

This is a digital document from the collections of the *Wyoming Water Resources Data System (WRDS) Library.*

For additional information about this document and the document conversion process, please contact WRDS at wrrds@uwyo.edu and include the phrase “**Digital Documents**” in your subject heading.

To view other documents please visit the WRDS Library online at:
<http://library.wrrds.uwyo.edu>

Mailing Address:

Water Resources Data System
University of Wyoming, Dept 3943
1000 E University Avenue
Laramie, WY 82071

Physical Address:

Wyoming Hall, Room 249
University of Wyoming
Laramie, WY 82071

Phone: (307) 766-6651

Fax: (307) 766-3785

Funding for WRDS and the creation of this electronic document was provided by the Wyoming Water Development Commission
(<http://wwdc.state.wy.us>)

*THERMOPOLIS STORAGE
AND
RAW WATER*

LEVEL II STUDY- EXECUTIVE SUMMARY



SUBMITTED TO:
***WYOMING WATER
DEVELOPMENT COMMISSION***

SUBMITTED BY:
***ENGINEERING ASSOCIATES – CODY, WY
MAY 1, 2006***



**TOWN OF THERMOPOLIS
STORAGE AND RAW WATER
LEVEL II STUDY**

EXECUTIVE SUMMARY

FUNDED BY: Wyoming Water Development Commission

MEMBERS: Floyd R. Field
George Jost
Robert E. Yemington
Bill Bensel
Dan S. Budd
Dick Geving
Anne MacKinnon
Charles Murray
William Steward
A. Lee Arrington

DIRECTOR: Lawrence M. Besson

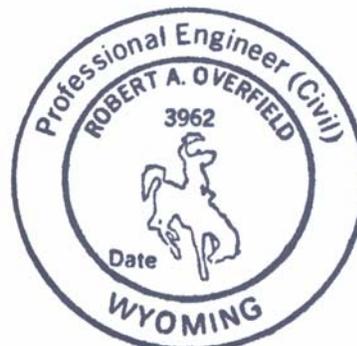
ADMINISTRATOR: Jon Wade

PROJECT MANAGER: Chace A. Tavelli

CONSULTANT: Engineering Associates
P.O. Box 1900
902 13th Street
Cody, Wyoming 82414
(307) 587-4911

DATE: May 1, 2006

JOB NUMBER: 05045



I. STORAGE

Rehabilitation or replacement of an existing 500,000-gallon tank (Old Arapahoe Tank) near Arapahoe and 14th Streets is a significant issue to maintaining the Town's ability to serve their users with adequate pressure and volume. This study will include:

- Defining service areas in and around Thermopolis that are or can be served
- Projecting treated water demands for those areas
- Evaluating existing treated water tanks
- Determining options for replacement of one aging 500,000-gallon tank
- Preparing and evaluating alternate preliminary layouts, materials, and equipment to identify the most viable alternate design. This information, with input from WWDC and the Owner, was used to select the option for which to prepare a concept level design
- Preparing a concept level design, economic analysis, and geotechnical analysis
- Evaluate project financing, and performing an environmental review as necessary to qualify for funding from various sources for the project

A. Back Ground Information

Several previous studies have been completed to evaluate the Town of Thermopolis System, including distribution and storage. EA created the first hydraulic model for the Town in a report in 1982, and has maintained newer generations of that model to-date.

The Town of Thermopolis also provides water to several surrounding service areas, as follows:

South Thermopolis Water & Sewer District	Town of East Thermopolis
Hot Springs State Park	Red Lane Water & Sewer District
Lucerne Water & Sewer District	Town of Kirby

B. Study Area

The Town of Thermopolis area for this report includes approximately 1553 acres of developed and proposed development areas. This study also provides a brief overview of a proposed service area west of Thermopolis along Highway 120 and continuing west along Owl Creek. It also addresses the irrigable green areas likely to be serviced by a proposed buried raw water system. Those areas were estimated at approximately 100 acres.

