2020 | City of Deming

Water Conservation Plan

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Abbreviations and Acronyms

AFY	acre-feet per year
AMR	automated meter read
AutoCAD	Computer Aided Design
AWWA	American Water Works Association
BMPs	best management practices
CMA	critical management area
CMB	critical management block
CPA	Certified Public Accountant
DVS	data validity score
GIS	Geographical Information System
GPCD	gallons per capita per day
ILI	Infrastructure Leakage Index
ISC	Interstate Stream Commission
MFR	multi-family residential
MG/Yr	million gallons per year
MUWB	Mimbres Underground Water Basin
NMOSE	New Mexico Office of the State Engineer
PWS	public water suppliers
SFR	single-family residential
WCP	water conservation plan
WRCC	Western Regional Climate Center

Acknowledgement

Photos, including cover photo, courtesy of Santana Valentine.

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EXECUTIVE SUMMARY

The City of Deming operates a water utility which supplies municipal water to nearly 15,000 residents. The city is in southwest New Mexico along interstate 10. The City relies solely on groundwater for its water source. The city averages less than 9-inches of rain annually, most of which comes during the monsoons in mid to late summer. It is imperative for the City of Deming to continuously improve on conservation efforts to ensure a sustainable water supply which promotes conservation of water for future generations and minimizes water supply shortages due to droughts and climate change.

As part of continuous improvements in water conservation, the City of Deming has conducted, and plans to continue conducting annually, the American Water Works Association's (AWWA) Water Audit and New Mexico Office of the State Engineer's (NMOSE) Gallons per Capita per Day (GPCD) Calculator. These tools enable the city to monitor and document water supply and demand characteristics which assists in making better informed management decisions related to water conservation. These tools not only provide a means for monitoring and documenting results, but also provides guidance for developing manageable goals and best management practices (BMPs) for continuing to improve water conservation efforts.

This document, the City of Deming's 2020 Water Conservation Plan (WCP) is broken down into five sections: Data Collection and Overview; Assessing City of Deming's Water Supplier Performance; Setting Water Conservation Goals; Public Involvement, Education, and Outreach; and Developing a Water Conservation Program.

The first section, "Data Collection and Overview", describes the City's environment which includes a description of why this document is needed; the team which will drive this plan; and local conditions such as location, water supply, demographics, housing, temperature and precipitation, water rights and city ordinances related to water conservation.

The second section, "Assessing City of Deming's Water Supply", digs into the data and results included in the 2019 AWWA Water Audit and NMOSE GPCD Calculator. These tools identify several operational and infrastructure improvements that can be made to increase the overall efficiency of the water system. The AWWA Water Audit identifies the City's water system as having a Data Validity Score (DVS) of 59 out of 100. This indicates that the city is at a loss control planning level III status. This means that the City's water utility has a base to work with as far as data collection is concerned; however, the city can improve the efficiency of their water utility by focusing on improving in this area. A level III public water supplier (PWS) can also begin setting goals for long-term water conservation programs. The NMOSE GPCD Calculator indicates that the residential GPCD is approximately 108 GPCD, but also indicates that the GPCD has been decreasing over the past four-years.

Section 3, "Setting Water Conservation Goals", describes the process for identifying, selecting, and prioritizing the City's objective, goals, and BMPs. The following is the city's objective for this WCP:

> The City of Deming's objective for developing a water conservation plan is to increase the efficiency in the way we deliver water to the citizens of Deming. Increasing efficiency involves understanding all the dynamics of the water system which enables the City to reduce waste of water, engage the public in water saving practices, maintain a degree of infrastructure which proactively minimizes waste, and create a rate structure which covers the cost of the utility and promotes water conservation while keeping water rates as low as possible. In a broader sense, the City of Deming wants to operate its municipal water system in a manner that conserves water for future generations and minimizes water supply shortages due to droughts and climate change.

The City has also identified five goals and prioritized them as follows:

1. Improve system management within 5 years as reflected in a DVS of 71 or better on the AWWA Water Audit which would raise the City to a loss control planning level 4 status.
2. Develop written policies and procedures related to water conservation best practices as identified as weaknesses within the AWWA Water Audit and review annually. These policies and procedures should be written and implemented within a year of this audit.
3. Reduce nonrevenue water by 65 MG/Yr by 2025.
4. Ensure water utility annual revenues cover annual operational expenses plus funding to cover inter-period equity costs estimated for asset and infrastructure replacement by 2025.
5. Reduce residential GPCD to a level below 80 GPCD within the next 15 years.

Several BMP's were identified. The City selected 23 of the BMPs identified as being important enough to be considered for this plan. Those 23 BMPs were prioritized as follows:

1. Written Policy and Procedure with Periodic Reviews
2. Annual Completion of the AWWA Water Audit and NMOSE GPCD Calculator
3. Annual Meter Testing and Meter Calibration (Source Side and Demand Side)
4. Meter Replacement Plan
5. Conservation Coordinator
6. Repair Known Leaks
7. Continue Efforts for Utilizing Reuse Water and Incentives for Home Reuse Projects

8. Water Leak Locations Mapped with Date Stamp
9. Water Main GIS File Updated Routinely
10. Billing Report Indicators Prior to Billing (Hi/Lows)
11. Unbilled Metered Accounts Included in Billing System and Reported Monthly
12. Active and Inactive Service Connections Reported Monthly
13. Inactive Service Connections Routinely Audited
14. Pressure Zones and Tank Levels Identified and Monitored Regularly
15. Water Conservation Ordinances Reviewed and Updated
16. Conservation Oriented Rates and Tap Fees
17. Public Involvement Plan
18. Public Information/Outreach Plan
19. In-School Educational Program
20. Requirements for New Development and Initiatives for Existing Residents for Installing Water-Efficient Fixtures and Appliances
21. Promotion of Low-Water-Use Landscaping and Efficient Irrigation Practices
22. Requirements for Efficient Commercial and Industrial Water Use Processes
23. Annual Report to NMOSE Water Use and Conservation Bureau

The fourth section, “Public Involvement, Education, and Outreach”, involves written plans for the City to get the public involved in the decision-making processes regarding water conservation. This section also discusses public outreach plans and a plan for the City to work with the Deming Public Schools for developing education opportunities for students to be indoctrinated in water conservation. The City does identify in the WCP that the focus of the first five-years of this plan is on making operational and infrastructure improvements while introducing public involvement, education, and outreach to develop a more long-term water conservation strategy.

The last section, “Developing a Water Conservation Program”, brings the City’s objective, goals and BMPs together with detailed descriptions for how the plan will be executed, tracked, documented, and reported.

A major component of this program involves continuous improvement in water conservation which requires the Planning Team to review what is working and what is not working periodically and adjust, as necessary. This process will also require public buy-in for water conservation for which the City will actively promote water conservation and actively pursue public input for water conservation initiatives. The focus of everything that the City of Deming does is on the citizens of this city and without an active WCP in place, the future of our citizens would be jeopardized. The State of New Mexico refers to water being the State’s most valuable resource. We consider our citizens as being the City’s most valuable resource, however without water, our citizens could not exist. A sustainable water resource will sustain a quality of life for our citizens long into the future.

1. Data Collection and System Overview

1.1 Purpose

The purpose of this document is to organize and implement a sustainable approach for ensuring that the City of Deming maximizes efficiencies and minimizes waste within the City of Deming's municipal water system.

The City of Deming has taken on several recent projects and have passes several ordinances with the intentions to conserve one of the City's most valuable resource. These projects include efforts to treat effluent from the City's wastewater treatment plant to acceptable standards to allow for reuse for a variety of purposes, extending treated effluent water lines to various parks and golf courses throughout the City for irrigation purposes, installation of artificial turf at ball fields, contracting treated effluent water to commercial industries for non-consumption purposes, the construction of a recreational lake, as seen in Figure 1 below, which is intended to eventually be supplied by treated re-use water, and projects to replace and repair aged infrastructure.

All these projects come at a cost to a community where the median per capita income levels are well below national and state averages. This document will assist the community in meeting the requirements to access state funding opportunities that might not otherwise be accessible.

FIGURE 1: CITY OF DEMING RECREATIONAL LAKE

1.2 Planning Team

The implementation and planning team for this document will consist of City of Deming staff members. City of Deming Staff members involved with implementing this plan consists of the Mayor, City Administrator, Public Works Director, Public Works Assistant, Community Services Director, City Engineer, City Treasurer, and Water/Wastewater Foreman.

The team consists of individuals with a diverse set of backgrounds with many years of experience in their related fields. The Public Works Director, City Engineer and Water/Wastewater Foreman all bring several years of experience managing water resources for the City of Deming and work closely with other government agencies to ensure the City complies with environmental and permitting requirements related to operating a water treatment facility. Figure 2, below, shows the City of Deming Organizational Chart as presented on the City of Deming website. The chart is not current, but it does give an idea for the structure of the positions and should be used as a guide to refer to positions, rather than the individual people who are in the position.

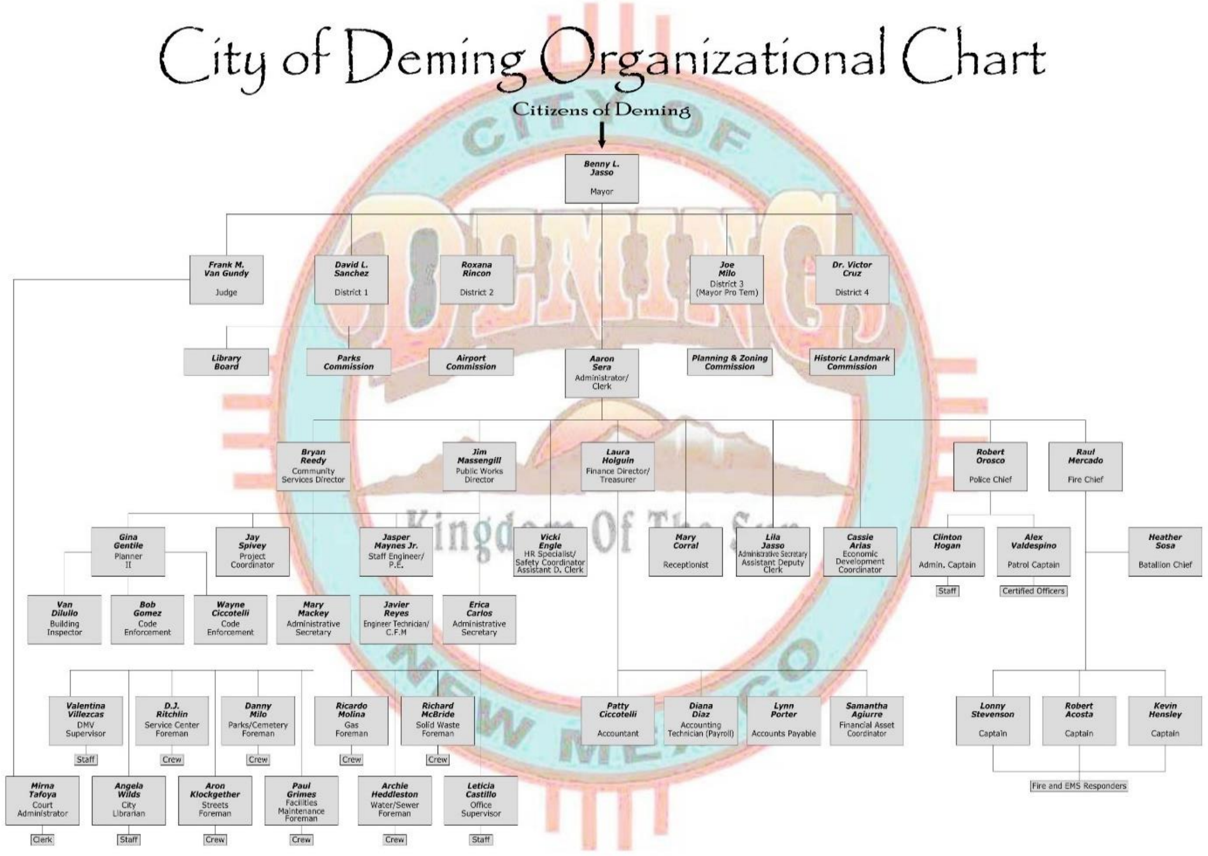


Figure 2: City of Deming Organizational Chart. Source: City of Deming website: www.cityofdeming.org

1.3 Local Conditions

1.3.1 Map

Deming is located in the southwestern part of New Mexico, 33 miles North of the Mexico border, a land of an ever-present sun and flowing desert rocks and cacti (City of Deming, 2010). The City of Deming is the county seat for Luna County, NM. The 2010 Decennial Census estimated the population of Deming to be 14,855 (US Department of Commerce, n.d.). The city is located along Interstate 10 approximately 100 miles east of the Arizona/New Mexico state line and approximately 100 miles west of the New Mexico/Texas state line. The City of Deming is located in a valley between the Florida Mountains to the southeast and Cooke's Range to the North (Daniel B. Stephens & Associates, Inc., 2018). The valley floor's elevation sits at about 4340 feet above sea level.

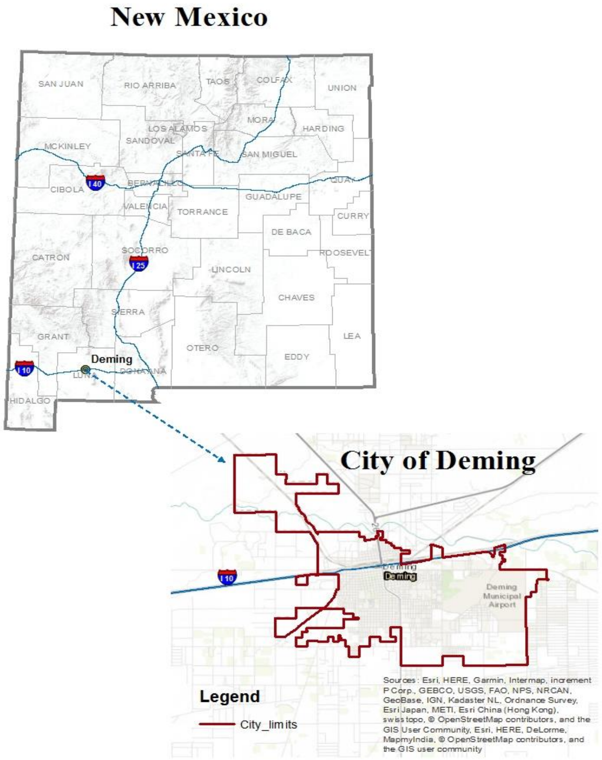


Figure 3: City of Deming Location Reference Map

1.3.2 Water Supply Overview

The City of Deming's supply water source is comprised completely from groundwater sources from the Mimbres Underground Water Basin (MUWB). Refer to Appendix C, the City of Deming's 40-year Water Plan prepared by Daniel B Stephens & Associates Inc., Section 2 (Daniel B. Stephens & Associates, Inc., 2018), and Appendix D, Groundwater Model of the Mimbres Basin published by the NMOSE (Cuddy & Keyes, 2011), to get a very thorough and still relevant description of the water supply characteristics for the City of Deming.

The City of Deming currently has 20 wells for which they can divert water for municipal purposes. Some of these wells need repair or replacement. Figure 5 and Table 1, below, give a general description as to location and general characteristics of the water rights associated with the municipal wells.

FIGURE 4: 3-MILLION GALLON GROUND LEVEL WATER TANK

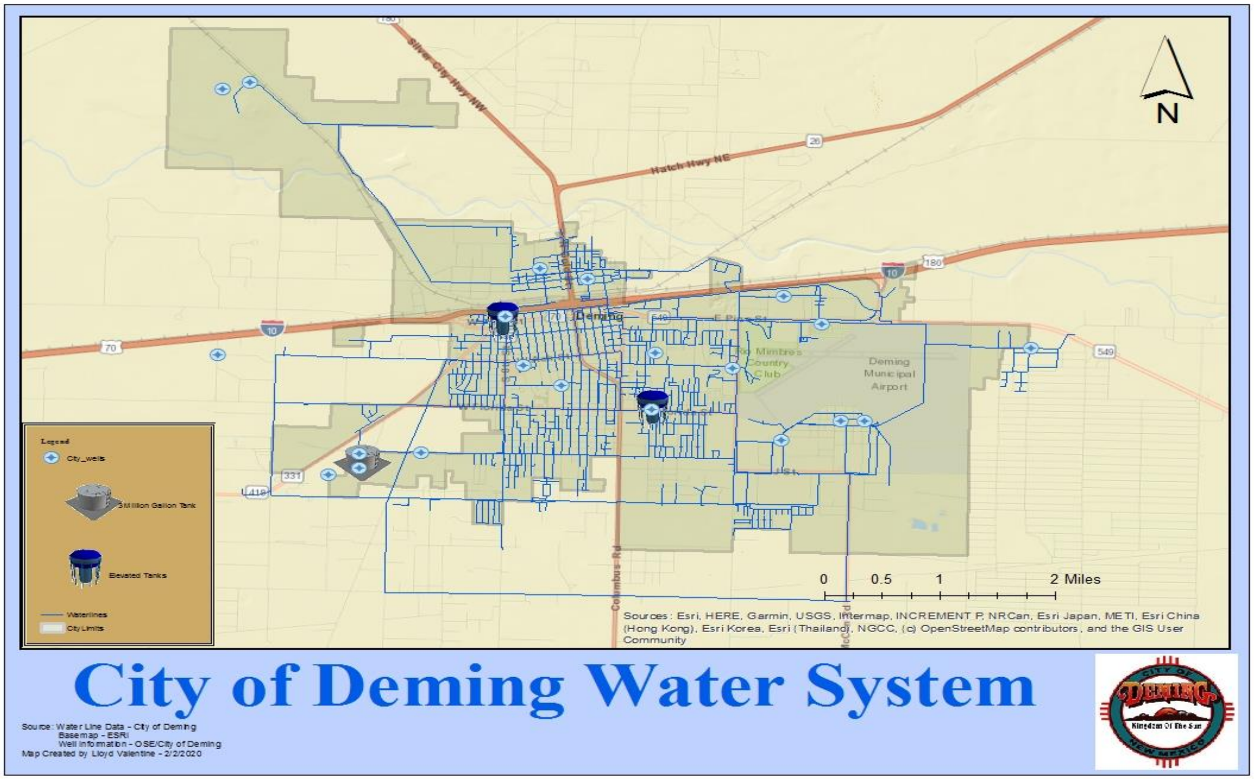


Figure 5: Map of City of Deming's Water Distribution System

Table 1: City of Deming Municipal Water Rights

City of Deming - File/Well Breakdown - Jan 2020

File Number	City Name	Acres	Diversion	Wells	Pumping Restriction	Meter Rqmt	BU?
			Municipal Rights				
M-00049	Bilbo Farm		185.60	M-00049-S	566.34	QTR	Pending
			380.74	M-00109	566.34	QTR	Pending
				M-00109-S	566.34	QTR	
	Brdecko Well			M-00127	380.74	QTR	
M-00208	Diaz Farm		216.64	M-00208	216.64	QTR	Pending
M-00214	#14 Hervol Farm		176.00	M-00214	468.96	QTR	Pending
			160.00	M-00214-S2 (Plugged?)	468.96	QTR	Pending
			132.96				Pending
M-00272-A	Peru Mill		159.20	M-00272	701.90	QTR	Pending
			100.80	M-00273	701.90	QTR	Pending
			441.90				Pending
M-00299	#6		4415.00	M-299-S	1210.00	QTR	Pending
	#5			M-299-S5	1210.00	QTR	
	#1			M-299-S6	1210.00	QTR	
No more than 4340	#2			M-299-S7	1210.00	QTR	
	#7			M-299-S8	1210.00	QTR	
	#10			M-299-S10	1210.00	QTR	
	#8			M-299-S11	1210.00	QTR	
	#3			M-299-S2	1210.00	QTR	
No More than 4415	#11			M-299-S4	1210.00	QTR	
	#9			M-299-S12	1210.00	QTR	
	#4			M-299-S15	1210.00	QTR	
	City Airbase Well			M-299-S9	50.00	QTR	
	Total		***6368.84***				

The City of Deming is located within a critical management area (CMA) as determined by the NMOSE. See Appendix E – Guidelines for the Deming-Columbus Administrative Area (Office of the State Engineer - John R D`Antonio, 2011) for details concerning the administrative limitations for moving water rights around the City of Deming area. Because of the CMA determination, the movement of water rights in and out of critical management blocks (CMB) is very difficult. This has put constraints and defined where the City of Deming can draw its water from.

The City of Deming's initial well field consists of 12-wells that they can currently pump up to 4415 AFY of water for municipal purposes. These 12-wells are known by the NMOSE as the M-299 wells. Each well has been permitted to pump up to 1210 AFY of water, except for well M-299-S9 which is limited to pumping only 50 AFY. In addition to the restrictions just described, wells M-299-S, S5, S6, S7, S8, S10, and S11 are collectively restricted to pumping only up to 4340 AFY.

The City of Deming has been successful at purchasing irrigation water rights from nearby farms and converting those rights to municipal purposes. On a couple of occasions, the City has been able to transfer some of these rights to production wells closer to the City limits. The City of Deming has expanded their municipal purposes by adding four additional wells, known by the City as Bilbo Farm, to pump an additional 566.34 AFY of water, adding an additional well known by the City as Diaz Farm to pump an additional 216.64 AFY, adding an additional well known by the City as Well #14 to pump an additional 468.98 AFY, and adding two additional wells known by the City as Peru Mill to pump an additional 701.9 AFY. This brings the City's total municipal water right to 6368.84 AFY.

The City also owns several irrigation rights for which they intend to convert to municipal purposes when the City's demand increase. For the purposes of this report, the irrigation water rights are not discussed.

Figure 5 above, also gives an overview of the City's distribution system. The City has three storage tanks to serve the system – a 3 million-gallon ground level water tank (figure 4 above) and two 500,000-gallon elevated storage tanks (figure 6 right). There are approximately 150-miles of distribution lines. The tables below show the size and types of piping used. As seen in tables 2 and 3 below, there are approximately 0.15 miles of piping

FIGURE 6: ONE OF TWO 500,000-GALLON ELEVATED STORAGE TANKS. THE SECOND TANK IS PICTURED ON THE COVER OF THIS DOCUMENT.

where there is uncertainty as to what size the pipes are and 17.35 miles where the type of pipe is unknown. This information was extracted from the City's GIS project where all the distribution lines have been identified.

TABLE 2: DISTRIBUTION LINES BY SIZE

Distribution Lines By Size	
Diameter (in)	**Length (Miles)**
UNK Total	0.15
0.7 Total	0.02
1 Total	2.08
1.5 Total	0.16
2 Total	7.48
4 Total	7.62
6 Total	74.17
8 Total	14.05
10 Total	13.23
12 Total	30.50
18 Total	0.08
Grand Total	149.53

TABLE 3: DISTRIBUTION LINES BY TYPE

Distribution Lines By Type	
Type	**Length (Miles)**
AC Total	37.38
CI Total	25.26
PTUB Total	1.87
PVC Total	67.68
UNK Total	17.35
Grand Total	149.53

The City has metered all production wells and meters are manually read monthly. Meter readings are submitted to the NMOSE quarterly. The distribution system is dated and in need of repairs frequently. The City has put forth an effort to document and track distribution leaks in order to identify problem areas and to prioritize areas to expend resources. City Council has recently approved a rate increase to help provide resources to maintain the water system.

FIGURE 7: METER AT ACCESS POINT FOR FILL OF THE CITY'S RECREATIONAL LAKE.

1.3.3 Demographics

Figure 8: Leyendecker Plaza, City of Deming. Cultural artwork that incorporates water into the roots of the community.

The 2010 Census estimated the City of Deming population to be 14,855 people. The 2010: ACS 5-year Estimates Data Profile (DP05) helps break down some of the demographics of the City of Deming. Approximately 50.3% of the population is female while 49.7% are male. The median age of the population is 34.7 years old. 98% of the population identified as being a single race in the 2010 Census. Of that 98%, 90.3% identified as being White, 1.5% identified as being Black or African American, 0.9% identified as being American Indian or Alaskan Native, 0.3% identified as being Asian, and 2% identified as being some other race. Of the total population, 69.4% of the population identified as being Hispanic or Latino of which 63.8% identified as being Mexican (US Department of Commerce, n.d.).

Approximately 81.4% of the population reported speaking English “very well”. 53.2% of the population reported that they speak Spanish. Only 35% of the population who indicated that they speak Spanish also reported that they do not speak English “very well”. 15% of households reported that no one in their household speaks any English or do not speak it “very well” (US Department of Commerce, n.d.).

The 2018: ACS 5-Year Estimates Subject Tables (S1701) estimate 34.6% of the population is below the poverty level (US Department of Commerce, n.d.). The City of Deming/Luna County has been characterized for having very high unemployment rates compared to the rest of the state and nation. While the nation has been experiencing a current unemployment rate of about 4%, the unemployment rate for Luna County has recently ranged from 8% to 17% (New Mexico Department of Workforce Solutions, 2020). The wide range of fluctuation is due to a significant seasonal work force.

As seen in the next section of this report, there are approximately 6,226 total housing units reported by the 2010 Census. This number appears to be somewhat inflated compared to the number of service connections that the City of Deming bills on a monthly basis. Billing reports show this to be closer to 4,500 units. Some of the difference may just be how this data is reported on both sides. The City does not separate out multi-family residences in their billing procedures. If the City meters each apartment in a complex, those apartments get counted simply as residential. If the apartment complex has one meter for all apartments, the complex gets metered as commercial.

There are very few big water users on the City of Deming's distribution system. The biggest user would be Mizkan Foods who is a food canning and processing plant. The next big user would be the Deming Public Schools. These are the only two users currently that the City of Deming would consider "big users".

1.3.4 Housing

The 2010 US Census gives data on housing. The census webpage does give housing estimates on an annual basis; however, the estimates for housing fluctuate from year to year in an unrealistic manner. Therefore, the 2010 US Census data is used for this report (2010 US Census, 2010).

TABLE 4: U.S. CENSUS HOUSING DATA FOR THE CITY OF DEMING

Subject	Number	Percent
OCCUPANCY STATUS		
Total housing units	**6,226**	**100.0**
Occupied housing units	**5,582**	**89.7**
Vacant housing units	**644**	**10.3**

QT-H1-Geography-Deming city, NewMexico:
2010 Census Summary File 1

1.3.5 Temperature and Precipitation

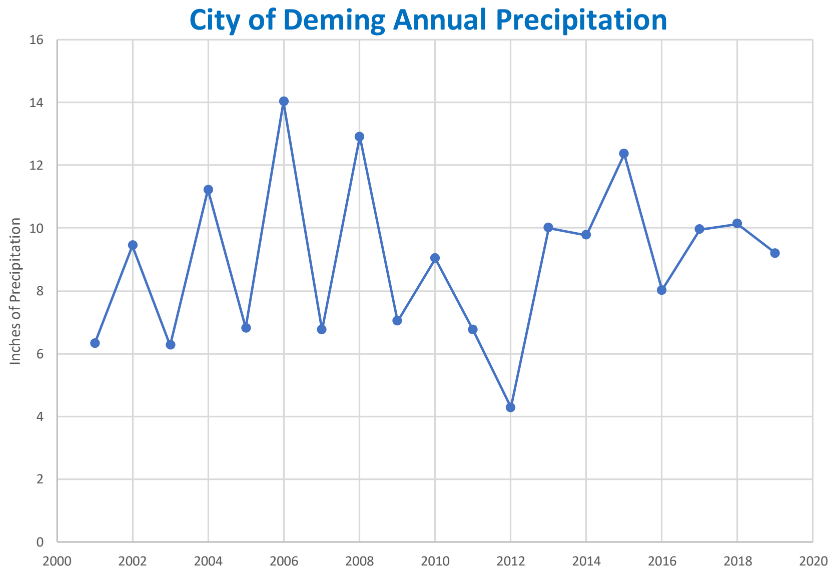
The climate in Deming is characterized by large ranges in annual temperature, with low humidity and a high evaporation rate (Daniel B. Stephens & Associates, Inc., 2018). Table 5, below, shows the annual average max temperature to be 76.5°F, while the annual average minimum temperatures to be 44.0°F. The table also shows the annual average precipitation to be 8.33 inches (Western Regional Climate Center, n.d.); most precipitation occurs during heavy thunderstorms from July through September (Daniel B. Stephens & Associates, Inc., 2018).

Table 5: WRCC temperature and precipitation data for the City of Deming

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	**56.80**	**61.70**	**68.70**	**76.90**	**85.30**	**94.90**	**95.00**	**92.50**	**86.10**	**77.80**	**65.30**	**57.20**	**76.50**
Average Min. Temperature (F)	**25.60**	**28.70**	**34.20**	**40.90**	**49.30**	**59.10**	**65.80**	**63.50**	**56.90**	**44.60**	**33.30**	**26.60**	**44.00**
Average Total Precipitation (in.)	**0.55**	**0.37**	**0.29**	**0.13**	**0.14**	**0.29**	**1.72**	**1.56**	**1.24**	**0.79**	**0.47**	**0.77**	**8.33**
Average Total SnowFall (in.)	**1.40**	**0.70**	**0.20**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.10**	**0.40**	**1.00**	**3.80**

Period of Record : 05/01/1920 to 06/10/2016
Station ID: DEMING MUNI AP, NEW MEXICO (292440)
Source: https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?nm2440

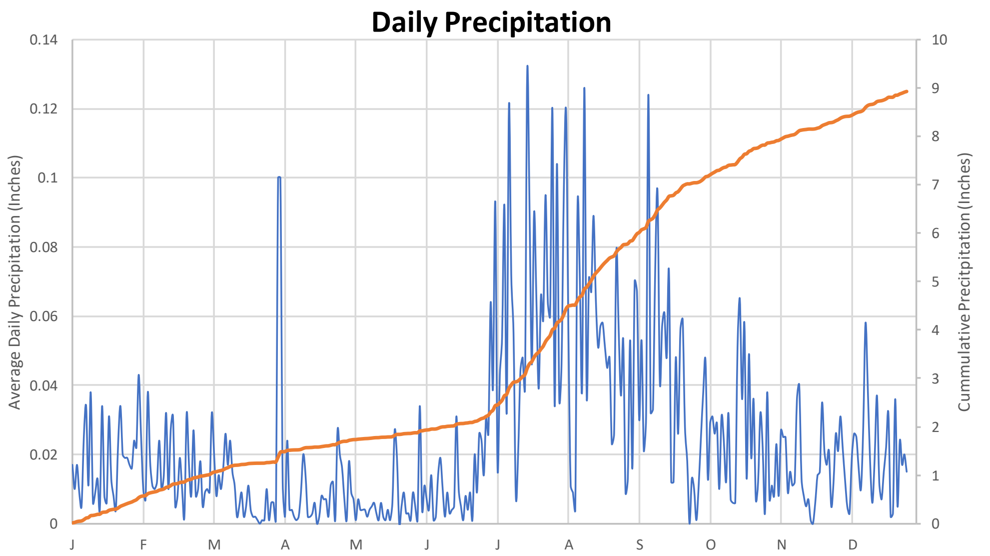
Table 5, above, utilizes all data recorded from weather station 292440 for a period between May 1st, 1920 to June 10th, 2016; however, significant data gaps exist. Figure 9, below, shows a graph of the annual precipitation but only includes a time period for years 2001 to 2019. There are several years of data missing for years prior to 2001. From the figure below one can see that annual precipitation for the past 19 years ranged from a low of approximately 4 inches of precipitation in 2012 to a high of 14 inches of precipitation in 2006. From 2001 through 2013 the City of Deming has experienced some significant shifts in precipitation from year to year. 2013 through 2019, the City's precipitation amounts seem to have been a little more consistent with the average annual rainfall of about 9 inches per year, maybe even slightly more.



Source of Data: https://wrcc.dri.edu./cgi-bin/cliMAIN.pl?nm2440

Figure 9: Graph showing annual precipitation for the City of Deming 2001-2019.

Figure 10, on the next page, shows a hydrograph depicting average daily precipitation. Like Table 5 above, this average comes from all available data collected between May 1st, 1920 to June 10th, 2016. There are significant data gaps within the data set; however, this is the best available data found. The hydrograph shows that most of the precipitation experienced by the City of Deming occurs between June and October. This coincides with the summer monsoons mentioned previously in this section. The monsoons are associated with high temperatures, usually averaging between 95°F and 105°F, and high evaporation rates. Much of this precipitation is lost to evaporation.



Source of Data: https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?nm2440

FIGURE 10: HYDROGRAPH DEPICTING THE CITY OF DEMING'S ANNUAL PRECIPITATION. WRCC DATA USED 1920-2016.

1.3.6 Regional Water Plan

The City of Deming is in New Mexico's Region 4 – Southwest New Mexico Water Region. The Interstate Stream Commission (ISC) published a Southwest New Mexico Water Region Plan in 2017 (New Mexico Interstate Stream Commission, 2017). Much of the regional water plan focuses on places north of Deming; however, one component addressed under conservation is countywide GPCD goals. The City of Deming includes approximately half of Luna County's population.

The City of Deming is focusing on short-term conservation efforts in this initial plan but does have a goal to reduce residential GPCD and nonrevenue water. The City of Deming's system total GPCD is just under 300 GPCD. The regional water plan suggests that a county with a GPCD between 200 to 300 should try to reach a future goal of 150 GPCD. As previously mentioned, the City has a goal to reduce residential GPCD, which will contribute to reducing systemwide GPCD. Future WCP goals may specifically target systemwide GPCD.

The regional water plan also promotes the use of the AWWA Water Audit software and NMOSE's GPCD Calculator. The City of Deming has incorporated those two tools into our future water conservation efforts by memorializing annual water audits using those tools as part of this WCP.

Another major component of the regional water plan is the use of reuse water. Many of the more recent projects that the City of Deming has pursued involve improvements to their reuse efforts and expanding the use of the reuse water. One example, the City has recently extended the city's reuse water lines to several parks throughout the city with plans to use reuse water for irrigation purposes in those parks. This WCP incorporates the City's desire to continue improving our reuse water operations through incorporating best management practices related to reuse water and tying them to the goals of the WCP.

The Public Works Director has been and will continue to be an active participant in the State's regional water planning processes. The City of Deming has taken active rolls in various regional processes and activities. Another issue discussed in the regional water plan is the importance to use Central Arizona Project water. An entity was created from regional water user organizations to spearhead the efforts to utilize 14,000 AFY of water authorized under the Arizona Water Settlement Act. The City of Deming has volunteered to be the entity's fiscal agent. This demonstrates the City of Deming's willingness and seriousness to engage in regional water planning efforts.

1.3.7 Other Local Conditions

This section tends to be reserved for water right information, for which has already been discussed in the water supply section. It is important to mention that the City of Deming works closely with the NMOSE to ensure the City's water rights remain in good standing. Failure to maintain a good standing status with the NMOSE jeopardizes the City's access to potential State grants and loans. This entails the City to comply with the conditions of approval associated with each of the permits approved by the NMOSE, such as submitting meter readings, filing Proof of Beneficial Use, ensuring well records are submitted when drilling new wells, submitting annual Block System filings, and requesting extensions of times when conditions of permits will not be met by the time granted by the NMOSE. In addition to NMOSE permitting conditions, the City of Deming must also be diligent at filing proper filings with other state and federal agencies related to water, such as discharge permit filings and water conservation fee assessments to the appropriate state and/or federal agencies.

In addition to groundwater supply, the City of Deming has been actively pursuing the use of reuse water treated at our wastewater plant. For more than 20-years the City has been treating wastewater to appropriate environmentally safe levels to reuse the water to irrigate landscape such as the municipal golf course. The City has recently extended our purple pipes to various parks within the City and soon plan to start irrigating those parks with reuse water. The City has also used the reuse water to irrigate non-consumptive use crops at City farms. In the early 2000's the City of Deming contracted with a local power plant to supply up to a million gallons of reuse water per day for cooling purposes for their gas turbine generators. The City continues to improve the wastewater treatment plant reuse water to higher standards to hopefully one day be to a level that could be safe for consumption. More information on the City's wastewater system and reuse plans can be seen in the City's 40-year Water Plan which is Appendix C of this document (Daniel B. Stephens & Associates, Inc., 2018).

One current project that the City has taken on is the construction of a recreational lake located next to the City's amphitheater on the East side of town. The lake was recently filled with groundwater and a variety of fish species were introduced. Although there was some initial concern from the public about the use of the groundwater to fill the reservoir, there has been a tremendous amount of interest from residents in the project indicated by the number of residents seen on a daily basis fishing at the lake.

The concern of utilizing groundwater to fill the lake is only temporary. The City's intention of this lake is to use reuse water from the wastewater treatment plant to keep the lake full. The City still has some operational hurdles to get over to get the treated wastewater to acceptable safe levels for fish and consumption standards. In the long run, the lake is envisioned to be a storage tank for reuse water where additional treatment (aeration) can occur before returning to the wastewater treatment plant for additional treatment.

Figure 11: City of Deming Recreational Lake

The City has also adopted several water conservation ordinances to minimize wasteful water practices which are listed below. These ordinances also address the use of water efficient fixtures and appliances, low water use landscaping, and efficient irrigation practices.

9-4-2: WATER METERS:

A. Property Of City: All water meters installed by the public works department shall remain at all times the property of the city, and shall be maintained and repaired when rendered unserviceable through fair wear and tear, and renewed by the public works department; provided, that where repair or adjustment of any meter is rendered necessary by the act, neglect or carelessness of the owner or occupant of the premises, any expense caused to the department thereby shall be charged against and collected from the owner of the premises.

B. Removal For Nonpayment; Reinstallation Fee: In the event that any water meter of the city is removed for nonpayment or delinquent water charges, the owner or occupant of the premises shall pay for the reinstallation of the water meter a minimum charge of one hundred dollars ($100.00) prior to the installation thereof.

