

APPENDIX A

WESTERN UNIT OF THE UTAH
CHAPTERS OF THE NAVAJO NATION



TABLE OF CONTENTS

1	Introduction	A1
2	Halchita Projects	A2
2.1	Analysis/Design Criteria.....	A2
2.1.1	Water Modeling	A2
2.1.2	Mexican Hat Existing Capacities.....	A3
2.2	Mexican Hat to Halchita Interconnect.....	A3
2.2.1	Well Sizing Requirements	A3
2.2.2	Environmental Requirements.....	A4
2.2.3	Cost Estimate	A4
2.3	San Juan River Treatment Plant (Halchita)	A4
2.3.1	Cost Estimates.....	A5
2.3.2	Environmental Requirements	A6
2.4	Halchita to Oljato Pipeline	A6
2.4.1	Water Quality and Age.....	A6
2.4.2	Environmental Requirements.....	A7
2.4.3	Cost Estimate	A7
3	Navajo Mountain Treatment Plant	A7
3.1	Cost Estimate.....	A7
3.1.1	Environmental Requirements.....	A8
4	Conclusion	A8

ATTACHMENTS

A-1	Exhibits
A-2	Cost Estimates
A-3	Mexican Hat to Halchita HDPE Hydraulic Report
A-4	Pump Submittal

LIST OF FIGURES

Figure 1	- Mexican Hat Water Usage	A2
Figure 2	- San Juan River Treatment Plant Intake	A4
Figure 3	- Halchita Pipe Condition at Tanks	A5

LIST OF TABLES

Table 1	- Project Summary	A1
Table 2	- Design Criteria.....	A2
Table 3	- Mexican Hat & Halchita Water Usage Capacity.....	A3
Table 4	- Water Age Analysis	A6

1 INTRODUCTION

This study analyzes the western unit of the Utah chapters of the Navajo Nation. Two areas were analyzed as part of this study: Halchita and Navajo Mountain.

Halchita's water system is currently supplied by water trucks hauling water to the tank site. Hauling water is costly and unreliable in the long term. A study of the culinary water system in the neighboring community of Mexican Hat was undertaken in 2019. Equivalent residential connection (ERC) values from that report and existing conditions of Mexican Hat's system were taken into consideration for this analysis. A hydraulic model was created for the proposed alternative of connecting the Halchita and Mexican Hat water systems. The model was used to evaluate the effect on the system's pressure in accordance with applicable Utah State rules, codes, and guidelines. Minimum sizing requirements have been determined using both Utah Administrative Code (UAC) R309-510 and actual water usage from Mexican Hat. Information from that report, including water usage, was interpolated and applied towards Halchita's water system due to the lack of water usage information. A similar growth rate was assumed for the Halchita water system.

Four projects were analyzed as part of this unit's study. Each project's respective cost estimate is summarized in **Table 1**.

Table 1 - Project Summary

Project Name	Description	Estimated Cost
Mexican Hat to Halchita Interconnect	Includes interconnect to Mexican Hat and pipeline improvements to tank site.	\$7,692,000
San Juan River Treatment Plant (Halchita)	Includes newly refurbished treatment plant and pipeline improvements to tank site.	\$10,211,000
Halchita to Oljato Pipeline	Dependent on the implementation of the San Juan River Treatment Plant. Pipeline to Oljato from Halchita.	\$22,251,000
Navajo Mountain Treatment Plant	Beaver Spring treatment plant to increase source supply in Navajo Mountain.	\$2,501,000

2 HALCHITA PROJECTS

2.1 Analysis/Design Criteria

Due to the lack of Peak Day usage, a statistical approach to the source production of Mexican Hat was conducted. Mexican Hat's water usage is seasonal, with most of the water being used from May to September. The monthly production of each well has been monitored and the data from the peak months was used to perform a statistical analysis. The standard deviation was found to be 0.61 acre-feet. One standard deviation from the mean provides 90% confidence that all water usage will be within that range. Using that standard deviation and adding it to the mean provides a peak monthly water usage of 2.36 acre-feet, which was used for analysis and design. This statistical approach is much more realistic for the flows observed in both Mexican Hat and what is anticipated in Halchita. Therefore, the statistical approach was used for modeling and sizing of the system. The state rule was analyzed but is not included in this report as a result. **Table 2** summarizes the flows used for both the state standard and the statistical approach outlined above.