C. Population Projections

Current population projections for the Thermopolis Treated Water System were completed using data from the United States Census Bureau and the Wyoming Department of Administration and Information. It has been estimated that annual population growth will be 0.68%. The following population estimates were calculated:

**TABLE 1.2.1
ACTUAL OR PROJECTED**

<u>YEAR</u>	<u>POPULATION</u>	<u>YEAR</u>	<u>POPULATION</u>
1950	2870	2000	3172
1960	3955	2005	3,283
1970	3063	2015	3,514
1980	3852	2025	3,760
1990	3247	2035	4,024

D. Land Uses

The current Thermopolis Zoning District Map was used to determine the current total acreage within the Town limits. The Town of Thermopolis has a mixture of residential, commercial, and industrial properties. Most of the commercial and industrial facilities are located along U.S. Highway 20 and Broadway Street. It is probable that commercial and industrial facilities along these two corridors will continue. This maximizes exposure to pass-through traffic, which increases business opportunities in this area. A total of 739 acres are currently developed in the Town Service Area.

Land use projections for the year 2035 were calculated based on the same 0.68% yearly growth rate. That projection totaled an additional 1108 acres.

E. Water Demands

The Town of Thermopolis has maintained water records of flow into and out of the Water Plant. This information in Table 1.3.1 is a summary of that data for the entire distribution system for 2003 through 2005.

**TABLE 1.3.1
ESTIMATED WATER DEMANDS (MGD & GPM)**

	Average Daily Demand	Maximum Daily Demand	Peak Hour Demand
In-Town System	0.798 MGD	2.595 MGD	3.192 MGD
In-Town System	554 GPM	1802 GPM	2217 GPM
Other Water Districts	0.106 MGD	0.345 MGD	0.424 MGD
Other Water Districts	74 GPM	239 GPM	295 GPM
Water Plant Total	0.904 MGD	2.940 MGD	3.616 MGD
Water Plant Total	628 GPM	2042 GPM	2511 GPM

A peak flow of nearly 3.0 MGD (2083GPM) has been experienced at the plant. There is a dramatic increase in water consumption during the summer months due to additional tourist activity throughout Thermopolis and landscaping irrigation.

The 2035 design ADD and MDD were 679 GPM and 2209 GPM respectively. Those demands and the projected 2035 population of 4,024 people were used to determine a per capita design ADD of 243 gpcd and a design MDD of 791 gpcd.

F. Fire Flow Requirements

The total fire flow required for Thermopolis for the year 2005 is 1815 gpm (2.61 MGD) for a population of 3283. The total fire flow required for Thermopolis for the year 2035 is 2005 gpm (2.89 MGD) for a population of 4024. The results of our hydraulic modeling indicated several locations in the Town distribution system that cannot currently meet the required fire flows.

G. Storage

The actual Total Net Normal Operating Storage is 2,110,300 – 380,000 (Bottom Storage) or 1,730,300 gallons, not including clear well volume. Future storage needs are projected to be 2.4 MG based on our estimated growth expectations.

H. Priority of Improvements and Costs

- First priority should be the new tank at the Airport Tank site, with salvage of the existing tank for future use, if its condition warrants it.

500k-gallon steel tank = \$362,500

Salvage existing 250k-gal. steel tank = \$ 20,000

- Second priority should be painting the interior of the State Park Tank. Recent inspections of this tank indicate that a new interior paint coat is necessary to maintain the integrity of this tank.

Paint interior of 264k-gallon tank = \$ 65,000

- The third priority for the Town should be consideration of a second tank in Cedar Ridge. There is ample room to install a 20k-gallon tank adjacent to the existing 50k-gallon tank. This second tank is needed to allow regular maintenance of both tanks by allowing one tank to handle storage needs while the second tank is cleaned and/or painted on a regular basis.

20k-gallon steel tank = \$100,000

- The fourth priority should be replacement of the Airport Tank pump station, new 8-inch PVC line to a location southwest of Roundtop Mountain, and construction of dual 200k-gallon tanks at that site. A return pipeline with pressure-reducing valve station should be extended south to approximately 11th Street and Arapahoe. This would allow growth in this area of Town. These tanks would also accommodate growth around and at the Airport, if that site is vacated by creation of a new County airport at a different location. These tanks would also provide the best connection for the proposed Owl Creek service area west of Thermopolis. If the old Airport Tank is deemed salvageable, it should be considered for use at this location.

Dual 200k-gallon steel tanks = \$500,000

Airport pump station replacement = \$275,000

8-inch PVC feed line

5500 lf @ \$60 plf = \$330,000

PVC return line

10" - 3500 lf @ \$65 plf = \$227,500

8" - 2500 lf @ \$60 plf = \$150,000

Pressure-reducing station = \$ 75,000

- The fifth priority for improvements in Thermopolis should be the fire flow replacement needs at both 13th and Meadowlark Lane.

