional treatment capacity needs (if technical potential exceeds current reclaimed water system capacity).
 - For communities without an existing reclaimed system:
 - New/replacement treatment facility, storage and pumping, and distribution infrastructure.

Assumptions

- Levelized costs represent construction of a new advanced wastewater treatment facility producing Class 1A Reclaimed Water and corresponding storage, pumping, and transmission/distribution infrastructure to serve consumptive potable water demand sources.
 - For communities with existing reclaimed water infrastructure, additional levelized cost estimates are provided to reflect the range of possible investments that combine one or more cost components (i.e., treatment capacity, storage, pumping, and distribution infrastructure).
- Treatment facility costs represent new/replacement treatment facilities, unless otherwise noted.
- Reclaimed system distribution inputs are sized for average daily reclaimed wastewater production for consumptive water uses.
 - Incorporating potable water demand offsets for non-consumptive water use can be estimated by adding capital costs for dual-plumbing of non-potable end uses in reclaimed customer properties. These costs are highly dependent on community-level decisions related to reclaimed system size and service area and must be assessed on a case-by-case basis.
 - Levelized cost range represents the typical scale of implementation (low estimate) and maximum implementation to serve all customers within the service area (high estimate).
- Average 8" diameter of reclaimed transmission and distribution mains (weighted average by length), not including service mains.

Example Levelized Cost Calculation

Water Inputs:

Input	Value	Units	References
Reclaimed System Capacity	5	MGD	Assumed
Average Daily Reclaimed Water Demand	63.8	gpcd	Modeled
Average Population Per Connection	3.04	person per connection	(U.S. Environmental Protection Agency 2025)

Monetary Inputs:

Input	Category	Value	Units	References
Unit Capital Cost of Advanced Treatment and Disinfection Facility	Treatment	69,500,000	\$/MGD capacity	(National Research Council 2012)
Annual Treatment Facility O&M (Including Energy)	Treatment	1,350	\$/MG	(National Research Council 2012)
Unit Capital Cost - Reclaimed Water Storage Reservoirs	Distribution	$729,000 * MG + 1,130,000$	\$	(HDR Inc. et al. 2018)
Unit Capital Cost - Reclaimed Water Pump Stations	Distribution	$4,660,000 * MGD^{0.395}$	\$	(HDR Inc. et al. 2018)
Unit Capital Cost - Reclaimed Water Distribution System	Distribution	$59.8 * Diameter^{0.189}$	\$/linear foot	(HDR Inc. et al. 2018)
Annual Storage, Pump Station, and Distribution System O&M	Distribution	5% of Total Capital Cost	%	(HDR Inc. et al. 2018)

Other Inputs:

Input	Value	Units	References
Peak Hour Demand Factor	5	-	Assumed
Maximum Distribution Main Velocity	5	feet per second	Assumed
Connection-Main Density	70	connections per mile of main	Assumed
Population-Connection Density	3	persons per connection	(Albuquerque Bernalillo County Water Utility Authority, n.d.; Baca 2023; Daniel B. Stephens & Associates, Inc. 2007; Diaz 2017; Hydrosphere Resource Consultants 2007; Water Prospecting and Resource Consulting 2007)
Average System Service Life	30	years	(Albuquerque Bernalillo County Water Utility Authority, n.d.; Baca 2023; Daniel B. Stephens & Associates, Inc. 2007; Diaz 2017; Hydrosphere Resource Consultants 2007; Water Prospecting and Resource Consulting 2007)

Example Levelized Cost Calculation: New Centralized Reclaimed Water System (Maximum Implementation Scenario).

Present Value Interest Factor (PVIF):

$$\left(\frac{\left(1 - \left(\frac{1}{(1 + 0.030)^{30}} \right) \right)}{0.030} \right) = 19.6$$

Lifetime Reclaimed Water Volume:

*Annual Treated Wastewater Volume * System Service Life =*

$$5 \text{ MGD} * \frac{1 \text{ acre-foot}}{325,851 \text{ gallons}} * \frac{365 \text{ days}}{\text{year}} * 30 \text{ years} =$$

$$\frac{5,600 \text{ AF}}{\text{year}} * 30 \text{ years} =$$

168,000 AF

Capital Cost:

$$\begin{aligned}
 & \text{Treatment Facility Cost} + \text{Storage \& Pumping Cost} + \text{Distribution System Cost} = \\
 & \quad (\text{Unit Cost of Treatment} * \text{Average Day Demand}) + \\
 & \quad ((\text{Unit Cost Storage} + \text{Unit Capital Cost Pump Stations}) * \text{Average Day Demand}) + \\
 & \quad \left(\text{Unit Cost Distribution Mains} * \text{Number of Connections} * \left(\frac{\text{Average Length of Main}}{\text{Connection}} \right) \right) = \\
 & \quad \left(\left(\frac{\$69,500,000}{\text{MGD}} * 5 \text{ MGD} \right) + \left(\frac{\$729,000}{\text{MG}} * 5 \text{ MG} + 1,130,000 \right) \right) + \\
 & \quad + \left(\frac{\$4,660,000}{\text{MGD}^{0.3953}} * 5 \text{ MGD}^{0.3953} \right) + \\
 & \quad \left(\frac{\$59.8}{(\text{linear} - \text{foot}) - \text{inch}^{0.187}} * (12 \text{ inches})^{0.189} \right) \\
 & \quad * \left(\left(\frac{5,000,000 \text{ gallons/day}}{\left(\frac{63.8 \text{ gallons}}{\text{person} - \text{day}} * \frac{3.04 \text{ persons}}{\text{connection}} \right)} \right) \text{connections} \right. \\
 & \quad \left. * \left(\frac{1 \text{ mile}}{70 \text{ connections}} * \frac{5,280 \text{ linear feet}}{1 \text{ mile}} \right) \right) = \\
 & \quad \$345,000,000 + \$4,800,000 + \$70,000,000 + \$1,590,000,000 = \\
 & \quad \mathbf{\$2,000,000,000}
 \end{aligned}$$