Table 2 - Design Criteria

Design Approach	Peak Day Demand	Average Day Demand
State Standard R309-510	800 GPD	400 GPD
Actual Usage	400 GPD	200 GPD (2.36 ac-ft)

Figure 1 shows the production of both sources in Mexican Hat. This was assumed to correlate directly with water usage as it is monitored monthly it allowed for insight into peak usage months.

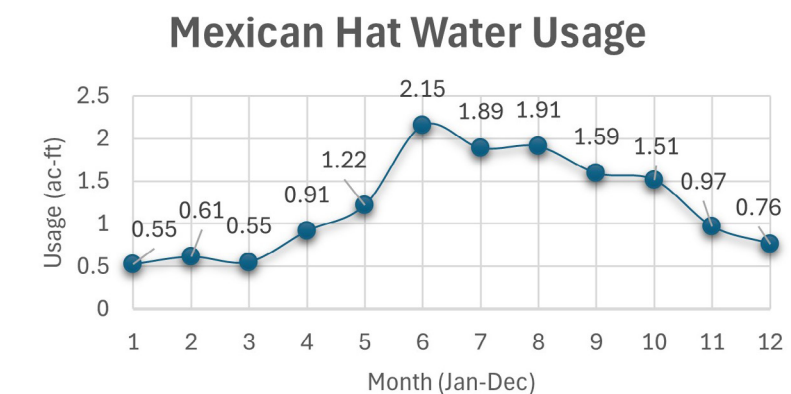


Figure 1 - Mexican Hat Water Usage

2.1.1 Water Modeling

The water model was created for the proposed improvement using InfoWater Pro 2025.1. GIS data was used to determine tank location and elevation, meter locations, and pipe diameters. The proposed line connecting the two systems is a 12-inch-diameter pipe. The flow for the PDD scenario was calculated to be approximately 0.14 gallons per minute (GPM) per ERC. Exhibits were created from this water model showing important information including pressures, water age and system layout. These exhibits are located in Appendix A.1.

2.1.2 Mexican Hat Existing Capacities

Three critical components of the existing system were analyzed for remaining ERC capacities using the statistical approach mentioned previously. The existing system would require upsizing if they were to connect to Halchita's water system. The source capacity is limited, connecting to Halchita's water system will require new sources of water be developed. Two additional wells are recommended to achieve the required amount of water for Halchita.

2.2 Mexican Hat to Halchita Interconnect

A simple solution for Halchita to obtain a regular water supply would consist of connecting the Halchita and Mexican Hat water systems and adding at least two new wells for the Mexican Hat system. To meet the increased demand associated with connecting to Halchita, two additional wells at least ½ a mile radius from the existing wells. Additionally, this project would consist of adding and replacing a pipeline from the north side of the San Juan River to the water storage tanks above Halchita. The pipeline would connect to the existing Mexican Hat system and would cross the river on the US-163 bridge. A booster pump and a chlorinator would be required at or near the water treatment plant to supply sufficient flow and maintain a healthy water age. The booster pump would need to provide 250 feet of head at a flow of 100 GPM. The chlorinator would keep the water age under 5 days in the Halchita water system. The operating point of this pump would be 100 GPM and 450 feet of head to reach the tanks. A pump submittal for the pump required is located in Appendix A.4. **Table 3** summarizes the source and treatment capacities that would need to be upgraded. Developing a new source and adding a skid to the reverse osmosis treatment building would be required to meet the demands.