C. Properties Under Separate Ownership: No one service shall provide water to properties under separate ownership.

D. Bypass Restricted: No bypass or connection between the meter and the main shall be made, maintained, or permitted.

E. Examination and Testing:

1. Customer Request Test; Deposit: Any customer shall have the right to request that the meter through which water is being furnished be examined and tested by the public works department with the following amounts charged for the various sizes:

    a. For testing a five-eighths inch ($^{5}/_{8}$") meter, ten dollars ($10.00).

    b. For testing a one-inch (1") meter, twenty dollars ($20.00).

2. Registering Overage: If on such an examination and test the meter shall be found to register over three percent (3%) more water than actually passes through it, another meter will be substituted therefor, and the fee charged in the application for a test shall be repaid to the person making the application.

F. Failure to Register Correctly: Wherever a meter gets out of order and fails to register correctly, the consumer shall be charged with an average daily consumption as shown by the meter when in good working order and registering correctly.

G. City Replacement of Meters: The city of Deming retains unto itself the right to replace any water meter, at any time, for any reason, at its sole discretion. (Ord. 1190, 7-13-2009)

9-4-3: WATER USER PROVISIONS:

A. Approved Shutoff: Consumers shall install an approved shutoff inside the property line, at a location accessible in case of emergency.

B. Check Valve: If in the judgment of the public works director, the placing of an approved check valve on the property side of a water meter of any consumer is considered necessary for the safety of the water system, such approved check valve shall be immediately installed, at the expense of the consumer, after due notice in writing shall have been given to the consumer by the public works director.

C. Cross Connections: Water hookups to properties with private wells or other potential hazardous cross connections will not be allowed until the city plumbing inspector has certified that there exists a physical separation between the city water system and the hazard.

D. Authority to Turn Water On or Off: It shall be unlawful for any person or entity, other than the authorized agents or employees of the public works department, to turn on or turn off water service. Water turned off by the city for delinquent bills, leaks or other reasons cannot be turned back on until the reason for turn off has been corrected and the turn on authorized by the public works department. If an unauthorized turn on is made, the meter and/or service will be removed, and all applicable penalties will be charged against the user.

E. Water Turn Off for Repairs: The public works director may at any time order the water cut off from any premises connected with the waterworks system, without notice, for repairs, extensions, or other necessary purposes.

F. Plumber Requirements: Whenever plumbers or other persons connecting service pipe to the property side of a meter may use the water for testing the pipes, they shall at all times shut off the water from unoccupied premises before leaving same, and leave meter box properly installed to full depth in the ground or sidewalk, with cover securely fastened to top of and square with top of box.

G. Consumer Supplying Water To Others: It shall be unlawful for any consumer to supply water to any person other than to the occupant of the premises of said consumer, or to knowingly permit leaks or wastage of water, or for any person to tap, open or connect with any water main or pipe which forms a part of the waterworks system of the city. (Ord. 1190, 7-13-2009)

9-4-7: OUTDOOR WATER CONSERVATION:

A. Definition: For purposes of this section "irrigation" means the watering of turf, trees, shrubs, flowers, ornamental grasses, plants, native plant material or other vegetation through overhead spray heads, handheld hose, bubblers, drip emitters or other similar devices for delivering water.

   The definitions contained in section 12-2-1 of this code are incorporated into this section by reference.

B. Water Conservation Compliance: No person who uses water from the city of Deming water supply system shall make, cause, use or permit the use of water received from the city water supply system for residential, commercial, industrial, agricultural, institutional, governmental or any other purposes in a manner contrary to any of the provisions of this section.

C. Turf and Landscape Irrigation: The following mandatory water conservation measures shall apply to all customers of, or persons that use or receive water from the city water supply system:

   1. All outdoor irrigation of turf, trees, shrubs, flowers, ornamental grasses, plants, native plant material or other vegetation on residential, industrial and commercial property with even numbered addresses may irrigate on Mondays, Wednesdays, and Fridays; and for odd numbered addresses, such vegetation may be irrigated only on Tuesdays, Thursdays, and Saturdays; and on Sundays, properties with either odd or even addresses may irrigate. Provisions of this subsection shall apply during the entire calendar year.

   2. From April 1 through September 30 of each calendar year all outdoor irrigation of turf and other vegetation is prohibited between the hours of ten o'clock (10:00) A.M. and six o'clock (6:00) P.M.

   3. The city planning and zoning commission shall have the authority to review variance requests upon written application of any person and shall make a recommendation to the city council who shall make the final decision.

D. Nonessential Water Use Restrictions: The following restrictions shall apply to all customers of, or persons who use or receive water from the city of Deming water supply system:

   1. The washing of houses, or automobiles, trucks, trailers, recreational vehicles, boats, airplanes or any other type of mobile equipment shall be done only with a handheld bucket or pail, or a handheld hose equipped with a shutoff nozzle that completely shuts off the flow of water. This restriction does not apply to commercial car washes or a commercial service station. When used in this section, "bucket" or "pail" means a container holding five (5) gallons or less.

   2. After the effective date hereof, no building permit for a commercial car wash or service station shall be issued until the applicant for such permit provides to the city building inspector a certification that the car wash will use no more than fifty (50) gallons of water per vehicle washed or integrate a water reclamation system. Existing commercial car wash establishments that upgrade their facilities shall upgrade to the extent that the car wash will

use no more than fifty (50) gallons of water per vehicle washed or an integrated water reclamation system.

E. Wasting Water Prohibited: The following uses of water are considered wasting water and are prohibited:

1. Irrigating any vegetation, or otherwise using water from the city of Deming water supply system to permit or cause water to pond, or to flow, spray or otherwise move or be discharged from the premises of any person who receives water from the city of Deming to or upon any street, alley, gutter, ditch, drain or other public right of way.

2. Failing to repair a leak in a system that delivers or discharges water within ten (10) working days of discovering or being informed of such leak.

3. Washing of sidewalks, streets, driveways, parking lots, service station aprons, exteriors of homes or apartments, commercial or industrial buildings, government or institutional buildings, or any other impervious outdoor surface with a hose, or a pressure washer except in emergencies, or in construction preparation, or where such cleaning is mandated by federal, state or local law.

4. In this section a "swimming pool" means any portable or permanent structure containing water twenty-four inches (24") in depth and containing one thousand one hundred twenty-two (1,122) gallons of water and intended for recreational purposes. All swimming pools constructed after the effective date hereof must be equipped with filtration, pumping and recirculation systems. It is unlawful to drain swimming pools into the street, alley, gutter, ditch, drain or any other public right of way. Swimming pools may be drained into the sanitary sewer system.

5. The serving of drinking water in restaurants except upon request of the customer, excluding establishments that serve beer and alcohol.

F. Variances and Permits: The following procedure shall apply for those persons seeking a variance from the provisions of this section:

1. The planning and zoning commission shall review hardship or special cases of persons, groups, organizations, or corporations who cannot fully comply with the provisions of this section. The planning and zoning commission shall review written applications from persons, groups, organizations, and corporations who claim some hardship or special circumstances. The planning and zoning commission shall recommend approval to the city council of an application only for reasons of economic hardship or medical hardship, or if there is a legitimate public health or safety concern. An "economic hardship" is defined as a threat to an individual's or business' primary source of income. A "medical hardship" is defined as a situation where it is determined that a person's ill health or medical condition requires a dependency upon others to irrigate or water. Under no circumstances shall inconvenience or the potential for damages to landscaping be considered an economic hardship, which justifies a variance. The decision of the city council is final and binding. The prescribed fee

for such variance applications shall be twenty-five dollars ($25.00) or as otherwise prescribed by the city council.

2. A variance or permit granted by the city council expires under its own terms and conditions, but in no case shall a variance be granted, or a permit issued for a period greater than three (3) years. Any person issued a variance or permit shall provide proof of such variance or permit upon demand of any person authorized to enforce this section.

G. Exceptions to Enforcement: The following shall constitute exceptions from compliance with the provisions of this section:

1. The water is the result of natural events such as rain or snow.

2. The flow of water is the result of temporary failures or malfunctions of the water system.

3. The flow of water is the result of water used for firefighting purposes including the inspection and pressure testing of fire hydrants or the use of water for firefighting training activities.

4. The use of water is required for the control of dust or the compaction of soil as may be required by law.

5. The water is used to wash down areas where flammable or otherwise hazardous substances have been spilled and creates a dangerous situation.

6. The water is used to prevent or abate public health, safety, or accident hazards when alternate methods are not available.

7. The water is used for routine inspection or maintenance of the water supply system.

8. The water is used to facilitate construction within public rights of way in accordance with the requirements of the city and good construction practices.

9. The use of water is permitted under the terms of a variance or permit granted by the city council.

10. The water is used for street sweeping, sewer maintenance or other established utility and public works practices.

11. Watering contrary to the provisions of subsection C of this section may be permissible for one day only where application of chemicals requires immediate watering to preserve an existing lawn. In cases of commercial application, a receipt from a commercial lawn treatment company indicating the date of treatment, the address of the property treated, the name and address of the commercial contractor and the chemical treatment required shall constitute evidence that the owner or person responsible for the property is entitled to this exception. Where treatment with a noncommercial application of chemicals requires

immediate watering to preserve an existing lawn, the owner or person responsible for the property must contact the city code enforcement officer prior to application of the chemicals and provide evidence satisfactory to the code enforcement officer for approval of this exception.

12. Outdoor irrigation necessary for the establishment of newly seeded or sodded turf grass and landscaping in new residential and nonresidential developments.

H. Water Emergency, Restriction Of Water Use: The city council, on the advice of the city administrator and the director of public works, may declare a water emergency in case of severe drought, any condition that interrupts the ability of the city to supply water such as loss of a major water transmission line, loss of or damage to the water treatment facility, or extended periods of high consumer demand, or where restriction on the use of water is necessary because of natural disaster, or war, or to protect the public health, safety and welfare, or to preserve the water supply. Where a water emergency is declared, the city council may restrict or prohibit, by resolution, any or all of the following uses, or any uses not specified, of water from the city water system:

1. Irrigation of lawns, trees, shrubs, or any other outdoor vegetation.

2. The washing of all motor vehicles and other equipment, except in commercial car wash facilities.

3. The filling or refilling of, or addition of water to swimming pools.

4. The issuance or granting of any variances to the provisions of this section.

5. The operation of any ornamental fountain or other similar structure.

6. Any other use deemed appropriate by the city council in the circumstances.

I. Penalty: Any person violating any of the provisions of this section, shall be punished as provided in section 1-4-1 of this code, and a separate offense shall be deemed committed on each day during or on which a violation occurs or continues. (Ord. 1190, 7-13-2009)

11-1-5: INDOOR WATER CONSERVATION:

The following regulations shall apply to promote indoor water conservation:

A. Definition: "Water conservation" means any beneficial reduction in water use or water loss.

B. Indoor Plumbing Fixtures:

1. All new residential buildings and all new nonresidential buildings, including all additions and renovations to existing residential and nonresidential buildings that involve either the

installation of new toilets or the replacement of existing toilets, shall install low flush toilets which use no more than 2.0 gallons per flush (gpf).

2. All new residential buildings and all new nonresidential buildings, including all additions and renovations to existing residential and nonresidential buildings that involve either the installation of new showerheads or the replacement of existing showerheads, shall install showerheads with a maximum flow rate that does not exceed 2.5 gallons per minute (gpm).

3. All new residential buildings and all new nonresidential buildings, including all additions and renovations to existing residential and nonresidential buildings that involve either the installation of new faucets or the replacement of existing faucets, shall install faucets with a maximum flow rate that does not exceed 1.5 gallons per minute (gpm).

C. Indoor Appliances:

1. It is recommended, but not mandatory that all new residential buildings and all new nonresidential buildings, including all additions and renovations to existing residential and nonresidential buildings that involve either the installation of new dishwashers or the replacement of existing dishwashers, to install low water use dishwashers which require no more than thirteen (13) gallons of water in the regular cycle and have a cycle adjustment that reduces the water used for small loads.

2. It is recommended, but not mandatory that all new residential buildings and all new nonresidential buildings, including all additions and renovations to existing residential and nonresidential buildings that involve either the installation of new clothes washing machines or the replacement of existing clothes washing machines, to install low water use clothes washing machines which require no more than forty three (43) gallons of water in the regular cycle and no more than fifty three (53) gallons of water in the permanent press cycle, and have a cycle or water level adjustment that reduces the water used for small loads.

3. It is recommended, but not mandatory that all new residential buildings and all new nonresidential buildings, to install a hot water recirculation system approved by Underwriters Laboratories or other similar, nationally accepted approval agency. Alternatively, a "demand water heater" system, installed centrally or at the point of use, may be used if such system is approved by Underwriters Laboratories, or other similar, nationally accepted approval agency.

D. Outdoor Appliances:

1. It is recommended, but not mandatory that all new residential buildings and all new nonresidential buildings, including all additions and renovations to existing residential and nonresidential buildings that involve either the installation of new evaporative coolers or the replacement of existing evaporative coolers, to install manufactured coolers with certified water conservative features.

E. Penalty: Any person violating any of the provisions of this section, shall be punished as provided in section 1-4-1 of this code, and a separate offense shall be deemed committed on each day during or on which a violation occurs or continues. (Ord. 1087, 6-14-2004)

11-1-6: WATER CONSERVATION; USE OF GRAY WATER:

The following regulations shall apply to the use of gray water for residential landscape purposes:

A. Definitions:

GRAY WATER: Untreated household wastewater that has not come in contact with toilet waste and includes wastewater from bathtubs, showers, washbasins, clothes washing machines and laundry tubs, but does not include wastewater from kitchen sinks or dishwashers or laundry water from the washing of material soiled with human excreta, such as diapers.

B. Use of Gray Water for Residential Landscape Purposes:

1. Under sections 74-6-2 and 74-6-4, New Mexico Statutes Annotated 1978, as amended, a resident, without a permit from the New Mexico environmental department, may apply less than two hundred fifty (250) gallons per day of private residential gray water originating from his/her residence for the resident's household gardening, composting or landscape irrigation if:

    a. A constructed gray water distribution system provides for overflow into the sewage collection or on-site wastewater treatment and disposal system;

    b. A gray water storage tank is covered to restrict access and to eliminate habitat for mosquitoes or other vectors;

    c. A gray water system is sited outside of a floodway;

    d. Gray water is vertically separated at least five feet (5') above the ground water table. Gray water shall not be applied within one hundred feet (100') of a domestic well or within two hundred feet (200') of a public water well;

    e. Gray water pressure piping is clearly identified as a nonpotable water conduit;

    f. Gray water is used on the site where it is generated and does not run off the property lines;

    g. Gray water is applied in a manner that minimizes the potential for contact with people or domestic pets. Gray water application methods that reduce contact include drip irrigation, shallow piping systems, or mulch trenches;

h. Ponding of gray water is prohibited and application of gray water must be managed to minimize standing water and to prevent saturation of the soil;

i. Gray water is not sprayed;

j. Gray water is not discharged to a watercourse. Discharge of gray water must be at least one hundred feet (100') from streams or lakes or twenty-five feet (25'), plus the depth of the arroyo, from an arroyo; and

k. Gray water use within municipalities or counties complies with all applicable municipal or county ordinances enacted pursuant to chapter 3, article 53, New Mexico Statutes Annotated 1978.

2. A gray water system that is designed to discharge more than two hundred fifty (250) gallons per day from a private residence requires a permit from the New Mexico environment department.

3. Notwithstanding that a permit from the New Mexico environment department is not required in order to apply less than two hundred fifty (250) gallons per day of private water, any resident who wishes to apply less than two hundred fifty (250) gallons per day of private residential gray water, and who wishes to construct, install, or alter, or cause to be constructed, installed or altered any gray water system, shall first obtain a plumbing permit, from the construction industries division of the regulation and licensing department of the state of New Mexico, and such gray water system shall comply with all standards for gray water systems set out in appendix G of the uniform plumbing code, 1997 edition as adopted by the city of Deming, or such later editions, as may be adopted, from time to time, by the city of Deming. The installation of a gray water system shall be done or supervised by a licensed plumber, and such licensed plumber shall certify that such installation complies with the standards of the uniform building code.

C. Penalty: Any person violating any of the provisions of this section, shall be punished as provided in section 1-4-1 of this code, and a separate offense shall be deemed committed on each day during or on which a violation occurs or continues. (Ord. 1087, 6-14-2004)

12-18-2: LANDSCAPE STANDARDS:

A. Purpose and Intent: These standards are intended to be applied throughout the city as specified in the subsections that follow. These standards are provided for the general health and welfare of the citizens of Deming through the conservation of water, reduction of air pollution, and public safety. The intent is to achieve a high quality of appearance, to assure design compatibility, to promote character and form, to promote water conservation, and to enhance the overall value of development to the community.

The conservation of water is deemed to be a key purpose to be achieved through the application of these landscape standards. The standards set out in this section are designed to encourage the preservation of desirable native vegetation and the use of low water use and drought tolerant plant material.

C. General Design Standards:

1. Landscape Plans:

b. Land Devoted To Plant Material: The landscape plan shall clearly set out the area of a lot or block or other division of land that will be devoted to plant material, such as turf, that is not a low water use/drought tolerant plant according to the "Low Water Use/Drought Tolerant Plant List", published by the Arizona department of water resources-Tucson active management area (March 2002, or any later edition), and the plants listed for New Mexico climate area 3-south, in the publication entitled "The Enchanted Xeriscape" available from the office of the state engineer, New Mexico (no date specified, but most recent edition is to be used).

2. Landscaping:

a. Water Conservation: All landscape plant material shall be low water use and drought tolerant except as specified in subsections D2, D3 and E2 of this section. The following documents will be used by the city of Deming as accepted guidelines for low water use/drought tolerant plants:

(1) "Low Water Use/Drought Tolerant Plant List", Arizona department of water resources-Tucson active management area, (March 2002 or any later editions).

(2) "The Enchanted Xeriscape, A Guide to Water-Wise Landscaping In New Mexico", office of the state engineer (no date specified, but most recent edition at time of application of the provisions in this section is to be used).

b. Prohibited Plants: The following plants are prohibited in all developments in the city of Deming:

(1) European olive trees, all fruiting varieties.

(2) Fruitless mulberry trees.

(3) Salt cedar.

(4) Any plant listed on the "New Mexico Noxious Weed List" (September 20, 1999, as amended from time to time), published by the New Mexico department of agriculture.

3. Turf: Turf areas are generally prohibited in public street medians and boulevards. Turf is prohibited in street landscape borders (subsections D5, E4 and F3 of this section), and in any required interior landscape border (subsections D6, E5 and F4 of this section). Turf is prohibited as a landscape material in all new commercial and industrial developments and in any commercial or industrial development where there is proposed an addition of twenty five percent (25%) or more in terms of gross floor area of buildings or structures, and/or building perimeter, including additions that increase the total number of required parking spaces by twenty five percent (25%) or more, either with a single addition or cumulative additions subsequent to the effective date hereof.

4. Irrigation:

   a. Dependent upon the size and complexity of the proposed project and its potential impact on neighboring properties, an irrigation plan may be required along with any landscape plan, required in subsection C1 of this section. The irrigation plan may include, but shall not be limited to, such matters as:

      (1) Type, size, and location of piping;

      (2) Type, size, and location of irrigation heads;

      (3) Type and location of backflow prevention devices, valves, and controllers;

      (4) Source of irrigation water, whether potable or reclaimed; and

      (5) Calculations demonstrating the matching of application rates with infiltration rates as required in subsection C4d of this section.

   b. An automatic irrigation system is required for all planting areas.

   c. All irrigation water shall be retained on site.

   d. The design of irrigation systems and irrigation schedules shall attempt to match application rates with infiltration rates in order to minimize runoff and reduce evaporation.

   e. Rain sensing and moisture sensing devices are encouraged.

D. Landscape Design Standards for Single-Family and Two-family Dwelling Developments: All new single-family and/or two-family developments shall comply with the following standards:

1. Plant Material: Each new single-family or two-family dwelling lot shall employ only low water use and drought tolerant plant material as specified in the guideline documents described in subsection C2a of this section.

2. Turf On Single- Or Two-Family Lot: Turf is permitted as a landscape material on any single-family or two-family lot, provided no more than fifty percent (50%) of the remaining lot area (excluding concreted areas), to a maximum of three thousand (3,000) square feet is planted in turf.

3. Turf On Common Areas: Where a common area (clubhouse, swimming pool or other recreational activities) is provided for use of all residents in a plan of subdivision, a maximum of fifteen percent (15%) of the area actually devoted to the common area may be in turf.

4. Purchaser Notification Of Landscape Requirements: The landscape plans and grading information specified in subsections C1a, C1b, and C1c of this section, and the irrigation plan specified in subsection C4 of this section are not required for individual lots in single-family and two-family developments; however, the owner or subdivider of land proposed for subdivision shall be required to include in any agreement of purchase and sale for any lot in the subdivision, a clause notifying the purchaser of the landscaping requirements of subsections D1 and D2 of this section.

5. Street Landscape Borders: Street landscape borders are required for all new subdivisions or for any replat of existing subdivisions. The following provisions shall apply:

   a. Street landscape borders are required adjacent to urban principal arterial streets, or urban minor arterial streets or urban collector streets, as designated by the city of Deming for all single-family and/or two-family developments in all new plans of subdivision, and in existing plans of subdivision, where through an amendment to the subdivision plan and/or the zoning ordinance there is an increase in the number of dwelling units of twenty five percent (25%) or more, either with a single increase or a cumulative increase subsequent to the effective date hereof.

   b. The street landscape border minimum width is ten feet (10') (see figure 2 of this section). The street landscape border is to be located on site and measured from the street property line. Covered parking canopies or other structural canopies shall not overhang into the street landscape border.

   c. Within the street landscape border, deciduous or evergreen shade trees shall be provided in number equal to or greater than an average of one shade tree per fifty (50) lineal feet, on center, of the site frontage length along the street. See figure 2 of this section.

   d. All plant material shall be low water use and drought tolerant and such material shall be taken from the guideline documents listed in subsection C2a of this section.

   e. All shade trees shall be six (6) to eight feet (8') in height with a minimum trunk caliper of one inch (1"). Clustering of trees is allowed. Figure 2 of this section illustrates one possible clustering alternative.

f. A minimum of two (2) shrubs per each required shade tree is recommended in the street landscape border.

g. The street landscape border area shall contain a two-inch (2") layer of low water use and drought tolerant ground cover, or rock mulch, or both.

h. Existing drought tolerant material within the street landscape border area may be used to fulfill the landscape requirements in accordance with the provisions of subsection C6 of this section.

i. Street landscape borders shall be irrigated with drip irrigation only.

6. Interior Landscape Border: An interior landscape border may be required by the city along the outer perimeter of a subdivision. The width of such area shall be such that it maintains compatibility with existing adjacent area setbacks, and such that it provides adequate separation between different land uses. Where such an interior landscape border is required it shall comply with the requirements of subsections D5c through and including D5i of this section. Turf may be permitted in any interior landscape border.

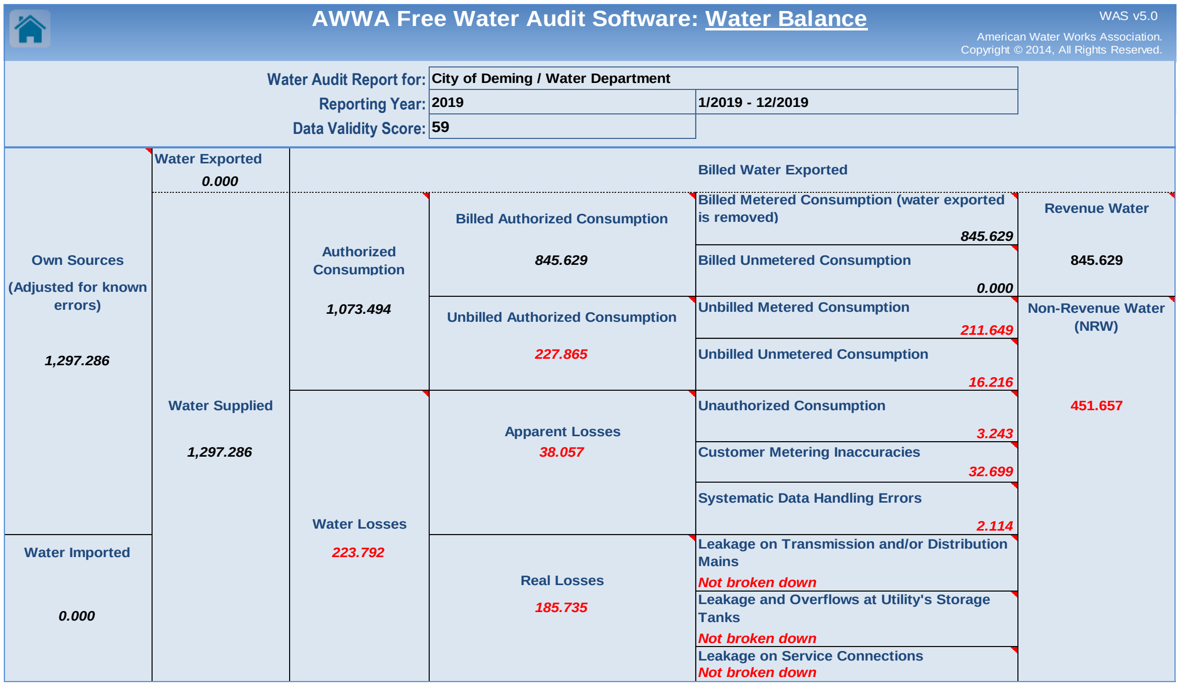
Figure 12: Mimbres River.
The Mimbres River runs through Deming; however, it only flows through Deming for short periods of time every 2 or 3 years. The Mimbres River is the main source of recharge for the MUWB.

2. Assessing City of Deming's Water Supplier Performance

2.1 Data Results and Analysis, American Water Works Association (AWWA) Water Loss Control Committee (WLCC) Free Water Audit Software© Reporting Worksheet

As described in New Mexico's Water Conservation Planning Guide for Public Water Suppliers, "A water audit provides a systematic method to organize water diversion data and track its path through the distribution system. A primary result of this analysis is "nonrevenue water," which is an estimation of water losses, theft, meter inaccuracies, and non-billed authorized consumption. The audit requires financial data to help value nonrevenue water." (New Mexico Office of the State Engineer, 2013). This section examines the results of the AWWA Water Audit performed for the City of Deming's 2019 calendar year. Table 6, below, shows the water balance sheet that summarizes the results of the AWWA Water Audit. Also note, all units of measurement in the water audit for water are in millions of gallons and the financial data is in US dollars.

TABLE 6: AWWA WATER AUDIT WATER BALANCE TABLE



AWWA Free Water Audit Software: Water Balance

WAS v5.0

American Water Works Association.
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Water Audit Report for: City of Deming / Water Department
Reporting Year: 2019 1/2019 - 12/2019
Data Validity Score: 59

Own Sources (Adjusted for known errors) *1,297.286*	Water Exported *0.000*			Billed Water Exported	
	Water Supplied *1,297.286*	Authorized Consumption *1,073.494*	Billed Authorized Consumption *845.629*	Billed Metered Consumption (water exported is removed) *845.629*	Revenue Water 845.629
				Billed Unmetered Consumption *0.000*	
			Unbilled Authorized Consumption *227.865*	Unbilled Metered Consumption *211.649*	Non-Revenue Water (NRW) 451.657
				Unbilled Unmetered Consumption *16.216*	
		Water Losses *223.792*	Apparent Losses *38.057*	Unauthorized Consumption *3.243*	
				Customer Metering Inaccuracies *32.699*	
				Systematic Data Handling Errors *2.114*	
Water Imported *0.000*			Real Losses *185.735*	Leakage on Transmission and/or Distribution Mains *Not broken down*	
				Leakage and Overflows at Utility's Storage Tanks *Not broken down*	
				Leakage on Service Connections *Not broken down*	

2.1.1 Performance Indicators

a) Financial

The annual cost of apparent losses is $7,785. Relative to the budget, this number is quite low; however, data used to determine this value has a high level of uncertainty. The City recently installed new meters to all users and installed a new automated meter read (AMR) system to allow for a higher level of accuracy. Previously the meters had to be manually read every month. Even though the City has deployed new technology to improve accuracy, the City continues to explore the functionality of the system to maximize the benefits that potentially could be created.

Also, the City currently does not have a consistent meter testing and replacement plan in place. The City's current practice involves only testing meters when they are suspect or if a water user requests for the meter to be tested. The lack of meter testing and meter replacement will be given attention later in this document.

The annual cost of real losses is estimated to be $55,535. The water audit indicates that nonrevenue water accounts for 34.8% of total supplied water. Nearly half of this nonrevenue water is accounted for through metered city use, specifically the irrigation of city parks. The other half of this nonrevenue water is estimated with many unknown variables. The focus of this water conservation plan is to help identify and minimize these losses.

b) Operational Efficiency

The apparent losses per service connection per day is estimated to be 18.96 gallons per connection per day. This is derived from estimated percentages inputted for unauthorized consumption, customer metering inaccuracies, and systematic data handling errors. Percentages were defaulted in the program to calculate the inaccuracies for the items mentioned in the previous sentence: 0.25%, 3.0%, and 0.25%, respectively. The 0.25% values were defaulted due to insufficient data to determine a real value, and the 3.0% value was entered as a low guestimate due to recently installed new residential meters.

As noted in the Financial section, the City has recently installed new meters to all residential users and has installed an AMR system that eliminates the need for manual meter reads. This new technology is aimed at reducing meter read error and to gain other benefits such as better leak detection technologies. City personnel are still learning about all the capabilities of this new system and hope that it can be used to help reduce apparent losses.

The City lacks procedures to document nonrevenue water. The City does document meter readings for much of the City's non-billed uses but lacks written procedures for all uses. The City knows that not all the City's non-billed uses are being reported which include some City buildings and fire hydrant uses. This makes it difficult to estimate water losses and to distinguish between apparent losses and real losses.

2.1.2 Data Validity Score

The overall DVS for the City of Deming is a 59 out of 100. This number seems to be very low; however, the City was objective and fair when grading each of the topics within the water audit. The grading ranged from a low of 2 to a high of 10. The City seems to have some good tools but lack procedure and documentation to ensure consistent and valid data collection.

"Volume from own sources" received a grade of 5. All the City's source water is metered. The City lacks a policy and procedure for testing and replacing supply meters on a consistent basis.

"Master Meter error adjustment" received a grade of 2. Meter readings are manually collected on paper monthly. Tank level elevations are monitored but not used to calculate volume from own sources. This is an area where the City might need to focus on to improve their DVS. A value -2% was used for the error adjustment and was an estimate based off the age of the meters.

"Billed Metered" received a grade of 7. All the City's billed usages are metered, and the City has recently installed an AMR system. The City lacks a meter testing and replacement plan, which prevents them from scoring higher than a 7 for this topic.

"Unbilled Metered" received a score of 5. Written policy and procedure for unbilled metered water does not exist. Most of the unbilled metered water is used on City parks and accurate manual readings are taken monthly. Other unbilled metered uses, such as for some municipal buildings, are not accounted for in the billing reports. Staff believe that these meters are being read and recorded, but not reported. A procedure should be written for how these accounts should be entered into the accounting system and included in the monthly billing reports.

"Unbilled Unmetered" received a score of 3. Unbilled consumption is pretty much a mystery. The City knows that losses to fire hydrants are not measured and accounted for, but as to what other losses might be is unknown. Losses due to known leaks are not estimated and reported. Lack of written policy and procedures for documenting unbilled unmetered water is the reason for such a low score.

“Unauthorized Consumption” received a score of 2. The default percentage of 0.25% was used for this category. A message indicates that if the default percentage is used, a default grade of 5 is given. This default grade of 5 was downgraded to a 2 because unauthorized consumption is somewhat of a mystery to the City of Deming. On occasion city personnel do discover instances where someone bypasses a meter or removes a meter. Appropriate actions are taken in accordance with city code to resolve the situation.

“Customer Metering Inaccuracies” received a score of 5. The City’s lack of a meter testing and replacement policy and procedure prevents the City from being able to score this at anything above a 5.

“Systematic Data Handling Errors” received a score of 7. The City’s accounting system generates reports to assist on identifying hi and low usage accounts. City staff should be reviewing these reports prior to running the billing process and correct any errors discovered. There were instances while reviewing data for the GPCD calculator that indicate that these reports might not be being looked at consistently. The policies and procedures are also not reviewed biannually.

“Length of Mains” received a grade of 4. The City does have a GIS shapefile that was created several years ago by a contractor. Although the City feels that the data in the shapefile is accurate, staff states that the shapefile has not been updated with recent changes. There is also a lack of written policy and procedures for how to document additions and deletions of water mains.

“Number of Active and Inactive Service Connections” received a grade of 5. City staff is confident with the accounting systems accounting of active service connections but lacks a report that indicates the total number of service connections and the number of inactive service connections. A value of 5500 total service connections has been entered. Data entered into the GPCD Calculator suggested that there are at least 4500 residential connections. 1000 connections were added to this to account for commercial and inactive accounts as an estimate. The City utility billing records were used to identify the number of active accounts. The billing records do not list inactive accounts. City staff was unsure for how to determine the number of inactive accounts. The 1000 connections added includes the number of active commercial connections listed in the billing (approximately 500 commercial connections) and an estimated 500 inactive connections estimated for the City, which includes both residential and commercial inactive connections. This is an area that the City will need to improve.

“Average Operating Pressure” received a grade of 3. City personnel could not answer yes to all the items listed to be graded as a 4. The City may need to look into how average system pressure is calculated and consider reviewing their current technology used to monitor system pressures.

“Total Annual Cost of Operating Water System” received a grade of 10. The City is confident in their financial management systems ability to record all pertinent water system operating costs. The City’s financial statements are audited annually by an independent CPA.

“Customer Retail Unit Cost” received a grade of 9. A consistent and reliable rate structure is in place. Rate analyses are conducted routinely. The only reason city staff do not think this can be graded as a 10 is because someone knowledgeable in the M36 process does not review this. One other area that might need consideration is how the billing system categorizes uses. Currently there are only two major classes – residential and commercial. The customer retail unit cost seems to be too low. The City has recently implemented a rate increase that is not reflected in this audit.

“Variable Production Cost” received a grade of 5. Variable production cost is calculated by using power and chemical costs with no consideration of other potential costs as indicated by a grade of 6.

2.1.3 Priority Areas for Attention and Grading Matrix

The three priority areas for attention indicated in the AWWA Water Audit for the City of Deming include “Volume from Own Sources”, “Unbilled Metered”, and “Customer Metering Inaccuracies”. Recommendations to improve these scores for each of these areas are listed below as given within the grading matrix of the water audit. Other recommendations are given in the grading matrix for the areas not listed as “priority areas” and will be considered later in the conservation plan.

Volume from Own Sources:

a) Formalize annual meter accuracy testing for all source meters.
b) Specify the frequency of testing.
c) Complete the installation of meters on unmetered water production sources.
d) Complete replacement of all obsolete/defective meters.

Unbilled Metered:

a) Draft a new written policy regarding billing exemptions based upon consensus criteria allowing this occurrence.
b) Assign resources to audit meter records and billing records to obtain census of unbilled metered accounts.
c) Gradually include a greater number of these metered accounts to the routes for regular meter reading.

Customer Metering Inaccuracies:

- *a)* Standardize the procedures for meter recordkeeping within an electronic information system.
- *b)* Accelerate meter accuracy testing and meter replacements guided by testing results.

2.1.4 Loss Control Planning

Based on the results of the City of Deming's water audit DVS of 59, the Loss Control Planning section identifies the City of Deming as a Level III. This section helps identify what the City should be focusing on for improving conservation efforts. The following are the Functional Focus Areas identified in the water audit along with a description of what should be focused on for a Level III PWS.

1. Audit Data Collection: Establish/revise policies and procedures for data collection.
2. Short-Term Loss Control: Establish ongoing mechanisms for customer meter accuracy testing, active leakage control and infrastructure monitoring.
3. Long-Term Loss Control: Begin to assemble economic business case for long-term needs based upon improved data becoming available through the water audit process.
4. Target-Setting – Establish long-term apparent and real loss reduction goals (+10-year horizon).
5. Benchmarking – Preliminary comparisons – can begin to rely upon the Infrastructure Leakage Index (ILI) for performance comparisons for real losses.

2.2 Data Results and Analysis, GPCD Calculator Table

2.2.1 Period of Study

The GPCD Calculator suggests that 7-years of data be inputted for this report and the Water Conservation Planning Guide suggests that 5-years of data be used for this section (Office of the State Engineer, 2013). After reviewing the City of Deming's available billing data, only four years of data appears to be complete. Although there appears to be some inaccuracies within some of the data, the data was entered as reported. The period of study for this report is for calendar years 2016 through 2019.

2.2.2 Average Size of Household

Table 7, below, shows data that was pulled from the US Census website giving 2010 household data for the City of Deming (2010 US Census, 2010). According to this data the average size of household for the City of Deming is estimated to be 2.56 people.

Table 7: U.S. Census housing vacancy rate - City of Deming.

US Census Table	**Description**		**INPUT**
DP-1	**Profile of General Population and Housing Characteristics**	**Census Year**	**2010**
Subject			
Relationship	In group quarters	Total	**549**
Housing Occupancy	Total housing units	Total	**6,226**
	Occupied housing units		**5,582**
	Vacant housing units		**644**
Households by Type	Average household size	Total	**2.56**
	Formula: Household Size = Total Population / Total Number of Housing Units		
	Vacancy Rate %		10.3%

2.2.3 Annual Single-Family Residential (SFR) Gallons per Capita per Day (GPCD)

The City of Deming's billing system classifies user accounts as either residential or commercial. For the purposes of the WCP, residential usage will be referred to either as residential or SFR. The annual SFR GPCD is calculated to be 108.41 GPCD for the City of Deming in 2019. The GPCD calculator also indicates that the SFR GPCD has been declining each year from 2016 to 2019 as seen in Table 8, below.