Lifetime O&M Cost:

$$\begin{aligned}
 & \left(((\text{Annual Treatment O\&M Cost} * \text{Average Treated Volume}) * \text{Service Life}) \right. \\
 & \quad \left. + (0.05 * (\text{Storage, Pump Station, and Distribution Capital Cost})) \right) * \text{PVIF} =
 \end{aligned}$$

$$\left(\left(\frac{\$1,350}{MG} * \left(5 \text{ MGD} * \left(\frac{365 \text{ days}}{\text{year}} \right) \right) \right) + (0.05 * (\$4,800,000,000 + \$70,000,000 + \$1,590,000,000)) \right) * 19.6 =$$

$$\mathbf{\$2,360,000,000}$$

Levelized Cost:

$$\frac{\text{Centralized Reclaimed System Net Present Value}}{\text{Lifetime Reclaimed Water Volume}} =$$

$$\frac{\$2,000,000,000 + \$2,360,000,000}{168,000 \text{ AF}} =$$

Excluding new storage, pumping, and distribution infrastructure:

$$\frac{\mathbf{\$2,300}}{\mathbf{AF}}$$

Including new storage, pumping, and distribution infrastructure:

$$\frac{\mathbf{\$26,000}}{\mathbf{AF}}$$

A.2.4. Urban Stormwater Runoff

Analysis Scenarios

- Construction of building-scale and centralized systems to capture and reuse urban stormwater runoff:
 - Building-Scale Non-Potable Reuse (Irrigation Only)
 - On-Site Rainwater Collection
 - Laundry Graywater Recycling
 - Whole-Building Graywater Recycling
 - Combined Rainwater Collection and Whole-Building Graywater Diversion
 - Centralized Stormwater Capture for:
 - Managed Aquifer Recharge
 - Aquifer Storage and Recovery

Assumptions

- Building-scale system capacity taken as lesser of available supply volume and applicable non-potable demand.
- Building-scale system components include:
 - Storage capacity up to 24 hours (excluding laundry graywater diversion)
 - Treatment capacity for supply generated over 24 hours
 - Plumbing diversion cost (for graywater recycling)
- Whole-Building Graywater supply volume represents wastewater collected from laundry, showers, and bathroom faucets.

Water Inputs:

Input	Value	Units	References
Non-Potable Reuse Demand	58	gallons/capita per day	Modeled
Annual Precipitation	13.6	inches/year	Modeled
Laundry Graywater Supply Volume	6,200–7,500	gallons/household per year	Modeled
Building Graywater Supply Volume	16,200–26,900	gallons/household per year	Modeled
Average Urban Stormwater Runoff	3.6	gallons/square foot per year (impervious area)	Modeled

Cost Inputs:

Input	Category	Value	Units	References
Unit Capital Cost – Treatment	Rainwater	45	\$	(Water Wise Group, n.d.)
	Graywater	630–980	\$	(Water Wise Group, n.d.)
Unit Capital Cost – Storage	Rainwater	125	\$/50-gallon capacity	(National Research Council 2012)
Unit Capital Cost - Diversion	Graywater	1,240–3,350	\$	(Yu et al. 2015)
Annual O&M Cost – Treatment	Rainwater	30	\$/year	(Water Wise Group, n.d.)
	Graywater	50	\$/year	(Water Wise Group, n.d.)
Levelized Cost - Managed Aquifer Recharge	Stormwater	1,900	\$/AF	(Cooley et al. 2016)
Levelized Cost - Aquifer Storage and Recovery	Stormwater	2,500	\$/AF	(Cooley et al. 2016)

Input	Value	Units	References
Unit Cost of Water	.00379	USD per 1,000 gallons	(Albuquerque Bernalillo County Water Utility Authority 2025; Las Cruces Utilities 2021; City of Rio Rancho 2025; City of Roswell 2025; City of Santa Fe 2025)
Unit Cost of Wastewater	.00413	USD per 1,000 gallons	(Albuquerque Bernalillo County Water Utility Authority 2025; Las Cruces Utilities 2020; City of Rio Rancho 2025; City of Roswell 2025; City of Santa Fe 2025)
Unit Cost of Natural Gas	2.68	USD per dekatherm	(Las Cruces Utilities 2022; New Mexico Gas Company, n.d.)
Unit Cost of Electricity	0.1627	USD per kWh	(U.S. Energy Information Administration, n.d.)
Unit Cost of Technology Adoption	112.5	USD	Assumed

Other Inputs:

Input	Value	Units	References
Average Rooftop Area	1,700	square feet	(U.S. Census Bureau 2024b)
Average Rainwater Storage Duration	14	days	Assumed
Average Urban Land Area	14,600	acres	Derived from Berhanu et al. (2024)
Average Urban Area Impervious Cover	28	%	Derived from Berhanu et al. (2024)
Average System Service Life	15	years	Assumed