Table 3 - Water Age Analysis

Hydraulic Element	Flow (GPM)	Existing ERC Capacity	ERC Capacity with Interconnect	State Rule ERC Capacity with Interconnect	Annual Flow (ac-ft)
Source (4 Year)	43.00	26.51	-71.49	-187.30	14.60
Treatment	75	141.50	43.50	-158.50	120.98
Storage	-	471	373	74	-

2.2.1 Well Sizing Requirements

Interconnecting Halchita and Mexican Hat would require drilling of at least two new wells to achieve the necessary flow. The minimum flow requirements for a source are determined by UAC R309-510-7, which states the source capacity shall be able to meet the anticipated peak day demand and supply the average yearly demand. To properly size the pump for the well, the peak day demand will be used.

Based on the design criteria shown in Table 2, the system will require approximately 0.28 GPM per connection. The total amount of proposed and existing connections (226 ERC) equates to approximately 63 GPM during the peak day demand. The new well and treatment system would need to provide approximately 40 GPM in addition to what the system is already capable of. Due to the lack of available groundwater, it is anticipated that two wells would be required to reach the additional 40 GPM.

2.2.2 Environmental Requirements

The Mexican Hat and Halchita interconnect would likely require a National Environmental Policy Act (NEPA) analysis, which is anticipated to be an Environmental Assessment (EA)-level analysis. A cultural resource inventory would be required along the pipeline corridor. In coordination with funding agencies and the Navajo Nation Department of Fish and Wildlife (NNDFW), a Biological Evaluation document would need to be prepared to address potential impacts to federally listed species; however, no adverse impacts to federally listed species are anticipated. However, the NNDFW and Navajo Natural Heritage Program (NNHP) may have additional special status species (animal and plant) that would need to be surveyed for after initial coordination efforts. No impacts to Waters of the U.S. are anticipated due to the lack of channel crossings along the pipeline alignment, and no Clean Water Act (CWA) Section 404 permitting requirements are anticipated; however, a CWA Section 401 Certification would likely be required. Coordination would be required with the funding agency, the Navajo Nation, and Bureau of Indian Affairs (BIA). During construction, a stormwater pollution prevention plan (SWPPP) would likely be required.

2.2.3 Cost Estimate

This project would require a minimum of two wells to be drilled, and additional treatment capacity. The proposed connection would also require chlorination, a booster pump, and pipe. Additional storage capacity should be evaluated before design. More design and analysis are required for each aspect of this alternative. This project is estimated to cost \$7,692,000. Each of the above items are listed in the cost estimate in Appendix A.2 "Mexican Hat to Halchita Interconnect Cost Estimate".

2.3 San Juan River Treatment Plant (Halchita)

The San Juan River Treatment Plant project includes rehabilitation of the treatment plant south of Mexican Hat. This project also includes the replacement and upsizing of a corroded pipeline from the treatment plant to the existing tanks. This project would provide water to Halchita as a reliable source, while also allowing for growth and other connections in the future. The existing San Juan River treatment plant has not been in operation since the early 2000s and would require significant upgrades. The treatment plant failed to properly treat the water when it was active, which led to it being taken offline. The treatment plant intake from the San Juan River is shown in Figure 2.



Figure 2 - San Juan River Treatment Plant Intake

The plant operated by pulling water out of the San Juan River, which is known for high turbidity and total suspended solids (TSS). The recommended improvements to this plant would include complete remodeling of the structure itself and site improvements. The recommended method of treatment would be reverse osmosis or ultra-filtration due to its ability to remove high levels of TSS and turbidity as well as any other pathogens. Extensive design would be required to ensure that proper levels of treatment are achieved. Due to the nearly 5-day water age in the system downstream of the treatment plant, it is recommended that a small chlorinator be installed to provide residual disinfection throughout the system. The treated water would then be transported via a pump station and 8-inch-diameter HDPE pipe to the existing storage tanks. The water age is not primarily a concern at 5 days; however, with fluctuating seasonal demands in Halchita, the actual water age could increase beyond 5 days, which could be a hazard.