Meadowlark lane

12" PVC 815 lf @ \$80 plf = \$ 65,000

10" PVC 680 lf @ \$75 plf = \$ 51,000

8" PVC 1285 lf @ \$70 plf = \$ 86,450

13th & Arapahoe

8" PVC 775 lf @ \$70 plf = \$ 54,250

II. WEST THERMOPOLIS

The Thermopolis Economic Development Council (EDC) requested consideration of the servicing of an area approximately one mile west of the Town of Thermopolis with treated water. There is a small subdivision and numerous landowners that have created an interest group to pursue this possibility. EDC held several meetings with this group and they gathered momentum towards becoming a district. We completed a cursory review of the possibility to serve this new area. Following the completion of the planned hydraulic model in the storage study, evaluation of an extension of service to this area has been accomplished.

A. Population Projections

The following population estimates were calculated using a growth factor of 1.5% per year for the area:

**TABLE 2.2.1
POPULATION ESTIMATES**

Year	Population	Year	Population
2005	288	2025	387
2010	310	2030	417
2015	334	2035	449
2020	359		

B. Land Use Plan

The area west of Thermopolis has a mixture of residential and agricultural properties. There is also a small subdivision located in Sage Valley. This subdivision has nearly 20 lots developed with a potential of 59 more lots that can be developed. Land use projections for the year 2035 were calculated using a growth rate of 1.5% per year.

C. Water Demands

Water use projections were based on an average usage of 0.23 gpm per connection. Max day demand is 2.6 x the average daily demand and peak hour is four times average daily demand. Assuming the area west of Thermopolis has 125 connections, total average daily demand in 2005 is 41,400 GPD. The following Table projects domestic water usage for the area west of Thermopolis over the next 30 years.

**TABLE 2.3.1
RESIDENTIAL USEAGE**

Description (GPM)	2005	2005	2035	2035
	ADD	MDD	ADD	MDD
Total Projected Water	29	75	45	117

Rural water systems cannot provide fire flows in an economic and efficient manner. Therefore, no fire flows are included in this Owl Creek Study.

The Town of Thermopolis has indicated that the water supply needs of this proposed rural service area are currently anticipated to be available from their system.

D. Storage Requirements

A minimum storage requirement estimate for this system was found by assuming 85% of the total houses would initially connect onto this rural water system ($330 \times 125 \times .85 = 35,000$ gallons). The minimum storage to be provided to Owl Creek is 35,000 gallons. Future additional storage may become necessary as the district grows.

E. Transmission/Distribution/Storage improvements

Two scenarios are provided for Owl Creek. Alternate No. 1 is a two-pressure zone system including a pump station near the current 1-mg tank on Arapahoe, 11,000-foot line extension westerly up Highway 120 to an area near Sage Valley Subdivision, and a pair of small tanks located near the highway. The system would then follow Highway 120 to Highway 170 and continue on Highway 170 to the west end of the service area. Two additional buried fiberglass tanks will be provided at the west end of this line. A second loop of 11 miles is proposed to reach the properties south of Owl Creek. A pumping station would be needed on Highway 170 before reaching the west tanks for Pressure Zone 2. A pressure-reducing station would be needed on the south loop to separate Zone 2 from Zone 1.

**TABLE 2.6.1
ALT. 1 - PROPOSED IMPROVEMENTS**

Pipe Description	Length (feet)	Diameter	Area
Line 1	11,000	6"	Thermopolis Tank to Sage Valley Tank
Line 2	83,449	6"	Sage Valley Tank to West Tank
Line 3	57,191	4"	Bottom Loop
Line 4	1,943	2"	From 4" loop to Whitcomb & Gray Area
Line 5	5,223	2"	From 4" loop to Ken Lyold Area
Line 6	2,468	2"	From 4" loop to Marvin Meyer Area
Line 7	3,725	2"	From 6" to west limit of Service Area