Example Levelized Cost Calculation: Hybrid Rainwater Collection-Graywater Recycling System

Present Value Interest Factor (PVIF):

$$\left(\frac{\left(1 - \left(\frac{1}{(1 + 0.030)^{15}} \right) \right)}{0.030} \right) = 11.9$$

Lifetime Reclaimed Water Volume:

*System Service Life * minimum* $\left\{ \frac{(\text{Rainwater Supply Volume} + \text{Graywater Supply Volume})}{\text{Irrigation Demand Volume}} \right\} =$

$$\left(\left(\frac{13.6 \text{ inches precipitation}}{\text{year}} * \frac{1 \text{ foot}}{12 \text{ inches}} \frac{1,700 \text{ square feet}}{\text{system}} * \frac{7.48 \text{ gallons}}{\text{cubic foot}} \right) + \left(\frac{16,200 \text{ gallons}}{\text{system} - \text{year}} \right) \right) * 15 \text{ years} =$$

$$\frac{30,200 \text{ gallons}}{\text{year}} * \frac{1 \text{ acre} - \text{foot}}{325,851 \text{ gallons}} * 15 \text{ years} =$$

$$\frac{1.4 \text{ AF}}{\text{system}}$$

Capital Cost:

$$\begin{aligned}
 & \text{Treatment Cost} + \text{Storage Cost} + \text{Diversion Cost} = \\
 & (\text{Unit Cost of Treatment} * \text{System Capacity}) + \\
 & \left(\left(\text{Unit Cost of Rainwater Treatment} * \left(\frac{\text{System Capacity}}{50} \right) \right) \right. \\
 & \left. + \text{Unit Cost of Graywater Treatment} \right) + \\
 & \text{Unit Cost of Graywater Diversion} =
 \end{aligned}$$

$$(\$45 + \$949) + \left(\$125 * \left(\text{ceiling} \left(\frac{83}{50} \right) \right) \right) + \$3,354 =$$

$$\$994 + \$250 + \$3,354 =$$

$$\mathbf{\$4,600}$$

Lifetime O&M Cost:

$$(\text{Annual O\&M Cost} - \text{Annual Monetary Savings}) * PVIF =$$

$$\left(\frac{\$50}{\text{year}} - \left(\frac{\$0.00413}{\text{gallon wastewater}} * \frac{30,200 \text{ gallons}}{\text{year}} \right) \right) * 11.9 =$$

$$- \frac{\$75}{\text{year}} * 11.9 =$$

$$- \frac{\mathbf{\$890}}{\text{device} - \text{year}}$$

Levelized Cost:

$$\frac{\text{Centralized Reclaimed System Net Present Value}}{\text{Lifetime Reclaimed Water Volume}} = \frac{\$4,600 - \$890}{1.4 \text{ AF}} =$$

$$\frac{\mathbf{\$2,650}}{\text{AF}}$$

A.2.5. Produced Water

Analysis Scenarios

Increased On-Site Recycling:

- No marginal capital cost to increase recycling rate.
- Additional O&M cost for increased transportation of produced water to existing recycling facility for treatment.
- Monetary savings generated from avoided saltwater disposal well fees (including transportation).

Treatment and Transport for Off-Site Reuse in Nearby Power Plants:

Assumptions

- Example levelized cost calculation represents a hypothetical scenario of treatment and transport of produced water to the closest water-cooled thermal power plant to offset water withdrawals used for power plant cooling in the Permian Basin.
 - Further analysis to broaden applicable uses should account for water quality parameters and transport distance to the desired source of demand.
 - Treatment assumes screening/grit removal, primary and secondary treatment, advanced tertiary treatment using thermal distillation and post-treatment polishing.
- Levelized costs include monetary savings generated by avoided saltwater disposal costs.
- Concentrated brine from treatment facility can be disposed of via saltwater disposal well or construction of evaporation pond(s) and subsequent hauling of evaporated solids (assuming 50% moisture content).
- Transportation costs include trucking produced water to newly constructed treatment facility centrally located between all wells (by basin) and construction and operation of a new transmission pipeline to convey treated water to the receiving power plant.

Example Levelized Cost Calculation

Water Inputs:

Input	Value		Units	References
	Permian Basin	San Juan Basin		
Net Produced Water Generated (excluding recycled volume)	213,000	3,300	AFY	(New Mexico Oil Conservation Division, n.d.)
Thermal Power Plant Cooling Water Demand	9,600	18,700	AFY	Modeled

Note: The Raton Basin was excluded from the scenario due to its >100-mile distance from nearest thermal power plant demand source and minimal available produced water volume (~1,000 AFY).