The existing pipe condition was visually determined to be in poor condition. The pipe has been laid in a box and routed to the tanks. The pipe material was observed to be ductile iron that has been severely corroded and needs immediate replacement. Pipe conditions are shown in Figure 3. Ductile iron pipe is susceptible to corrosion over time, especially in unfavorable soil conditions. The pipe shown in the image below was uncovered and exposed to elements that cause corrosion to rapidly progress. When ductile iron is used it should be buried and proper cathodic protection measures should be taken to prevent pipe corrosion and prolong the life of the pipeline. HDPE is a much less susceptible material to corrosion and would be a favorable material in this application.



Figure 3 - Halchita Pipe Condition at Tanks

2.3.1 Cost Estimates

This alternative would include structural components to be addressed, a new treatment system to be designed and constructed, as well as a new pipeline. The total cost of this alternative is estimated to be \$10,211,000. Each of these items are listed in the cost estimate in Appendix A.2 "Alternative 2A Cost Estimate."

2.3.2 Environmental Requirements

The San Juan River Treatment Plant would likely require a NEPA analysis, which is anticipated to be an EA-level analysis. A cultural resource inventory would be required for any proposed new structures or site improvements, as well as for the pipeline alignment. In coordination with funding agencies and the NNDFW, a Biological Evaluation document would need to be prepared to address potential impacts to federally listed species; however, no adverse impacts to federally listed species are anticipated. However, Southern willow flycatcher habitat near the river may require noise and timing considerations from the Navajo Nation and/or the USFWS. The NNDFW and NNHP may have additional special status species (animal and plant) that would need to be surveyed for after initial coordination efforts. No impacts to Waters of the U.S. are anticipated due to the lack of channel crossings along the pipeline alignment, and no Clean Water Act (CWA) Section 404 permitting requirements are anticipated; however, a CWA Section 401 Certification would likely be required. Coordination would be required with the funding agency, the Navajo Nation, and Bureau of Indian Affairs (BIA). During construction, a stormwater pollution prevention plan (SWPPP) would likely be required.

2.4 Halchita to Oljato Pipeline

This project considers connecting Halchita's water system to the Oljato water system. Approximately 24.8 miles of 8-inch pipeline with a booster pump and three pressure reducing valves would connect the Halchita system to the tanks from Oljato. The report explaining this potential project in detail can be found in Appendix A.3.

2.4.1 Water Quality and Age

Water age and quality is a concern with this length of transmission pipe; the longer water is in the pipe, the more bacterial growth will become a concern. Water age below 7 days is considered to be safe. The analysis summarized in **Table 4** shows the parameters that were considered in determining suitable pipeline sizes.

Table 4 - Water Age Analysis

Pipe Size (inches)	Downstream Demand (GPM)	Velocity (ft/s)	Headloss per Mile (ft)	Water Age @5 Miles (Days)	Water Age @10 Miles (Days)	Water Age @15 Miles (Days)	Water Age @20 Miles (Days)	Water Age @25 Miles (Days)
8	100	0.6	40.55	0.5	1.0	1.4	1.9	2.4
10	100	0.4	13.69	0.7	1.5	2.2	3.0	3.7
12	100	0.3	5.64	1.1	2.2	3.2	4.3	5.4
18	100	0.1	0.78	2.4	4.8	7.3	9.7	12.1
24	100	0.1	0.19	4.3	8.6	12.9	17.2	21.5

Connecting the two systems would allow for fill stations that would benefit individuals living outside of the limits of water systems, as well as provide more source capacity and pressure for Oljato, Halchita, and other nearby systems. This project would improve the source capacity for multiple systems and would also improve access to water through fill stations in remote areas.