Table 8: Annual SFR GPCD as presented in NMOSE Calculator City of Deming

ANNUAL SFR GPCD	
2019	**108.41**
2018	**111.61**
2017	**116.54**
2016	**129.94**

2.2.4 Monthly SFR GPCD

The Monthly SFR GPCD can be seen in Table 9 below.

TABLE 9: MONTHLY SFR GPCD AS PRESENTED IN NMOSE CALCULATOR - CITY OF DEMING 2016-2019

SFR GPCD CALCULATION (Monthly)												
Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2019	61.80	81.76	68.17	102.13	130.93	162.99	158.29	138.86	150.41	87.70	96.38	61.93
2018	80.09	82.20	80.62	118.22	161.01	120.12	161.05	143.48	133.15	103.76	84.40	68.92
2017	109.32	72.18	74.42	123.54	127.09	154.82	168.71	128.79	140.18	126.29	93.59	77.09
2016	94.10	92.03	98.60	147.86	136.42	166.98	200.82	166.99	172.49	95.82	109.00	77.06

As seen in Figure 13 below, one can see that the highest GPCD values are experienced during the summer months when more outdoor use occurs, and the lows occur in the winter months.

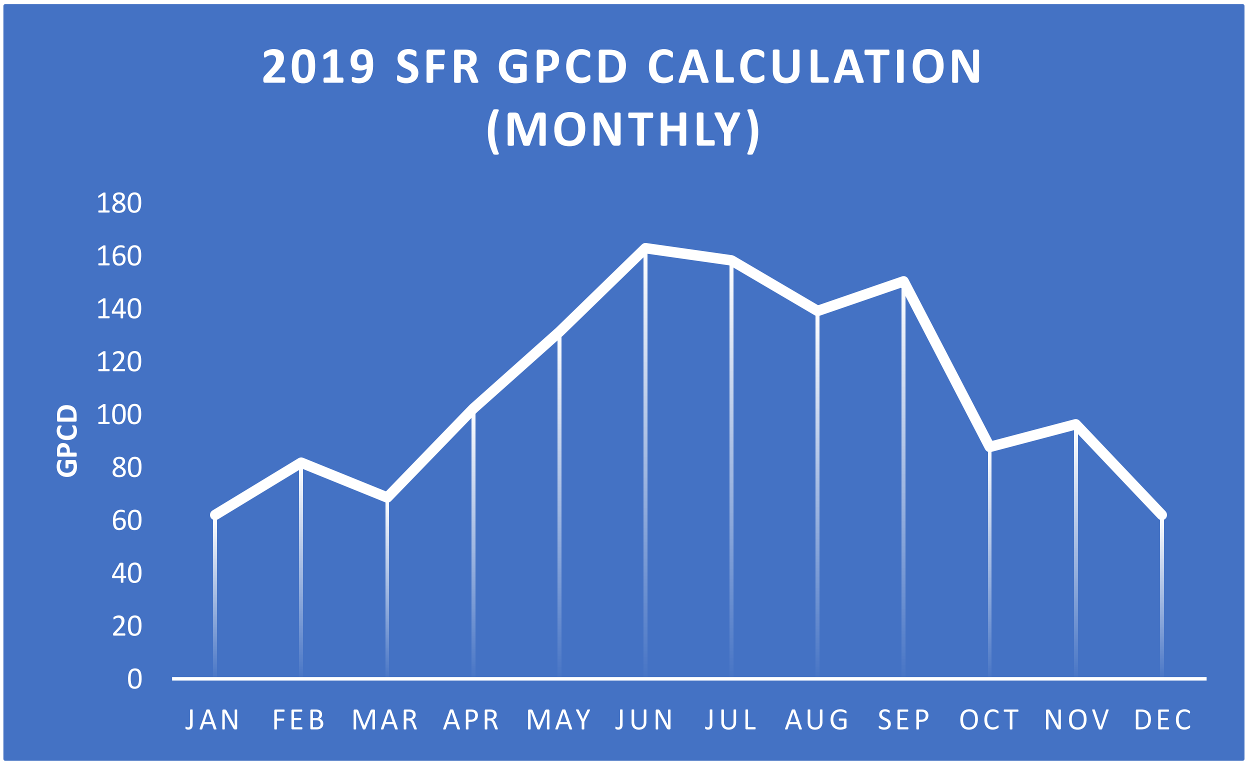


FIGURE 13: GRAPH OF MONTHLY SFR GPCD - CITY OF DEMING 2019

2.2.5 Estimated SFR Indoor Water Use

Table 10, below, shows the estimated SFR indoor water GPCD by year. This was calculated by taking the average GPCD of the 3 lowest winter months. For 2019, the estimated SFR indoor use is estimated to be 68.49 GPCD.

TABLE 10: ESTIMATED SFR INDOOR WATER USE - CITY OF DEMING 2016-2019

ESTIMATED SFR GPCD INDOOR USE					
Year	**JAN**	**FEB**	**NOV**	**DEC**	**AVG 3 LOWEST**
2019	61.80	81.76	96.38	61.93	**68.49**
2018	80.09	82.20	84.40	68.92	**77.07**
2017	109.32	72.18	93.59	77.09	**80.95**
2016	94.10	92.03	109.00	77.06	**87.73**

2.2.6 Estimated SFR Outdoor Water Use

Table 11, below, shows the estimated SFR outdoor water GPCD by year. This was calculated by taking the annual SFR GPCD and subtracting out the calculated indoor use for each year. For 2019, the estimated SFR outdoor use is estimated to be 39.92 GPCD.

TABLE 11: ESTIMATED SFR OUTDOOR WATER USE - CITY OF DEMING 2016-2019

	ANNUAL SFR GPCD	ESTIMATED ANNUAL SFR GPCD - INDOOR USE	ESTIMATED ANNUAL SFR GPCD - OUTDOOR USE (ANNUAL - INDOOR)
2019	**108.41**	**68.49**	**39.92**
2018	**111.61**	**77.07**	**34.54**
2017	**116.54**	**80.95**	**35.59**
2016	**129.94**	**87.73**	**42.21**

2.2.7 Annual Multi-Family Residential (MFR) GPCD

The City of Deming does not classify MFR within their utility billing accounting system. MFRs are classified as either residential (SFR) or commercial depending on whether individual residents are being metered separately (residential) or if the MFR facility has only one meter (commercial).

2.2.8 Estimated MFR Indoor Water Use

The City of Deming does not classify MFR within their utility billing accounting system. MFRs are classified as either residential (SFR) or commercial depending on whether individual residents are being metered separately (residential) or if the MFR facility has only one meter (commercial).

2.2.9 Estimated MFR Outdoor Water Use

The City of Deming does not classify MFR within their utility billing accounting system. MFRs are classified as either residential (SFR) or commercial depending on whether individual residents are being metered separately (residential) or if the MFR facility has only one meter (commercial).

2.2.10 Monthly MFR GPCD

The City of Deming does not classify MFR within their utility billing accounting system. MFRs are classified as either residential (SFR) or commercial depending on whether individual residents are being metered separately (residential) or if the MFR facility has only one meter (commercial).

2.2.11 Industrial, Commercial, Institutional (ICI), and Other Metered Uses

See Tables 12 and 13, below, for ICI and other metered uses consumption data.

Table 12: Monthly Industrial, Commercial, Institutional, and Other Metered Uses - City of Deming 2016-2019

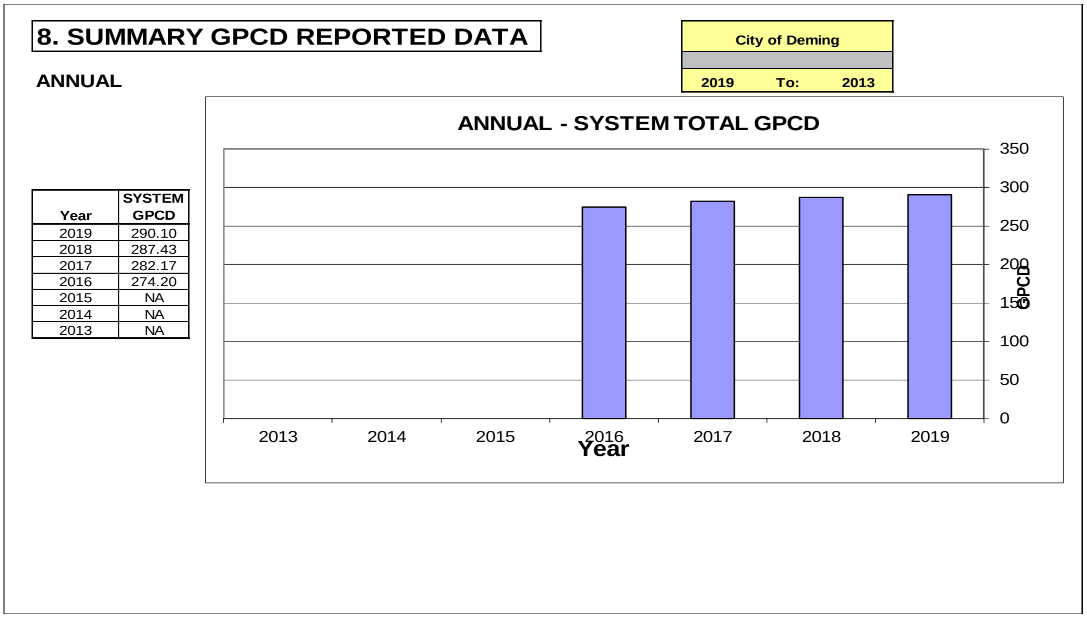
ICI WATER CONSUMPTION (Gallons (US))												
Year	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**
2019	11,228,400	150,407,900	11,520,500	14,307,800	16,895,500	18,916,800	19,210,100	17,298,000	20,652,800	83,095,100	16,794,600	11,936,300
2018	15,455,300	15,308,674	16,423,500	17,389,800	17,964,200	20,232,500	493,592,100	17,942,300	17,591,600	16,968,900	14,869,500	12,405,300
2017	27,416,100	13,658,300	13,934,300	17,735,000	16,597,900	19,789,200	21,663,800	20,695,800	20,581,500	19,196,800	23,010,500	14,286,000
2016	10,225,700	21,707,100	18,934,900	94,679,500	14,294,600	15,050,500	21,843,300	19,342,500	24,847,100	14,626,600	17,043,100	15,005,500

Table 13: Annual Industrial, Commercial, Institutional, and Other Metered Uses GPCD - City of Deming 2016-2019

ICI GPCD	
2019	**89.51**
2018	**154.33**
2017	**51.50**
2016	**63.75**

2.2.12 Annual System Total GPCD

Figures 14 and 15, below, shows the annual system total GPCD as reported in the GPCD calculator. System total GPCD includes all uses of water as reported in the NMOSE GPCD Calculator.



8. SUMMARY GPCD REPORTED DATA

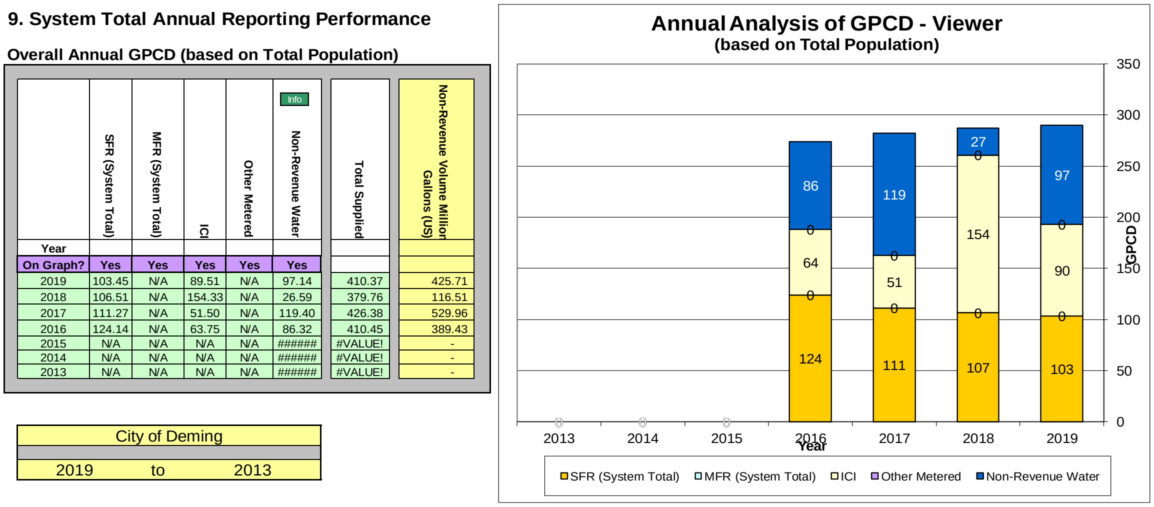
ANNUAL

City of Deming

2019 To: 2013

Year	SYSTEM GPCD
2019	290.10
2018	287.43
2017	282.17
2016	274.20
2015	NA
2014	NA
2013	NA

FIGURE 14: NMOSE GPCD - ANNUAL - SYSTEM TOTAL GPCD GRAPH - CITY OF DEMING 2016-2019



9. System Total Annual Reporting Performance

Overall Annual GPCD (based on Total Population)

Year	SFR (System Total)	MFR (System Total)	ICI	Other Metered	Info Non-Revenue Water	Total Supplied	Non-Revenue Volume Million Gallons (US)
On Graph?	Yes	Yes	Yes	Yes	Yes		
2019	103.45	N/A	89.51	N/A	97.14	410.37	425.71
2018	106.51	N/A	154.33	N/A	26.59	379.76	116.51
2017	111.27	N/A	51.50	N/A	119.40	426.38	529.96
2016	124.14	N/A	63.75	N/A	86.32	410.45	389.43
2015	N/A	N/A	N/A	N/A	######	#VALUE!	-
2014	N/A	N/A	N/A	N/A	######	#VALUE!	-
2013	N/A	N/A	N/A	N/A	######	#VALUE!	-

City of Deming

2019 to 2013

FIGURE 15: NMOSE GPCD - ANNUAL ANALYSIS GPCD TABLE AND GRAPH - CITY OF DEMING 2016-2019

2.2.13 Monthly System Total GPCD

Table 14, below, shows the monthly system total GPCD. System total GPCD includes all uses of water as reported in the NMOSE GPCD Calculator.

TABLE 14: NMOSE CALCULATOR - MONTHLY SYSTEM TOTAL GPCD - CITY OF DEMING 2016-2019

SYSTEM TOTAL GPCD (Monthly)												
Year	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**
2019	172.84	167.43	218.65	293.84	331.14	412.83	446.39	432.43	367.88	286.12	184.95	158.01
2018	170.90	190.01	235.61	329.79	331.36	427.05	362.59	406.31	365.96	261.92	194.66	168.94
2017	153.49	158.91	241.98	316.03	363.33	377.61	356.17	344.77	394.57	283.53	215.67	173.74
2016	155.12	194.57	253.10	274.93	305.12	388.07	423.24	346.24	302.39	304.50	188.20	149.08

3. Setting Water Conservation Goals

3.1 Objective

The City of Deming's objective for developing a water conservation plan is to increase the efficiency in the way we deliver water to the citizens of Deming. Increasing efficiency involves understanding all the dynamics of the water system which enables the City to reduce waste of water, engage the public in water saving practices, maintain a degree of infrastructure which proactively minimizes waste, and create a rate structure which covers the cost of the utility and promotes water conservation while keeping water rates as low as possible. In a broader sense, the City of Deming wants to operate its municipal water system in a manner that conserves water for future generations and minimizes water supply shortages due to droughts and climate change.

3.2 Reasons why the City of Deming is Developing a Water Conservation Plan

A water conservation plan is a requirement of the NMOSE and certain state funding opportunities require a conservation plan be in place to be eligible. The City of Deming does recognize the benefits of developing a water conservation plan and desires to become better stewards of New Mexico's most valuable resource and operate in a manner that best serves the citizens of the City of Deming. Several issues have been brought to light that the City can improve on that will help conserve water, improve record keeping, and save the City money.

3.3 Identify Water Conservation Goals

Five goals are listed below that generalize what the City intends to accomplish in the short and long-term. These goals were developed keeping in mind the three priority areas of attention as indicated within the Water Audit. Each of these goals will require activities to be accomplished that relate directly to the volume of own sources, unbilled unmetered water, and customer metering inaccuracies.

- Improve system management within 5 years as reflected in a data validity score of 71 or better on the Water Audit which would raise the City to a Loss Control Planning Level 4 status.
- Reduce nonrevenue water by 65 MG/Yr by 2025.
- Ensure water utility revenues cover annual operational expenses plus funding to cover inter-period equity costs estimated for asset and infrastructure replacement by 2025.
- Reduce residential GPCD to a level below 80 GPCD within the next 15 years.
- Develop written policies and procedures related to water conservation best practices as identified as weaknesses within the Water Audit and review annually. These policies and

procedures should be written and implemented within the first two years of implementing this WCP.

3.4 Prioritize Goals

The biggest weaknesses observed when conducting the Water Audit are 1) testing and replacing meters and 2) the lack of written policies and procedures. Goals that directly involve improving on these two things were given a higher priority than others. Reducing nonrevenue water has also been identified as a high priority since it relates directly to waste and increased costs. The five goals have been prioritized as shown below, the lowest numbered goal having the highest priority.

1. Improve system management within 5 years as reflected in a data validity score of 71 or better on the Water Audit which would raise the City to a Loss Control Planning Level 4 status.
2. Develop written policies and procedures related to water conservation best practices as identified as weaknesses within the Water Audit and review annually. These policies and procedures should be written and implemented within the first two years of implementing this WCP.
3. Reduce nonrevenue water by 65 MG/Yr by 2025.
4. Ensure water utility annual revenues cover annual operational expenses plus funding to cover inter-period equity costs estimated for asset and infrastructure replacement by 2025.
5. Reduce residential GPCD to a level below 80 GPCD within the next 15 years.

3.5 Evaluate Goals

Since the City's highest priority is to improve on their data validity score, the City will conduct the AWWA Water Audit on an annual basis. The year-to-year data validity score will give clear evidence as to whether the City is accomplishing activities that lead to a better score. The AWWA Water Audit grading criteria from year-to-year will be used as a measure for how well the City is doing with creating and implementing written policies and procedures. The AWWA Water Audit will be used to determine how the City is doing to reduce nonrevenue water.

A combination of the retail unit cost, variable production cost, annual rate analysis, and City of Deming's annual financial audit will be used to evaluate the City's ability to cover annual operating costs and inter-period equity costs estimated for asset and infrastructure replacement. The City will also utilize the NMOSE GPCD Calculator on an annual basis to monitor progress towards reducing annual residential GPCD.

The City will review and update the City Water Conservation Plan every five-years to ensure that progress is being made or has been met to achieve stated goals and to ensure listed goals are still relevant. The five-year Water Conservation Plan update will give the City the opportunity to develop new goals and/or to adjust current goals that may not be making adequate progress.

3.6 Best Management Practices

3.6.1 Describe Best Management Practices (BMPs) Considered

The City of Deming has identified the following Best Management Practices to be considered:

- Conservation Coordinator
- Annual Meter Testing and Meter Calibration (Source Side and Demand Side)
- Written Policy and Procedure with Periodic Reviews
- Leak Detection
- Billing Report Indicators Prior to Billing (Hi/Lows)
- Conservation Oriented Rates and Tap Fees
- Public Involvement Plan
- Public Information/Outreach Plan
- In-School Educational Program
- Automated Datalogging Equipment on Production Meters
- Meter Replacement Plan
- Routine Internal Auditing of Billing Records and Verified by third Party every 5-years.
- Unbilled Metered Accounts Included in Billing System and Reported Monthly
- Unbilled Unmetered Water Documented and Estimated on a Monthly Basis
- Unauthorized Consumption Documented and Estimated on a Monthly Basis and Code/Penalty Actions Strictly Enforced
- Water Main GIS/Auto CAD File Updated Routinely
- Water Leak Locations Mapped with Date Stamp
- Active and Inactive Service Connections Reported Monthly
- Inactive Service Connections Routinely Audited
- Pressure Zones and Tank Levels Identified and Monitored Regularly
- Repair Known Leaks
- Water Bill Inserts
- Selective End Use Audits
- Separate Billings by Single-Family Residential, Multi-Family Residential, and Commercial Users
- Water Conservation Ordinances Reviewed and Updated
- Requirements for New Development and Initiatives for Existing Residents for Installing Water-Efficient Fixtures and Appliances
- Promotion of Low-Water-Use Landscaping and Efficient Irrigation Practices
- Requirements for Efficient Commercial and Industrial Water Use Processes

- Continue Efforts for Utilizing Reuse Water and Incentives for Home Reuse Projects
- Annual Completion of the AWWA Water Audit and NMOSE GPCD Calculator
- Annual Report to NMOSE Water Use and Conservation Bureau

3.6.2 List BMPs Selected

The City of Deming selected the following BMP's based on their prioritized goals.

1. Written Policy and Procedure with Periodic Reviews
2. Annual Completion of the AWWA Water Audit and NMOSE GPCD Calculator
3. Annual Meter Testing and Meter Calibration (Source Side and Demand Side)
4. Meter Replacement Plan
5. Conservation Coordinator
6. Repair Known Leaks
7. Continue Efforts for Utilizing Reuse Water and Incentives for Home Reuse Projects
8. Water Leak Locations Mapped with Date Stamp
9. Water Main GIS File Updated Routinely
10. Billing Report Indicators Prior to Billing (Hi/Lows)
11. Unbilled Metered Accounts Included in Billing System and Reported Monthly
12. Active and Inactive Service Connections Reported Monthly
13. Inactive Service Connections Routinely Audited
14. Pressure Zones and Tank Levels Identified and Monitored Regularly
15. Water Conservation Ordinances Reviewed and Updated
16. Conservation Oriented Rates and Tap Fees
17. Public Involvement Plan
18. Public Information/Outreach Plan
19. In-School Educational Program
20. Requirements for New Development and Initiatives for Existing Residents for Installing Water-Efficient Fixtures and Appliances
21. Promotion of Low-Water-Use Landscaping and Efficient Irrigation Practices
22. Requirements for Efficient Commercial and Industrial Water Use Processes
23. Annual Report to NMOSE Water Use and Conservation Bureau

4. Public Involvement, Education, Outreach

4.1 Describe Public Involvement During the Planning Process

The City of Deming does understand and value the importance of the public's input and involvement with all the City's processes. During this initial water conservation process, we have identified several practices that need to be worked on. Our current goals focus on short-term internal activities such as better bookkeeping, the writing of policies and procedures, and implementing meter testing, calibration, and maintenance plans. The City did not solicit public input on identifying these internal issues, rather they surfaced during the Water Audit process.

Moving forward, the City plans to develop a public information program. As our short-term goals are realized, we plan to solicit public input on ways the City can further reduce nonrevenue water. The Planning Team described in section 1.2 will periodically solicit input from the public on topics as described in the Public Information Program explained in section 4.2.1 below.

As described in the NMOSE Water Use and Conservation's publication titled "A Water Conservation Guide for Public Utilities", a "program takes thoughtful planning and conscience implementation" (New Mexico Office of the State Engineer, 2001). The City of Deming is initiating this WCP which will be reviewed and updated at a minimum of every five years. During the five-years following the adoption of the 2020 WCP, the City will solicit public input to develop a long-term strategy for conserving water. Public input opportunities may be made available at semi-annual water conservation meetings with the Planning Team that may be open to the public with opportunities for public input, through the use of public surveys and information sheets that may be mailed out as needed by the City as inserts with the monthly billings, through the use of social media outlets, and by setting up a water conservation email address and listing it on the City's website. Other key stakeholder involvement opportunities may be initiated by the Planning Team, as necessary.

4.2 Education and Outreach after a Plan is Adopted

4.2.1 Describe the Public Information Program

The following Public Information Plan is developed following the formatting in NMOSE's Water Conservation Guide for Public Utilities (New Mexico Office of the State Engineer, 2001).

Target Audience:	Residential usage accounts for most of the water use consumed by the City's water utility; therefore, the target audience for this program will focus on residential users. The annual SFR GPCD has been identified as

being approximately 108 GPCD with outdoor use accounting for approximately 37% and indoor use accounting for approximately 63%. Therefore, the City shall focus on ways to reduce residential indoor use.

Program Activities: The City of Deming has several mediums for getting information out to the public. The following activities may be used by the City of Deming:

The Deming Headlight is the local newspaper that is used by the City of Deming to get out important information using news releases to its residents. Stories and important issues on water conservation can be published in the Deming Headlight to keep the public informed. The Deming Headlight also uses social media, such as Facebook and Twitter, to disseminate important stories and information.

The City utilizes bill stuffers to disseminate important information water users. Water quality reports is one example of a bill stuffer that the City currently gets out routinely. A summarized description of the WCP or water conservation information sheets can be included with monthly bills.

For any updates to the WCP, the City will hold a public meeting to present the updated WCP and provide a public input period.

The City of Deming will add a water conservation page to their website where documents such as the WCP can be linked to for public access. This page can also include water conservation information documents, long-term plans, and links to useful water conservation pages, such as the ones listed on the NMOSE website.

Social media can also be used by the City of Deming to promote water conservation by proving links to interesting current article and posts about water conservation. Social media can also be used to promote the City’s efforts and long-term plans to a large sector of its water users at a minimal cost.

Program Support: The Planning Team described in section 1.2 is made up of all levels of management within the City of Deming. The City has developed several projects related to water conservation, such as reuse projects and the installation of an AMR system, that is driven by upper management. Upper management is fully supporting the efforts to put a WCP in place and to promote it to the public as detailed in this plan. Key upper management Planning Team members include the Mayor, City

Administrator, Public Works Director, Community Services Director, and the City Treasurer.

Staff and Funding Resources:

The Public Works Assistance is assigned the duties as the Conservation Coordinator. This position will be the lead contact for monitoring and reporting the progress of the WCP. This person will also coordinate the efforts and distribution of information to the public as described in this section of the WCP. The Public Works Assistance will have several resources, such as support from upper management and the diverse staff of the City, within the City to assist with the efforts needed to successfully implement this plan.

Funding resources will come from the Water and Wastewater budgets and outside funding sources. The Planning Team will evaluate and consider the different program activities, as described above, to best inform stakeholders about important information. The City Administrator, Public Works Director, and City Treasurer will evaluate the Water and Wastewater budget annually to determine a budget number for the Planning Team to work with for water conservation purposes, including Public Information Program efforts.

Track Program Efforts and Evaluate Results:

Policies and procedures will be developed to track program efforts and evaluate results. The policy will require the Conservation Coordinator to track activity used to inform or collect data from the public concerning water conservation efforts. The policy will require the Conservation Coordinator to monitor and track feedback from stakeholders. This can be the number of responses received from a survey, the number of emails received from the water conservation email address, number of visits to the water conservation webpage, social media activity, etc. This information shall be reported on a monthly basis as part of the City Council packet. A report shall be made and presented at each of the semi-annual Planning Team public meetings. Over time the effectiveness of the program can be evaluated, and improvements or modifications can be made based on the observations made.

4.2.2 Describe Outreach Program Activities

This topic was covered in section 4.2.1 as part of the Public Information Program but will be repeated here.

Program Activities: The City of Deming has several mediums for getting information out to the public. The following activities may be used by the City of Deming:

The Deming Headlight is the local newspaper that is used by the City of Deming to get out important information using news releases to its residents. Stories and important issues on water conservation can be published in the Deming Headlight to keep the public informed. The Deming Headlight also uses social media, such as Facebook and Twitter, to disseminate important stories and information.

The City utilizes bill stuffers to disseminate important information that can be printed on a page or two. Water quality reports is one example of a bill stuffer that the City currently routinely gets out. A summarized description of the WCP or water conservation information sheets can be included with monthly bills.

For any updates to the WCP, the City will hold a public meeting to present the updated WCP and provide a public input period.

The City of Deming will add a Water Conservation page to their website where documents such as the WCP can be linked to for public access. This page can also include water conservation information documents and links to useful water conservation pages, such as the ones listed on the NMOSE website.

Social media can also be used by the City of Deming to promote water conservation by proving links to interesting current article and posts about water conservation. Social media can also be used to promote the City’s efforts and plan to a large sector of its water users at a minimal cost.

4.2.3 Describe In-School Educational Programs

The City of Deming will initiate working with the Deming Public School District to formulate an In-School Educational plan using the guide described in NMOSE's Water Conservation Guide for Public Utilities (New Mexico Office of the State Engineer, 2001).

- **Prepare an "Introduction to Water" Report.** The City will create a briefing paper for educators that describes the current and projected status of the local water supply and demand in the City's utility's service area. An important element of this paper will be an overview of the utility's conservation plan. An explanation of the value to the community of an in-school conservation program and description of the support the utility can provide to the educational system will be made. The City of Deming will show determination, enthusiasm, and commitment to gain support for the conservation initiative.
- **Contact the School System.** The City will contact the school board and the superintendent of education to schedule a meeting to solicit their support in establishing an in-school water conservation program. If support is obtained, the City will suggest a steering committee to be established. The roles of the steering committee will be defined.
- **Announce the Water Conservation Initiative.** Using various public media and school communication networks, the cooperative educational initiative will be announced. The City and School District will solicit participation on the steering committee from interested parties. Subsequent steps in this procedure will require the assistance of the steering committee.
- **Assign Utility Personnel to the Program.** Utility personnel who will develop and run the program will be determined. Office space and equipment needed to conduct the program will be identified and provided. Transportation for the program coordinator will be made available to visit schools during the formative and implementation phases of the project.
- **Contact Schools to Determine Existing Conservation Activities.** City staff, or steering committee, will contact schools and other agencies that work with children to determine what conservation activities, if any, are already underway.
- **Review Conservation Materials.** The City and the School District, or steering committee, will review existing conservation materials and select the most appropriate items for each grade level, or develop new materials as needed. An estimation of the quantity of selected items that will be required for the school system and a calculation of

the annual cost will be made. A list of resources within NMOSE's Water Conservation Guide for Public Utilities will be a starting point for identifying materials.

- **Establish Evaluation Methods.** A means of evaluating the students' understanding of the subject matter before and after the conservation lessons have been completed will be created. Results from student tests may be used to measure the effectiveness of the program and to identify deficiencies in the teaching materials and techniques that need to be corrected.
- **Establish In-Service Training.** A means of providing in-service conservation training for teachers and an estimate of the annual cost of providing such training will be determined.
- **Determine Annual Budget.** The costs of educational materials and teacher training to arrive at the total annual cost will be compiled. The purchase of educational materials and teacher training may be subsidized not only by our water utility but also by various state agencies, federal agencies, and private institutions. If financial resources fall short of the required funding, the City may prepare proposals to obtain grants from institutions such as community-minded businesses, federal and/or state government agencies, or private foundations.

5. Developing a Water Conservation Program

5.1 Describe Challenges

Since the City's highest priority goal is to increase the City's data validity score to or above a 71, which will get the City to a Water Loss Control Planning Level 4 status, many of the City's challenges will be financial and staffing related. The City implemented new water rates in February 2020. Our annual rate analysis and the AWWA water audit flagged that the retail costs of the water are less than the production costs. The need for the recent rate increase was driven by dwindling Water Fund cash balances covering the cost of the utility. The new rates are expected to get the utility balanced. Many of the activities that will be required to implement this water conservation program will cost money and increase demands on staffing. The additional resources that the WCP will require have not yet been considered in the City's budget.

The City has plenty of water rights secured to support an expanding population and/or increased economic uses; however, the challenge is that some of these water rights are located several miles out of the City limits and moving them closer to town is very difficult due to the City being located within a critical management area as determined by the NMOSE. The NMOSE has determined that increased water depletions within this critical management area will be detrimental. Water right moves into critical management areas are prohibited and water right movement within a critical management area are tightly regulated. Generally, only relatively small transfers are permitted to move within a critical management area. In addition to this, other water right owners within the critical management area have their own concerns regarding the protection of their water rights and have recently protested applications proposed to make such transfers. This places a higher importance on conserving water that is already within the City limits.

Another challenge for the City is that a recent study conducted on the water utility's infrastructure indicates that nearly all the water mains need replacement. The preliminary engineering report has estimated costs being far above what the City can afford. A plan is being put together to replace these lines over time; however, the funding strategy has not yet been developed or added to the City's budget. The Public Works Department has been tracking the location of leaks and prioritizing problem areas to focus the City's attention on. Just recently, the City has been awarded funding to begin replacing water mains in an area that the Public Works Department has identified as being one of the City's most needed areas for water main replacement. The funding awarded, which the City is very grateful for receiving, is not enough to fund the whole project, for which the City will continue to seek additional grant/loans funds.

The City of Deming is also known to be one of the most poverty-stricken cities in New Mexico. The residents are not supportive of rate increases. The current rate structure is a flat rate based on consumption. A different type of rate structure, such as an increasing block rate structure, would be difficult to gain support for. This type of change will take efforts within the public information and outreach activities of this program.

Being located within a desert with the only water source for the community being groundwater, the climate is always a concern. New Mexico has experienced severe drought conditions during the past couple of years. This past year, 2019, drought indicators have shown improvements, but more recently have started to trend back towards to increasing drought conditions. We have also been experiencing a pattern of increased temperatures which brings with it increased evapotranspiration rates. This has a direct effect on natures ability to recharge the aquifer that the City of Deming relies on for our water source.

Municipal water conservation efforts require a continuous improvement program. Since this is the City's first WCP using this method, several improvement opportunities have been identified. To view this as one long-term program that is written and implemented for several years to follow is unreasonable and would most likely have a high failure probability. Because of this, the City plans to review, update, and implement the plan every five years. The focus of this first plan is on more short-term improvements with long-term goals in mind. Several internal operational improvements have been identified and will be the initial focus of the City's plan. Other parts of the plan, such as public involvement, outreach plans, educational programs, and long-term water conservation plans, should not be rushed. The City of Deming has included these activities within this initial plan with the intention to define and implement the details of these activities over the next five years.

5.2 Program Components

5.2.1 Program Title

City of Deming Water Conservation Program

5.2.2 Summary of Program

This program is focused on the short-term. Twenty-three best management practices have been selected as being important considerations to work on. Some of these BMP's are internal management and operational in nature and will be implemented within the next five years.

Others will require public input or outside input for which the City plans to use the next five-years to gather that input and develop comprehensive goals for achieving the wants and needs related to water conservation from the data collected.

The primary goal of the City is to improve on the City's data validity score calculated in the AWWA Water Audit. The City of Deming's data validity score indicates that the City's water utility is at a Level 3 Water Loss Control measure. The Water Loss Control measure is an indicator that helps the water utility understand what they should focus on. A Level 1 and Level 2 water utility should focus on data collection and short-term loss control. Level 3 through Level 5 can start focusing on long-term loss control, target setting, and benchmarking. The City of Deming scored a 59 DVS, which is within the Level 3 range of 51-70. This indicates that there is still some issue with data collection and should focus on short-term loss control, however, should also start considering long-term loss control, target-setting, and benchmarking. This is the reasoning for the City of Deming's plan to develop this initial program into a five-year program focusing on internal management and operational best management practices while soliciting public input and educating the public on water conservation to better position the City to develop comprehensive target setting and benchmarking attributes toward long-term water conservation efforts. This would also be in-line with the City's short-term goal to achieve a DVS of 71 which will place the City in the Level 4 Loss Control measure.

The City of Deming has categorized the selected BMP's into four categories: Administrative, Operational, Financial, and Public Involvement. The first three categories represent the short-term BMP's that tend to have a high priority, while Public Involvement has a more long-term focus and are lower in priority but have been identified as being important for this next 5-year planning period. Below are descriptions of the BMP's within their respective category with their ranking listed.

Administrative:

(Ranked 1) ***Written Policy and Procedure with Periodic Reviews*** – Water Audit grading scores over several of the areas were limited due to lack of written policy and procedures and/or due to the policy and procedures lack of being routinely reviewed. Needed policies and procedures include, but are not limited to, meter testing and calibration, meter replacement plans, reporting of inactive accounts, auditing of inactive accounts, reporting of data for water audits and GPCD Calculator, identifying and reporting metered not billed accounts (City Buildings, etc.), identifying and estimating non-metered not billed usages such as fire hydrant uses, and water infrastructure mapping and data collection.

(Ranked 2) ***Annual Completion of the AWWA Water Audit and NMOSE GPCD Calculator:*** To measure the success of this five-year plan, it will be imperative to complete the AWWA Water Audit and NMOSE GPCD calculator on an annual basis. The Planning Team will meet in a public meeting semi-annually and, at a minimum of once annually, will review the results and ensure that the City is making progress towards achieving our goals.

(Ranked 5) ***Conservation Coordinator:*** The Public Works Assistant will take on the duties as Conservation Coordinator. This duty will involve monitoring and tracking the conservation program efforts, scheduling the semi-annual meetings, creating agendas, and any other duties as assigned. The Public Works Director and HR Director will create duty descriptions and have them added to the Public Works Assistant's job description.

(Ranked 8) ***Water Leak Locations Mapped with Date Stamp:*** The Public Works Director and City Engineer will develop a policy and procedure for mapping and collecting data on water main breaks.

(Ranked 9) ***Water Main GIS/AutoCAD File Updated Routinely:*** The Public Works Director and City Engineer will develop a policy and procedure for maintaining additions and deletions to the City's GIS/AutoCAD file. Currently a GIS project exists, but additions and deletions are not routinely updated on the project.

(Ranked 15) ***Water Conservation Ordinances Reviewed and Updated:*** Appropriate staff will review and update, as needed, ordinances related to water conservation every two years.

(Ranked 23) ***Annual Report to NMOSE Water Use and Conservation Bureau:*** The Conservation Coordinator will submit a brief, couple of paragraphs, report to the NMOSE Water Use and Conservation Bureau annually after the completion of the AWWA Water audit and NMOSE GPCD calculator. The report will generalize progress made to achieving goals. This report will demonstrate continued efforts by the City of Deming to conserve water.