Cost Inputs:

Input	Value	Units	References
Unit Production Cost, Treatment (Including Capital and Life-Cycle O&M Costs)	8,800–138,000 (Median: 49,200)	\$/AF	(Bhojwani et al. 2019; Cooper et al. 2022; Hightower et al. 2022; New Mexico Environment Department et al. 2024; Tavakkoli et al. 2017; U.S. Environmental Protection Agency 2018)
Unit Capital Cost, Transmission Pipeline	14.1*Diameter ^{1.4}	\$/linear-foot	(HDR Inc. et al. 2018)
Unit Capital Cost, Evaporation Pond	530,000	\$/acre	(Xu 2023)
Unit Cost of Produced Water Disposal via Saltwater Disposal Well (Including Transport)	1	\$/bbl	(Thomson 2025)
Avoided Unit Cost of Produced Water Disposal via	0.5	\$/bbl	(New Mexico Environment

Saltwater Disposal Well (Excluding Transport)			Department et al. 2024)
Unit Cost of Produced Water, Transport – Trucking	0.031	\$/bbl-mile	(Sanchez-Rosario et al. 2022)
Unit O&M Cost, Transport – Transmission Pipeline	0.259	\$/bbl-mile	(Sanchez-Rosario et al. 2022)
Unit O&M Cost – Evaporated Solids Disposal	18.6	\$/cubic yard	(Xu et al. 2022)

Other Inputs:

Input	Value	Units	References
Treatment Recovery Factor	0.5	-	(Bhojwani et al. 2019; Cooper et al. 2022; New Mexico Environment Department et al. 2024; Tavakkoli et al. 2017; U.S. Environmental Protection Agency 2018)
Treatment Facility Service Life	20	Years	Assumed
Evaporation Pond Depth	1.5	Feet	Modeled via (Xu 2023)
Evaporated Brine Moisture Content	50	%	Assumed
Produced Water Particle Density	2,400	kg/L	Assumed, via (Robertson 1962; Thomson 2025)
Evaporation Pond Unit Storage Capacity	0.22	gallons storage per gallons/year concentrated brine	Modeled via (Xu 2023)

Input	Value	Units	Reference(s)
Thermo-Electric Power Plant Net Generation	7.3 / 8.49	million MWh/year	(U.S. Energy Information Administration 2024b)
<i>Coal</i>	<i>N/A / 8.49</i>		
<i>Natural Gas – Combined Cycle (NG-CC)</i>	<i>3.88 / N/A</i>		
<i>Natural Gas – Steam (NG-S)</i>	<i>3.38 / N/A</i>		

<i>Thermo-Electric Power Plant Water Withdrawal Intensity</i>	<i>420 / 720</i>	gallons per MWh	(U.S. Energy Information Administration 2024c)
<i>Coal</i>	<i>N/A / 720</i>		
<i>Natural Gas – Combined Cycle (NG-CC)</i>	<i>156 / N/A</i>		
<i>Natural Gas – Steam (NG-S)</i>	<i>720 / N/A</i>		
Average Well Distance to Nearest Power Plant	25.6 / 45.4	miles	Modeled via (New Mexico Oil Conservation Division 2025; U.S. Energy Information Administration 2025)
Average Well Distance to Basin Center (for transport to treatment facility)	24.4 / 20.5	miles	Modeled via (New Mexico Oil Conservation Division 2025)

Note: Inputs with multiple values separated by “/” denote the Permian and San Juan basins, respectively.

Example: Treatment and Transport of Produced Water to Nearest Thermoelectric Power Plant to Offset Freshwater Withdrawals (Permian Basin, Median Unit Treatment Cost, Disposal via Evaporation Pond)

Present Value Interest Factor (PVIF):

$$\left(\frac{\left(1 - \left(\frac{1}{(1 + 0.030)^{20}} \right) \right)}{0.030} \right) = 14.9$$

Lifetime Water Volume Supplied:

Annual Produced Water Generated =

$$\frac{213,000 \text{ acre} - \text{feet}}{\text{year}} * 0.5 \text{ Recovery} = 106,000 \text{ AFY}$$

Lifetime Power Plant Withdrawals =

$$\sum_{\text{Power Plant}} \text{Net Electricity Generation} * \text{Water Withdrawal Intensity} =$$

$$\left(\left(3.882 * 10^6 \frac{\text{MWh}}{\text{year}} * 156 \frac{\text{gallons}}{\text{MWh}} \right)_{\text{NG-CC}} + \left(3.375 * 10^6 \frac{\text{MWh}}{\text{year}} * 721 \frac{\text{gallons}}{\text{MWh}} \right)_{\text{NG-S}} \right) * \left(\frac{1 \text{ acre} - \text{ft}}{325,851 \text{ gallons}} \right) = 9,300 \text{ AFY}$$

Lifetime Water Volume Supplied =

$$\left(\min \left\{ \begin{array}{l} \text{Annual Produced Water Available} \\ \text{Annual Power Plant Withdrawals} \end{array} \right\} * \text{Service Life} =$$

$$\frac{9,300 \text{ AF}}{\text{year}} * 20 \text{ years} =$$

$$\mathbf{186,000 \text{ AF}}$$

Minimum Transmission Pipeline Diameter:

$$\text{Average Flow Rate} = \left(\text{Maximum Velocity} * \left(\pi * \left(\frac{\text{Diameter}}{2} \right)^2 \right) \right)$$

$$\left(9,300 \frac{\text{acre} - \text{feet}}{\text{year}} * \frac{325,851 \text{ gallons}}{\text{acre} - \text{foot}} * \frac{1 \text{ year}}{365 \text{ days}} * \frac{1 \text{ day}}{86,400 \text{ seconds}} * \frac{1 \text{ cubic foot}}{7.48 \text{ gallons}} \right) = 5 \frac{\text{feet}}{\text{second}} * \pi * \left(\frac{\text{Diameter}}{2} \right)^2 =$$

$$12.85 \frac{\text{cubic feet}}{\text{second}} = 1.25\pi * \text{Diameter}^2$$

$$\text{Diameter} = \sqrt{\frac{12.85 \frac{\text{cubic feet}}{\text{second}}}{1.25\pi}} = 1.7 \text{ feet} = 19.9 \text{ inches} \approx$$