Total = 164,999 = 31.2 mi

**TABLE 2.6.2
ALT. 1 - CONSTRUCTION COSTS FOR PROPOSED IMPROVEMENTS**

Diameter	Quantity	Unit Price	Total
6"	94,449	\$26	\$2,455,674
4"	57,191	\$23	\$1,315,393
2"	13,359	\$16	\$213,741
Service Tap	125 EA	\$2500	\$312,500
Pump Station	2 EA	\$300,000	\$600,000
35,000 Gal Fiberglass Tank	2 EA	\$80,000	\$160,000
PRV	1 EA	\$75,000	\$75,000
Telemetry	2 EA	\$16,000	\$32,000
6" Connection tap to Thermopolis *	1 EA	\$28,800	\$28,800

Total = \$5,193,108

Assume: 200 psi pipe with current pipe costs (August 2005)

Alternate No. 2 includes service to the Owl Creek area as an extension from a new Thermopolis Roundtop Mountain tank site. A new pump station would feed a 16-mile line extension proposed to run westerly from the new tank site to a location at the west end of the currently defined service area. A pair of 35,000-gallon buried fiberglass tanks will be provided at the west end of this line. This line would require a second pump station two miles west of Highway 120. A second loop of 11 miles is proposed to reach the properties south of Owl Creek. A pressure-reducing station and additional storage is proposed on this loop to define the separation between Pressure Zone 1 and 2. A third line is proposed to run south along Hwy 120 for 8700 feet to the Sage Valley Subdivision. Additional storage should be considered at that location. Construction of the Thermopolis Roundtop Mountain Tank system is under review at this time. Obviously, if this system is not built, Owl Creek would not have the opportunity to choose Alternate No.2.

**TABLE 2.6.3
ALT. 2 - PROPOSED IMPROVEMENTS**

Pipe Description	Length (feet)	Diameter	Area
Line 1	83,093	6"	West Tank to Thermopolis Tank
Line 2	57,191	4"	Bottom Loop
Line 3	8,683	4"	From 6" to Sage Valley
Line 4	1,943	2"	From 4" loop to Whitcomb & Gray Area
Line 5	5,223	2"	From 4" loop to Ken Lyold Area
Line 6	2,468	2"	From 4" loop to Marvin Meyer Area
Line 7	3,725	2"	From 6" to west limit of Service Area
Line 8	360	6"	From South Tank to Bottom Loop

Total = 162,686 = 30.8 mi

**TABLE 2.6.4
ALT. 2 - CONSTRUCTION COSTS FOR PROPOSED IMPROVEMENTS**

Diameter	Quantity	Unit Price	Total
6"	83,453	\$26	\$2,169,778
4"	65,874	\$23	\$1,515,102
2"	13,359	\$16	\$213,741
Service Tap	125 EA	\$2500	\$312,500
Pump Station	3 EA	\$300,000	\$900,000
35,000 Gal Fiberglass Tank	2 EA	\$80,000	\$160,000
PRV	1 EA	\$75,000	\$75,000
Telemetry	2 EA	\$16,000	\$32,000
Connection tap to Thermopolis *	1 EA	\$28,800	\$28,800

Total = \$5,406,921

Assume: 200 psi pipe with current pipe costs (August 2005)

III. RAW WATER

The raw water portion of the study is limited in scope to examine the possibility of creating a raw water system for large green areas within the Town. The areas reviewed were:

- | | |
|---|--------------------|
| Riverside Cemetery | Southside Parkway |
| Middle School | Fire Drill Field |
| Candy Jack Park | Bicentennial Park |
| Hot Springs Fairgrounds | Library |
| Monument Hill Cemetery | Legion Golf Course |
| High School Areas - Football Field, Border, Yard, Tennis Courts | |
| Elementary School Playground and School Areas | |
| Hot Springs County Recreation Board (Baseball Fields) | |

Two raw water sources exist, the Big Horn River and the new wastewater treatment lagoons, near 8th Street. Ground water wells are also another source, but currently there are no existing wells in

locations where they could be used for raw water. Ideally, a raw water system should supply water at a relatively high elevation and deliver raw water to its users via gravity. Thermopolis is situated along the Big Horn River surrounded by hills in all directions, and unfortunately, no high elevation sources of water exist.

Because of the seasonal and weather induced sediment loading associated with raw water from rivers, raw water systems using these sources must have settling facilities. Settling is usually accomplished in reservoirs prior to distribution to the users. If treated domestic wastewater is used as a source, additional settling is generally unnecessary, but disinfection, monitoring and testing, and permitting will be required.