Operational

(Ranked 3) ***Annual Meter Testing and Meter Calibration (Source Side and Demand Side):*** The Water/Wastewater Foreman will develop and implement a policy and procedure, approved by the Public Works Director, to select a sample of meters, both source and demand side, to test and calibrate on an annual basis. Age, size, and location of meters should be considered and documented when testing and selected as part of the sample population. Separate procedures will be written for source and demand meters. Meter accuracy shall be within 2% and, when required, calibration and/or replacement procedures will be followed when meter accuracy exceeds specified limits. Meter testing results shall be documented and reported to the Public Works Director on an annual basis. This information will be entered into the annual water audit.

(Ranked 4) ***Meter Replacement Plan:*** The Public Works Director and Water/Wastewater Foreman will develop a policy and procedure for systematically replacing aged meters.

(Ranked 6) ***Repair Known Leaks:*** The Water Department shall repair, and document all known leaks when they are reported. This would have been ranked higher; however, this is already practiced by the Water Department. This is still important because failure to repair known leaks will have a significant impact on water loss and financial resources for the City of Deming.

(Ranked 14) ***Pressure Zones and Tank Levels Identified and Monitored Regularly:*** The Water/Wastewater Foreman shall develop and implement a policy and procedure for identifying and monitoring pressure zones and tank levels on a monthly basis. The method used to determine an average system pressure shall be clearly documented. The average system pressure and tank levels shall be reported to the Public Works Director on a monthly basis and entered into the water audit on an annual basis.

Financial

(Ranked 10) ***Billing Report Indicators Prior to Billing (Hi/Lows):*** Treasurer and Utility Billing Manager will create and implement written policies and procedures that will reduce the amount of data errors that occur and are difficult to remove after billing runs. One example, a hi/low report should be ran prior to billing runs that identify accounts with unusually hi and unusually low usage amounts. The identified accounts should be field checked and corrected prior to billing being run for that cycle. Another consideration should be to re-classify residential users as single-family residential and multi-family residential, which is not currently being done. Other policies and procedures should be created to help minimize data errors.

(Ranked 11) ***Unbilled Metered Accounts shall be Included in Billing System and Reported Monthly:*** Treasurer and Utility Billing Manager shall create and implement a policy and procedure for accounting and reporting for unbilled metered accounts. These are generally City buildings. These should also not be combined with park irrigation within reports. The unbilled metered accounts should be routinely inventoried and monitored. These numbers shall be included within the annual water audit.

(Ranked 12) ***Active and Inactive Service Connections Reported Monthly:*** The Treasurer and Utility Billing Manager shall create a policy and procedure for tracking and reporting active and inactive utility accounts monthly. This data should be documented and reported monthly.

(Ranked 13) ***Inactive Service Connections Routinely Audited:*** The Treasurer, Utility Billing Manager, and Water/Wastewater Foreman shall create a policy and procedure for auditing inactive service connections routinely. The results of this audit shall be documented and reported routinely.

(Ranked 16) ***Conservation Oriented Rates and Tap Fees:*** Alternative rate structures should be explored. This item should also involve public input. The rate structure should incentivize water users to conserve water.

Public Involvement

(Ranked 7) ***Continue Efforts for Utilizing Reuse Water and Incentives for Home Reuse Projects:*** The City is currently working on expanding the City's water reuse efforts. The City shall continue working towards improving the quality of reuse water and explore additional uses the reuse water can be used for. Public involvement in this subject is crucial. The City needs to give assurance for the quality of the water and promote its use so that the public is comfortable with the use of reuse water. The City and the public will explore further incentives for home reuse projects.

(Ranked 17) ***Public Involvement Plan:*** A Public Involvement Plan is included within this document. The Conservation Coordinator will be given the duties for ensuring the tasks described in the plan are being completed and implemented. Also as described above and below in other BMP's, public involvement will be necessary for numerous aspects of this WCP.

(Ranked 18) ***Public Information/Outreach Plan:*** The Conservation Coordinator will be responsible for working with other City staff for identifying and distributing water conservation information to the public as well as identifying interested stakeholders to assist in the planning process. Some of these duties may include organizing news releases, creating a webpage on the City's website, identifying online water conservation links, managing social media accounts, and identifying information for bill stuffers and/or handouts within City Hall. Public input shall be solicited as part of this BMP.

(Ranked 19) ***In-School Educational Program:*** The Conservation Coordinator will be the lead on exploring the City's and Deming Public School District's interests in creating an In-School Educational Program. To initiate this, the Conservation Coordinator shall write up a proposal and meet with appropriate school officials to discuss the details as what is to be expected in a program. Public input shall be solicited as part of this BMP.

(Ranked 20) ***Requirements for New Development and Initiatives for Existing Residents for Installing Water-Efficient Fixtures and Appliances:*** A public input plan shall be created to explore ideas on how the City can promote water users use of water-efficient fixtures and appliances. After reviewing and evaluating public input, the City shall review existing code and consider if updates and/or new ordinances are needed. Other mechanisms for promoting the use of water-efficient fixtures and appliances may be considered.

(Ranked 21) ***Promotion of Low-Water-Use Landscaping and Efficient Irrigation Practices:*** The City has regulated low water use landscaping through City Code. The City shall revisit these ordinances and evaluate what has worked. A public input plan shall be created to explore ideas on how the City can promote water users use of low-water-use landscaping and efficient irrigation practices. After reviewing and evaluating public input, the City shall consider adopting or updating code concerning low-water-use landscaping and efficient irrigation systems.

(Ranked 22) ***Requirements for Efficient Commercial and Industrial Water Use Processes:*** The City shall solicit input from the public, commercial water users, and industrial water users for recommendations on ways that can incentivize commercial and industrial water users to use water more efficiently. The City will also explore/research industry standards for similar businesses water use rates. Depending on the results of the research, a plan or ordinances can be implemented to incentivize the efficient use of water by commercial and industrial users.

5.2.3 Targeted User

Since this plan is focused on short-term goals to improve data collection and reporting efforts, many of the conservation measures are related directly to the City of Deming. The list below includes the targeted user followed by the rankings of the conservation measures associated with that user. Some of the conservation measures are listed for multiple targeted users.

City of Deming – 1 thru 16, and 23

Residential Users – 7, 20, and 21

Commercial and Industrial Users - 22

All Water Users – 15 thru 18, and 23

Students – 19

5.2.4 Saturation of Target User

Four target users have been identified: City of Deming, Residential Users, Commercial and Industrial Users, and Students. There is not a significant number of commercial and industrial big water users, so changes to policies focused on these users may not be as significant as change to residential users. Residential use makes up most of the water use within the City of Deming. Items identified as the City of Deming being the targeted user are related more to administrative improvements that would have an effect on the efficiency of the entire water system. Students is a very narrow focus group; however, if students are educated in water conservation, long-term water conservation efforts may be realized through indoctrinating water conservation values into the community.

5.2.5 Implementation Dates

TABLE 15: IMPLEMENTATION SCHEDULE FOR BMPS

BMPs	2020	2021	2022	2023	2024
Written Policy and Procedure with Periodic Reviews	Develop	Implement	Review	Continue	Review
Annual Completion of the AWWA Water Audit and NMOSE GPCD Calculator	Perform	Perform	Perform	Perform	Perform
Annual Meter Testing and Meter Calibration (Source Side and Demand Side)	Develop	Implement	Continue	Continue	Continue
Meter Replacement Plan		Develop	Implement	Continue	Continue
Conservation Coordinator	Develop/Implement	Continue	Continue	Continue	Continue
Repair Known Leaks	Continue	Continue	Continue	Continue	Continue
Continue Efforts for Utilizing Reuse Water and Incentives for Home Reuse Projects	Continue	Public Input	Continue	Continue	Continue
Water Leak Locations Mapped with Date Stamp	Develop	Implement	Continue	Continue	Continue
Water Main GIS File Updated Routinely	Develop	Implement	Continue	Continue	Continue
Billing Report Indicators Prior to Billing (Hi/Lows)	Develop/Implement	Continue	Continue	Continue	Continue
Unbilled Metered Accounts Included in Billing System and Reported Monthly	Develop	Implement	Continue	Continue	Continue
Active and Inactive Service Connections Reported Monthly	Develop	Implement	Continue	Continue	Continue
Inactive Service Connections Routinely Audited	Develop	Implement	Continue	Continue	Continue
Pressure Zones and Tank Levels Identified and Monitored Regularly	Develop	Implement	Continue	Continue	Continue
Water Conservation Ordinances Reviewed and Updated	Continue	Review/Update	Continue	Review/Update	Continue

TABLE 15 CONTINUED: IMPLEMENTATION DATES FOR BMPS

BMPs	2020	2021	2022	2023	2024
Conservation Oriented Rates and Tap Fees		Public Input	Review	Continue	Review
Public Involvement Plan	Develop	Implement	Continue	Continue	Continue
Public Information/Outreach Plan	Develop	Implement	Review	Implement Updates	Continue
In-School Educational Program		Develop	Meet with School	Implement	Continue
Requirements for New Development and Initiatives for Existing Residents for Installing Water-Efficient Fixtures and Appliances		Public Input	Develop	Implement	Continue
Promotion of Low-Water-Use Landscaping and Efficient Irrigation Practices		Public Input	Develop	Implement	Continue
Requirements for Efficient Commercial and Industrial Water Use Processes		Public Input	Develop	Implement	Continue
Annual Report to NMOSE Water Use and Conservation Bureau:		Submit	Submit	Submit	Submit

5.2.6 Anticipated Cost

Table 16, below, shows the anticipated costs for each of the BMPs per year. Note that the City plans to utilize existing staffing to perform all the labor duties listed. The average additional cost to the city per year is approximately $10,000. The labor cost amounts to the equivalent to about a 0.5 FTE.

TABLE 16: ANTICIPATED COSTS FOR BMP'S

BMPs	2020	2021	2022	2023	2024
Written Policy and Procedure with Periodic Reviews	$2000 Labor Only	$2000 Labor Only	$2000 Labor Only	$2000 Labor Only	$2000 Labor Only
Annual Completion of the AWWA Water Audit and NMOSE GPCD Calculator	$1000 Labor Only	$1000 Labor Only	$1000 Labor Only	$1000 Labor Only	$1000 Labor Only
Annual Meter Testing and Meter Calibration (Source Side and Demand Side)	$1000 Labor Only	$8000 + $2000 Labor	$2000 Labor Only	$2000 Labor Only	$2000 Labor Only
Meter Replacement Plan		$1000 Labor Only	$2500 + $1500 Labor	$2500 + $1500 Labor	$2500 + $1500 Labor

Table 16 Continued: Anticipated Costs for BMPs

BMPs	**2020**	**2021**	**2022**	**2023**	**2024**
Conservation Coordinator	$10,500 Labor Only	$10,500 Labor Only	$10,500 Labor Only	$10,500 Labor Only	$10,500 Labor Only
Repair Known Leaks	$5000 + $2000 Labor	$5000 + $2000 Labor	$5000 + $2000 Labor	$5000 + $2000 Labor	$5000 + $2000 Labor
Continue Efforts for Utilizing Reuse Water and Incentives for Home Reuse Projects	Unknown - Fluctuates	Unknown - Fluctuates	Unknown - Fluctuates	Unknown - Fluctuates	Unknown - Fluctuates
Water Leak Locations Mapped with Date Stamp	$500 Labor Only	$500 Labor Only	$500 Labor Only	$500 Labor Only	$500 Labor Only
Water Main GIS File Updated Routinely	$500 Labor Only	$500 Labor Only	$500 Labor Only	$500 Labor Only	$500 Labor Only
Billing Report Indicators Prior to Billing (Hi/Lows)	$4000 Labor Only	$4000 Labor Only	$4000 Labor Only	$4000 Labor Only	$4000 Labor Only
Unbilled Metered Accounts Included in Billing System and Reported Monthly	$1000 Labor Only	$200 Labor Only	$200 Labor Only	$200 Labor Only	$200 Labor Only
Active and Inactive Service Connections Reported Monthly	$1000 Labor Only	$200 Labor Only	$200 Labor Only	$200 Labor Only	$200 Labor Only
Inactive Service Connections Routinely Audited	$1000 Labor Only	$1000 Labor Only	$1000 Labor Only	$1000 Labor Only	$1000 Labor Only
Pressure Zones and Tank Levels Identified and Monitored Regularly	$1000 Labor Only	$500 Labor Only	$500 Labor Only	$500 Labor Only	$500 Labor Only
Water Conservation Ordinances Reviewed and Updated	$0	$1000 Labor Only	$0	$1000 Labor Only	$0
Conservation Oriented Rates and Tap Fees		$2000 Labor Only	$2000 Labor Only	$0	$2000 Labor Only
Public Involvement Plan	$2000 Labor Only	$2000 Labor Only	$2000 Labor Only	$2000 Labor Only	$2000 Labor Only
Public Information/Outreach Plan	$1000 + $1000 Labor	$1000 + $1000 Labor	$1000 + $1000 Labor	$1000 + $1000 Labor	$1000 + $1000 Labor
In-School Educational Program		$1000 Labor Only	$1000 Labor Only	$1000 + $1000 Labor	$1000 + $1000 Labor
Requirements for New Development and Initiatives for Existing Residents for Installing Water-Efficient Fixtures and Appliances		$2000 Labor Only	$2000 Labor Only	$1000 + $1000 Labor	$1000 + $1000 Labor
Promotion of Low-Water-Use Landscaping and Efficient Irrigation Practices		$2000 Labor Only	$2000 Labor Only	$1000 + $1000 Labor	$1000 + $1000 Labor
Requirements for Efficient Commercial and Industrial Water Use Processes		$2000 Labor Only	$2000 Labor Only	$0	$0
Annual Report to NMOSE Water Use and Conservation Bureau:		$500 Labor Only	$500 Labor Only	$500 Labor Only	$500 Labor Only
Annual Totals	**$6000 + $28500 Labor**	**$14000 + $38900 Labor**	**$8500 + $38400 Labor**	**$11500 + $33400 Labor**	**$11500 + $34400 Labor**
5-Year Total	**$51500 + 173,600 Labor**				

5.2.7 Anticipated Staffing

The City of Deming plans to use existing staff to perform the functions of the Water Conservation Program. As seen above in the anticipated cost section, the City anticipates that these additional duties will amount to 0.5 FTE. These duties will be split between several staff members.

The lion share of the duties will be placed on the Conservation Coordinator; however, a big chunk of the initial duties involves writing policy and procedures which will be written by the appropriate upper level manager. More specifically the Public Works Director, Treasurer, and City Engineer may be responsible for the content within each policy and procedure. The Conservation Coordinator, billing staff, meter readers, and water plant staff will incorporate the implementation duties from the policies and procedures into their normal day-to-day duties.

5.2.8 Funding Source

Funding will be allocated from the current Water Fund budget. For large projects, such as water main replacement and water reuse improvements, the City may leverage City assets and seek grants and loans. The City currently applies for federal grants and low interest loans as well as state grants and loans from sources such as Colonias funding, Water Trust Board Funding, etc.

5.2.9 Anticipated Results and How They Align with Goals

Table 17, below, shows how the BMPs align with the goals of this water conservation program.

TABLE 17: ALIGNMENT OF BMPS TO GOALS

		Goals (Ordered by Priority)				
BMPs	**Anticipated Results**	**DVS >= 71**	**Policies & Procedures**	**Non-Revenue Water**	**Adequate Rates**	**GPCD**
Written Policy and Procedure with Periodic Reviews	Clear written policies and procedures that will enable sustainable consistent gathering and organizing of data water audits.	X	X	X	X	X
Annual Completion of the AWWA Water Audit and NMOSE GPCD Calculator	Data set that will be used to monitor the City's water consumption which will be used to help set and modify conservation goals.	X	X	X		X
Annual Meter Testing and Meter Calibration (Source Side and Demand Side)	Assurance that water is being accounted for accurately.	X		X	X	X
Meter Replacement Plan	Maintaining operational and accurate inventory of in-use water meters proactively, rather than reactively.	X		X	X	X
Conservation Coordinator	The ability to create a sustainable water conservation program with periodic progress reports.	X	X	X	X	X

Table 17 Continued: Alignment of BMPs to Goals

		Goals (Ordered by Priority)				
BMPs	**Anticipated Results**	**DVS >= 71**	**Policies & Procedures**	**Non-Revenue Water**	**Adequate Rates**	**GPCD**
Repair Known Leaks	Maintain a water distribution system with minimal water loss.	X		X	X	X
Continue Efforts for Utilizing Reuse Water and Incentives for Home Reuse Projects	Reduce the amount of groundwater pumping for municipal purposes. Conserve water rights.			X	X	X
Water Leak Locations Mapped with Date Stamp	Systematically identify problem areas where available resources should be spent for improvements.	X		X	X	X
Water Main GIS File Updated Routinely	Maintain up-to-date and easily accessible inventory of water system infrastructure,	X		X		X
Billing Report Indicators Prior to Billing (Hi/Lows)	Reduce significant data errors in the billing system, which also affects water audit calculations.	X	X	X		X
Unbilled Metered Accounts Included in Billing System and Reported Monthly	Identify all known metered water uses, including all City unbilled uses.	X	X			
Active and Inactive Service Connections Reported Monthly	Better accounting of total accounts which will allow the water utility more data to make more informed decisions.	X	X	X	X	X
Inactive Service Connections Routinely Audited	The ability to identify accounts that should be billed that aren't. Direct connection to identifying non-revenue water.	X		X	X	X
Pressure Zones and Tank Levels Identified and Monitored Regularly	Better understanding of water system and the ability to identify system leaks more quickly.	X		X		X
Water Conservation Ordinances Reviewed and Updated	Control undesirablemunicipal water inefficiencies.		X			X
Conservation Oriented Rates and Tap Fees	Incentivize conservation practices that lead to lower GPCD.		X			X
Public Involvement Plan	Expand, identify and gain support of a diverse collection of water conservation ideas to enhance the conservation program.		X	X	X	X
Public Information/Outreach Plan	Inform the public of water conservation practices and City initiatives to conserve water.		X	X		X
In-School Educational Program	Indoctrinate students in water conservation methods.		X	X		X
Requirements for New Development and Initiatives for Existing Residents for Installing Water-Efficient Fixtures and Appliances	Incentivize water conservation through the use of water-efficient fixtures and appliances.		X			X
Promotion of Low-Water-Use Landscaping and Efficient Irrigation Practices	Incentivize water conservation through the use of low-water-use landscaping and efficient irrigation practices.		X	X		X
Requirements for Efficient Commercial and Industrial Water Use Processes	Incentivize water conservation through efficient commercial and industrial water use practices.		X			X
Annual Report to NMOSE Water Use and Conservation Bureau:	Build sustainable practices towards conserving water and to show NMOSE the City's dedication toward the WCP.		X		X	

5.2.10 Why the Program was Chosen

The City chose 23 of the BMPs identified. While 23 BMP’s seems a little overwhelming, many of them are interrelated with other BMP’s. The City also categorized the BMP’s into four categories which helps identify who will be responsible for implementing and managing them.

This program was chosen primarily due to the results of the water audit. Several deficiencies were identified working through the water audit. The City scored in the Level 3 Loss Control level which means that they scored high enough to start considering long-term water conservation goals, but low enough that continued focus should be on data collection and reporting. Therefore, the focus of this program is on short-term improvements focused on improving internal operations of the water system.

5.2.11 Estimated Lifetime Impact of the Program

The impact of implementing this program shall provide better management of data for tracking the City’s water usage. Within the initial target five-years of this program, the City’s data management is expected to be relatively lean. This will enable tools that will be used to better manage non-revenue water and unaccounted-for water. The lifetime impact will include a more efficient water delivery system that will stretch the City’s water rights to meet the demands of the City well into the future. The implementation of the selected BMPs should have an everlasting impact on the operations of the public water utility.

5.2.12 How the Program Will be Implemented

This program involves several City staff members for it to be successful. The Planning Team described in this program is made up of key positions that have the authority to take responsibility and delegate the tasks required in this program. The first step in implementing this program is to assemble the Planning Team to discuss a plan of action and delegate the different components of the program to the appropriate managers.

A key component of this Program is the need for written policies and procedures. The City feels that this component is so important that we have listed it as both a goal and a BMP. The focus of the first year will be on developing several written policies and then implementing them in the second year. These policies and procedures will straddle different departments within the City organization, such as the water utility, finance, engineering, etc. It is important that these policies and procedures are formalized in each of the department’s day-to-day routines. Each of these policies shall also be documented in a Water Conservation manual maintained by the Conservation Coordinator.

The Public Works Director shall immediately create and assign the Conservation Coordinator Duties to the Public Works Assistant. The Conservation Coordinator shall then organize the initial Planning Team meeting to develop a plan of action. Part of this meeting shall address the scheduling of semi-annual Planning Team public meetings.

Within the first year, policies and procedures should be formalized for the following BMPs (the Planning Team may add more to this list; however, the ones listed here are directly listed as prioritized BMPs of this program):

- AWWA Annual Water Audit Policy and Procedure (Public Works Director)
- Annual NMOSE GPCD Calculator Policy and Procedure (Public Works Director)
- Annual Meter Testing and Meter Calibration Policy and Procedure (Water/Wastewater Foreman)
- Meter Replacement Plan Policy and Procedure (Second Year – to follow Meter Testing and Calibration Policy and Procedure) (Water/Wastewater Foreman)
- Leak Repair Policy and Procedure (Water/Wastewater Foreman)
- Water Leak Mapping Policy and Procedure (City Engineer)
- Water Main GIS Mapping Policy and Procedure (City Engineer)
- Billing Report Indicators Policy and Procedure (a system to identify errors before billing is run) (Treasurer/Utility Billing Manager)
- Unbilled-Metered Accounts Policy and Procedure (Treasurer/Utility Billing Manager)
- Active and Inactive Service Connections Reporting Policy and Procedure (Treasurer/Utility Billing Manager)
- Inactive Service Connections Audit Policy and Procedure (Treasurer/Utility Billing Manager)
- Pressure Zones and Tank Levels Reporting Policy and Procedures (Water/Wastewater Foreman)
- Public Involvement Plan Policy and Procedures (Conservation Coordinator)
- Public Information/Outreach Plan Policy and Procedures (Conservation Coordinator)
- In-School Educational Program Policy and Procedure (Second Year) (Conservation Coordinator)

As seen above, the first year is dedicated to getting policy and procedures written. The second year focuses on implementing those policies and procedures, reporting, and public involvement. The second year should really be all about gaining public support. This is when the City will start getting information out to the public about water conservation and to solicit public input on how the City can incentivize residential water conservation efforts. The third year's focus will shift a little towards water conservation education in the Deming Public Schools.

Each year involves new reporting measures which will enable the City to have a better outlook for our water system as well as for our water conservation efforts. The Conservation Coordinator will be responsible for collecting and memorializing these reports for future uses. The Conservation Coordinator shall also develop a semi-annual or annual (whatever the Planning Team feels enough) dashboard report which could be placed on the City's website or distributed by mail to the public. The Conservation Coordinator shall also produce an annual summary of progress made to the NMOSE Water Use and Conservation Bureau. This will act as demonstrated commitment to adhering to the policy which should also help secure future funding opportunities which have a requirement for a water conservation program to be in place.

The Planning Team will meet twice a year in a public meeting to review progress and to adjust the plan of action as needed. This Water Conservation Program is meant to be a sustainable plan to conserve water indefinitely. The City plans to conduct a comprehensive review of this program every five years to re-evaluate goals and BMPs. The Planning Team reserves the right to renew this program for an additional five-years without change if the Planning Team feels that the goals and BMP's are still relevant and do not require change.

5.2.13 Explanation of Tracking and Evaluation

Tracking of the progress of the Program's goals will be documented and reported periodically. The Conservation Coordinator will be tasked with tracking the progress of the program and documenting it in a water conservation manual. The manual will include all pertinent information and documents generated for the City of Deming Water Conservation Program.

Progress will also be tracked using time series analysis by comparing AWWA Water audit and NMOSE GPCD calculator results from year-to-year. Annual reports will be created to inform the Planning Team, NMOSE Water Use and Conservation Bureau, and the public of the Program's progress. Lastly, the Planning Team will periodically evaluate program goals and make adjustments to the program as needed to ensure adequate progress is being made to conserve municipal water and to ensure that the municipal water system is running in the most efficient and productive manner possible.

5.2.14 Annual Reporting and Updates

Annual reports will be produced to inform stakeholders of the progress made towards achieving the City's goals for this Program. As previously noted, the City will conduct the AWWA Water Audit and the NMOSE GPCD Calculator annually. The City's Conservation Coordinator will ensure that an annual report is generated. A brief overview of the City's progress will be reported to the NMOSE Water Use and Conservation Bureau annually. Progress reports will be given at each of the semi-annual Planning Team public meetings. The City may also create a dashboard report that can be distributed to the public annually. These reports may also be published on the City's website.

5.3 Describe Process of Prioritizing Projects

The process of conducting the AWWA Water Audit and the NMOSE GPCD Calculator identified several weaknesses with the operations of the City's water system operations. This led to our process for prioritizing the different conservation measures the City has included within this document. The number one concern for the City that kept preventing the City from grading AWWA Water Audit inputs higher and causing for an increased estimated water loss is lack of written policies and procedures. This was such an important realization that the City decided to prioritize the development of policies and procedures as the number one goal for the City. The City also listed and prioritized written policies and procedures as the City's highest prioritized BMP.

The M36 structure for developing a water conservation program is a very thorough and overwhelming process; however, the M36 process also gives direction for what public water utilities should focus on. Public water utilities who score in the Level 1 and Level 2 loss control planning levels are advised to focus on internal operations improvements while levels above 2 can focus on more long-term water conservation measures. The City of Deming did score in the Level 3 range; however, the City of Deming is on the lower end of the Level 3 score. Since there were many improvement opportunities identified from conducting the water audit, the City of Deming felt that the City needs to focus on short-term improvements while introducing long-term water conservation measures gradually over the next five-years.

Several of the prioritized BMP's require an initial policy and procedure to be generated. Section 5.2.12 has a list of policies and procedures needing to be written. The priority of the first year of this program is to get these policies and procedures written and adopted. To keep from making this feel like an overwhelming process, the responsible person assigned to ensuring these policies and procedures get written have also been identified in section 5.2.12.

The second year has been identified as the year for implementing all these policies and procedures as well as a push for public involvement in the process. There will also be a higher emphasis on getting water conservation materials out to the public and to introduce them to the City's Water Conservation Plan. This is really the seed for long-term water conservation planning and development for the City of Deming.

Following years are devoted to increasing the efficiency of the City's water plant, collecting and organizing better data through the implementation of the adopted water conservation policies and procedures, and developing long-term strategies for water conservation. Public involvement will help gain the support of our citizens and introduce new ideas for consideration.

As part of creating a long-term strategy the City will also begin reaching out to the public schools to develop an in-school water conservation program to start introducing students to water conservation practices. An in-school program, as well as public outreach, will give the City the opportunity to educate the public on the importance of water conservation and ways to conserve, such as using water-efficient fixtures and appliances, low water use irrigation practices, and water efficient commercial operations.

To summarize, the City prioritized based on the Loss Control Planning values described in the AWWA Water Audit. The City hopes that improved operations will have a significant impact on our AWWA Water Audit DVS score. Once we can get our operations lean, our focus will shift to long-term water conservation measures.

5.4 Current and Past Water Conservation Programs

5.4.1 Summary

A water conservation plan, included as Appendix F of this document, was included in the City of Deming 2009 40-Year Water Plan (Daniel B. Stevens & Associates, Inc., 2009). The 40-Year Water Plan was updated in 2018 and did not include a water conservation plan; however, the 2018 40-Year Water Plan did include an AWWA Water Audit and a NMOSE GPCD Calculator computation for 2016 included in its appendices.

The 2009 water conservation plan did not include a water audit. GPCD was calculated but not using the NMOSE Calculator. The plan suggested that the City of Deming was doing everything they could to conserve water. The goals of the plan focused on customer awareness and educating the public on the importance of water conservation.

The document explained all of the things the City had recently implemented to encourage water conservation, such as implementing new City ordinances, installing automated billing system, having a 10-year meter replacement program, installation of a SCADA system to minimize storage tank overflows, performing leak surveys every five years, and explaining the City’s water reuse activity. Other than educating the public, the water conservation plan lacked actions that the City was going to take in the future to conserve water. The plan seemed to simply rely on the water users to conserve water. Also, many of the things mentioned in the policy are not still followed today, most likely due to lack of written policy and procedures.

The 2016 AWWA Water Audit, provided in the 2018 40-Year Water Plan, is comparable to the 2019 water audit performed in conjunction with this WCP. Many of the grades assigned are similar. Water losses were significantly greater in the 2019 water audit; however, the water audit score increased from a 53 to a 59. It is difficult to see why the score increased. It appears that the score increased due to improvements in the financial section of the audit.

The 2016 and 2019 NMOSE GPCD calculations are somewhat comparable. The 2016 calculation only has the 2016 data entered. While performing the 2019 audit, only data from 2016 to present was identified as being complete. Comparing the 2016 data for both audits, even though some of the data was similar, some of the data was significantly different. Different data sources were used for inputting the data. This is reason enough to get a written policy and procedure in place to conduct these water audits annually. We cannot compare apples to oranges and expect to get useful and reliable results out of these audits. It is also worthy of noting that residential GPCD has declined over the past four years; however, system total GPCD has steadily increased.

5.4.2 Time Frames

A time frame was not included in the 2009 Water Conservation Plan. The plan just speculated that the GPCD would decrease as the public became more aware of the importance of water conservation and that the public's own initiative would lead to water conservation.

5.4.3 Results

Based on current results of the water audit and GPCD calculations, the intended results of the 2009 Water Conservation Plan did not materialize. This was most likely due to the lack of a plan to actively track and monitor the progress of the plan and to implement written policies and procedures.

5.5 Proposed Water Conservation Programs

5.5.1 Narrative Describing How Selected Water Conservation Programs Meet Stated Goals and Objectives

Below are the objectives, goals and selected BMPs identified in this document. Each of the selected BMPs includes a narrative for how they meet the stated objective and goals.

Objective: The City of Deming's objective for developing a water conservation plan is to increase the efficiency in the way we deliver water to the citizens of Deming. Increasing efficiency involves understanding all the dynamics of the water system which enables the City to reduce waste of water, engage the public in water saving practices, maintain a degree of infrastructure which proactively minimizes waste, and create a rate structure which covers the cost of the utility and promotes water conservation while keeping water rates as low as possible. In a broader sense, the City of Deming wants to operate the municipal water system in a manner that conserves water for future generations and minimizes water supply shortages due to droughts and climate change.

Goals:

1. Improve system management within 5 years as reflected in a data validity score of 71 or better on the Water Audit which would raise the City to a Loss Control Planning Level 4 status.
2. Develop written policies and procedures related to water conservation best practices as identified as weaknesses within the Water Audit and review annually. These policies and procedures should be written and implemented within the first two years of implementing this WCP.
3. Reduce nonrevenue water by 65 MG/Yr by 2025.
4. Ensure water utility annual revenues cover annual operational expenses plus funding to cover inter-period equity costs estimated for asset and infrastructure replacement by 2025.
5. Reduce residential GPCD to a level below 80 GPCD within the next 15 years.

BMPs:

1. Written Policy and Procedure with Periodic Reviews:

Objective: Meets objective by promoting efficient and sustainable practices that will lead to better accounting, reduced leaks, manage costs for better rate settings, and promotes long-term water conservation.

Goals: Aligns with all 5 goals. The water audit score was significantly affected by lack of policies and procedures. This measure was so important that it was also identified as being goal number 2. The policies and procedures will reduce non-revenue water through better accounting of water usage, which includes policies that will lead to minimizing data errors and more accurate meter readings. Improved accuracy in data collection provides more accurate information for evaluating rates and rate structures.

2. Annual Completion of the AWWA Water Audit and NMOSE GPCD Calculator

   Objective: Meets objective by promoting efficient and sustainable practices that will lead to better accounting, reduced leaks, manage costs for better rate settings, and promotes long-term water conservation.

   Goals: Directly relates to determining the data validity score. The loss control measures and results of the water audit and GPCD calculator aid in developing and/or improving written policies and procedures. This measure also provides the tools for putting together a time-series analysis to track progress of non-revenue water and GPCD.

3. Annual Meter Testing and Meter Calibration (Source Side and Demand Side)

   Objective: Meets objective by improving efficiencies, maintaining a degree of infrastructure, improved data collection, and provides a tool for improved water rates and rate structure analyses.

   Goals: Aligns with goals 1,2,4 and 5. Improvement on this measure allows the City to grade water audit topics higher which will increase the data validity score, and provide more accurate data for writing/revising policy and procedures, accounting for non-revenue water and accounting for GPCD data.

4. Meter Replacement Plan

   Objective: Meets objective by maintaining and increasing operational efficiencies as well as maintaining a degree of infrastructure. Meter replacement will also improve billing operations and increase efficiencies with rate analyses and rate structure analyses.

   Goals: Aligns with goals 1,3,4 and 5. Improvement on this measure allows the City to grade water audit topics higher which will increase the data validity score, and provide more accurate data for writing/revising policy and procedures, accounting for non-revenue water and accounting for GPCD data.

5. Conservation Coordinator

Objective: Meets objective by providing an individual who will be responsible for documenting, reporting, and ensuring the progress of the program is being made.

Goals: Aligns with all five of the goals because this person will be the go-to-person for ensuring that all the goals are being met.

6. Repair Known Leaks

Objective: Meets objective by maintaining and increasing operational efficiencies as well as maintaining a degree of infrastructure. Repairing known leaks reduces waste, reduces operational costs, and conserves water for future generations.

Goals: Aligns with goals 1,3,4 and 5. Improvement on this measure allows the City to grade water audit topics higher which will increase the data validity score, and provide more accurate data for writing/revising policy and procedures, accounting for non-revenue water and accounting for GPCD data. This measure will also reduce non-revenue water and decrease GPCD.

7. Continue Efforts for Utilizing Reuse Water and Incentives for Home Reuse Projects

Objective: Meets objective by conserving water for future generations and minimizing water supply shortages due to droughts and climate change.

Goals: Aligns with goals 3, 4, and 5. Utilizing more reuse water can lead to a decrease in the use of groundwater pumping non-revenue water and GPCD numbers. The use of reuse water will also reduce the amount of supply water that gets counted as billed-not metered water which can help minimize water rates.

8. Water Leak Locations Mapped with Date Stamp

Objective:	Meets objective by maintaining a degree of infrastructure.
Goals:	Aligns with goals 1, 3, 4, and 5. Written policy and implementation of mapping leaks will aid in increasing the data validity score, help reduce non-revenue water by identifying and repairing problem areas, creating a more accurate tool for determining infrastructure costs for budget which leads to better rate analyses, and reduce GPCD by identifying and replacing problem areas reducing waste.

9. Water Main GIS File Updated Routinely

Objective:	Meets objective by maintaining a degree of infrastructure and creating tools needed to promote a sustainable infrastructure system to conserve and protect water for future generations.
Goals:	Aligns with goals 1, 3, and 5. Written policy and implementation of maintaining a water main GIS file will aid in increasing the data validity score by improving infrastructure management, and help reduce non-revenue water and GPCD by having the capability to easily identify the location of water mains and shutoff points to minimize waste.

10. Billing Report Indicators Prior to Billing (Hi/Lows)

Objective: Meets objective by increasing the efficiency in the way we deliver water to our customers by identifying errors in consumption data prior to billing, helps create a rate structure which covers the cost of the utility and promotes water conservation while keeping water rates as low as possible by improving the data used to determine the rate structure, and contributes to the operation of the municipal water system in a manner that conserves water for future generations and minimizes water supply shortages due to droughts and climate change by identifying leaks and illegal uses early.

Goals: Aligns with goals 1, 2, 3, and 5. Written policy and implementation of creating billing report indicators prior to billing will aid in increasing the data validity score by improving data used to calculate the data validity score, help reduce non-revenue water and GPCD through improved data collection processes and in identifying leaks and illegal uses, and aid in better data collection for rate structure and rate analyses.

11. Unbilled Metered Accounts Included in Billing System and Reported Monthly

Objective: Meets objective by increasing the efficiency of the water system which allows us to understand all the dynamics of the water system which enables the City to reduce waste of water and ensures conservation of water for the future.

Goals: Aligns with goals 1 and 2. This conservation measure limited the City’s ability to grade items in the water audit higher. By entering the unbilled-metered accounts into the billing system will help the City account for these water uses better allowing them to grade items higher, which will lead to a higher data validity score. This measure will also require a policy and procedure to be created, which aligns with the City’s goal to write and implement policies and procedures.

12. Active and Inactive Service Connections Reported Monthly

Objective: Meets objective by increasing the efficiency of the water system which allows us to understand all the dynamics of the water system which enables the City to reduce waste of water and ensures conservation of water for the future.

Goals: Aligns with all five goals. This conservation measure limited the City’s ability to grade items in the water audit higher. By identifying and reporting active and inactive service connections monthly will enable the city to grade these items higher on the water audit, which will increase the City’s data validity score. This measure will also require a policy and procedure to be created, which aligns with the City’s goal to write and implement policies and procedures. This measure will also help identify possible illegal uses and leaks from inactive service connections easier, which can lead to reduced nonrevenue water and a lower GPCD. By minimizing theft and waste, water rate increases can be reduced.

13. Inactive Service Connections Routinely Audited

Objective: Meets objective by increasing the efficiency of the water system which allows us to understand all the dynamics of the water system which enables the City to reduce waste of water and ensures conservation of water for the future.

Goals: Aligns with goals 1, 3, 4, and 5. This conservation measure limited the City’s ability to grade items in the water audit higher. By identifying and auditing inactive service connections routinely will enable the city to grade these items higher on the water audit, which will increase the City’s data validity score. This measure will also help identify possible illegal uses and leaks from inactive service connections easier, which can lead to reduced nonrevenue water and a lower GPCD. By minimizing theft and waste, water rate increases can be reduced.