20 inches

Minimum Evaporation Pond Area:

Minimum Evaporation Pond Area =

$$\frac{\text{Minimum Evaporation Pond Storage Volume}}{\text{Evaporation Pond Depth}} =$$

$$\begin{aligned}
& \frac{(\text{Produced Water Volume} * \text{Treatment Recovery Ratio} * \text{Unit Storage Capacity})}{\text{Evaporation Pond Depth}} = \\
& \frac{\left(9,300 \frac{\text{acre} - \text{feet}}{\text{year}} * \frac{325,851 \text{ gallons}}{\text{acre} - \text{foot}} * 0.5\right) * \frac{0.22 \text{ gallons storage}}{\frac{\text{gallons}}{\text{year}} \text{ concentrated brine}} * \left(\frac{1 \text{ cubic foot}}{7.48 \text{ gallons}}\right)}{1.5 \text{ feet}} = \\
& 44,600,000 \text{ square feet} = \\
& 1,000 \text{ acres}
\end{aligned}$$

Capital Cost (excluding treatment facility):

Capital Cost, Transport + Capital Cost, Disposal =

$$\begin{aligned}
& \text{Unit Capital Cost, Transmission Pipeline} * \text{Average Transport Distance} \\
& + \text{Unit Capital Cost, Evaporation Pond} * \text{Evaporation Pond Area} = \\
& \left(\left((10.53 * 20^{1.4}) \frac{\$}{\text{inch} - \text{linear foot}} \right) * 25.6 \frac{5,280 \text{ feet}}{\text{miles}} \right) + \left(500,000 \frac{\$}{\text{acre}} * 1,000 \text{ acres} \right) = \\
& \$94,000,000 + \$500,000,000 = \\
& \mathbf{\$594,000,000}
\end{aligned}$$

Lifetime O&M Cost (excluding treatment):

Annual Solids Mass =

$$\frac{129,000 \frac{\text{mg}}{\text{L}}}{0.5 \text{ recovery}} * \frac{2.2 \text{ lbs}}{1,000,000 \text{ mg}} * \frac{3.785 \text{ L}}{\text{gallon}} * \left(9,300 \text{ AFY} * (1 - 0.5) * \frac{325,851 \text{ gallons}}{\text{acre} - \text{foot}} \right) = 6,710,000,000 \text{ lbs}$$

Bulk Evaporated Sludge Density =

$$\begin{aligned}
& \frac{(\text{Annual Solids Mass} + \text{Annual Water Mass})}{\text{Annual Sludge Volume}} = \\
& \frac{\left(\text{Annual Solids Mass} + \left(\frac{\text{Moisture Content}}{1 - \text{Moisture Content}} \right) * \text{Annual Solids Mass} \right)}{\left(\frac{\text{Annual Solids Mass}}{\text{Annual Solids Density}} \right) + \left(\frac{\left(\frac{\text{Moisture Content}}{1 - \text{Moisture Content}} \right) * \text{Annual Solids Mass}}{\text{Annual Water Density}} \right)} =
\end{aligned}$$

$$\frac{\left(6,710,000,000 \text{ lbs} + \left(\frac{0.5}{1-0.5}\right) * 6,710,000,000 \text{ lbs}\right)}{\left(\frac{6,710,000,000 \text{ lbs}}{150 \frac{\text{lbs}}{\text{ft}^3}}\right) + \left(\frac{\left(\frac{0.5}{1-0.5}\right) * 6,710,000,000 \text{ lbs}}{62.4 \frac{\text{lbs}}{\text{ft}^3}}\right)} = 88.1 \frac{\text{lbs}}{\text{ft}^3}$$

Evaporation Pond Waste Volume =

$$\frac{6,710,000,000 \text{ lbs}}{\text{year}} * \left(\frac{1}{1-0.5}\right) * \left(\frac{1 \text{ ft}^3}{88.1 \text{ lbs}}\right) * \left(\frac{1 \text{ yd}^3}{27 \text{ ft}^3}\right) = \frac{5,650,000 \text{ cubic yards}}{\text{year}}$$

Lifetime O&M Cost =

*(Unit O&M Cost, Trucking * Treatment Facility Distance * Annual Treated Volume) +*

*((Unit O&M Cost, Pipeline * Power Plant Distance) * Annual Supplied Volume) +*

*(Unit O&M Cost, Disposal * Annual Evaporation Pond Waste Volume) * PVIF =*

$$\left(\left(\frac{\$0.03}{\text{bbl} - \text{mile}}\right) * 24.4 \text{ miles} * \frac{\left(9,300 \text{ AFY} * \frac{325,851 \text{ gallons}}{\text{acre} - \text{foot}} * \frac{1 \text{ bbl}}{42 \text{ gallons}}\right)}{0.5 \text{ recovery}}\right) + \left(\left(\left(\frac{\$0.25}{\text{bbl} - \text{mile}}\right) * 25.6 \text{ miles}\right) * \left(9,300 \text{ AFY} * 0.5 * \frac{325,851 \text{ gallons}}{\text{acre} - \text{foot}} * \frac{1 \text{ bbl}}{42 \text{ gallons}}\right)\right) + \left(\frac{\$18}{\text{cubic yard}} * \frac{5,650,000 \text{ cubic yards}}{\text{year}}\right) =$$

$$= (\$52,800,000 + \$462,000,000 + \$102,000,000) * 14.9 =$$

$$\$9,180,000,000$$

Lifetime Monetary Savings:

*(Unit Cost of Disposal * Annual Treated Volume) * PVIF =*

$$\left(\frac{\$0.5}{bbl} * \left(\frac{9,300 \text{ acre} - \text{feet}}{\text{year}} * \frac{325851 \text{ gallons}}{\text{acre} - \text{feet}} * \frac{1 \text{ bbl}}{42 \text{ gallons}} \right) \right) * 14.8 =$$

\$534,000,000

Levelized Cost:

$$\frac{(\text{Capital Cost} + \text{Lifetime O\&M Cost} - \text{Lifetime Monetary Savings})}{\text{Lifetime Water Volume Supplied}}$$

+ Treatment Levelized Cost =

$$\frac{(\$594,000,000 + \$9,180,000,000) - 534,000,000}{770,000 \text{ acre} - \text{feet}} + \frac{\$49,200}{\text{acre} - \text{foot}} =$$

$$\frac{\$2,300,000,000}{186,000} =$$

\$98,680

AF

Appendix B – Additional Results

This appendix provides a summary of the results of the technical potential assessment for the nine New Mexico Water Security Planning Regions defined by OSE in 2025 (Figure B1). These regions form the primary geographic units for state water planning efforts as defined in the Water Security Planning Act enacted in 2023, roughly corresponding to a mix of county and major river boundaries in the state. We provide summaries of the technical potential of each water supply alternative investigated in this study and discuss the implications of region-level estimates for downstream flow obligations and interstate compact compliance.

B.1. Current and Future Water Availability

The surface water supplies of New Mexico are already fully appropriated, with diversions and storage regulated by OSE to meet downstream flow obligations in accordance with water rights seniority and interstate compact requirements (New Mexico Interstate Stream Commission 2018). Groundwater supplies and use in the state are not as well defined as for surface water, due to variability in the level of investigation and characterization of water quality and quantity across basins. As shown in Table 3, 63% of agricultural surface water withdrawals are measured, while only 39% of groundwater withdrawals are measured. Previous investigations have

consistently identified declining groundwater levels across several aquifers, predominantly in the eastern and southwestern regions of the state.

Over the next several decades, every basin in the state is projected to experience a gap between total water supplies and demand during drought conditions (Table B1). The largest gaps are expected for the Arkansas-White-Red basin, Texas Gulf basin, and the Lower and Middle Rio Grande subbasins, driven by a combination of decreasing supplies and increasing demands. In other basins, the projected gaps are predominantly driven by increasing demands though decreasing supplies are also projected for the Lower Colorado basin and the Central closed subbasin within the Rio Grande basin (New Mexico Interstate Stream Commission 2018). The consistent influence of increasing demands across basins highlights the potential role for conservation and reuse strategies to reduce water demands, though the most appropriate strategy depends on the locations of water withdrawals and discharges within each basin.

Table B1. Projected Difference Between Water Supply and Demand, by Basin (Negative Value Indicates Supply-Demand Gap).

	Water Supply-Demand Difference (AFY)			
Basin	2030	2040	2050	2060
Arkansas–White–Red	(157,000)– (72,000)	(259,000)– (183,000)	(262,000)– (183,000)	(263,000)– (184,000)
Central	(356,000)– (224,000)	(439,000)– (381,000)	(544,000)– (397,000)	(595,000)– (420,000)
Upper Colorado	(192,000)– (58,100)	(321,000)– (193,000)	(441,000)– (305,000)	(505,000)– (376,000)
Lower Colorado	(183,000)– (45,300)	(189,000)– (49,200)	(200,000)– (52,300)	(211,000)– (56,100)
Pecos	(125,000)– (99,200)	(215,000)– (137,000)	(219,000)– (138,000)	(224,000)– (138,000)
Upper Rio Grande	(110,000)– 111,000	(116,000)– 68,300	(134,000)– 12,400	(151,000)– (1,990)
Middle Rio Grande	(384,000)– (83,400)	(388,000)– (140,000)	(396,000)– (189,000)	(404,000)– (206,000)
Lower Rio Grande	(272,000)– (175,000)	(286,000)– (194,000)	(309,000)– (195,000)	(330,000)– (190,000)
Texas Gulf River	(144,000)– (123,000)	(186,000)– (147,000)	(248,000)– (151,000)	(259,000)– (153,000)

Note: Values represent sum of projected water supply and demand differences for water planning regions that overlap each basin, as reported by ISC in the 2018 State Water Plan (New Mexico Interstate Stream Commission 2018).