Currently, the Riverside Cemetery and the Legion Golf Course have raw water irrigation systems. Each of these systems pumps water from the Big Horn River, but these two systems are completely separate. The cemetery system is at a low elevation and located on the south side of Town. The higher Golf Course system is located on the north side of Town.

The Riverside Cemetery system appears to be adequate for their uses, and does not impact the Town of Thermopolis treated water quantity produced. Information on this system was gathered, but no modifications are proposed for this system.

The Legion Golf Course is a more complex raw water system, with three separate pumping systems to transfer the water from the river to the golf course. Initially, water is pumped from a river side channel along the east side of the railroad tracks to a settling pond located on the west side of the tracks. Water flows through the settling pond, and then flows through a pipe to a well with a vertical turbine pump mounted on it. From that point, water is pumped 245 feet vertically up to an earthen reservoir located on the Golf Course. The reservoir is approximately 900,000 gallons in capacity. This existing force main pipe appears to be 6" interior diameter steel pipe, approximately 3,600 feet long.

Most of the pumps and wet wells/intake structures require upgrades or replacement. They also have no duplication so if the existing pump were to fail, there is no backup. The reservoir and force main piping, however, appear to be in useful condition and would only require minimal improvements.

A. Service Area Delineation

Possible areas to serve were determined using aerial photography of "green areas" in Town, as well as property boundaries and water record information. During a future phase of this project, more specific information on the ground should be obtained to accurately assess this data. At this level, it is considered appropriate for general review and analysis.

B. Water Demands

Demands were determined by analyzing the last 3 years of billed treated water usage for all green areas currently using treated water for irrigation. In addition, information was gained on the two raw water systems (Riverside Cemetery and Golf Course) by analyzing data received from personnel, pump nameplates, and other records that were available.

Below is a summary of the data gathered and detailed more specifically in the Final Report.

EXISTING USE DATA – TREATED AND RAW WATER		
<i>Thermopolis Water Treatment Plant</i>	<i>MGD</i>	<i>Comments</i>
Average Summer Use	1.240	
Average Winter Use	0.570	
Difference (Summer – Winter)	0.680	Includes Irrigation & Tourism
Average Summer Irrigation Only Use	0.530	Reduced based on Wastewater Treatment Plant Flows
Average Green Area Usage	0.131	
Average Residential Usage	0.399	
<i>Raw Water Irrigation Systems</i>	<i>MGD</i>	<i>Comments</i>
Legion Golf Course	0.297	From Big Horn River
Riverside Cemetery - Existing Only	0.077	From Big Horn River
Total Raw and Treated Water Usage	0.904	

Likely, the treated water usage figures are low, since there have been water conservation efforts encouraged by the Town. In addition, when switching to a raw water system, demands often increase since raw water is typically not metered, which is desirable by the users. The raw water usage information reported for the Golf Course and Riverside Cemetery was 7,306 GPD per acre. Comparing this data with the City of Cody's, the raw water average daily demand used for design purposes was 7,500 GPD per acre.

C. Raw Water Supply Facilities - Design Criteria

The magnitude of implementing a green area raw water system, even though it excludes most of the residential areas, is large. Any proposed raw water system should be based on conservation of treated water, prolonging the life of the water treatment facility, and minimizing the costs of facilities that may be required to bring water to Thermopolis through the Big Horn Regional Joint Powers Board Water Supply System.

By comparing the location of possible water sources with the location of various green areas, it was determined that development of an expanded system using some of the existing Golf Course raw water systems, as well as the Monument Hill Cemetery's existing storage tanks, is the only reasonable economic approach at this time. Monument Hill Cemetery and the High School football field and High School green areas are significant water users. The Monument Hill Cemetery owns and uses two 22,000 gallon storage tanks to assist in irrigating their acreage. In order to water this cemetery, the Town pumps water up to the top of Airport Hill to these tanks.

1. Maintain Existing Raw Water Systems

Data has shown the magnitude of water presently being supplied by the Legion Golf Course and the Riverside Cemetery raw water systems. The golf course is an asset to the economic health and viability of the community. The present system is in need of upgrades and repairs, but substantial infrastructure is in place in the form of transmission mains, settling facilities, and storage that make rehabilitation of this system attractive. The existing water treatment plant could not handle the irrigation needs of the golf course or Riverside Cemetery if either raw water system was abandoned.