14. Pressure Zones and Tank Levels Identified and Monitored Regularly

Objective: Meets objective by increasing the efficiency of the water system which allows us to understand all the dynamics of the water system which enables the City to reduce waste of water and ensures conservation of water for the future.

Goals: Aligns with goals 1, 3, and 5. This conservation measure limited the City's ability to grade items in the water audit higher. By identifying, monitoring, and reporting pressure zones and tank levels will enable the city to grade these items higher on the water audit, which will increase the City's data validity score. This measure will also help identify possible leaks sooner, which can lead to reduced nonrevenue water and a lower GPCD.

15. Water Conservation Ordinances Reviewed and Updated

Objective: Meets objective by being one tool that can be used to engage the public in water saving practices. This measure also promotes water conservation which aids keeping water rates as low as possible. Ordinances helps enable the City of Deming to operate the municipal water system in a manner that conserves water for future generations and minimizes water supply shortages due to droughts and climate change.

Goals: Aligns with goals 2 and 5. Reviewing and updating water conservation ordinances leads to increased public involvement to create better written policies and procedures for which the public is likely to support. These ordinances are aimed at conserving water which leads to lower GPCD.

16. Conservation Oriented Rates and Tap Fees

Objective:	Meets objective by being one tool that can be used to engage the public in water saving practices. This measure also promotes water conservation which aids keeping water rates as low as possible. Conservation oriented rates and tap fees help enable the City of Deming to operate the municipal water system in a manner that conserves water for future generations and minimizes water supply shortages due to droughts and climate change.
Goals:	Aligns with goals 2 and 5. Conservation oriented water rates incentivize water users from wasting water and using more water conservative practices, appliances, and fixtures. Conservation oriented rates are aimed at conserving water which leads to lower GPCD.

17. Public Involvement Plan

Objective:	Meets objective by engaging the public in water saving practices. This measure also enables the City of Deming to operate the municipal water system in a manner that conserves water for future generations and minimizes water supply shortages due to droughts and climate change by gaining the buy-in from the water users.
Goals:	Aligns with goals 2, 3, 4, and 5. Public involvement generates a diverse collection of ideas that can be used to improve and/or create policies and procedures while gaining the support from and educating water users. Educating water users and getting them involved in water conservation leads to a water conscious community which helps lower non-revenue water uses and lowers GPCD. Public involvement also garners support for alternative rate structures and conservation-oriented rate increases.

18. Public Information/Outreach Plan

Objective: Meets objective by engaging the public in water saving practices. This measure also enables the City of Deming to operate the municipal water system in a manner that conserves water for future generations and minimizes water supply shortages due to droughts and climate change by gaining the buy-in from the water users.

Goals: Aligns with goals 2, 3, and 5. Public information and outreach educates water users which can increase the quality of diverse ideas that can be used to improve and/or create policies and procedures while gaining the support from water users. Educating water users and getting them involved in water conservation leads to a water conscious community which helps lower non-revenue water uses and lowers GPCD.

19. In-School Educational Program

Objective: Meets objective by engaging students in water saving practices. This measure also enables the City of Deming to operate the municipal water system in a manner that conserves water for future generations and minimizes water supply shortages due to droughts and climate change by indoctrinating students in water conservation practices.

Goals: Aligns with goals 2, 3, and 5. Educating students creates future adults with a water conservation mindset that can be used to improve and/or create policies and procedures in a sustainable manner. Educating students and getting them involved in water conservation leads to a sustainable water conscious community which can continue to lower non-revenue water uses and lower GPCD.

20. Requirements for New Development and Initiatives for Existing Residents for Installing Water-Efficient Fixtures and Appliances

Objective:	Meets objective by engaging the public in water saving practices. This measure also enables the City of Deming to operate the municipal water system in a manner that conserves water for future generations and minimizes water supply shortages due to droughts and climate change by reducing the amount of water used through the use of water efficient fixtures and appliances.
Goals:	Aligns with goals 2, and 5. Policies and procedures focused on the creation of ordinances that promote the use of water-efficient fixtures and appliances lead to lower GPCD.

21. Promotion of Low-Water-Use Landscaping and Efficient Irrigation Practices

Objective:	Meets objective by engaging the public in water saving practices. This measure also enables the City of Deming to operate the municipal water system in a manner that conserves water for future generations and minimizes water supply shortages due to droughts and climate change by reducing the amount of water used through the use of low-water-use landscaping and efficient irrigation practices.
Goals:	Aligns with goals 2, 3, and 5. Policies and procedures focused on the creation of ordinances that promote the use of water-efficient fixtures and appliances lead to lower non-revenue water and lower GPCD.

22. Requirements for Efficient Commercial and Industrial Water Use Processes

Objective: Meets objective by engaging commercial users in water saving practices. This measure also enables the City of Deming to operate the municipal water system in a manner that conserves water for future generations and minimizes water supply shortages due to droughts and climate change by reducing the amount of water used through the promotion of efficient commercial and industrial water use practices.

Goals: Aligns with goals 2, 3, and 5. Policies and procedures focused on the creation of ordinances that promote the efficient use of commercial and industrial water use practices lead to lower GPCD.

23. Annual Report to NMOSE Water Use and Conservation Bureau

Objective: Meets objective by demonstrating to the NMOSE the City’s commitment to water conservation which aids in keeping water rates as low as possible by keeping as many funding opportunities available. Maintaining a good-standing with the NMOSE enables the City of Deming to operate the municipal water system in a manner that conserves water for future generations and minimizes water supply shortages due to droughts and climate change by demonstrating the City’s efforts to conserve water and gain positive reports from the NMOSE which qualifies the City for various funding opportunities.

Goals: Aligns with goals 2 and 5. Policies and procedures focused on maintaining a positive relationship with the NMOSE leads to increased funding opportunities that can be utilized to create projects that ultimately lower GPCD, such as water reuse projects, infrastructure projects, water conservation planning, etc..

5.5.2 Overall Timeline of BMPs as Related to Objectives

Table 18, below, shows the general timeline for the BMPs, listed in section 5.5.1, as they have been related to the objectives of this plan.

TABLE 18: TIMELINE OF BMPS

BMPs	2020	2021	2022	2023	2024
Written Policy and Procedure with Periodic Reviews	Develop	Implement	Review	Continue	Review
Annual Completion of the AWWA Water Audit and NMOSE GPCD Calculator	Perform	Perform	Perform	Perform	Perform
Annual Meter Testing and Meter Calibration (Source Side and Demand Side)	Develop	Implement	Continue	Continue	Continue
Meter Replacement Plan		Develop	Implement	Continue	Continue
Conservation Coordinator	Develop/Implement	Continue	Continue	Continue	Continue
Repair Known Leaks	Continue	Continue	Continue	Continue	Continue

Table 18 Continued: Timeline of BMPs

BMPs	2020	2021	2022	2023	2024
Continue Efforts for Utilizing Reuse Water and Incentives for Home Reuse Projects	Continue	Public Input	Continue	Continue	Continue
Water Leak Locations Mapped with Date Stamp	Develop	Implement	Continue	Continue	Continue
Water Main GIS File Updated Routinely	Develop	Implement	Continue	Continue	Continue
Billing Report Indicators Prior to Billing (Hi/Lows)	Develop/Implement	Continue	Continue	Continue	Continue
Unbilled Metered Accounts Included in Billing System and Reported Monthly	Develop	Implement	Continue	Continue	Continue
Active and Inactive Service Connections Reported Monthly	Develop	Implement	Continue	Continue	Continue
Inactive Service Connections Routinely Audited	Develop	Implement	Continue	Continue	Continue
Pressure Zones and Tank Levels Identified and Monitored Regularly	Develop	Implement	Continue	Continue	Continue
Water Conservation Ordinances Reviewed and Updated	Continue	Review/Update	Continue	Review/Update	Continue
Conservation Oriented Rates and Tap Fees		Public Input	Review	Continue	Review
Public Involvement Plan	Develop	Implement	Continue	Continue	Continue
Public Information/Outreach Plan	Develop	Implement	Review	Implement Updates	Continue
In-School Educational Program		Develop	Meet with School	Implement	Continue
Requirements for New Development and Initiatives for Existing Residents for Installing Water-Efficient Fixtures and Appliances		Public Input	Develop	Implement	Continue
Promotion of Low-Water-Use Landscaping and Efficient Irrigation Practices		Public Input	Develop	Implement	Continue
Requirements for Efficient Commercial and Industrial Water Use Processes		Public Input	Develop	Implement	Continue
Annual Report to NMOSE Water Use and Conservation Bureau:		Submit	Submit	Submit	Submit

5.5.3 Anticipated / Reported Results for the Entire Water Conservation Plan

1. Data Validity Score – The City's primary goal is to reduce the water utility's data validity score to a score equal to or above 71 by 2025. This will show improvements in the City's operational capabilities and raise the City to a loss control level of "Level 4". A level 4 status indicates that the City's focus should shift towards a more long-term strategy for water conservation efforts.

2. Written Policies and Procedures – The City of Deming expects to have comprehensive water conservation related policies and procedures written and implemented within the first two-years of adopting this plan. An initial list of policies to be written have been identified in this plan. These policies are expected to drive the efforts of achieving all the goals listed in this plan.

3. Non-Revenue Water over Time – The city hopes to reduce the amount of non-revenue by 65 MG/Yr by 2025. This is expected to be accomplished by implementing several of the conservation measures listed in this plan. Things such as better accounting of billing data, meter testing, calibration, and replacement efforts, identifying and auditing inactive water accounts, and tracking and fixing leaks are expected to be measures that will make significant contributions at lowering non-revenue water, whether real or estimated. Regular annual water audits and GPCD calculations will track progress and can be used as a tool to modify ineffective components of the plan and/or initiate components that are being neglected.

4. Adequate Rates to Cover Current Operational and Inter-Period Equity Infrastructure Costs – The City recently enacted new water rates. The City has had to dip into reserves to cover annual costs of the utility. The City desires to get rates to a level that covers all annual operational costs as well as build reserves to cover future infrastructure costs.

5. System Total GPCD over Time – The one long-term goal included in this plan involves reducing residential GPCD to a level below 80 GPCD within the next 15 years. The focus of this plan revolves around the short-term period of the next 5-years; however, the City felt that it is important to start thinking long-term which will be the link towards public outreach and involvement, which will be the focus of the City's water conservation plan in 5-years from the adoption of this plan.

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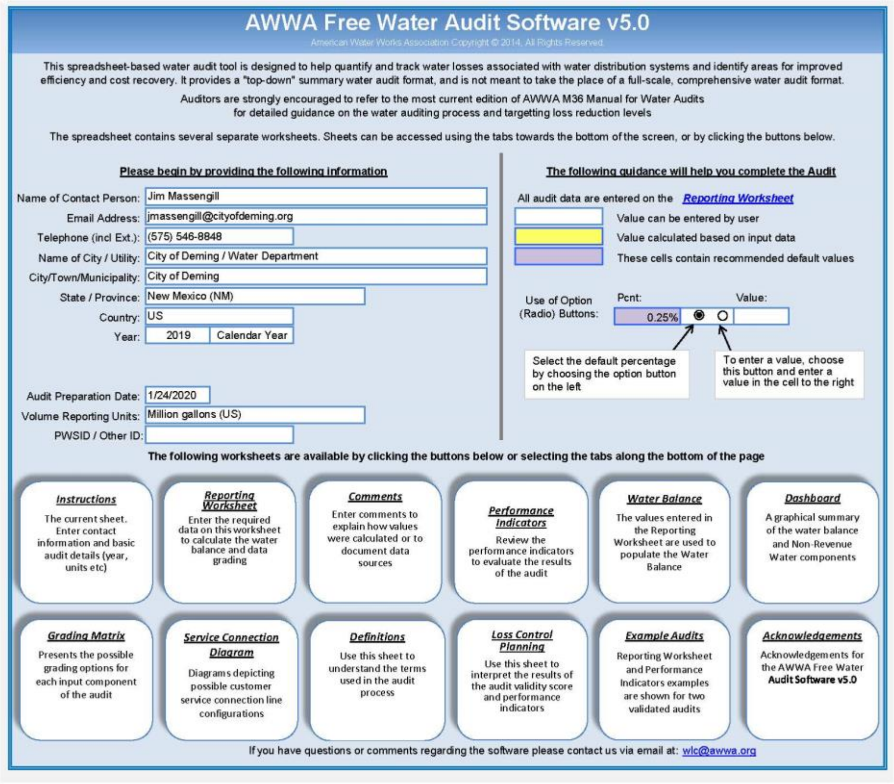
Appendix A AWWA Water Audit – 2019 City of Deming



AWWA Free Water Audit Software v5.0

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This spreadsheet-based water audit tool is designed to help quantify and track water losses associated with water distribution systems and identify areas for improved efficiency and cost recovery. It provides a "top-down" summary water audit format, and is not meant to take the place of a full-scale, comprehensive water audit format.

Auditors are strongly encouraged to refer to the most current edition of AWWA M36 Manual for Water Audits for detailed guidance on the water auditing process and targetting loss reduction levels

The spreadsheet contains several separate worksheets. Sheets can be accessed using the tabs towards the bottom of the screen, or by clicking the buttons below.

Please begin by providing the following information

Name of Contact Person: Jim Massengill
Email Address: jmassengill@cityofdeming.org
Telephone (incl Ext.): (575) 546-8848
Name of City / Utility: City of Deming / Water Department
City/Town/Municipality: City of Deming
State / Province: New Mexico (NM)
Country: US
Year: 2019 Calendar Year

Audit Preparation Date: 1/24/2020
Volume Reporting Units: Million gallons (US)
PWSID / Other ID:

The following guidance will help you complete the Audit

All audit data are entered on the *Reporting Worksheet*

☐	Value can be entered by user
🟨	Value calculated based on input data
🟪	These cells contain recommended default values

Use of Option (Radio) Buttons: Pcnt: 0.25% ● ○ Value:

Select the default percentage by choosing the option button on the left

To enter a value, choose this button and enter a value in the cell to the right

The following worksheets are available by clicking the buttons below or selecting the tabs along the bottom of the page

Instructions The current sheet. Enter contact information and basic audit details (year, units etc)

Reporting Worksheet Enter the required data on this worksheet to calculate the water balance and data grading

Comments Enter comments to explain how values were calculated or to document data sources

Performance Indicators Review the performance indicators to evaluate the results of the audit

Water Balance The values entered in the Reporting Worksheet are used to populate the Water Balance

Dashboard A graphical summary of the water balance and Non-Revenue Water components

Grading Matrix Presents the possible grading options for each input component of the audit

Service Connection Diagram Diagrams depicting possible customer service connection line configurations

Definitions Use this sheet to understand the terms used in the audit process

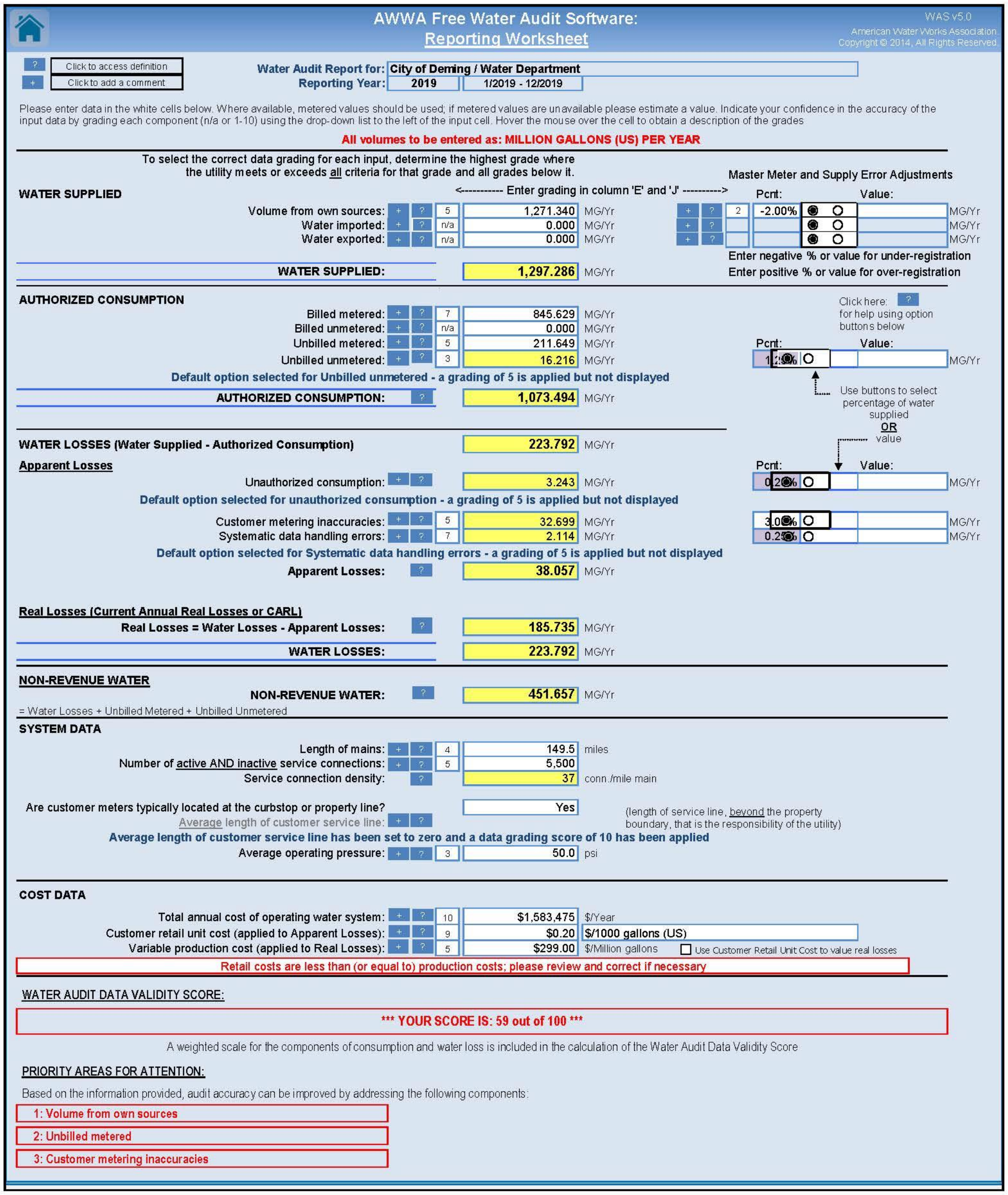
Loss Control Planning Use this sheet to interpret the results of the audit validity score and performance indicators

Example Audits Reporting Worksheet and Performance Indicators examples are shown for two validated audits

Acknowledgements Acknowledgements for the AWWA Free Water **Audit Software v5.0**

If you have questions or comments regarding the software please contact us via email at: wlc@awwa.org

AWWA Free Water Audit Software v5.0 Instructions 1



AWWA Free Water Audit Software:
Reporting Worksheet

WAS v5.0
American Water Works Association.
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Water Audit Report for: City of Deming / Water Department
Reporting Year: 2019 1/2019 - 12/2019

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (n/a or 1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

To select the correct data grading for each input, determine the highest grade where the utility meets or exceeds all criteria for that grade and all grades below it.

<----------- Enter grading in column 'E' and 'J' ---------->

Master Meter and Supply Error Adjustments

WATER SUPPLIED

	Grade	Value		Grade	Pcnt:		Value:	
Volume from own sources:	5	1,271.340	MG/Yr	2	-2.00%	● ○		MG/Yr
Water imported:	n/a	0.000	MG/Yr			● ○		MG/Yr
Water exported:	n/a	0.000	MG/Yr			● ○		MG/Yr
WATER SUPPLIED:		**1,297.286**	MG/Yr					

Enter negative % or value for under-registration
Enter positive % or value for over-registration

AUTHORIZED CONSUMPTION

Click here: ? for help using option buttons below

	Grade	Value		Pcnt:		Value:	
Billed metered:	7	845.629	MG/Yr				
Billed unmetered:	n/a	0.000	MG/Yr				
Unbilled metered:	5	211.649	MG/Yr				
Unbilled unmetered:	3	16.216	MG/Yr	1.2●%	○		MG/Yr

Default option selected for Unbilled unmetered - a grading of 5 is applied but not displayed

AUTHORIZED CONSUMPTION:	**1,073.494**	MG/Yr

Use buttons to select percentage of water supplied
OR
value

WATER LOSSES (Water Supplied - Authorized Consumption)	**223.792**	MG/Yr

Apparent Losses

	Grade	Value		Pcnt:		Value:	
Unauthorized consumption:		3.243	MG/Yr	0.2●%	○		MG/Yr

Default option selected for unauthorized consumption - a grading of 5 is applied but not displayed

	Grade	Value		Pcnt:		Value:	
Customer metering inaccuracies:	5	32.699	MG/Yr	3.0●%	○		MG/Yr
Systematic data handling errors:	7	2.114	MG/Yr	0.2●%	○		MG/Yr

Default option selected for Systematic data handling errors - a grading of 5 is applied but not displayed

Apparent Losses:	**38.057**	MG/Yr

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses:	**185.735**	MG/Yr
WATER LOSSES:	**223.792**	MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER:	**451.657**	MG/Yr

= Water Losses + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

	Grade	Value	
Length of mains:	4	149.5	miles
Number of active AND inactive service connections:	5	5,500	
Service connection density:		37	conn./mile main

Are customer meters typically located at the curbstop or property line? Yes

Average length of customer service line: (length of service line, beyond the property boundary, that is the responsibility of the utility)

Average length of customer service line has been set to zero and a data grading score of 10 has been applied

	Grade	Value	
Average operating pressure:	3	50.0	psi

COST DATA

	Grade	Value	
Total annual cost of operating water system:	10	$1,583,475	$/Year
Customer retail unit cost (applied to Apparent Losses):	9	$0.20	$/1000 gallons (US)
Variable production cost (applied to Real Losses):	5	$299.00	$/Million gallons

☐ Use Customer Retail Unit Cost to value real losses

Retail costs are less than (or equal to) production costs; please review and correct if necessary

WATER AUDIT DATA VALIDITY SCORE:

***** YOUR SCORE IS: 59 out of 100 *****

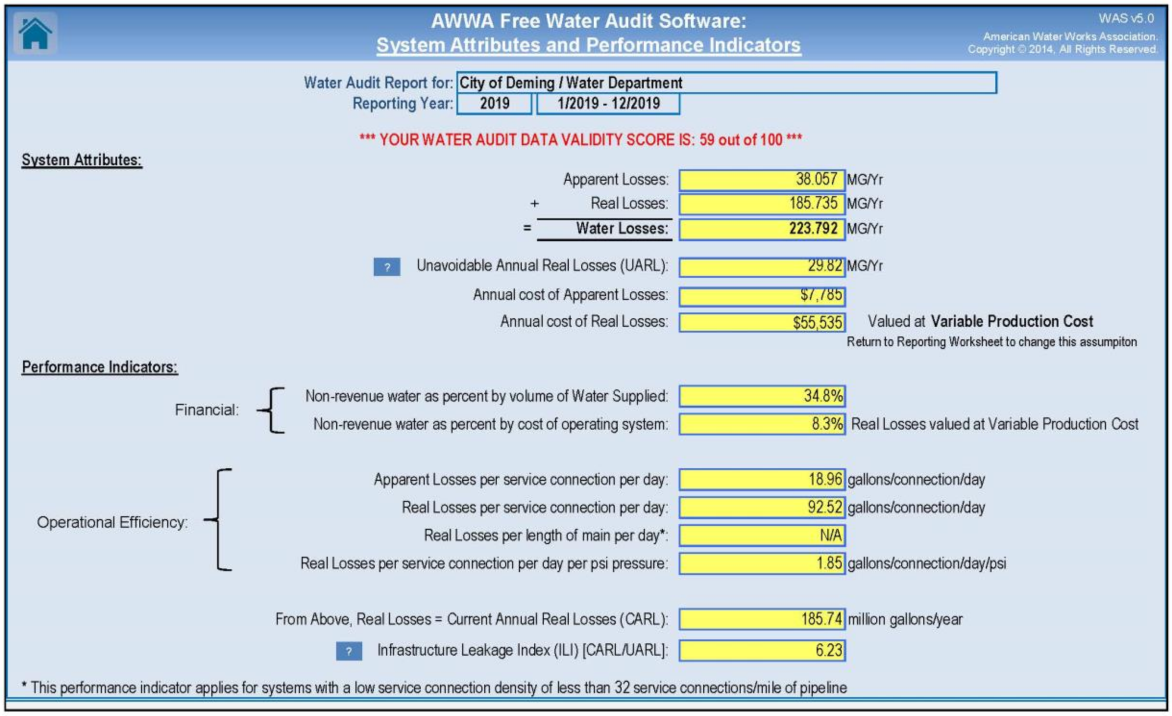
A weighted scale for the components of consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION:

Based on the information provided, audit accuracy can be improved by addressing the following components:

1: Volume from own sources
2: Unbilled metered
3: Customer metering inaccuracies

AWWA Free Water Audit Software v5.0 Reporting Worksheet 1



AWWA Free Water Audit Software:
System Attributes and Performance Indicators

WAS v5.0
American Water Works Association.

Water Audit Report for: City of Deming / Water Department
Reporting Year: 2019 1/2019 - 12/2019

***** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 59 out of 100 *****

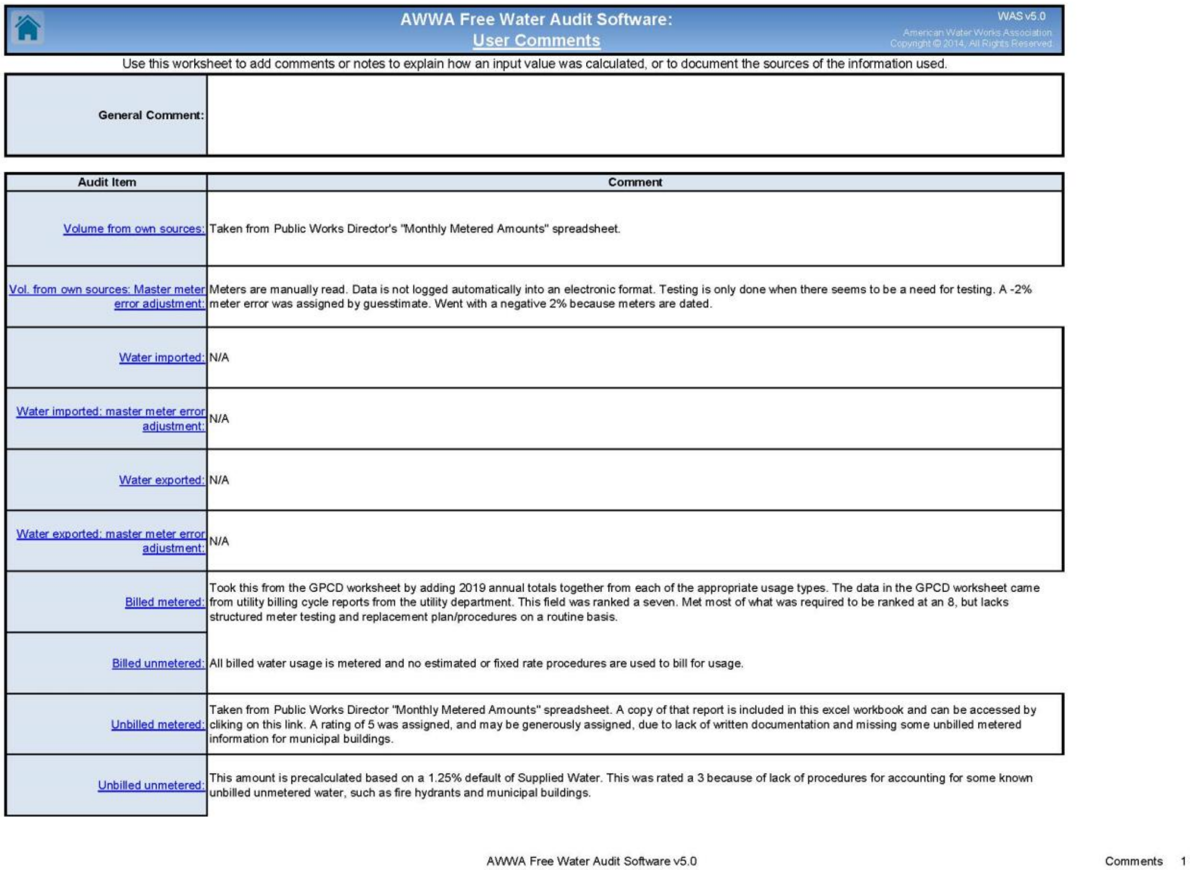
System Attributes:

Apparent Losses:	38.057	MG/Yr
+ Real Losses:	185.735	MG/Yr
= **Water Losses:**	**223.792**	MG/Yr
? Unavoidable Annual Real Losses (UARL):	29.82	MG/Yr
Annual cost of Apparent Losses:	$7,785	
Annual cost of Real Losses:	$55,535	Valued at **Variable Production Cost** Return to Reporting Worksheet to change this assumpiton

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	34.8%	
	Non-revenue water as percent by cost of operating system:	8.3%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	18.96	gallons/connection/day
	Real Losses per service connection per day:	92.52	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	1.85	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	185.74	million gallons/year
	? Infrastructure Leakage Index (ILI) [CARL/UARL]:	6.23	

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline



AWWA Free Water Audit Software:
User Comments

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American Water Works Association
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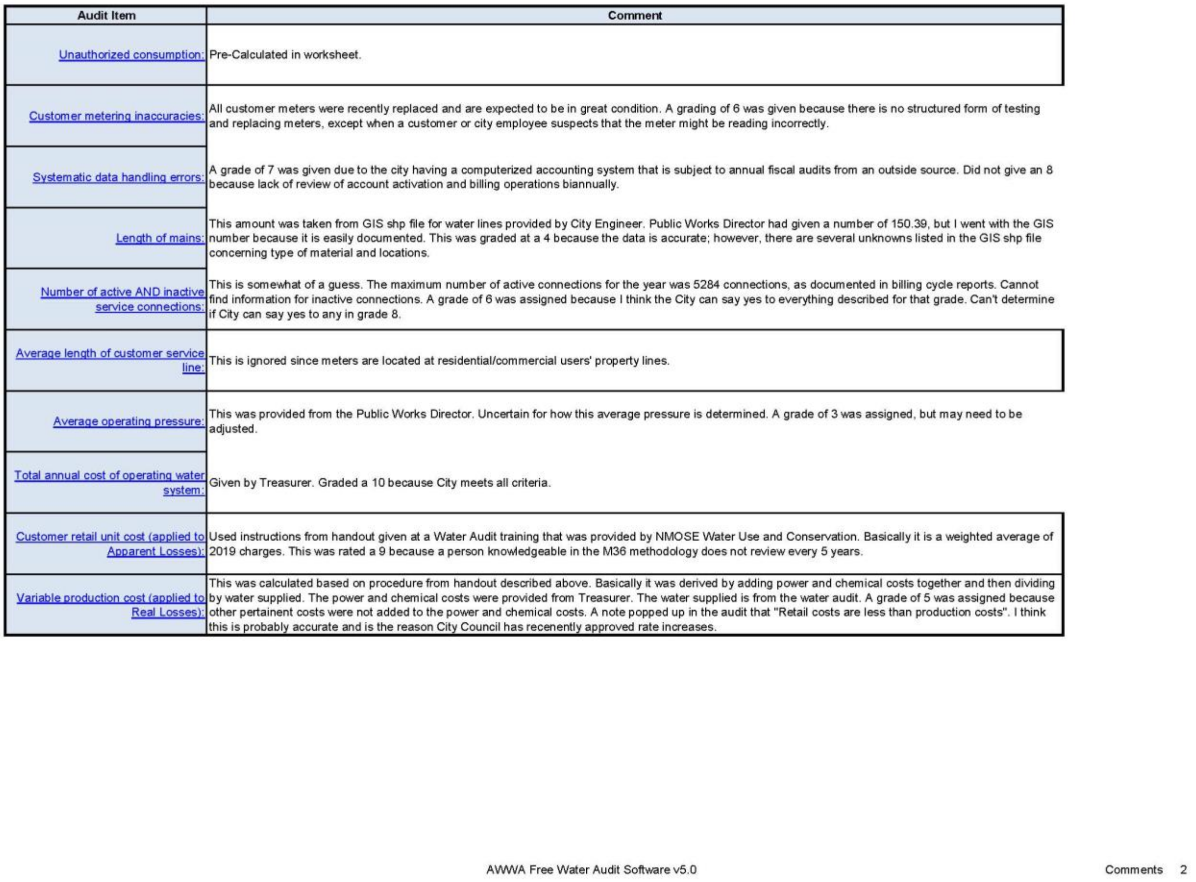
Use this worksheet to add comments or notes to explain how an input value was calculated, or to document the sources of the information used.

General Comment:

Audit Item	Comment
Volume from own sources:	Taken from Public Works Director's "Monthly Metered Amounts" spreadsheet.
Vol. from own sources: Master meter error adjustment:	Meters are manually read. Data is not logged automatically into an electronic format. Testing is only done when there seems to be a need for testing. A -2% meter error was assigned by guesstimate. Went with a negative 2% because meters are dated.
Water imported:	N/A
Water imported: master meter error adjustment:	N/A
Water exported:	N/A
Water exported: master meter error adjustment:	N/A
Billed metered:	Took this from the GPCD worksheet by adding 2019 annual totals together from each of the appropriate usage types. The data in the GPCD worksheet came from utility billing cycle reports from the utility department. This field was ranked a seven. Met most of what was required to be ranked at an 8, but lacks structured meter testing and replacement plan/procedures on a routine basis.
Billed unmetered:	All billed water usage is metered and no estimated or fixed rate procedures are used to bill for usage.
Unbilled metered:	Taken from Public Works Director "Monthly Metered Amounts" spreadsheet. A copy of that report is included in this excel workbook and can be accessed by cliking on this link. A rating of 5 was assigned, and may be generously assigned, due to lack of written documentation and missing some unbilled metered information for municipal buildings.
Unbilled unmetered:	This amount is precalculated based on a 1.25% default of Supplied Water. This was rated a 3 because of lack of procedures for accounting for some known unbilled unmetered water, such as fire hydrants and municipal buildings.

AWWA Free Water Audit Software v5.0

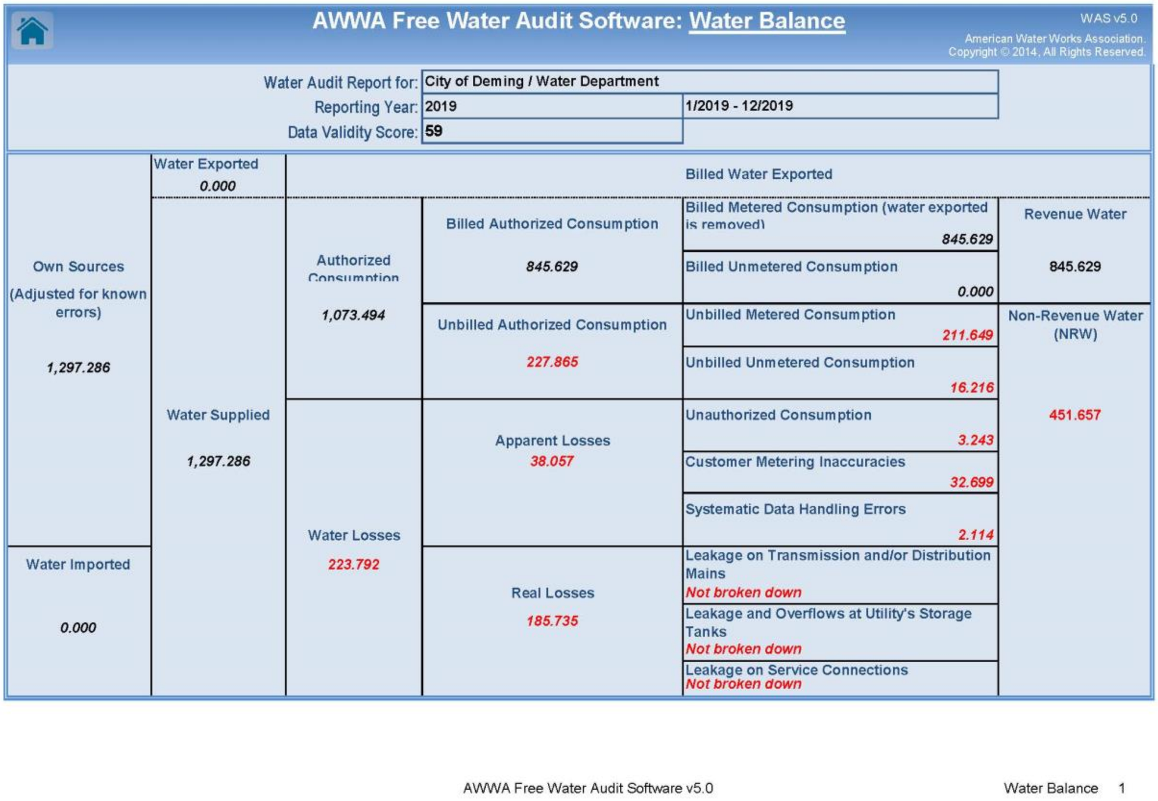
Comments 1



Audit Item	Comment
Unauthorized consumption:	Pre-Calculated in worksheet.
Customer metering inaccuracies:	All customer meters were recently replaced and are expected to be in great condition. A grading of 6 was given because there is no structured form of testing and replacing meters, except when a customer or city employee suspects that the meter might be reading incorrectly.
Systematic data handling errors:	A grade of 7 was given due to the city having a computerized accounting system that is subject to annual fiscal audits from an outside source. Did not give an 8 because lack of review of account activation and billing operations biannually.
Length of mains:	This amount was taken from GIS shp file for water lines provided by City Engineer. Public Works Director had given a number of 150.39, but I went with the GIS number because it is easily documented. This was graded at a 4 because the data is accurate; however, there are several unknowns listed in the GIS shp file concerning type of material and locations.
Number of active AND inactive service connections:	This is somewhat of a guess. The maximum number of active connections for the year was 5284 connections, as documented in billing cycle reports. Cannot find information for inactive connections. A grade of 6 was assigned because I think the City can say yes to everything described for that grade. Can't determine if City can say yes to any in grade 8.
Average length of customer service line:	This is ignored since meters are located at residential/commercial users' property lines.
Average operating pressure:	This was provided from the Public Works Director. Uncertain for how this average pressure is determined. A grade of 3 was assigned, but may need to be adjusted.
Total annual cost of operating water system:	Given by Treasurer. Graded a 10 because City meets all criteria.
Customer retail unit cost (applied to Apparent Losses):	Used instructions from handout given at a Water Audit training that was provided by NMOSE Water Use and Conservation. Basically it is a weighted average of 2019 charges. This was rated a 9 because a person knowledgeable in the M36 methodology does not review every 5 years.
Variable production cost (applied to Real Losses):	This was calculated based on procedure from handout described above. Basically it was derived by adding power and chemical costs together and then dividing by water supplied. The power and chemical costs were provided from Treasurer. The water supplied is from the water audit. A grade of 5 was assigned because other pertainent costs were not added to the power and chemical costs. A note popped up in the audit that "Retail costs are less than production costs". I think this is probably accurate and is the reason City Council has recenently approved rate increases.