B.2. Water Security Planning Regions

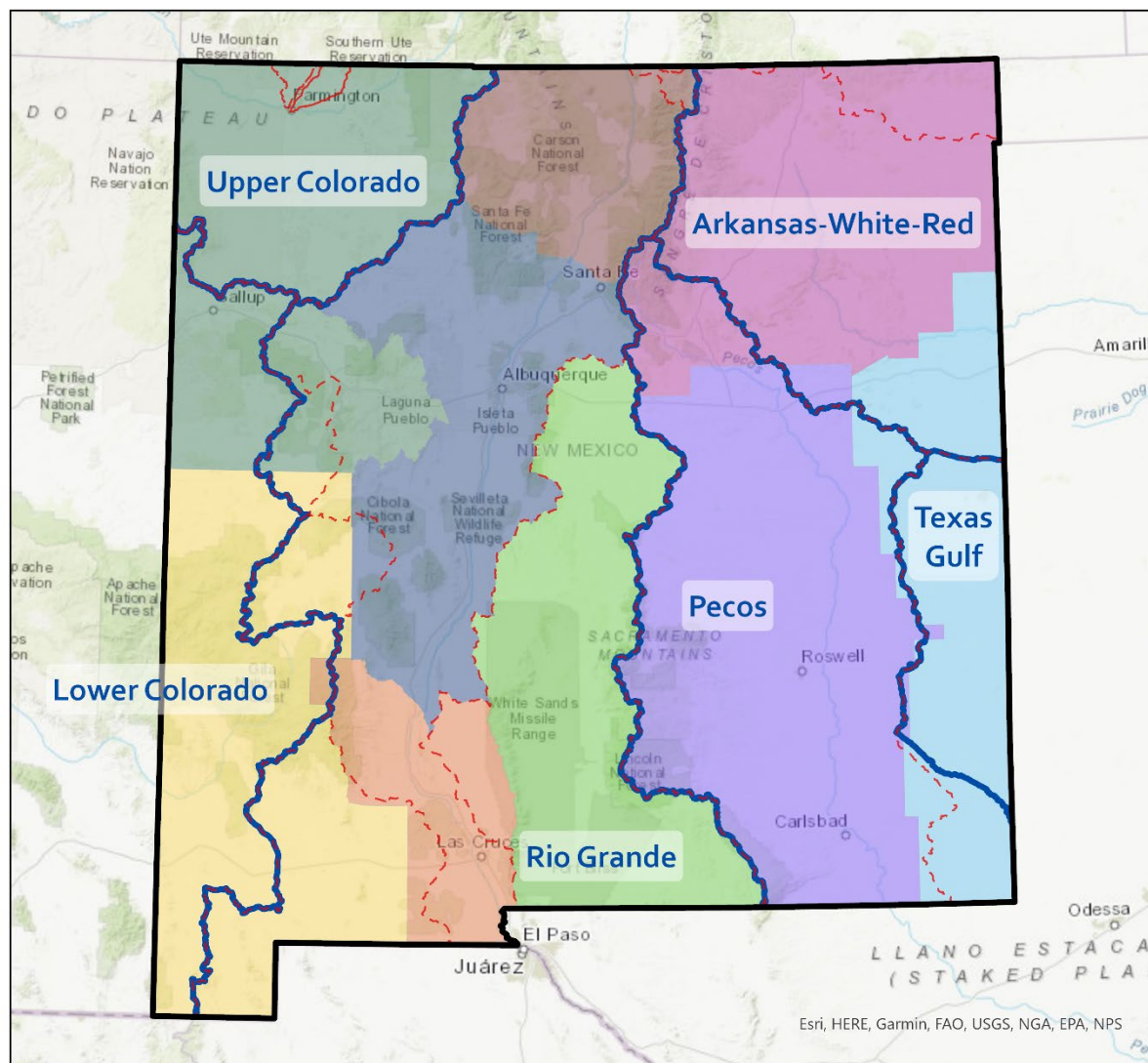
The Rio Grande River basin in New Mexico is subdivided into upper, middle, and lower sections, each with their own water planning regions, as well as the Central Basin planning region and portions of the Upper Colorado and Lower Colorado planning regions. The Rio Grande planning regions are hydrologically connected; the Upper Rio Grande planning region drains to the Middle Rio Grande planning region and then into the Lower Rio Grande region. These planning regions also fall within the Rio Grande Compact area and are therefore subject to downstream flow obligations to the Elephant Butte Reservoir located in the Lower Rio Grande planning region. The annual flow obligation is indexed to inflow at the Otowi gage, located at the transition point between the Upper and Middle Rio Grande sub-basins, and

varies by year. The compact also limits New Mexico's cumulative storage debt at any time to no greater than 200,000 AF.

The Pecos River Basin contains the vast majority of the Pecos planning region and small portions of the Canadian and High Plains planning regions (roughly 10% and 25% of each region's land area, respectively). The basin is subject to the Pecos River Compact and downstream flow obligations ranging from 50,000 AF in the winter to 90,000 AF in the summer. The ISC also manages several augmentation wellfields in the basin used to supplement surface water flows with additional groundwater to help meet compact requirements, when necessary. As of June 2025, the cumulative flow credit in the basin totaled 126,000 AF.

The Arkansas–White–Red river basin contains the majority of the Canadian planning region and roughly 25% of the High Plains planning region and is subject to the Canadian River Compact. The compact allows free and unrestricted use of all waters originating in the state above and below the Conchas Dam, located roughly 65 miles upstream of the river's border crossing into Texas, with conservation storage of unappropriated waters originating below the dam limited to 200,000 AF.