2. **Incorporate Close Proximity Green Areas**
Initially incorporate adjacent green areas presently using treated water to appropriate existing raw water systems. Monument Hill Cemetery is an obvious example since it is adjacent to the golf course and has large areas onto which expansion will inevitably occur. Areas such as the Middle School, the Fire Drill Field, and Candy Jack Park are located in residential areas requiring substantial lengths of existing streets to be disrupted to reach them. As a result, these areas are not considered for raw water in the first phases of the raw water system.

3. **Feed Green Areas By Gravity**
No high elevation supply of water exists in the Thermopolis area. Pumping is, therefore, required at some point. By accepting the premise that the golf course system must be maintained, a high elevation water source is established. All of the green areas discussed in this report could be fed raw water from a Legion Golf Course/Monument Hill Cemetery raw water system. The existing transmission line from the Big Horn River to the Golf Course is adequately sized to supply the Golf Course, cemetery, and Northeast Green Areas.

4. **Select Green Areas Causing Minimum Disruption to Existing Infrastructure**
Gravity supply those facilities which may be reached with a minimum disturbance to existing Town infrastructure. Providing raw water to a green area which requires tearing-up miles of paved streets is unattractive and very likely uneconomical. Initially, it appears that the green areas located in the northeast corner of Town may be reachable with minimal disruption of existing streets.

D. Recommended Improvements and Estimated Costs

The Town can best meet water needs by maintaining and improving the Legion Golf Course raw water system, which can provide substantial green area irrigation while meeting the design criteria. The improvements needed have been divided into three phases:

Phase	Description	Total Project Cost (2007 Dollars)	Number of Equiv. Persons (at 243 GPCD)	Reduction of Treatment Plant by %	Reduction in Treated Water Required
1	Upgrade and maintain the existing Legion Golf Course raw water system, which includes rehabilitation of features at the river, as well as pump replacements.	\$1,343,542	0	0%	0 (Would increase by 56 MG annually or 315,000 GPD if not using raw water)
2	Provide raw water to the present and future Monument Hill Cemetery via pumping, use of their storage tanks, and piping to their property.	\$1,913,787	320	6.27%	7.5 MG annually -or- 50,000 GPD
3	Provide raw water transmission line and pressure reducing station to Northeast Green Areas.	\$2,934,710	586	11.49%	17 MG annually -or- 113,381 GPD

While these costs are separated into phases, they are interdependent. Phase 1 must be completed before Phase 2, and Phase 2 must be completed before Phase 3. For each project phase, WWDC grant funding has been assumed at 67%. The remaining match is planned from a 20% SLIB grant and 13% from the Town of Thermopolis.

From the study, several significant factors were determined:

- If the Legion Golf Course and Riverside Cemetery had to be watered with treated water, the treatment plant would have to treat an additional 373,667 GPD (0.374 MGD). Assuming a 150 day watering cycle, this results in over 56 million gallons of additional water that would have to be treated. The water treatment plant simply could not handle that additional demand. This information indicates why it is vital to maintain the existing raw water systems at the Legion Golf Course and Riverside Cemetery.
- Monument Hill Cemetery District is the next largest user, and pays \$3.25 per 1,000 gallons instead of the Town's usual \$2.65 per 1,000 rate. They have an area earmarked for future expansion, which is beginning to see demand.
- Northeast Green Areas include over 10 acres of irrigated land. The majority of this land is owned by either Hot Springs County or Hot Springs County School District, and includes baseball fields, the football field, and playgrounds around schools.

Since the Town is planning to use its funds, and to utilize many of the existing Golf Course features (reservoir and force main, most importantly), the final costs to the Town (Golf Course) should be less than the costs to the remaining users. A rate schedule was created for the proposed new raw water users which is based on acreage, rather than usage. New rates of \$125 / acre for the Golf Course and \$600 / acre for all other users come close to covering the total annual O&M costs, as well as facility depreciation. As noted, some savings to the Town are difficult to quantify, such as personnel hours, reduction in disinfection and treatment chemicals, and pumping costs.

In summary, rehabilitation of the Golf Course's existing raw water system, with additional expansion to the Monument Hill Cemetery and Northeast Green Areas appears to be a financially viable solution to provide an alternative water source for these users to irrigate with while extending the life and capacity of the Town's water treatment plant.