2.4.2 Environmental Requirements

The Halchita to Oljato Pipeline would likely require preparation of an EA for review and approval from BIA. Cultural surveys would be required. Based on the length of pipeline and extent of associated disturbance, a BE would likely be required for approval from the NNDFW; biological surveys requested by NNDFW and or the NNHP may be required to complete the BE. Initial review of USFWS data suggests possible Mexican spotted owl (MSO) habitat in the project vicinity. Considerations for the species may require additional coordination and consultation efforts as well as project design features to minimize effects. The proposed pipeline alignment would cross at least one ephemeral channel; an aquatic resource delineation would be required if fill beyond the buried pipeline was needed. In that event, Clean Water Act Section 404 permitting with the U.S. Army Corps of Engineers and a Section 401 Certification with the Navajo Nation EPA would likely also be required, but no compensatory mitigation requirements are anticipated. A stormwater pollution prevention plan (SWPPP) would be required for construction as more than 1 acre would be disturbed by construction activities. Section 402 (stormwater permitting) is regulated on the Navajo Nation by Region IX of the Environmental Protection Agency (EPA); the NNEPA can certify 401 drinking water permits but EPA retains the jurisdiction for section 402 permitting.

2.4.3 Cost Estimate

This alternative would consist of a new treatment facility, nearly 25 miles of pipe, fill stations, and chlorination. Further analysis and design would be necessary before construction, this phase of this alternative is anticipated to cost \$22,251,000. Each of these items are listed in the cost estimate in Appendix A.2 "Halchita to Oljato Pipeline Cost Estimate".

3 NAVAJO MOUNTAIN TREATMENT PLANT

The Navajo Mountain Chapter is in south central Utah adjacent to the Arizona border and the San Juan River/Lake Powell. Historically, the chapter's water source came from Beaver Springs located in the mountains just west of the community. The water system was maintained and operated by the Navajo Nation Water Resources. Due to a wildfire in 2006 and resulting contamination in the spring watershed, the water quality in the spring was no longer suitable for culinary water. In order to provide clean drinking water for Navajo Mountain residents, water was piped in from Inscription House, AZ and is now the chapter's main culinary water source. Indian Health Services constructed the pipeline from Inscription House and added a new 200,000-gallon metal tank for storage. The Navajo Tribal Utility Authority (NTUA) currently operates and maintains the culinary water system.

It is recommended that the water from Beaver Springs be captured and treated to a culinary standard. To accomplish this, a new treatment facility and a dedicated culinary water tank would be required, along with potentially re-developing the well. This would allow Navajo Mountain to have redundancy in their source which is preferable in case of any emergency. Navajo Mountain could retain the overflow from these springs and utilize that water as secondary water, while having a steady redundant source of culinary water.

3.1 Cost Estimate

As part of this Navajo Mountain Treatment Plant project there would be a new dedicated culinary water tank, as well as a new treatment facility. This project is estimated to cost approximately \$2,501,000.

3.1.1 Environmental Requirements

The Navajo Treatment Plant would likely require preparation of an EA for review and approval from BIA. Cultural surveys would be required. Based on the overall acreage needed for construction of the plant and associated water storage tanks, a BE would likely be required for approval from the NNDFW; biological surveys requested by NNDFW and or the NNHP may be required to complete the BE. Initial review of USFWS data suggests possible Mexican spotted owl (MSO) habitat in the project vicinity. Considerations for the species may require additional coordination and consultation efforts as well as project design features to minimize effects. A Section 401 Certification with the Navajo Nation EPA would be required. A stormwater pollution prevention plan (SWPPP) would be required for construction as more than 1 acre would be disturbed by construction activities. Section 402 (stormwater permitting) is regulated on the Navajo Nation by Region IX of the EPA; the NNEPA can certify 401 drinking water permits but EPA retains the jurisdiction for section 402 permitting.

4 CONCLUSION

The Mexican Hat to Halchita interconnect project provides a mutually beneficial solution for Halchita to receive a regular source of water, and for Mexican Hat to have a larger source of revenue. The treatment plant on the San Juan River south of Mexican Hat would provide a large quantity of water for Halchita to use and potentially add more connections to in the future. The pipeline to Oljato from Halchita would provide multiple opportunities for those in rural areas to have better access to clean water and provide Oljato with more source capacity. The Navajo Mountain Treatment plant project would allow for Navajo Mountain to have more source capacity as well as a redundancy in sources.