The Colorado River basin in New Mexico is divided into upper and lower basins, each subject to the 1922 Colorado River Compact. The Upper Colorado Basin contains 60% of the Northwest planning region and is also subject to the 1948 Upper Colorado River Compact, which grants 11.25% of the total upper basin allotment to New Mexico, equivalent to an average of about 840,000 AFY. The Lower Colorado Basin contains another 20% of the region and about half of the Southwest planning region.



Legend

Water Security Planning Regions

- Canadian
- Central Basin
- High Plains
- Lower Rio Grande
- Middle Rio Grande
- Northwest
- Pecos
- Southwest
- Upper Rio Grande

- New Mexico Border
- NM Compact Area Borders
- Major River Basins

0 40 80 160 Miles



Figure B1. New Mexico Water Security Planning Regions, Major River Basins (Blue Outline and Labels), and Interstate Compact Area Boundaries (Red Dashed Outline).

B.3. Water Security Planning Region-Level Results

Table B2. Technical Potential of Agricultural Conservation Strategies, by Water Security Planning Region.

Water Security Planning Region	Conservation Savings (AFY)	
	Supply Conveyance Seepage Reduction	Locally Led Conservation Planning and Implementation
Northwest	32,300	29,900
Upper Rio Grande	34,500	1,210–30,200
Middle Rio Grande	52,700	35,800–164,000
Lower Rio Grande	56,200	51,900–177,000
Canadian	20,500	5,900–13,600
High Plains	20,300	1,510–34,900
Pecos	29,600	140,000–140,000
Central Basin	2,100	545–7,800
Southwest	20,200	41,600–78,900
Total	268,000	278,000–676,000

Table B3. Technical Potential of Municipal and Industrial Conservation Strategies, by Water Security Planning Region.

Water Security Planning Region	Demand (AFY)	Conservation Savings (AFY)		
		Consumptive	Non-Consumptive	Total
Northwest	41,400	8,310–9,610	6,270–8,980	15,100–19,100
Upper Rio Grande	26,200	5,750–5,990	8,330–9,610	15,100–16,700
Middle Rio Grande	153,000	21,400–23,500	24,200–36,700	46,900–61,600
Lower Rio Grande	45,000	7,130–7,760	10,300–13,500	18,900–22,800
Canadian	9,020	1,410–1,550	1,640–2,330	3,210–4,050
High Plains	27,000	4,560–4,870	5,760–7,560	11,100–13,200
Pecos	53,800	11,300–11,700	19,000–21,200	35,000–37,800
Central Basin	16,700	2,660–2,780	3,170–4,270	6,600–7,850
Southwest	18,200	4,610–4,720	6,350–7,030	12,000–12,800
Total	390,000	67,100–72,500	85,000–111,000	164,000–196,000

Table B4. Technical Potential of Municipal and Industrial Wastewater Reuse Strategies, by Water Security Planning Region.

	Demand Offset (AFY)	
Water Security Planning Region	Non-Potable Reuse	Total Wastewater Volume
Northwest	12,200–14,600	13,800–16,400
Upper Rio Grande	3,300–3,960	3,310–3,970
Middle Rio Grande	42,800–53,800	43,000–55,100
Lower Rio Grande	15,600–17,100	32,400–34,100
Canadian	1,780–2,120	5,140–5,500
High Plains	10,100–11,100	12,100–13,200
Pecos	10,900–12,000	12,300–13,500
Central Basin	4,780–5,570	5,800–6,680
Southwest	1,880–2,340	1,880–2,340
Total	103,000–122,000	130,000–151,000

Table B5. Technical Potential of Stormwater Runoff Reuse Strategies, by Water Security Planning Region.

	Demand Offset (AFY)			
Water Security Planning Region	On-Site Non-Potable Reuse of Stormwater and Graywater	Centralized Non-Potable Reuse of Stormwater and Wastewater	Centralized Non-Potable Reuse of Stormwater	Total Stormwater Runoff Volume
Northwest	47,500–54,800	18,400–22,300	12,000–12,000	25,600
Upper Rio Grande	16,800–18,700	10,100–11,900	7,370–7,370	12,900
Middle Rio Grande	175,000–199,000	87,300–106,000	54,400–54,400	178,000
Lower Rio Grande	68,300–72,900	19,300–23,600	12,800–12,800	12,800
Canadian	12,000–12,900	7,390–8,170	6,210–6,210	6,560
High Plains	47,400–50,200	36,600–39,200	35,000–36,400	41,800
Pecos	44,400–47,400	33,800–36,700	30,100–30,300	36,900
Central Basin	17,800–19,400	8,130–9,590	5,940–5,950	45,000
Southwest	11,300–12,400	9,590–10,400	8,660–8,890	8,660
Total	441,000–488,000	231,000–267,000	172,000–174,000	359,000

Table B6. Technical Potential of Produced Water Recycling and Reuse Strategies, by Water Security Planning Region.

	Technical Potential (AFY)					
	Increased On-Site Recycling			Net Produced Water Generated		
Water Security Planning Region	Oil	Gas	Total	Oil	Gas	Total
Northwest	33	425	458	801	2,430	3,230
Upper Rio Grande	1.4	0.66	2.1	35	3.8	39
Middle Rio Grande	2.5	0.11	2.6	62	0.65	62
Canadian	0	0	0	0	1,030	1,030
High Plains	1,980	0	1,980	82,700	16,600	99,200
Pecos	463	300	762	75,700	37,900	114,000
Total	2,480	726	3,210	159,000	57,900	217,000

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