AWWA Free Water Audit Software v5.0

Comments 2



AWWA Free Water Audit Software: Water Balance

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Water Audit Report for: City of Deming / Water Department
Reporting Year: 2019 1/2019 - 12/2019
Data Validity Score: 59

Own Sources (Adjusted for known errors) 1,297.286

Water Imported 0.000

Water Exported 0.000

Water Supplied 1,297.286

Billed Water Exported

Authorized Consumption 1,073.494

Billed Authorized Consumption 845.629

Billed Metered Consumption (water exported is removed) 845.629

Billed Unmetered Consumption 0.000

Revenue Water 845.629

Unbilled Authorized Consumption 227.865

Unbilled Metered Consumption 211.649

Unbilled Unmetered Consumption 16.216

Non-Revenue Water (NRW) 451.657

Water Losses 223.792

Apparent Losses 38.057

Unauthorized Consumption 3.243

Customer Metering Inaccuracies 32.699

Systematic Data Handling Errors 2.114

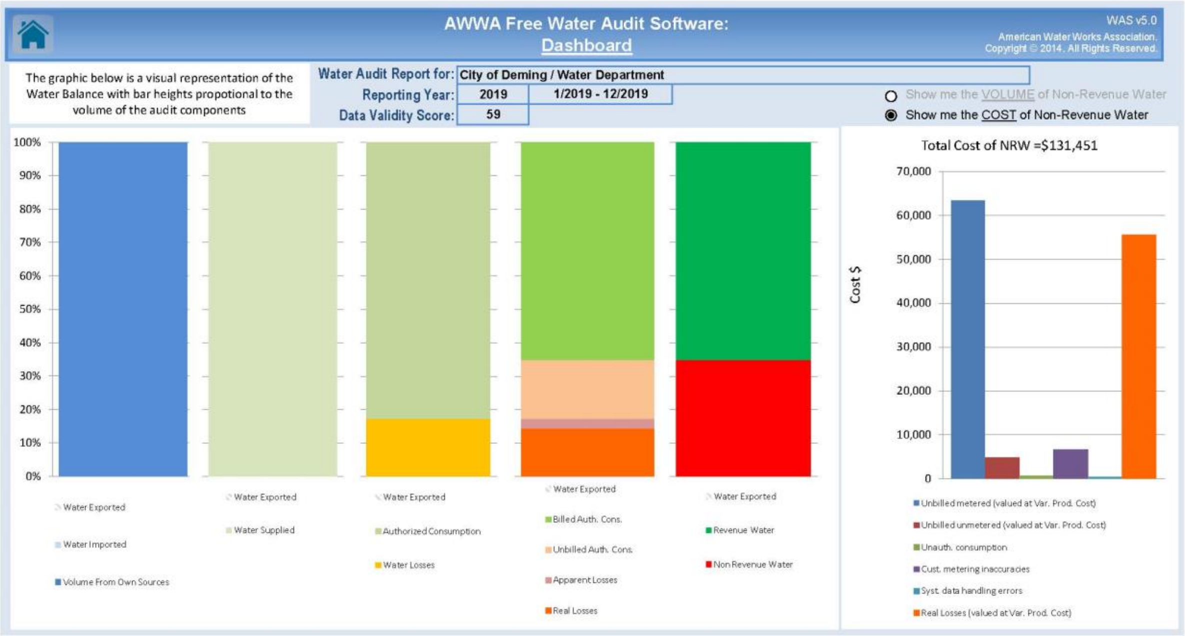
Real Losses 185.735

Leakage on Transmission and/or Distribution Mains
Not broken down

Leakage and Overflows at Utility's Storage Tanks
Not broken down

Leakage on Service Connections
Not broken down

AWWA Free Water Audit Software v5.0 Water Balance 1



AWWA Free Water Audit Software:
Dashboard

WAS v5.0
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The graphic below is a visual representation of the Water Balance with bar heights propotional to the volume of the audit components

Water Audit Report for: City of Deming / Water Department

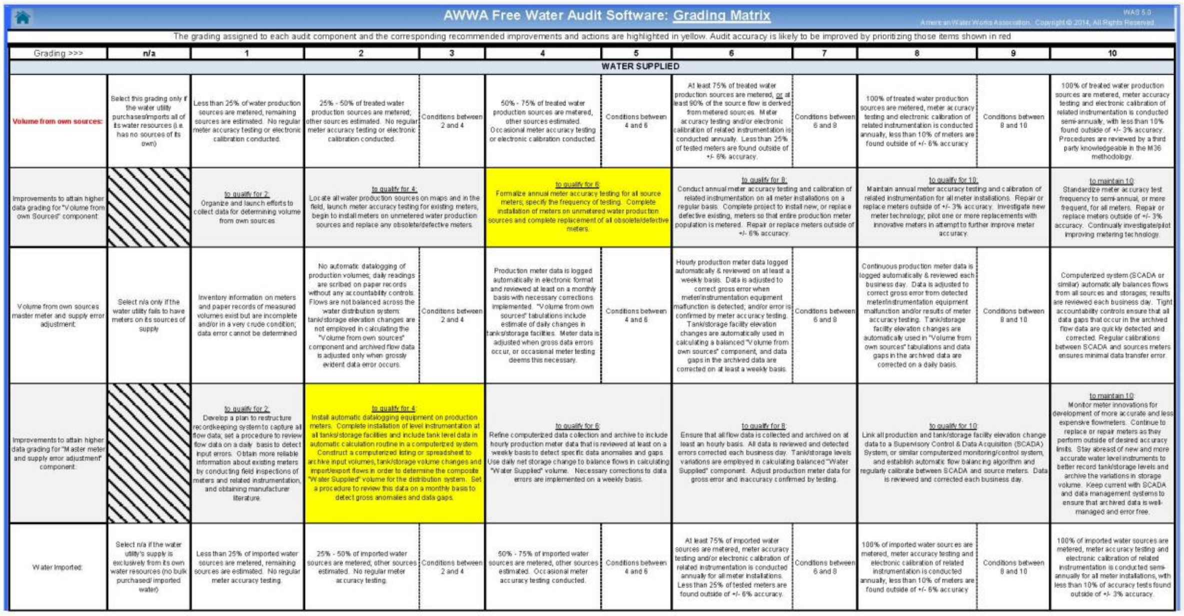
Reporting Year: 2019 1/2019 - 12/2019

Data Validity Score: 59

○ Show me the VOLUME of Non-Revenue Water

● Show me the COST of Non-Revenue Water

AWWA Free Water Audit Software v5.0 Dashboard 1



AWWA Free Water Audit Software: Grading Matrix

WAS 5.0
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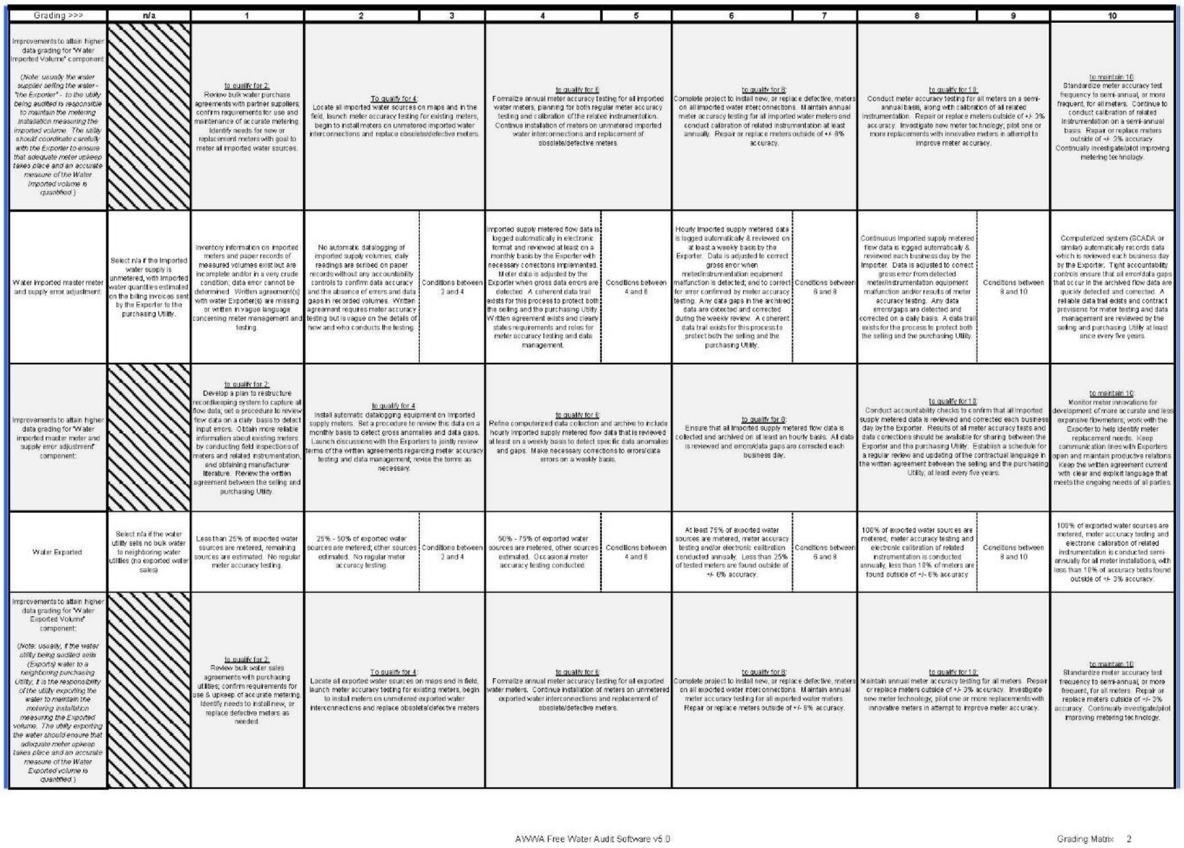
The grading assigned to each audit component and the corresponding recommended improvements and actions are highlighted in yellow. Audit accuracy is likely to be improved by prioritizing those items shown in red

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
WATER SUPPLIED											
Volume from own sources:	Select this grading only if the water utility purchases/imports all of its water resources (i.e. has no sources of its own)	Less than 25% of water production sources are metered, remaining sources are estimated. No regular meter accuracy testing or electronic calibration conducted.	25% - 50% of treated water production sources are metered; other sources estimated. No regular meter accuracy testing or electronic calibration conducted.	Conditions between 2 and 4	50% - 75% of treated water production sources are metered, other sources estimated. Occasional meter accuracy testing or electronic calibration conducted.	Conditions between 4 and 6	At least 75% of treated water production sources are metered, or at least 90% of the source flow is derived from metered sources. Meter accuracy testing and/or electronic calibration of related instrumentation is conducted annually. Less than 25% of tested meters are found outside of +/- 6% accuracy.	Conditions between 6 and 8	100% of treated water production sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted annually, less than 10% of meters are found outside of +/- 6% accuracy	Conditions between 8 and 10	100% of treated water production sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually, with less than 10% found outside of +/- 3% accuracy. Procedures are reviewed by a third party knowledgeable in the M36 methodology.
Improvements to attain higher data grading for "Volume from own Sources" component:	▨	to qualify for 2: Organize and launch efforts to collect data for determining volume from own sources	to qualify for 4: Locate all water production sources on maps and in the field, launch meter accuracy testing for existing meters, begin to install meters on unmetered water production sources and replace any obsolete/defective meters.		to qualify for 6: Formalize annual meter accuracy testing for all source meters; specify the frequency of testing. Complete installation of meters on unmetered water production sources and complete replacement of all obsolete/defective meters.		to qualify for 8: Conduct annual meter accuracy testing and calibration of related instrumentation on all meter installations on a regular basis. Complete project to install new, or replace defective existing, meters so that entire production meter population is metered. Repair or replace meters outside of +/- 6% accuracy.		to qualify for 10: Maintain annual meter accuracy testing and calibration of related instrumentation for all meter installations. Repair or replace meters outside of +/- 3% accuracy. Investigate new meter technology; pilot one or more replacements with innovative meters in attempt to further improve meter accuracy.		to maintain 10: Standardize meter accuracy test frequency to semi-annual, or more frequent, for all meters. Repair or replace meters outside of +/- 3% accuracy. Continually investigate/pilot improving metering technology.
Volume from own sources master meter and supply error adjustment:	Select n/a only if the water utility fails to have meters on its sources of supply	Inventory information on meters and paper records of measured volumes exist but are incomplete and/or in a very crude condition; data error cannot be determined	No automatic datalogging of production volumes; daily readings are scribed on paper records without any accountability controls. Flows are not balanced across the water distribution system: tank/storage elevation changes are not employed in calculating the "Volume from own sources" component and archived flow data is adjusted only when grossly evident data error occurs.	Conditions between 2 and 4	Production meter data is logged automatically in electronic format and reviewed at least on a monthly basis with necessary corrections implemented. "Volume from own sources" tabulations include estimate of daily changes in tanks/storage facilities. Meter data is adjusted when gross data errors occur, or occasional meter testing deems this necessary.	Conditions between 4 and 6	Hourly production meter data logged automatically & reviewed on at least a weekly basis. Data is adjusted to correct gross error when meter/instrumentation equipment malfunction is detected; and/or error is confirmed by meter accuracy testing. Tank/storage facility elevation changes are automatically used in calculating a balanced "Volume from own sources" component, and data gaps in the archived data are corrected on at least a weekly basis.	Conditions between 6 and 8	Continuous production meter data is logged automatically & reviewed each business day. Data is adjusted to correct gross error from detected meter/instrumentation equipment malfunction and/or results of meter accuracy testing. Tank/storage facility elevation changes are automatically used in "Volume from own sources" tabulations and data gaps in the archived data are corrected on a daily basis.	Conditions between 8 and 10	Computerized system (SCADA or similar) automatically balances flows from all sources and storages; results are reviewed each business day. Tight accountability controls ensure that all data gaps that occur in the archived flow data are quickly detected and corrected. Regular calibrations between SCADA and sources meters ensures minimal data transfer error.
Improvements to attain higher data grading for "Master meter and supply error adjustment" component:	▨	to qualify for 2: Develop a plan to restructure recordkeeping system to capture all flow data; set a procedure to review flow data on a daily basis to detect input errors. Obtain more reliable information about existing meters by conducting field inspections of meters and related instrumentation, and obtaining manufacturer literature.	to qualify for 4: Install automatic datalogging equipment on production meters. Complete installation of level instrumentation at all tanks/storage facilities and include tank level data in automatic calculation routine in a computerized system. Construct a computerized listing or spreadsheet to archive input volumes, tank/storage volume changes and import/export flows in order to determine the composite "Water Supplied" volume for the distribution system. Set a procedure to review this data on a monthly basis to detect gross anomalies and data gaps.		to qualify for 6: Refine computerized data collection and archive to include hourly production meter data that is reviewed at least on a weekly basis to detect specific data anomalies and gaps. Use daily net storage change to balance flows in calculating "Water Supplied" volume. Necessary corrections to data errors are implemented on a weekly basis.		to qualify for 8: Ensure that all flow data is collected and archived on at least an hourly basis. All data is reviewed and detected errors corrected each business day. Tank/storage levels variations are employed in calculating balanced "Water Supplied" component. Adjust production meter data for gross error and inaccuracy confirmed by testing.		to qualify for 10: Link all production and tank/storage facility elevation change data to a Supervisory Control & Data Acquisition (SCADA) System, or similar computerized monitoring/control system, and establish automatic flow balancing algorithm and regularly calibrate between SCADA and source meters. Data is reviewed and corrected each business day.		to maintain 10: Monitor meter innovations for development of more accurate and less expensive flowmeters. Continue to replace or repair meters as they perform outside of desired accuracy limits. Stay abreast of new and more accurate water level instruments to better record tank/storage levels and archive the variations in storage volume. Keep current with SCADA and data management systems to ensure that archived data is well-managed and error free.
Water Imported:	Select n/a if the water utility's supply is exclusively from its own water resources (no bulk purchased/ imported water)	Less than 25% of imported water sources are metered, remaining sources are estimated. No regular meter accuracy testing.	25% - 50% of imported water sources are metered; other sources estimated. No regular meter accuracy testing.	Conditions between 2 and 4	50% - 75% of imported water sources are metered, other sources estimated. Occasional meter accuracy testing conducted.	Conditions between 4 and 6	At least 75% of imported water sources are metered, meter accuracy testing and/or electronic calibration of related instrumentation is conducted annually for all meter installations. Less than 25% of tested meters are found outside of +/- 6% accuracy.	Conditions between 6 and 8	100% of imported water sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted annually, less than 10% of meters are found outside of +/- 6% accuracy	Conditions between 8 and 10	100% of imported water sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually for all meter installations, with less than 10% of accuracy tests found outside of +/- 3% accuracy.

AWWA Free Water Audit Software v5.0 Grading Matrix 1



Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Improvements to attain higher data grading for "Water Imported Volume" component: *(Note: usually the water supplier selling the water - "the Exporter" - to the utility being audited is responsible to maintain the metering installation measuring the imported volume. The utility should coordinate carefully with the Exporter to ensure that adequate meter upkeep takes place and an accurate measure of the Water Imported volume is quantified.)*		to qualify for 2: Review bulk water purchase agreements with partner suppliers; confirm requirements for use and maintenance of accurate metering. Identify needs for new or replacement meters with goal to meter all imported water sources.	To qualify for 4: Locate all imported water sources on maps and in the field, launch meter accuracy testing for existing meters, begin to install meters on unmetered imported water interconnections and replace obsolete/defective meters.		to qualify for 6: Formalize annual meter accuracy testing for all imported water meters, planning for both regular meter accuracy testing and calibration of the related instrumentation. Continue installation of meters on unmetered imported water interconnections and replacement of obsolete/defective meters.		to qualify for 8: Complete project to install new, or replace defective, meters on all imported water interconnections. Maintain annual meter accuracy testing for all imported water meters and conduct calibration of related instrumentation at least annually. Repair or replace meters outside of +/- 6% accuracy.		to qualify for 10: Conduct meter accuracy testing for all meters on a semi-annual basis, along with calibration of all related instrumentation. Repair or replace meters outside of +/- 3% accuracy. Investigate new meter technology; pilot one or more replacements with innovative meters in attempt to improve meter accuracy.		to maintain 10: Standardize meter accuracy test frequency to semi-annual, or more frequent, for all meters. Continue to conduct calibration of related instrumentation on a semi-annual basis. Repair or replace meters outside of +/- 3% accuracy. Continually investigate/pilot improving metering technology.
Water imported master meter and supply error adjustment:	Select n/a if the imported water supply is unmetered, with imported water quantities estimated on the billing invoices sent by the Exporter to the purchasing Utility.	Inventory information on imported meters and paper records of measured volumes exist but are incomplete and/or in a very crude condition; data error cannot be determined. Written agreement(s) with water Exporter(s) are missing or written in vague language concerning meter management and testing.	No automatic datalogging of imported supply volumes; daily readings are scribed on paper records without any accountability controls to confirm data accuracy and the absence of errors and data gaps in recorded volumes. Written agreement requires meter accuracy testing but is vague on the details of how and who conducts the testing.	Conditions between 2 and 4	Imported supply metered flow data is logged automatically in electronic format and reviewed at least on a monthly basis by the Exporter with necessary corrections implemented. Meter data is adjusted by the Exporter when gross data errors are detected. A coherent data trail exists for this process to protect both the selling and the purchasing Utility. Written agreement exists and clearly states requirements and roles for meter accuracy testing and data management.	Conditions between 4 and 6	Hourly Imported supply metered data is logged automatically & reviewed on at least a weekly basis by the Exporter. Data is adjusted to correct gross error when meter/instrumentation equipment malfunction is detected; and to correct for error confirmed by meter accuracy testing. Any data gaps in the archived data are detected and corrected during the weekly review. A coherent data trail exists for this process to protect both the selling and the purchasing Utility.	Conditions between 6 and 8	Continuous Imported supply metered flow data is logged automatically & reviewed each business day by the Importer. Data is adjusted to correct gross error from detected meter/instrumentation equipment malfunction and/or results of meter accuracy testing. Any data errors/gaps are detected and corrected on a daily basis. A data trail exists for the process to protect both the selling and the purchasing Utility.	Conditions between 8 and 10	Computerized system (SCADA or similar) automatically records data which is reviewed each business day by the Exporter. Tight accountability controls ensure that all error/data gaps that occur in the archived flow data are quickly detected and corrected. A reliable data trail exists and contract provisions for meter testing and data management are reviewed by the selling and purchasing Utility at least once every five years.
Improvements to attain higher data grading for "Water imported master meter and supply error adjustment" component:		to qualify for 2: Develop a plan to restructure recordkeeping system to capture all flow data; set a procedure to review flow data on a daily basis to detect input errors. Obtain more reliable information about existing meters by conducting field inspections of meters and related instrumentation, and obtaining manufacturer literature. Review the written agreement between the selling and purchasing Utility.	to qualify for 4 Install automatic datalogging equipment on imported supply meters. Set a procedure to review this data on a monthly basis to detect gross anomalies and data gaps. Launch discussions with the Exporters to jointly review terms of the written agreements regarding meter accuracy testing and data management; revise the terms as necessary.		to qualify for 6: Refine computerized data collection and archive to include hourly imported supply metered flow data that is reviewed at least on a weekly basis to detect specific data anomalies and gaps. Make necessary corrections to errors/data errors on a weekly basis.		to qualify for 8: Ensure that all imported supply metered flow data is collected and archived on at least an hourly basis. All data is reviewed and errors/data gaps are corrected each business day.		to qualify for 10: Conduct accountability checks to confirm that all imported supply metered data is reviewed and corrected each business day by the Exporter. Results of all meter accuracy tests and data corrections should be available for sharing between the Exporter and the purchasing Utility. Establish a schedule for a regular review and updating of the contractual language in the written agreement between the selling and the purchasing Utility, at least every five years.		to maintain 10: Monitor meter innovations for development of more accurate and less expensive flowmeters; work with the Exporter to help identify meter replacement needs. Keep communication lines with Exporters open and maintain productive relations. Keep the written agreement current with clear and explicit language that meets the ongoing needs of all parties.
Water Exported:	Select n/a if the water utility sells no bulk water to neighboring water utilities (no exported water sales)	Less than 25% of exported water sources are metered, remaining sources are estimated. No regular meter accuracy testing.	25% - 50% of exported water sources are metered; other sources estimated. No regular meter accuracy testing.	Conditions between 2 and 4	50% - 75% of exported water sources are metered, other sources estimated. Occasional meter accuracy testing conducted.	Conditions between 4 and 6	At least 75% of exported water sources are metered, meter accuracy testing and/or electronic calibration conducted annually. Less than 25% of tested meters are found outside of +/- 6% accuracy.	Conditions between 6 and 8	100% of exported water sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted annually, less than 10% of meters are found outside of +/- 6% accuracy	Conditions between 8 and 10	100% of exported water sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually for all meter installations, with less than 10% of accuracy tests found outside of +/- 3% accuracy.
Improvements to attain higher data grading for "Water Exported Volume" component: *(Note: usually, if the water utility being audited sells (Exports) water to a neighboring purchasing Utility, it is the responsibility of the utility exporting the water to maintain the metering installation measuring the Exported volume. The utility exporting the water should ensure that adequate meter upkeep takes place and an accurate measure of the Water Exported volume is quantified.)*		to qualify for 2: Review bulk water sales agreements with purchasing utilities; confirm requirements for use & upkeep of accurate metering. Identify needs to install new, or replace defective meters as needed.	To qualify for 4: Locate all exported water sources on maps and in field, launch meter accuracy testing for existing meters, begin to install meters on unmetered exported water interconnections and replace obsolete/defective meters		to qualify for 6: Formalize annual meter accuracy testing for all exported water meters. Continue installation of meters on unmetered exported water interconnections and replacement of obsolete/defective meters.		to qualify for 8: Complete project to install new, or replace defective, meters on all exported water interconnections. Maintain annual meter accuracy testing for all exported water meters. Repair or replace meters outside of +/- 6% accuracy.		to qualify for 10: Maintain annual meter accuracy testing for all meters. Repair or replace meters outside of +/- 3% accuracy. Investigate new meter technology; pilot one or more replacements with innovative meters in attempt to improve meter accuracy.		to maintain 10: Standardize meter accuracy test frequency to semi-annual, or more frequent, for all meters. Repair or replace meters outside of +/- 3% accuracy. Continually investigate/pilot improving metering technology.

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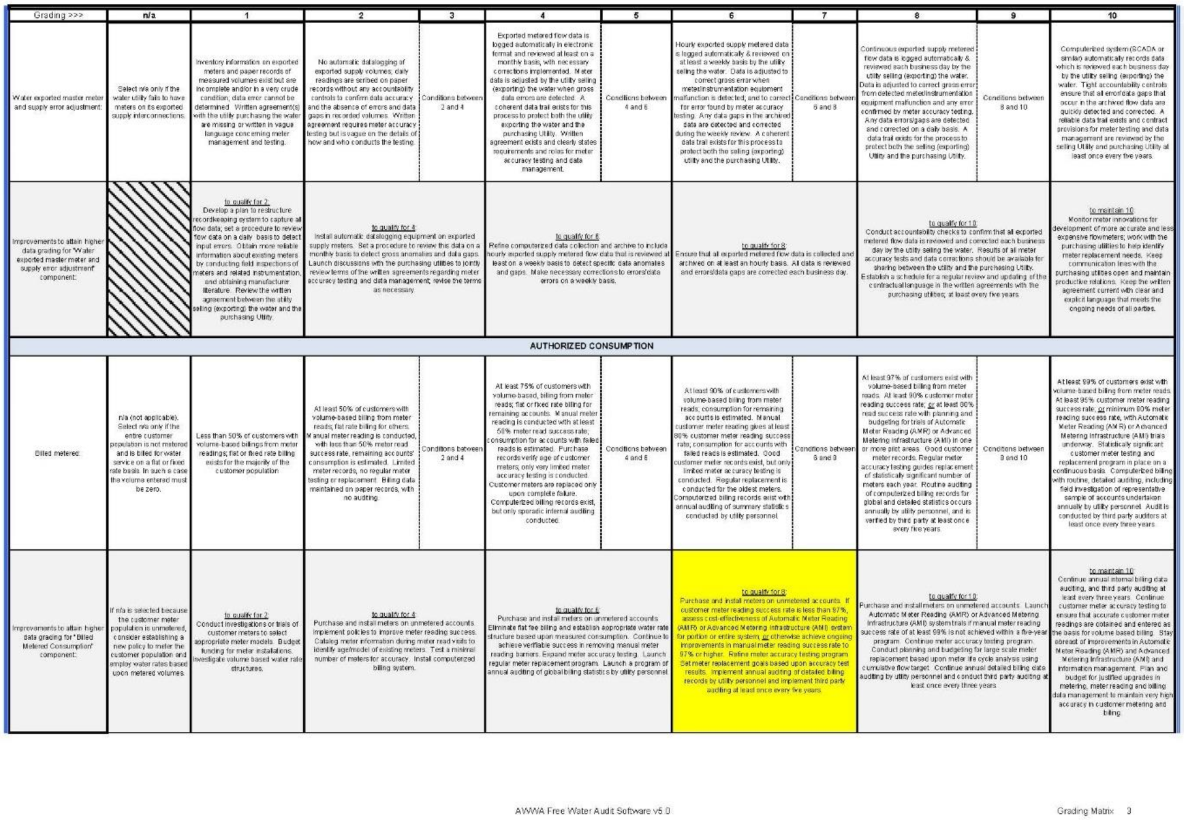
Grading Matrix 2



Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Water exported master meter and supply error adjustment:	Select n/a only if the water utility fails to have meters on its exported supply interconnections.	Inventory information on exported meters and paper records of measured volumes exist but are incomplete and/or in a very crude condition; data error cannot be determined. Written agreement(s) with the utility purchasing the water are missing or written in vague language concerning meter management and testing.	No automatic datalogging of exported supply volumes; daily readings are scribed on paper records without any accountability controls to confirm data accuracy and the absence of errors and data gaps in recorded volumes. Written agreement requires meter accuracy testing but is vague on the details of how and who conducts the testing.	Conditions between 2 and 4	Exported metered flow data is logged automatically in electronic format and reviewed at least on a monthly basis, with necessary corrections implemented. Meter data is adjusted by the utility selling (exporting) the water when gross data errors are detected. A coherent data trail exists for this process to protect both the utility exporting the water and the purchasing Utility. Written agreement exists and clearly states requirements and roles for meter accuracy testing and data management.	Conditions between 4 and 6	Hourly exported supply metered data is logged automatically & reviewed on at least a weekly basis by the utility selling the water. Data is adjusted to correct gross error when meter/instrumentation equipment malfunction is detected; and to correct for error found by meter accuracy testing. Any data gaps in the archived data are detected and corrected during the weekly review. A coherent data trail exists for this process to protect both the selling (exporting) utility and the purchasing Utility.	Conditions between 6 and 8	Continuous exported supply metered flow data is logged automatically & reviewed each business day by the utility selling (exporting) the water. Data is adjusted to correct gross error from detected meter/instrumentation equipment malfunction and any error confirmed by meter accuracy testing. Any data errors/gaps are detected and corrected on a daily basis. A data trail exists for the process to protect both the selling (exporting) Utility and the purchasing Utility.	Conditions between 8 and 10	Computerized system (SCADA or similar) automatically records data which is reviewed each business day by the utility selling (exporting) the water. Tight accountability controls ensure that all error/data gaps that occur in the archived flow data are quickly detected and corrected. A reliable data trail exists and contract provisions for meter testing and data management are reviewed by the selling Utility and purchasing Utility at least once every five years.
Improvements to attain higher data grading for "Water exported master meter and supply error adjustment" component:	▨	to qualify for 2: Develop a plan to restructure recordkeeping system to capture all flow data; set a procedure to review flow data on a daily basis to detect input errors. Obtain more reliable information about existing meters by conducting field inspections of meters and related instrumentation, and obtaining manufacturer literature. Review the written agreement between the utility selling (exporting) the water and the purchasing Utility.	to qualify for 4: Install automatic datalogging equipment on exported supply meters. Set a procedure to review this data on a monthly basis to detect gross anomalies and data gaps. Launch discussions with the purchasing utilities to jointly review terms of the written agreements regarding meter accuracy testing and data management; revise the terms as necessary.		to qualify for 6: Refine computerized data collection and archive to include hourly exported supply metered flow data that is reviewed at least on a weekly basis to detect specific data anomalies and gaps. Make necessary corrections to errors/data errors on a weekly basis.		to qualify for 8: Ensure that all exported metered flow data is collected and archived on at least an hourly basis. All data is reviewed and errors/data gaps are corrected each business day.		to qualify for 10: Conduct accountability checks to confirm that all exported metered flow data is reviewed and corrected each business day by the utility selling the water. Results of all meter accuracy tests and data corrections should be available for sharing between the utility and the purchasing Utility. Establish a schedule for a regular review and updating of the contractual language in the written agreements with the purchasing utilities; at least every five years.		to maintain 10: Monitor meter innovations for development of more accurate and less expensive flowmeters; work with the purchasing utilities to help identify meter replacement needs. Keep communication lines with the purchasing utilities open and maintain productive relations. Keep the written agreement current with clear and explicit language that meets the ongoing needs of all parties.
AUTHORIZED CONSUMPTION											
Billed metered:	n/a (not applicable). Select n/a only if the entire customer population is not metered and is billed for water service on a flat or fixed rate basis. In such a case the volume entered must be zero.	Less than 50% of customers with volume-based billings from meter readings; flat or fixed rate billing exists for the majority of the customer population	At least 50% of customers with volume-based billing from meter reads; flat rate billing for others. Manual meter reading is conducted, with less than 50% meter read success rate, remaining accounts' consumption is estimated. Limited meter records, no regular meter testing or replacement. Billing data maintained on paper records, with no auditing.	Conditions between 2 and 4	At least 75% of customers with volume-based, billing from meter reads; flat or fixed rate billing for remaining accounts. Manual meter reading is conducted with at least 50% meter read success rate; consumption for accounts with failed reads is estimated. Purchase records verify age of customer meters; only very limited meter accuracy testing is conducted. Customer meters are replaced only upon complete failure. Computerized billing records exist, but only sporadic internal auditing conducted.	Conditions between 4 and 6	At least 90% of customers with volume-based billing from meter reads; consumption for remaining accounts is estimated. Manual customer meter reading gives at least 80% customer meter reading success rate; consumption for accounts with failed reads is estimated. Good customer meter records exist, but only limited meter accuracy testing is conducted. Regular replacement is conducted for the oldest meters. Computerized billing records exist with annual auditing of summary statistics conducted by utility personnel.	Conditions between 6 and 8	At least 97% of customers exist with volume-based billing from meter reads. At least 90% customer meter reading success rate; or at least 80% read success rate with planning and budgeting for trials of Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) in one or more pilot areas. Good customer meter records. Regular meter accuracy testing guides replacement of statistically significant number of meters each year. Routine auditing of computerized billing records for global and detailed statistics occurs annually by utility personnel, and is verified by third party at least once every five years.	Conditions between 8 and 10	At least 99% of customers exist with volume-based billing from meter reads. At least 95% customer meter reading success rate; or minimum 80% meter reading success rate, with Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) trials underway. Statistically significant customer meter testing and replacement program in place on a continuous basis. Computerized billing with routine, detailed auditing, including field investigation of representative sample of accounts undertaken annually by utility personnel. Audit is conducted by third party auditors at least once every three years.
Improvements to attain higher data grading for "Billed Metered Consumption" component:	If n/a is selected because the customer meter population is unmetered, consider establishing a new policy to meter the customer population and employ water rates based upon metered volumes.	to qualify for 2: Conduct investigations or trials of customer meters to select appropriate meter models. Budget funding for meter installations. Investigate volume based water rate structures.	to qualify for 4: Purchase and install meters on unmetered accounts. Implement policies to improve meter reading success. Catalog meter information during meter read visits to identify age/model of existing meters. Test a minimal number of meters for accuracy. Install computerized billing system.		to qualify for 6: Purchase and install meters on unmetered accounts. Eliminate flat fee billing and establish appropriate water rate structure based upon measured consumption. Continue to achieve verifiable success in removing manual meter reading barriers. Expand meter accuracy testing. Launch regular meter replacement program. Launch a program of annual auditing of global billing statistics by utility personnel.		to qualify for 8: Purchase and install meters on unmetered accounts. If customer meter reading success rate is less than 97%, assess cost-effectiveness of Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) system for portion or entire system; or otherwise achieve ongoing improvements in manual meter reading success rate to 97% or higher. Refine meter accuracy testing program. Set meter replacement goals based upon accuracy test results. Implement annual auditing of detailed billing records by utility personnel and implement third party auditing at least once every five years.		to qualify for 10: Purchase and install meters on unmetered accounts. Launch Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) system trials if manual meter reading success rate of at least 99% is not achieved within a five-year program. Continue meter accuracy testing program. Conduct planning and budgeting for large scale meter replacement based upon meter life cycle analysis using cumulative flow target. Continue annual detailed billing data auditing by utility personnel and conduct third party auditing at least once every three years.		to maintain 10: Continue annual internal billing data auditing, and third party auditing at least every three years. Continue customer meter accuracy testing to ensure that accurate customer meter readings are obtained and entered as the basis for volume based billing. Stay abreast of improvements in Automatic Meter Reading (AMR) and Advanced Metering Infrastructure (AMI) and information management. Plan and budget for justified upgrades in metering, meter reading and billing data management to maintain very high accuracy in customer metering and billing.

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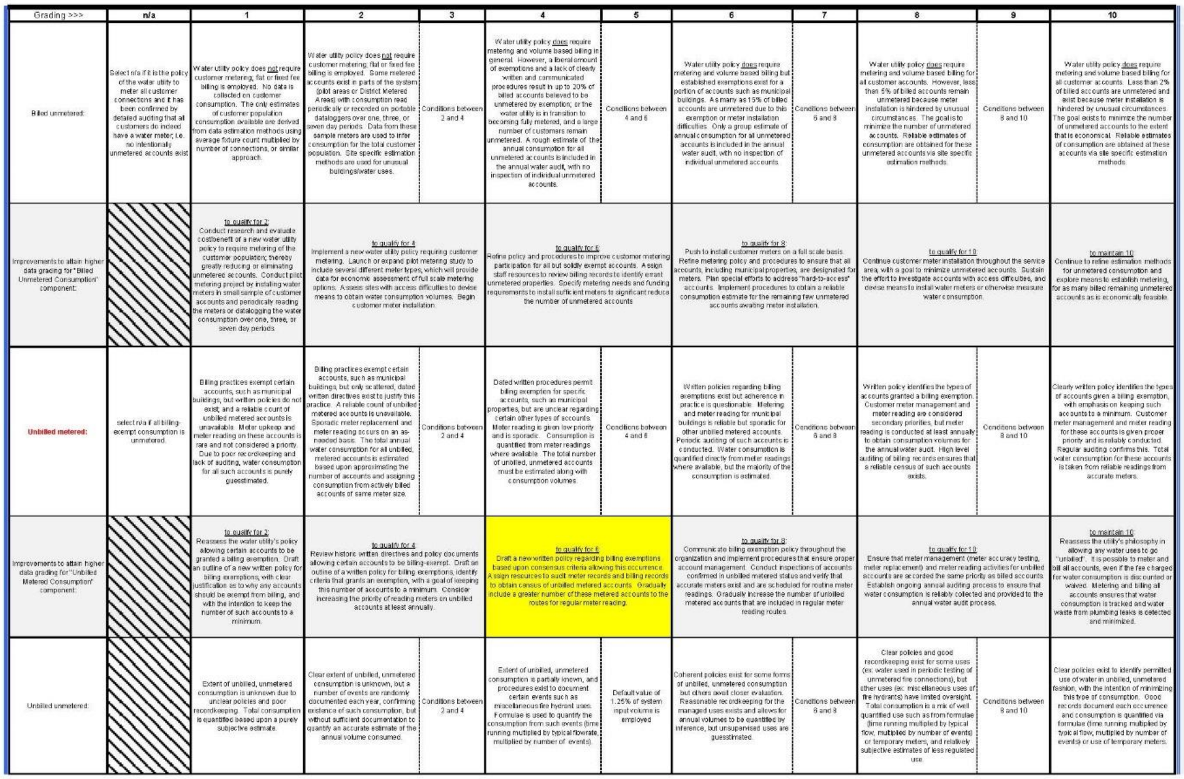
Grading Matrix 3



Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Billed unmetered:	Select n/a if it is the policy of the water utility to meter all customer connections and it has been confirmed by detailed auditing that all customers do indeed have a water meter; i.e. no intentionally unmetered accounts exist	Water utility policy does not require customer metering; flat or fixed fee billing is employed. No data is collected on customer consumption. The only estimates of customer population consumption available are derived from data estimation methods using average fixture count multiplied by number of connections, or similar approach.	Water utility policy does not require customer metering; flat or fixed fee billing is employed. Some metered accounts exist in parts of the system (pilot areas or District Metered Areas) with consumption read periodically or recorded on portable dataloggers over one, three, or seven day periods. Data from these sample meters are used to infer consumption for the total customer population. Site specific estimation methods are used for unusual buildings/water uses.	Conditions between 2 and 4	Water utility policy does require metering and volume based billing in general. However, a liberal amount of exemptions and a lack of clearly written and communicated procedures result in up to 20% of billed accounts believed to be unmetered by exemption; or the water utility is in transition to becoming fully metered, and a large number of customers remain unmetered. A rough estimate of the annual consumption for all unmetered accounts is included in the annual water audit, with no inspection of individual unmetered accounts.	Conditions between 4 and 6	Water utility policy does require metering and volume based billing but established exemptions exist for a portion of accounts such as municipal buildings. As many as 15% of billed accounts are unmetered due to this exemption or meter installation difficulties. Only a group estimate of annual consumption for all unmetered accounts is included in the annual water audit, with no inspection of individual unmetered accounts.	Conditions between 6 and 8	Water utility policy does require metering and volume based billing for all customer accounts. However, less than 5% of billed accounts remain unmetered because meter installation is hindered by unusual circumstances. The goal is to minimize the number of unmetered accounts. Reliable estimates of consumption are obtained for these unmetered accounts via site specific estimation methods.	Conditions between 8 and 10	Water utility policy does require metering and volume based billing for all customer accounts. Less than 2% of billed accounts are unmetered and exist because meter installation is hindered by unusual circumstances. The goal exists to minimize the number of unmetered accounts to the extent that is economical. Reliable estimates of consumption are obtained at these accounts via site specific estimation methods.
Improvements to attain higher data grading for "Billed Unmetered Consumption" component:	▨	to qualify for 2: Conduct research and evaluate cost/benefit of a new water utility policy to require metering of the customer population; thereby greatly reducing or eliminating unmetered accounts. Conduct pilot metering project by installing water meters in small sample of customer accounts and periodically reading the meters or datalogging the water consumption over one, three, or seven day periods.	to qualify for 4: Implement a new water utility policy requiring customer metering. Launch or expand pilot metering study to include several different meter types, which will provide data for economic assessment of full scale metering options. Assess sites with access difficulties to devise means to obtain water consumption volumes. Begin customer meter installation.		to qualify for 6: Refine policy and procedures to improve customer metering participation for all but solidly exempt accounts. Assign staff resources to review billing records to identify errant unmetered properties. Specify metering needs and funding requirements to install sufficient meters to significant reduce the number of unmetered accounts		to qualify for 8: Push to install customer meters on a full scale basis. Refine metering policy and procedures to ensure that all accounts, including municipal properties, are designated for meters. Plan special efforts to address "hard-to-access" accounts. Implement procedures to obtain a reliable consumption estimate for the remaining few unmetered accounts awaiting meter installation.		to qualify for 10: Continue customer meter installation throughout the service area, with a goal to minimize unmetered accounts. Sustain the effort to investigate accounts with access difficulties, and devise means to install water meters or otherwise measure water consumption.		to maintain 10: Continue to refine estimation methods for unmetered consumption and explore means to establish metering, for as many billed remaining unmetered accounts as is economically feasible.
Unbilled metered:	select n/a if all billing-exempt consumption is unmetered.	Billing practices exempt certain accounts, such as municipal buildings, but written policies do not exist; and a reliable count of unbilled metered accounts is unavailable. Meter upkeep and meter reading on these accounts is rare and not considered a priority. Due to poor recordkeeping and lack of auditing, water consumption for all such accounts is purely guesstimated.	Billing practices exempt certain accounts, such as municipal buildings, but only scattered, dated written directives exist to justify this practice. A reliable count of unbilled metered accounts is unavailable. Sporadic meter replacement and meter reading occurs on an as-needed basis. The total annual water consumption for all unbilled, metered accounts is estimated based upon approximating the number of accounts and assigning consumption from actively billed accounts of same meter size.	Conditions between 2 and 4	Dated written procedures permit billing exemption for specific accounts, such as municipal properties, but are unclear regarding certain other types of accounts. Meter reading is given low priority and is sporadic. Consumption is quantified from meter readings where available. The total number of unbilled, unmetered accounts must be estimated along with consumption volumes.	Conditions between 4 and 6	Written policies regarding billing exemptions exist but adherence in practice is questionable. Metering and meter reading for municipal buildings is reliable but sporadic for other unbilled metered accounts. Periodic auditing of such accounts is conducted. Water consumption is quantified directly from meter readings where available, but the majority of the consumption is estimated.	Conditions between 6 and 8	Written policy identifies the types of accounts granted a billing exemption. Customer meter management and meter reading are considered secondary priorities, but meter reading is conducted at least annually to obtain consumption volumes for the annual water audit. High level auditing of billing records ensures that a reliable census of such accounts exists.	Conditions between 8 and 10	Clearly written policy identifies the types of accounts given a billing exemption, with emphasis on keeping such accounts to a minimum. Customer meter management and meter reading for these accounts is given proper priority and is reliably conducted. Regular auditing confirms this. Total water consumption for these accounts is taken from reliable readings from accurate meters.
Improvements to attain higher data grading for "Unbilled Metered Consumption" component:	▨	to qualify for 2: Reassess the water utility's policy allowing certain accounts to be granted a billing exemption. Draft an outline of a new written policy for billing exemptions, with clear justification as to why any accounts should be exempt from billing, and with the intention to keep the number of such accounts to a minimum.	to qualify for 4: Review historic written directives and policy documents allowing certain accounts to be billing-exempt. Draft an outline of a written policy for billing exemptions, identify criteria that grants an exemption, with a goal of keeping this number of accounts to a minimum. Consider increasing the priority of reading meters on unbilled accounts at least annually.		to qualify for 6: Draft a new written policy regarding billing exemptions based upon consensus criteria allowing this occurrence. Assign resources to audit meter records and billing records to obtain census of unbilled metered accounts. Gradually include a greater number of these metered accounts to the routes for regular meter reading.		to qualify for 8: Communicate billing exemption policy throughout the organization and implement procedures that ensure proper account management. Conduct inspections of accounts confirmed in unbilled metered status and verify that accurate meters exist and are scheduled for routine meter readings. Gradually increase the number of unbilled metered accounts that are included in regular meter reading routes.		to qualify for 10: Ensure that meter management (meter accuracy testing, meter replacement) and meter reading activities for unbilled accounts are accorded the same priority as billed accounts. Establish ongoing annual auditing process to ensure that water consumption is reliably collected and provided to the annual water audit process.		to maintain 10: Reassess the utility's philosophy in allowing any water uses to go "unbilled". It is possible to meter and bill all accounts, even if the fee charged for water consumption is discounted or waived. Metering and billing all accounts ensures that water consumption is tracked and water waste from plumbing leaks is detected and minimized.
Unbilled unmetered:	▨	Extent of unbilled, unmetered consumption is unknown due to unclear policies and poor recordkeeping. Total consumption is quantified based upon a purely subjective estimate.	Clear extent of unbilled, unmetered consumption is unknown, but a number of events are randomly documented each year, confirming existence of such consumption, but without sufficient documentation to quantify an accurate estimate of the annual volume consumed.	Conditions between 2 and 4	Extent of unbilled, unmetered consumption is partially known, and procedures exist to document certain events such as miscellaneous fire hydrant uses. Formulae is used to quantify the consumption from such events (time running multiplied by typical flowrate, multiplied by number of events).	Default value of 1.25% of system input volume is employed	Coherent policies exist for some forms of unbilled, unmetered consumption but others await closer evaluation. Reasonable recordkeeping for the managed uses exists and allows for annual volumes to be quantified by inference, but unsupervised uses are guesstimated.	Conditions between 6 and 8	Clear policies and good recordkeeping exist for some uses (ex: water used in periodic testing of unmetered fire connections), but other uses (ex: miscellaneous uses of fire hydrants) have limited oversight. Total consumption is a mix of well quantified use such as from formulae (time running multiplied by typical flow, multiplied by number of events) or temporary meters, and relatively subjective estimates of less regulated use.	Conditions between 8 and 10	Clear policies exist to identify permitted use of water in unbilled, unmetered fashion, with the intention of minimizing this type of consumption. Good records document each occurrence and consumption is quantified via formulae (time running multiplied by typical flow, multiplied by number of events) or use of temporary meters.

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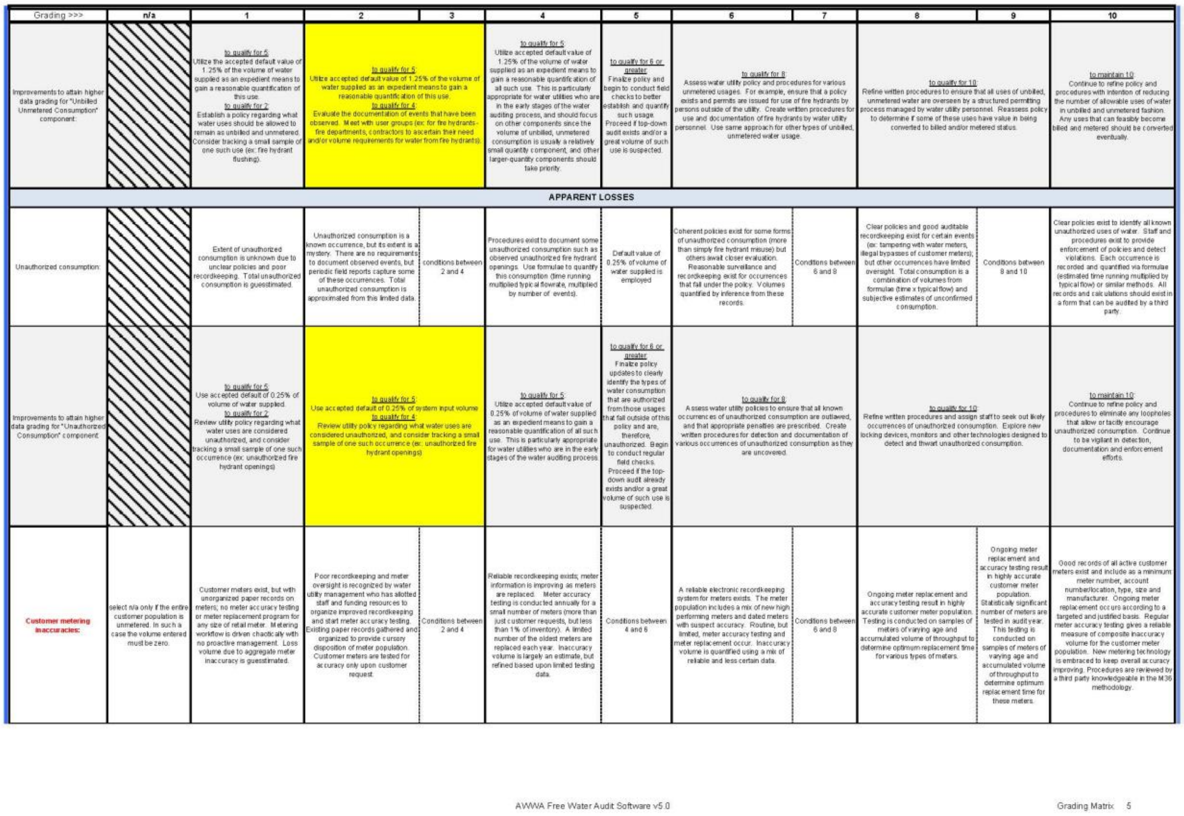
Grading Matrix 4



Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Improvements to attain higher data grading for "Unbilled Unmetered Consumption" component:		to qualify for 5: Utilize the accepted default value of 1.25% of the volume of water supplied as an expedient means to gain a reasonable quantification of this use. to qualify for 2: Establish a policy regarding what water uses should be allowed to remain as unbilled and unmetered. Consider tracking a small sample of one such use (ex: fire hydrant flushing).	to qualify for 5: Utilize accepted default value of 1.25% of the volume of water supplied as an expedient means to gain a reasonable quantification of this use. to qualify for 4: Evaluate the documentation of events that have been observed. Meet with user groups (ex: for fire hydrants - fire departments, contractors to ascertain their need and/or volume requirements for water from fire hydrants).		to qualify for 5: Utilize accepted default value of 1.25% of the volume of water supplied as an expedient means to gain a reasonable quantification of all such use. This is particularly appropriate for water utilities who are in the early stages of the water auditing process, and should focus on other components since the volume of unbilled, unmetered consumption is usually a relatively small quantity component, and other larger-quantity components should take priority.	to qualify for 6 or greater: Finalize policy and begin to conduct field checks to better establish and quantify such usage. Proceed if top-down audit exists and/or a great volume of such use is suspected.	to qualify for 8: Assess water utility policy and procedures for various unmetered usages. For example, ensure that a policy exists and permits are issued for use of fire hydrants by persons outside of the utility. Create written procedures for use and documentation of fire hydrants by water utility personnel. Use same approach for other types of unbilled, unmetered water usage.		to qualify for 10: Refine written procedures to ensure that all uses of unbilled, unmetered water are overseen by a structured permitting process managed by water utility personnel. Reassess policy to determine if some of these uses have value in being converted to billed and/or metered status.		to maintain 10: Continue to refine policy and procedures with intention of reducing the number of allowable uses of water in unbilled and unmetered fashion. Any uses that can feasibly become billed and metered should be converted eventually.
APPARENT LOSSES											
Unauthorized consumption:		Extent of unauthorized consumption is unknown due to unclear policies and poor recordkeeping. Total unauthorized consumption is guesstimated.	Unauthorized consumption is a known occurrence, but its extent is a mystery. There are no requirements to document observed events, but periodic field reports capture some of these occurrences. Total unauthorized consumption is approximated from this limited data.	conditions between 2 and 4	Procedures exist to document some unauthorized consumption such as observed unauthorized fire hydrant openings. Use formulae to quantify this consumption (time running multiplied typical flowrate, multiplied by number of events).	Default value of 0.25% of volume of water supplied is employed	Coherent policies exist for some forms of unauthorized consumption (more than simply fire hydrant misuse) but others await closer evaluation. Reasonable surveillance and recordkeeping exist for occurrences that fall under the policy. Volumes quantified by inference from these records.	Conditions between 6 and 8	Clear policies and good auditable recordkeeping exist for certain events (ex: tampering with water meters, illegal bypasses of customer meters); but other occurrences have limited oversight. Total consumption is a combination of volumes from formulae (time x typical flow) and subjective estimates of unconfirmed consumption.	Conditions between 8 and 10	Clear policies exist to identify all known unauthorized uses of water. Staff and procedures exist to provide enforcement of policies and detect violations. Each occurrence is recorded and quantified via formulae (estimated time running multiplied by typical flow) or similar methods. All records and calculations should exist in a form that can be audited by a third party.
Improvements to attain higher data grading for "Unauthorized Consumption" component:		to qualify for 5: Use accepted default of 0.25% of volume of water supplied. to qualify for 2: Review utility policy regarding what water uses are considered unauthorized, and consider tracking a small sample of one such occurrence (ex: unauthorized fire hydrant openings)	to qualify for 5: Use accepted default of 0.25% of system input volume to qualify for 4: Review utility policy regarding what water uses are considered unauthorized, and consider tracking a small sample of one such occurrence (ex: unauthorized fire hydrant openings)		to qualify for 5: Utilize accepted default value of 0.25% of volume of water supplied as an expedient means to gain a reasonable quantification of all such use. This is particularly appropriate for water utilities who are in the early stages of the water auditing process.	to qualify for 6 or greater: Finalize policy updates to clearly identify the types of water consumption that are authorized from those usages that fall outside of this policy and are, therefore, unauthorized. Begin to conduct regular field checks. Proceed if the top-down audit already exists and/or a great volume of such use is suspected.	to qualify for 8: Assess water utility policies to ensure that all known occurrences of unauthorized consumption are outlawed, and that appropriate penalties are prescribed. Create written procedures for detection and documentation of various occurrences of unauthorized consumption as they are uncovered.		to qualify for 10: Refine written procedures and assign staff to seek out likely occurrences of unauthorized consumption. Explore new locking devices, monitors and other technologies designed to detect and thwart unauthorized consumption.		to maintain 10: Continue to refine policy and procedures to eliminate any loopholes that allow or tacitly encourage unauthorized consumption. Continue to be vigilant in detection, documentation and enforcement efforts.
Customer metering inaccuracies:	select n/a only if the entire customer population is unmetered. In such a case the volume entered must be zero.	Customer meters exist, but with unorganized paper records on meters; no meter accuracy testing or meter replacement program for any size of retail meter. Metering workflow is driven chaotically with no proactive management. Loss volume due to aggregate meter inaccuracy is guesstimated.	Poor recordkeeping and meter oversight is recognized by water utility management who has allotted staff and funding resources to organize improved recordkeeping and start meter accuracy testing. Existing paper records gathered and organized to provide cursory disposition of meter population. Customer meters are tested for accuracy only upon customer request.	Conditions between 2 and 4	Reliable recordkeeping exists; meter information is improving as meters are replaced. Meter accuracy testing is conducted annually for a small number of meters (more than just customer requests, but less than 1% of inventory). A limited number of the oldest meters are replaced each year. Inaccuracy volume is largely an estimate, but refined based upon limited testing data.	Conditions between 4 and 6	A reliable electronic recordkeeping system for meters exists. The meter population includes a mix of new high performing meters and dated meters with suspect accuracy. Routine, but limited, meter accuracy testing and meter replacement occur. Inaccuracy volume is quantified using a mix of reliable and less certain data.	Conditions between 6 and 8	Ongoing meter replacement and accuracy testing result in highly accurate customer meter population. Testing is conducted on samples of meters of varying age and accumulated volume of throughput to determine optimum replacement time for various types of meters.	Ongoing meter replacement and accuracy testing result in highly accurate customer meter population. Statistically significant number of meters are tested in audit year. This testing is conducted on samples of meters of varying age and accumulated volume of throughput to determine optimum replacement time for these meters.	Good records of all active customer meters exist and include as a minimum: meter number, account number/location, type, size and manufacturer. Ongoing meter replacement occurs according to a targeted and justified basis. Regular meter accuracy testing gives a reliable measure of composite inaccuracy volume for the customer meter population. New metering technology is embraced to keep overall accuracy improving. Procedures are reviewed by a third party knowledgeable in the M36 methodology.

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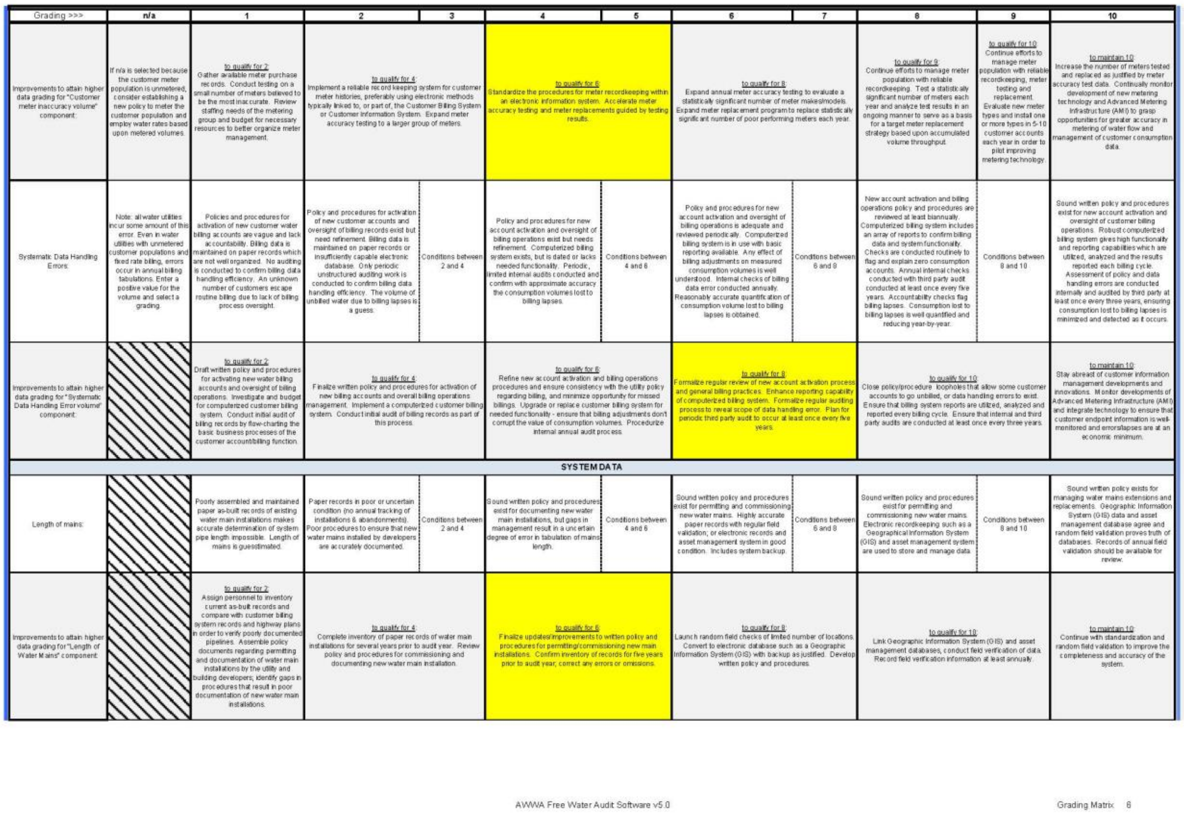
Grading Matrix 5



Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Improvements to attain higher data grading for "Customer meter inaccuracy volume" component:	If n/a is selected because the customer meter population is unmetered, consider establishing a new policy to meter the customer population and employ water rates based upon metered volumes.	to qualify for 2: Gather available meter purchase records. Conduct testing on a small number of meters believed to be the most inaccurate. Review staffing needs of the metering group and budget for necessary resources to better organize meter management.	to qualify for 4: Implement a reliable record keeping system for customer meter histories, preferably using electronic methods typically linked to, or part of, the Customer Billing System or Customer Information System. Expand meter accuracy testing to a larger group of meters.		to qualify for 6: Standardize the procedures for meter recordkeeping within an electronic information system. Accelerate meter accuracy testing and meter replacements guided by testing results.		to qualify for 8: Expand annual meter accuracy testing to evaluate a statistically significant number of meter makes/models. Expand meter replacement program to replace statistically significant number of poor performing meters each year.		to qualify for 9: Continue efforts to manage meter population with reliable recordkeeping. Test a statistically significant number of meters each year and analyze test results in an ongoing manner to serve as a basis for a target meter replacement strategy based upon accumulated volume throughput.	to qualify for 10: Continue efforts to manage meter population with reliable recordkeeping, meter testing and replacement. Evaluate new meter types and install one or more types in 5-10 customer accounts each year in order to pilot improving metering technology.	to maintain 10: Increase the number of meters tested and replaced as justified by meter accuracy test data. Continually monitor development of new metering technology and Advanced Metering Infrastructure (AMI) to grasp opportunities for greater accuracy in metering of water flow and management of customer consumption data.
Systematic Data Handling Errors:	Note: all water utilities incur some amount of this error. Even in water utilities with unmetered customer populations and fixed rate billing, errors occur in annual billing tabulations. Enter a positive value for the volume and select a grading.	Policies and procedures for activation of new customer water billing accounts are vague and lack accountability. Billing data is maintained on paper records which are not well organized. No auditing is conducted to confirm billing data handling efficiency. An unknown number of customers escape routine billing due to lack of billing process oversight.	Policy and procedures for activation of new customer accounts and oversight of billing records exist but need refinement. Billing data is maintained on paper records or insufficiently capable electronic database. Only periodic unstructured auditing work is conducted to confirm billing data handling efficiency. The volume of unbilled water due to billing lapses is a guess.	Conditions between 2 and 4	Policy and procedures for new account activation and oversight of billing operations exist but needs refinement. Computerized billing system exists, but is dated or lacks needed functionality. Periodic, limited internal audits conducted and confirm with approximate accuracy the consumption volumes lost to billing lapses.	Conditions between 4 and 6	Policy and procedures for new account activation and oversight of billing operations is adequate and reviewed periodically. Computerized billing system is in use with basic reporting available. Any effect of billing adjustments on measured consumption volumes is well understood. Internal checks of billing data error conducted annually. Reasonably accurate quantification of consumption volume lost to billing lapses is obtained.	Conditions between 6 and 8	New account activation and billing operations policy and procedures are reviewed at least biannually. Computerized billing system includes an array of reports to confirm billing data and system functionality. Checks are conducted routinely to flag and explain zero consumption accounts. Annual internal checks conducted with third party audit conducted at least once every five years. Accountability checks flag billing lapses. Consumption lost to billing lapses is well quantified and reducing year-by-year.	Conditions between 8 and 10	Sound written policy and procedures exist for new account activation and oversight of customer billing operations. Robust computerized billing system gives high functionality and reporting capabilities which are utilized, analyzed and the results reported each billing cycle. Assessment of policy and data handling errors are conducted internally and audited by third party at least once every three years, ensuring consumption lost to billing lapses is minimized and detected as it occurs.
Improvements to attain higher data grading for "Systematic Data Handling Error volume" component:	▨	to qualify for 2: Draft written policy and procedures for activating new water billing accounts and oversight of billing operations. Investigate and budget for computerized customer billing system. Conduct initial audit of billing records by flow-charting the basic business processes of the customer account/billing function.	to qualify for 4: Finalize written policy and procedures for activation of new billing accounts and overall billing operations management. Implement a computerized customer billing system. Conduct initial audit of billing records as part of this process.		to qualify for 6: Refine new account activation and billing operations procedures and ensure consistency with the utility policy regarding billing, and minimize opportunity for missed billings. Upgrade or replace customer billing system for needed functionality - ensure that billing adjustments don't corrupt the value of consumption volumes. Procedurize internal annual audit process.		to qualify for 8: Formalize regular review of new account activation process and general billing practices. Enhance reporting capability of computerized billing system. Formalize regular auditing process to reveal scope of data handling error. Plan for periodic third party audit to occur at least once every five years.		to qualify for 10: Close policy/procedure loopholes that allow some customer accounts to go unbilled, or data handling errors to exist. Ensure that billing system reports are utilized, analyzed and reported every billing cycle. Ensure that internal and third party audits are conducted at least once every three years.		to maintain 10: Stay abreast of customer information management developments and innovations. Monitor developments of Advanced Metering Infrastructure (AMI) and integrate technology to ensure that customer endpoint information is well-monitored and errors/lapses are at an economic minimum.
SYSTEM DATA											
Length of mains:	▨	Poorly assembled and maintained paper as-built records of existing water main installations makes accurate determination of system pipe length impossible. Length of mains is guesstimated.	Paper records in poor or uncertain condition (no annual tracking of installations & abandonments). Poor procedures to ensure that new water mains installed by developers are accurately documented.	Conditions between 2 and 4	Sound written policy and procedures exist for documenting new water main installations, but gaps in management result in a uncertain degree of error in tabulation of mains length.	Conditions between 4 and 6	Sound written policy and procedures exist for permitting and commissioning new water mains. Highly accurate paper records with regular field validation; or electronic records and asset management system in good condition. Includes system backup.	Conditions between 6 and 8	Sound written policy and procedures exist for permitting and commissioning new water mains. Electronic recordkeeping such as a Geographical Information System (GIS) and asset management system are used to store and manage data.	Conditions between 8 and 10	Sound written policy exists for managing water mains extensions and replacements. Geographic Information System (GIS) data and asset management database agree and random field validation proves truth of databases. Records of annual field validation should be available for review.
Improvements to attain higher data grading for "Length of Water Mains" component:	▨	to qualify for 2: Assign personnel to inventory current as-built records and compare with customer billing system records and highway plans in order to verify poorly documented pipelines. Assemble policy documents regarding permitting and documentation of water main installations by the utility and building developers; identify gaps in procedures that result in poor documentation of new water main installations.	to qualify for 4: Complete inventory of paper records of water main installations for several years prior to audit year. Review policy and procedures for commissioning and documenting new water main installation.		to qualify for 6: Finalize updates/improvements to written policy and procedures for permitting/commissioning new main installations. Confirm inventory of records for five years prior to audit year; correct any errors or omissions.		to qualify for 8: Launch random field checks of limited number of locations. Convert to electronic database such as a Geographic Information System (GIS) with backup as justified. Develop written policy and procedures.		to qualify for 10: Link Geographic Information System (GIS) and asset management databases, conduct field verification of data. Record field verification information at least annually.		to maintain 10: Continue with standardization and random field validation to improve the completeness and accuracy of the system.

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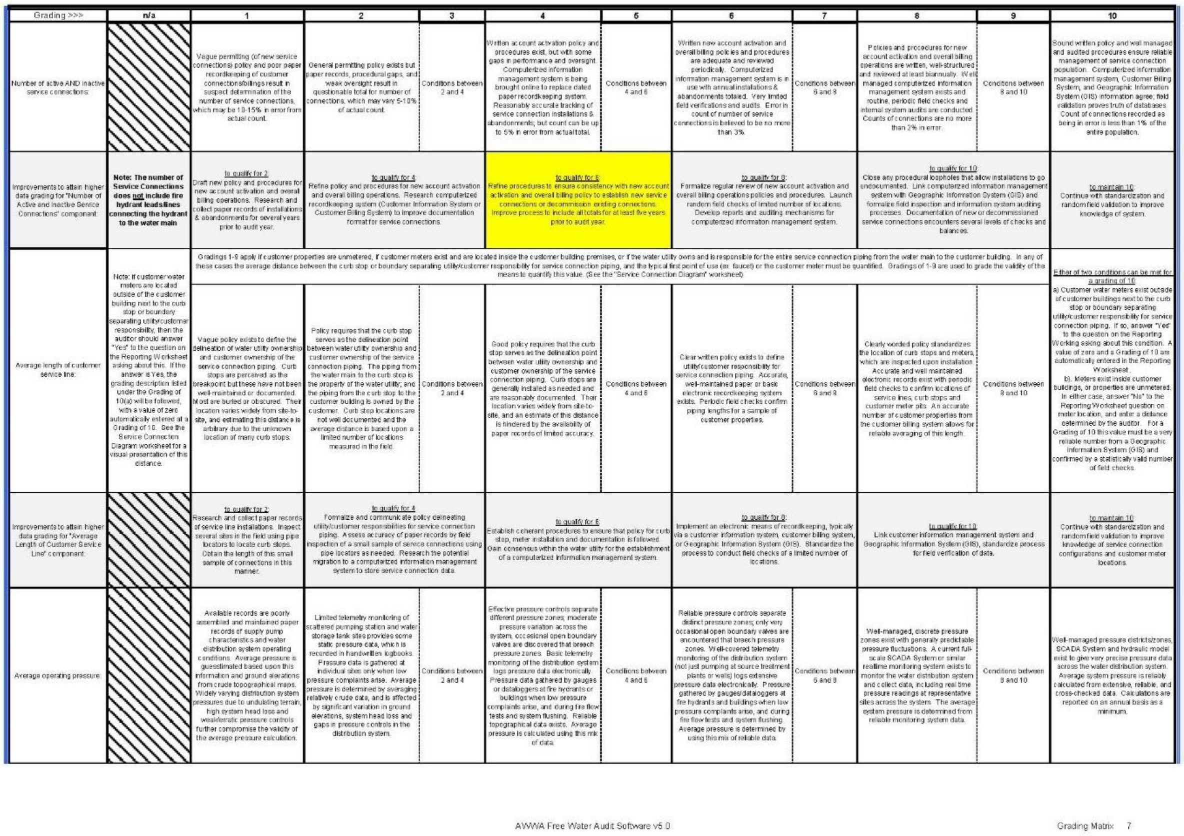
Grading Matrix 6



Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Number of active AND inactive service connections:	▨	Vague permitting (of new service connections) policy and poor paper recordkeeping of customer connections/billings result in suspect determination of the number of service connections, which may be 10-15% in error from actual count.	General permitting policy exists but paper records, procedural gaps, and weak oversight result in questionable total for number of connections, which may vary 5-10% of actual count.	Conditions between 2 and 4	Written account activation policy and procedures exist, but with some gaps in performance and oversight. Computerized information management system is being brought online to replace dated paper recordkeeping system. Reasonably accurate tracking of service connection installations & abandonments; but count can be up to 5% in error from actual total.	Conditions between 4 and 6	Written new account activation and overall billing policies and procedures are adequate and reviewed periodically. Computerized information management system is in use with annual installations & abandonments totaled. Very limited field verifications and audits. Error in count of number of service connections is believed to be no more than 3%.	Conditions between 6 and 8	Policies and procedures for new account activation and overall billing operations are written, well-structured and reviewed at least biannually. Well managed computerized information management system exists and routine, periodic field checks and internal system audits are conducted. Counts of connections are no more than 2% in error.	Conditions between 8 and 10	Sound written policy and well managed and audited procedures ensure reliable management of service connection population. Computerized information management system, Customer Billing System, and Geographic Information System (GIS) information agree; field validation proves truth of databases. Count of connections recorded as being in error is less than 1% of the entire population.
Improvements to attain higher data grading for "Number of Active and Inactive Service Connections" component:	**Note: The number of Service Connections does <u>not</u> include fire hydrant leads/lines connecting the hydrant to the water main**	<u>to qualify for 2</u>: Draft new policy and procedures for new account activation and overall billing operations. Research and collect paper records of installations & abandonments for several years prior to audit year.	<u>to qualify for 4</u>: Refine policy and procedures for new account activation and overall billing operations. Research computerized recordkeeping system (Customer Information System or Customer Billing System) to improve documentation format for service connections.		<u>to qualify for 6</u>: Refine procedures to ensure consistency with new account activation and overall billing policy to establish new service connections or decommission existing connections. Improve process to include all totals for at least five years prior to audit year.		<u>to qualify for 8</u>: Formalize regular review of new account activation and overall billing operations policies and procedures. Launch random field checks of limited number of locations. Develop reports and auditing mechanisms for computerized information management system.		<u>to qualify for 10</u>: Close any procedural loopholes that allow installations to go undocumented. Link computerized information management system with Geographic Information System (GIS) and formalize field inspection and information system auditing processes. Documentation of new or decommissioned service connections encounters several levels of checks and balances.		<u>to maintain 10</u>: Continue with standardization and random field validation to improve knowledge of system.
Average length of customer service line:	Note: If customer water meters are located outside of the customer building next to the curb stop or boundary separating utility/customer responsibility, then the auditor should answer "Yes" to the question on the Reporting Worksheet asking about this. If the answer is Yes, the grading description listed under the Grading of 10(a) will be followed, with a value of zero automatically entered at a Grading of 10. See the Service Connection Diagram worksheet for a visual presentation of this distance.	Gradings 1-9 apply if customer properties are unmetered, if customer meters exist and are located inside the customer building premises, or if the water utility owns and is responsible for the entire service connection piping from the water main to the customer building. In any of these cases the average distance between the curb stop or boundary separating utility/customer responsibility for service connection piping, and the typical first point of use (ex: faucet) or the customer meter must be quantified. Gradings of 1-9 are used to grade the validity of the means to quantify this value. (See the "Service Connection Diagram" worksheet)									<u>Either of two conditions can be met for a grading of 10</u>: a) Customer water meters exist outside of customer buildings next to the curb stop or boundary separating utility/customer responsibility for service connection piping. If so, answer "Yes" to the question on the Reporting Working asking about this condition. A value of zero and a Grading of 10 are automatically entered in the Reporting Worksheet. b). Meters exist inside customer buildings, or properties are unmetered. In either case, answer "No" to the Reporting Worksheet question on meter location, and enter a distance determined by the auditor. For a Grading of 10 this value must be a very reliable number from a Geographic Information System (GIS) and confirmed by a statistically valid number of field checks.
		Vague policy exists to define the delineation of water utility ownership and customer ownership of the service connection piping. Curb stops are perceived as the breakpoint but these have not been well-maintained or documented. Most are buried or obscured. Their location varies widely from site-to-site, and estimating this distance is arbitrary due to the unknown location of many curb stops.	Policy requires that the curb stop serves as the delineation point between water utility ownership and customer ownership of the service connection piping. The piping from the water main to the curb stop is the property of the water utility; and the piping from the curb stop to the customer building is owned by the customer. Curb stop locations are not well documented and the average distance is based upon a limited number of locations measured in the field.	Conditions between 2 and 4	Good policy requires that the curb stop serves as the delineation point between water utility ownership and customer ownership of the service connection piping. Curb stops are generally installed as needed and are reasonably documented. Their location varies widely from site-to-site, and an estimate of this distance is hindered by the availability of paper records of limited accuracy.	Conditions between 4 and 6	Clear written policy exists to define utility/customer responsibility for service connection piping. Accurate, well-maintained paper or basic electronic recordkeeping system exists. Periodic field checks confirm piping lengths for a sample of customer properties.	Conditions between 6 and 8	Clearly worded policy standardizes the location of curb stops and meters, which are inspected upon installation. Accurate and well maintained electronic records exist with periodic field checks to confirm locations of service lines, curb stops and customer meter pits. An accurate number of customer properties from the customer billing system allows for reliable averaging of this length.	Conditions between 8 and 10	
Improvements to attain higher data grading for "Average Length of Customer Service Line" component:	▨	<u>to qualify for 2</u>: Research and collect paper records of service line installations. Inspect several sites in the field using pipe locators to locate curb stops. Obtain the length of this small sample of connections in this manner.	<u>to qualify for 4</u> Formalize and communicate policy delineating utility/customer responsibilities for service connection piping. Assess accuracy of paper records by field inspection of a small sample of service connections using pipe locators as needed. Research the potential migration to a computerized information management system to store service connection data.		<u>to qualify for 6</u>: Establish coherent procedures to ensure that policy for curb stop, meter installation and documentation is followed. Gain consensus within the water utility for the establishment of a computerized information management system.		<u>to qualify for 8</u>: Implement an electronic means of recordkeeping, typically via a customer information system, customer billing system, or Geographic Information System (GIS). Standardize the process to conduct field checks of a limited number of locations.		<u>to qualify for 10</u>: Link customer information management system and Geographic Information System (GIS), standardize process for field verification of data.		<u>to maintain 10</u>: Continue with standardization and random field validation to improve knowledge of service connection configurations and customer meter locations.
Average operating pressure:	▨	Available records are poorly assembled and maintained paper records of supply pump characteristics and water distribution system operating conditions. Average pressure is guesstimated based upon this information and ground elevations from crude topographical maps. Widely varying distribution system pressures due to undulating terrain, high system head loss and weak/erratic pressure controls further compromise the validity of the average pressure calculation.	Limited telemetry monitoring of scattered pumping station and water storage tank sites provides some static pressure data, which is recorded in handwritten logbooks. Pressure data is gathered at individual sites only when low pressure complaints arise. Average pressure is determined by averaging relatively crude data, and is affected by significant variation in ground elevations, system head loss and gaps in pressure controls in the distribution system.	Conditions between 2 and 4	Effective pressure controls separate different pressure zones; moderate pressure variation across the system, occasional open boundary valves are discovered that breech pressure zones. Basic telemetry monitoring of the distribution system logs pressure data electronically. Pressure data gathered by gauges or dataloggers at fire hydrants or buildings when low pressure complaints arise, and during fire flow tests and system flushing. Reliable topographical data exists. Average pressure is calculated using this mix of data.	Conditions between 4 and 6	Reliable pressure controls separate distinct pressure zones; only very occasional open boundary valves are encountered that breech pressure zones. Well-covered telemetry monitoring of the distribution system (not just pumping at source treatment plants or wells) logs extensive pressure data electronically. Pressure gathered by gauges/dataloggers at fire hydrants and buildings when low pressure complaints arise, and during fire flow tests and system flushing. Average pressure is determined by using this mix of reliable data.	Conditions between 6 and 8	Well-managed, discrete pressure zones exist with generally predictable pressure fluctuations. A current full-scale SCADA System or similar realtime monitoring system exists to monitor the water distribution system and collect data, including real time pressure readings at representative sites across the system. The average system pressure is determined from reliable monitoring system data.	Conditions between 8 and 10	Well-managed pressure districts/zones, SCADA System and hydraulic model exist to give very precise pressure data across the water distribution system. Average system pressure is reliably calculated from extensive, reliable, and cross-checked data. Calculations are reported on an annual basis as a minimum.

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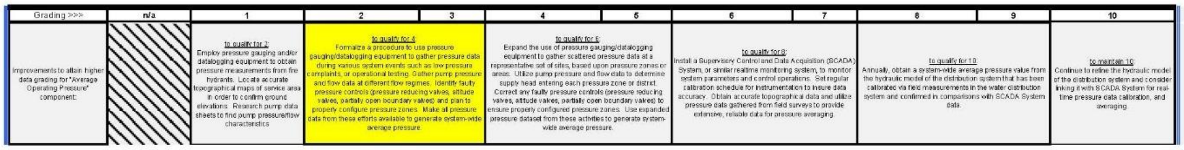
Grading Matrix 7



Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Improvements to attain higher data grading for "Average Operating Pressure" component:	▨	to qualify for 2: Employ pressure gauging and/or datalogging equipment to obtain pressure measurements from fire hydrants. Locate accurate topographical maps of service area in order to confirm ground elevations. Research pump data sheets to find pump pressure/flow characteristics	to qualify for 4: Formalize a procedure to use pressure gauging/datalogging equipment to gather pressure data during various system events such as low pressure complaints, or operational testing. Gather pump pressure and flow data at different flow regimes. Identify faulty pressure controls (pressure reducing valves, altitude valves, partially open boundary valves) and plan to properly configure pressure zones. Make all pressure data from these efforts available to generate system-wide average pressure.		to qualify for 6: Expand the use of pressure gauging/datalogging equipment to gather scattered pressure data at a representative set of sites, based upon pressure zones or areas. Utilize pump pressure and flow data to determine supply head entering each pressure zone or district. Correct any faulty pressure controls (pressure reducing valves, altitude valves, partially open boundary valves) to ensure properly configured pressure zones. Use expanded pressure dataset from these activities to generate system-wide average pressure.		to qualify for 8: Install a Supervisory Control and Data Acquisition (SCADA) System, or similar realtime monitoring system, to monitor system parameters and control operations. Set regular calibration schedule for instrumentation to insure data accuracy. Obtain accurate topographical data and utilize pressure data gathered from field surveys to provide extensive, reliable data for pressure averaging.		to qualify for 10: Annually, obtain a system-wide average pressure value from the hydraulic model of the distribution system that has been calibrated via field measurements in the water distribution system and confirmed in comparisons with SCADA System data.		to maintain 10: Continue to refine the hydraulic model of the distribution system and consider linking it with SCADA System for real-time pressure data calibration, and averaging.

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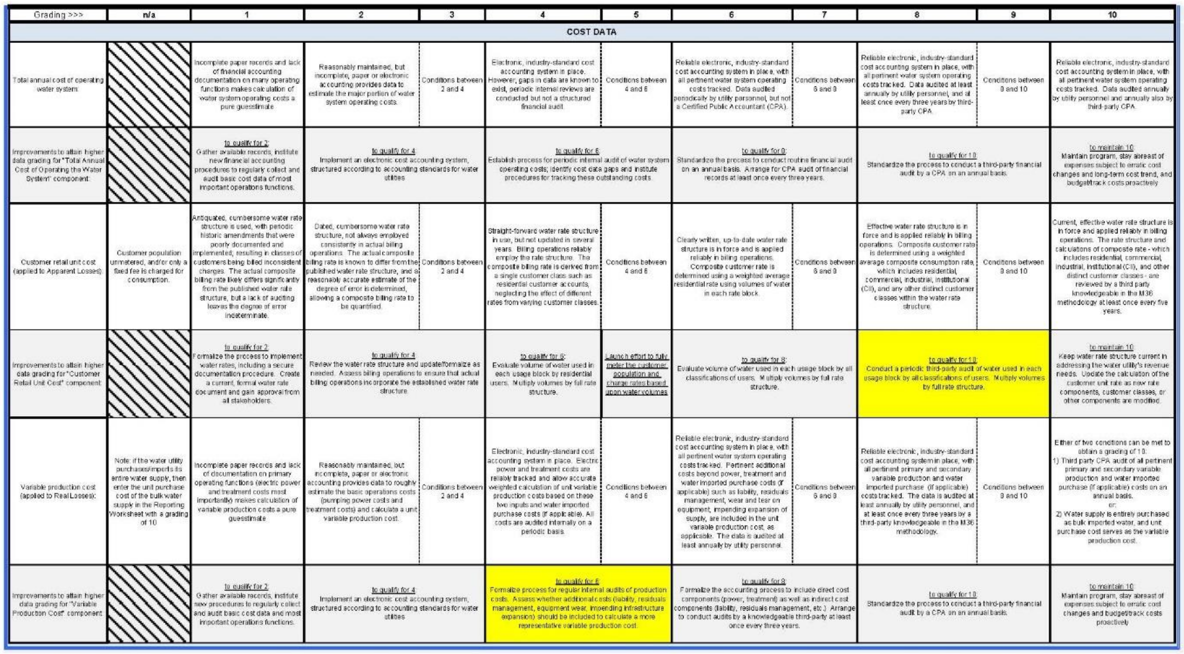
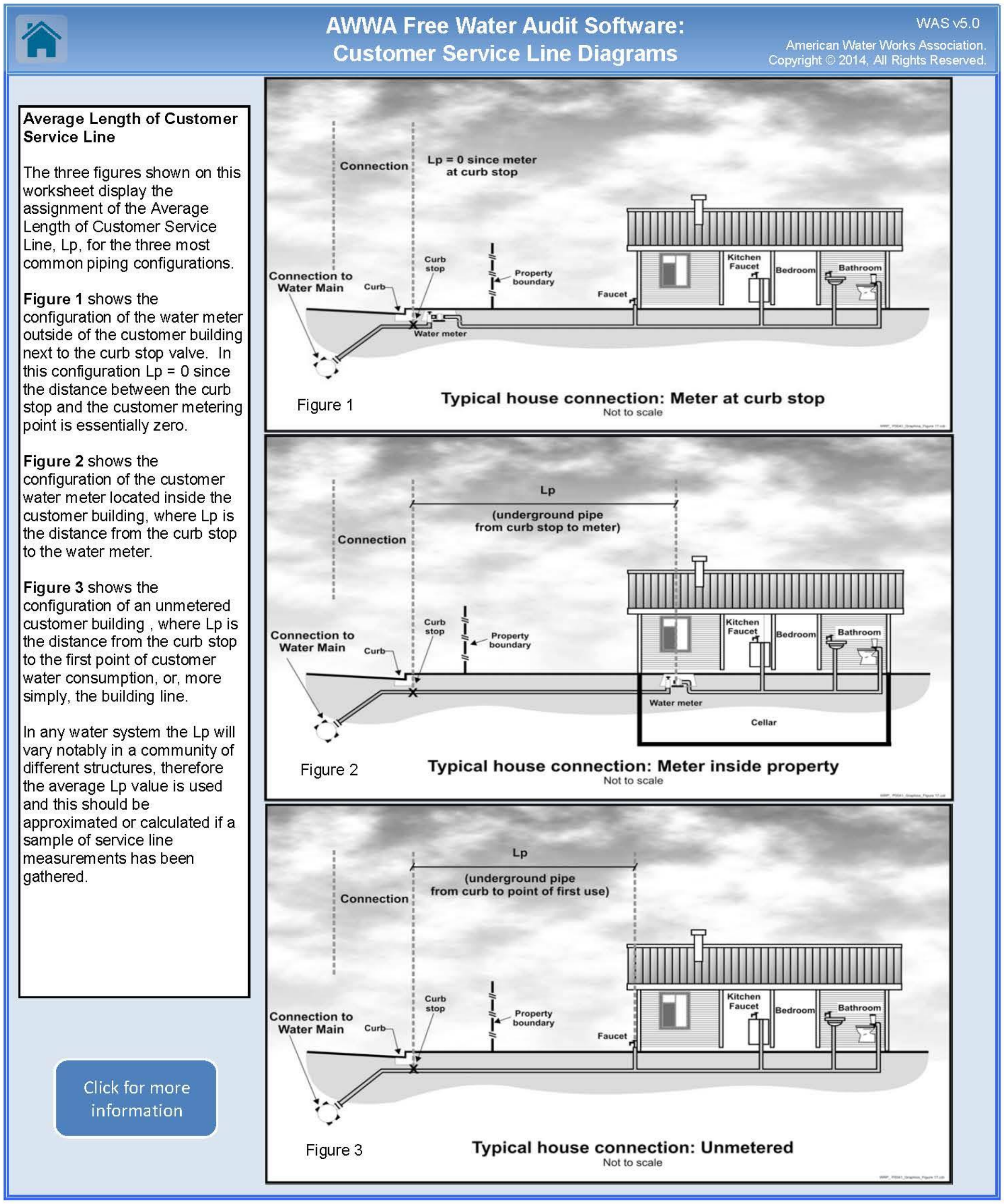
Grading Matrix 9



Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
COST DATA											
Total annual cost of operating water system:	▨	Incomplete paper records and lack of financial accounting documentation on many operating functions makes calculation of water system operating costs a pure guesstimate	Reasonably maintained, but incomplete, paper or electronic accounting provides data to estimate the major portion of water system operating costs.	Conditions between 2 and 4	Electronic, industry-standard cost accounting system in place. However, gaps in data are known to exist, periodic internal reviews are conducted but not a structured financial audit.	Conditions between 4 and 6	Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked. Data audited periodically by utility personnel, but not a Certified Public Accountant (CPA).	Conditions between 6 and 8	Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked. Data audited at least annually by utility personnel, and at least once every three years by third-party CPA.	Conditions between 8 and 10	Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked. Data audited annually by utility personnel and annually also by third-party CPA.
Improvements to attain higher data grading for "Total Annual Cost of Operating the Water System" component:	▨	to qualify for 2: Gather available records, institute new financial accounting procedures to regularly collect and audit basic cost data of most important operations functions.	to qualify for 4: Implement an electronic cost accounting system, structured according to accounting standards for water utilities		to qualify for 6: Establish process for periodic internal audit of water system operating costs; identify cost data gaps and institute procedures for tracking these outstanding costs.		to qualify for 8: Standardize the process to conduct routine financial audit on an annual basis. Arrange for CPA audit of financial records at least once every three years.		to qualify for 10: Standardize the process to conduct a third-party financial audit by a CPA on an annual basis.		to maintain 10: Maintain program, stay abreast of expenses subject to erratic cost changes and long-term cost trend, and budget/track costs proactively
Customer retail unit cost (applied to Apparent Losses):	Customer population unmetered, and/or only a fixed fee is charged for consumption.	Antiquated, cumbersome water rate structure is used, with periodic historic amendments that were poorly documented and implemented; resulting in classes of customers being billed inconsistent charges. The actual composite billing rate likely differs significantly from the published water rate structure, but a lack of auditing leaves the degree of error indeterminate.	Dated, cumbersome water rate structure, not always employed consistently in actual billing operations. The actual composite billing rate is known to differ from the published water rate structure, and a reasonably accurate estimate of the degree of error is determined, allowing a composite billing rate to be quantified.	Conditions between 2 and 4	Straight-forward water rate structure in use, but not updated in several years. Billing operations reliably employ the rate structure. The composite billing rate is derived from a single customer class such as residential customer accounts, neglecting the effect of different rates from varying customer classes.	Conditions between 4 and 6	Clearly written, up-to-date water rate structure is in force and is applied reliably in billing operations. Composite customer rate is determined using a weighted average residential rate using volumes of water in each rate block.	Conditions between 6 and 8	Effective water rate structure is in force and is applied reliably in billing operations. Composite customer rate is determined using a weighted average composite consumption rate, which includes residential, commercial, industrial, institutional (CII), and any other distinct customer classes within the water rate structure.	Conditions between 8 and 10	Current, effective water rate structure is in force and applied reliably in billing operations. The rate structure and calculations of composite rate - which includes residential, commercial, industrial, institutional (CII), and other distinct customer classes - are reviewed by a third party knowledgeable in the M36 methodology at least once every five years.
Improvements to attain higher data grading for "Customer Retail Unit Cost" component:	▨	to qualify for 2: Formalize the process to implement water rates, including a secure documentation procedure. Create a current, formal water rate document and gain approval from all stakeholders.	to qualify for 4: Review the water rate structure and update/formalize as needed. Assess billing operations to ensure that actual billing operations incorporate the established water rate structure.		to qualify for 6: Evaluate volume of water used in each usage block by residential users. Multiply volumes by full rate structure.	Launch effort to fully meter the customer population and charge rates based upon water volumes	to qualify for 8: Evaluate volume of water used in each usage block by all classifications of users. Multiply volumes by full rate structure.		to qualify for 10: Conduct a periodic third-party audit of water used in each usage block by all classifications of users. Multiply volumes by full rate structure.		to maintain 10: Keep water rate structure current in addressing the water utility's revenue needs. Update the calculation of the customer unit rate as new rate components, customer classes, or other components are modified.
Variable production cost (applied to Real Losses):	Note: if the water utility purchases/imports its entire water supply, then enter the unit purchase cost of the bulk water supply in the Reporting Worksheet with a grading of 10	Incomplete paper records and lack of documentation on primary operating functions (electric power and treatment costs most importantly) makes calculation of variable production costs a pure guesstimate	Reasonably maintained, but incomplete, paper or electronic accounting provides data to roughly estimate the basic operations costs (pumping power costs and treatment costs) and calculate a unit variable production cost.	Conditions between 2 and 4	Electronic, industry-standard cost accounting system in place. Electric power and treatment costs are reliably tracked and allow accurate weighted calculation of unit variable production costs based on these two inputs and water imported purchase costs (if applicable). All costs are audited internally on a periodic basis.	Conditions between 4 and 6	Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked. Pertinent additional costs beyond power, treatment and water imported purchase costs (if applicable) such as liability, residuals management, wear and tear on equipment, impending expansion of supply, are included in the unit variable production cost, as applicable. The data is audited at least annually by utility personnel.	Conditions between 6 and 8	Reliable electronic, industry-standard cost accounting system in place, with all pertinent primary and secondary variable production and water imported purchase (if applicable) costs tracked. The data is audited at least annually by utility personnel, and at least once every three years by a third-party knowledgeable in the M36 methodology.	Conditions between 8 and 10	Either of two conditions can be met to obtain a grading of 10: 1) Third party CPA audit of all pertinent primary and secondary variable production and water imported purchase (if applicable) costs on an annual basis. or: 2) Water supply is entirely purchased as bulk imported water, and unit purchase cost serves as the variable production cost.
Improvements to attain higher data grading for "Variable Production Cost" component:	▨	to qualify for 2: Gather available records, institute new procedures to regularly collect and audit basic cost data and most important operations functions.	to qualify for 4: Implement an electronic cost accounting system, structured according to accounting standards for water utilities		to qualify for 6: Formalize process for regular internal audits of production costs. Assess whether additional costs (liability, residuals management, equipment wear, impending infrastructure expansion) should be included to calculate a more representative variable production cost.		to qualify for 8: Formalize the accounting process to include direct cost components (power, treatment) as well as indirect cost components (liability, residuals management, etc.) Arrange to conduct audits by a knowledgeable third-party at least once every three years.		to qualify for 10: Standardize the process to conduct a third-party financial audit by a CPA on an annual basis.		to maintain 10: Maintain program, stay abreast of expenses subject to erratic cost changes and budget/track costs proactively

AWWA Free Water Audit Software v5.0 Grading Matrix 9



AWWA Free Water Audit Software:
Customer Service Line Diagrams

WAS v5.0

Average Length of Customer Service Line

The three figures shown on this worksheet display the assignment of the Average Length of Customer Service Line, Lp, for the three most common piping configurations.

Figure 1 shows the configuration of the water meter outside of the customer building next to the curb stop valve. In this configuration Lp = 0 since the distance between the curb stop and the customer metering point is essentially zero.

Figure 2 shows the configuration of the customer water meter located inside the customer building, where Lp is the distance from the curb stop to the water meter.

Figure 3 shows the configuration of an unmetered customer building , where Lp is the distance from the curb stop to the first point of customer water consumption, or, more simply, the building line.

In any water system the Lp will vary notably in a community of different structures, therefore the average Lp value is used and this should be approximated or calculated if a sample of service line measurements has been gathered.

Click for more information

Figure 1

Typical house connection: Meter at curb stop

Not to scale

Figure 2

Typical house connection: Meter inside property

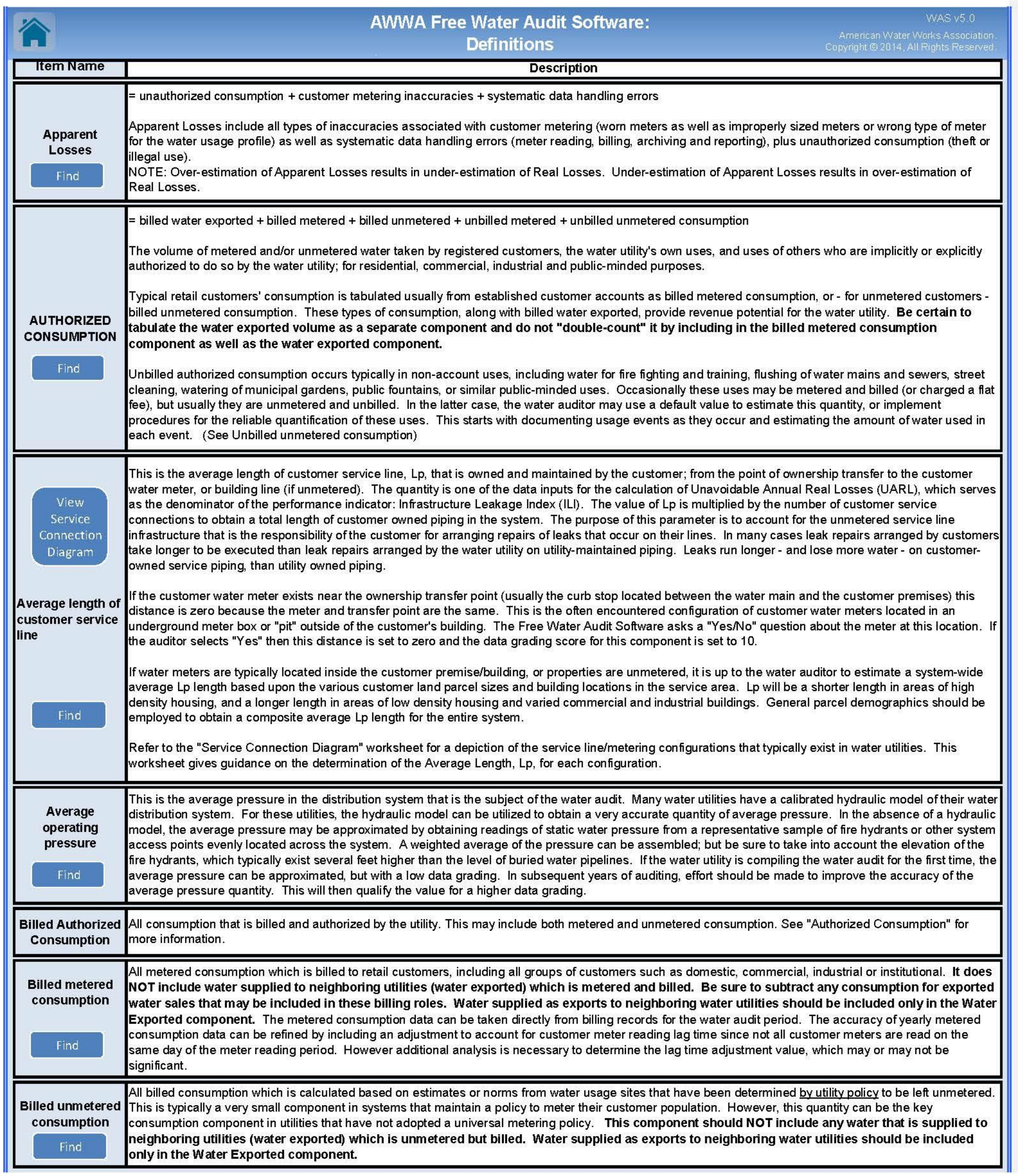
Not to scale

Figure 3

Typical house connection: Unmetered

Not to scale

AWWA Free Water Audit Software v5.0 Service Connection Diagram 1



AWWA Free Water Audit Software: Definitions

American Water Works Association.
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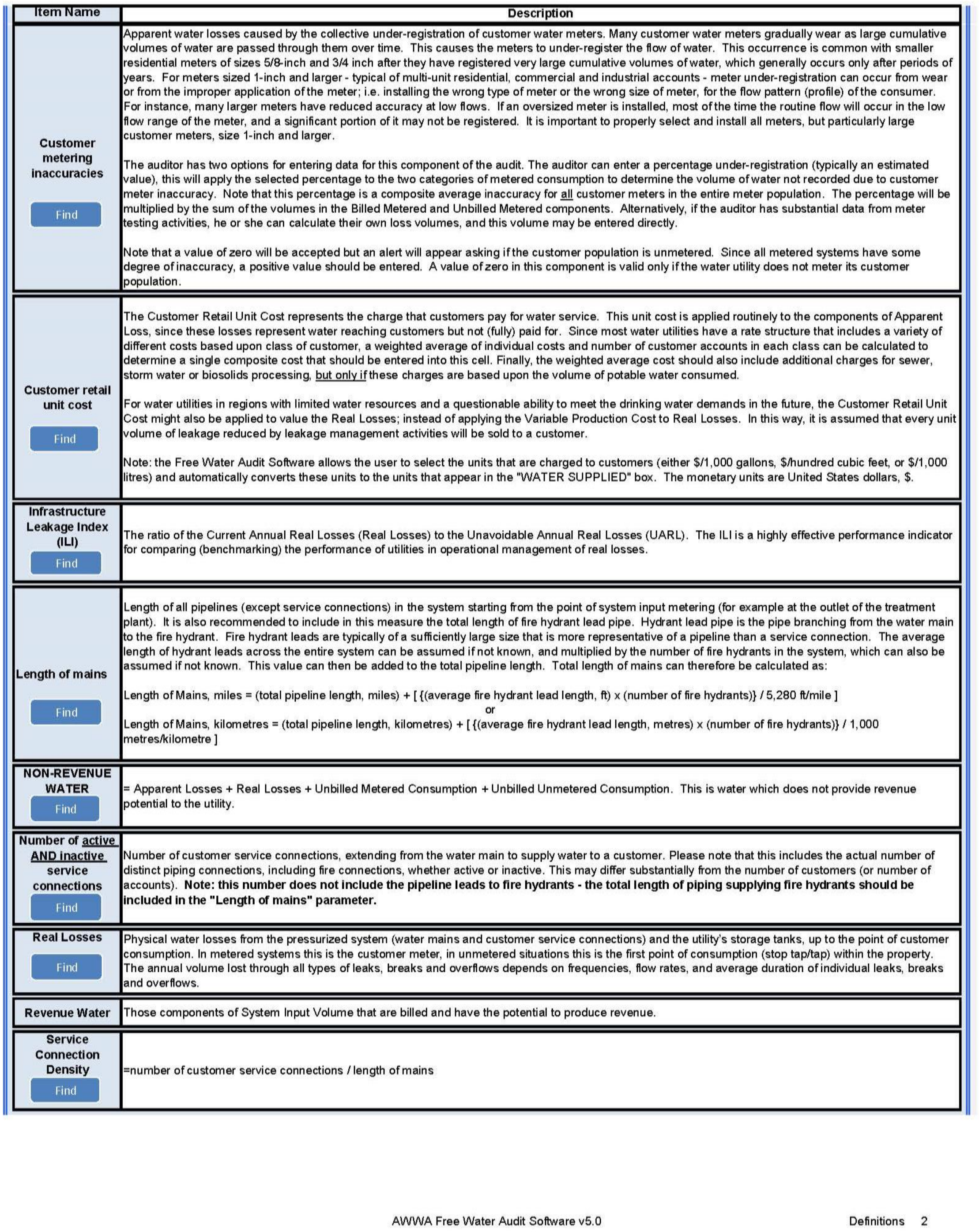
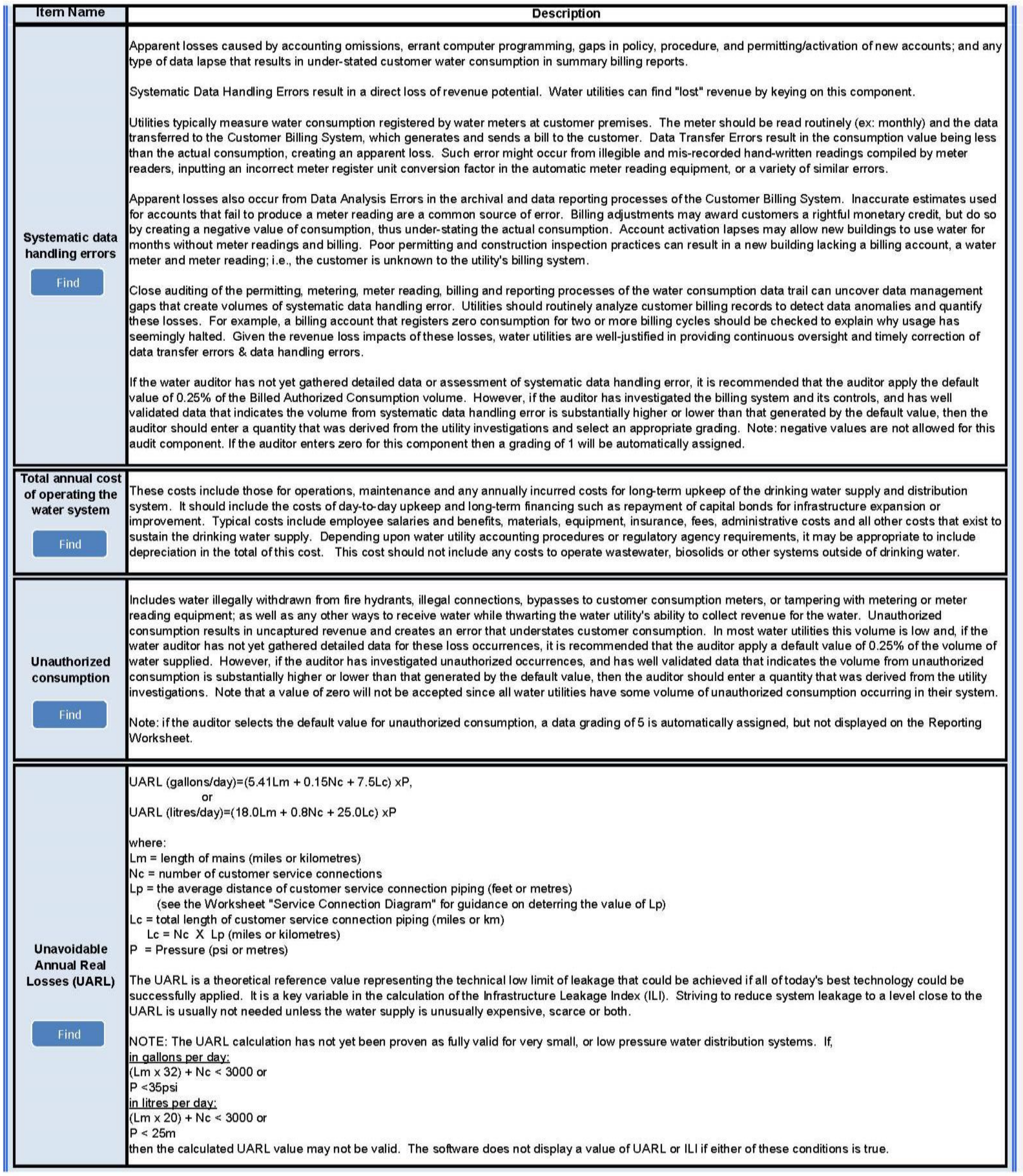
Item Name	Description
Apparent Losses	= unauthorized consumption + customer metering inaccuracies + systematic data handling errors Apparent Losses include all types of inaccuracies associated with customer metering (worn meters as well as improperly sized meters or wrong type of meter for the water usage profile) as well as systematic data handling errors (meter reading, billing, archiving and reporting), plus unauthorized consumption (theft or illegal use). NOTE: Over-estimation of Apparent Losses results in under-estimation of Real Losses. Under-estimation of Apparent Losses results in over-estimation of Real Losses.
AUTHORIZED CONSUMPTION	= billed water exported + billed metered + billed unmetered + unbilled metered + unbilled unmetered consumption The volume of metered and/or unmetered water taken by registered customers, the water utility's own uses, and uses of others who are implicitly or explicitly authorized to do so by the water utility; for residential, commercial, industrial and public-minded purposes. Typical retail customers' consumption is tabulated usually from established customer accounts as billed metered consumption, or - for unmetered customers - billed unmetered consumption. These types of consumption, along with billed water exported, provide revenue potential for the water utility. **Be certain to tabulate the water exported volume as a separate component and do not "double-count" it by including in the billed metered consumption component as well as the water exported component.** Unbilled authorized consumption occurs typically in non-account uses, including water for fire fighting and training, flushing of water mains and sewers, street cleaning, watering of municipal gardens, public fountains, or similar public-minded uses. Occasionally these uses may be metered and billed (or charged a flat fee), but usually they are unmetered and unbilled. In the latter case, the water auditor may use a default value to estimate this quantity, or implement procedures for the reliable quantification of these uses. This starts with documenting usage events as they occur and estimating the amount of water used in each event. (See Unbilled unmetered consumption)
Average length of customer service line	This is the average length of customer service line, Lp, that is owned and maintained by the customer; from the point of ownership transfer to the customer water meter, or building line (if unmetered). The quantity is one of the data inputs for the calculation of Unavoidable Annual Real Losses (UARL), which serves as the denominator of the performance indicator: Infrastructure Leakage Index (ILI). The value of Lp is multiplied by the number of customer service connections to obtain a total length of customer owned piping in the system. The purpose of this parameter is to account for the unmetered service line infrastructure that is the responsibility of the customer for arranging repairs of leaks that occur on their lines. In many cases leak repairs arranged by customers take longer to be executed than leak repairs arranged by the water utility on utility-maintained piping. Leaks run longer - and lose more water - on customer-owned service piping, than utility owned piping. If the customer water meter exists near the ownership transfer point (usually the curb stop located between the water main and the customer premises) this distance is zero because the meter and transfer point are the same. This is the often encountered configuration of customer water meters located in an underground meter box or "pit" outside of the customer's building. The Free Water Audit Software asks a "Yes/No" question about the meter at this location. If the auditor selects "Yes" then this distance is set to zero and the data grading score for this component is set to 10. If water meters are typically located inside the customer premise/building, or properties are unmetered, it is up to the water auditor to estimate a system-wide average Lp length based upon the various customer land parcel sizes and building locations in the service area. Lp will be a shorter length in areas of high density housing, and a longer length in areas of low density housing and varied commercial and industrial buildings. General parcel demographics should be employed to obtain a composite average Lp length for the entire system. Refer to the "Service Connection Diagram" worksheet for a depiction of the service line/metering configurations that typically exist in water utilities. This worksheet gives guidance on the determination of the Average Length, Lp, for each configuration.
Average operating pressure	This is the average pressure in the distribution system that is the subject of the water audit. Many water utilities have a calibrated hydraulic model of their water distribution system. For these utilities, the hydraulic model can be utilized to obtain a very accurate quantity of average pressure. In the absence of a hydraulic model, the average pressure may be approximated by obtaining readings of static water pressure from a representative sample of fire hydrants or other system access points evenly located across the system. A weighted average of the pressure can be assembled; but be sure to take into account the elevation of the fire hydrants, which typically exist several feet higher than the level of buried water pipelines. If the water utility is compiling the water audit for the first time, the average pressure can be approximated, but with a low data grading. In subsequent years of auditing, effort should be made to improve the accuracy of the average pressure quantity. This will then qualify the value for a higher data grading.
Billed Authorized Consumption	All consumption that is billed and authorized by the utility. This may include both metered and unmetered consumption. See "Authorized Consumption" for more information.
Billed metered consumption	All metered consumption which is billed to retail customers, including all groups of customers such as domestic, commercial, industrial or institutional. **It does NOT include water supplied to neighboring utilities (water exported) which is metered and billed. Be sure to subtract any consumption for exported water sales that may be included in these billing roles. Water supplied as exports to neighboring water utilities should be included only in the Water Exported component.** The metered consumption data can be taken directly from billing records for the water audit period. The accuracy of yearly metered consumption data can be refined by including an adjustment to account for customer meter reading lag time since not all customer meters are read on the same day of the meter reading period. However additional analysis is necessary to determine the lag time adjustment value, which may or may not be significant.
Billed unmetered consumption	All billed consumption which is calculated based on estimates or norms from water usage sites that have been determined by utility policy to be left unmetered. This is typically a very small component in systems that maintain a policy to meter their customer population. However, this quantity can be the key consumption component in utilities that have not adopted a universal metering policy. **This component should NOT include any water that is supplied to neighboring utilities (water exported) which is unmetered but billed. Water supplied as exports to neighboring water utilities should be included only in the Water Exported component.**



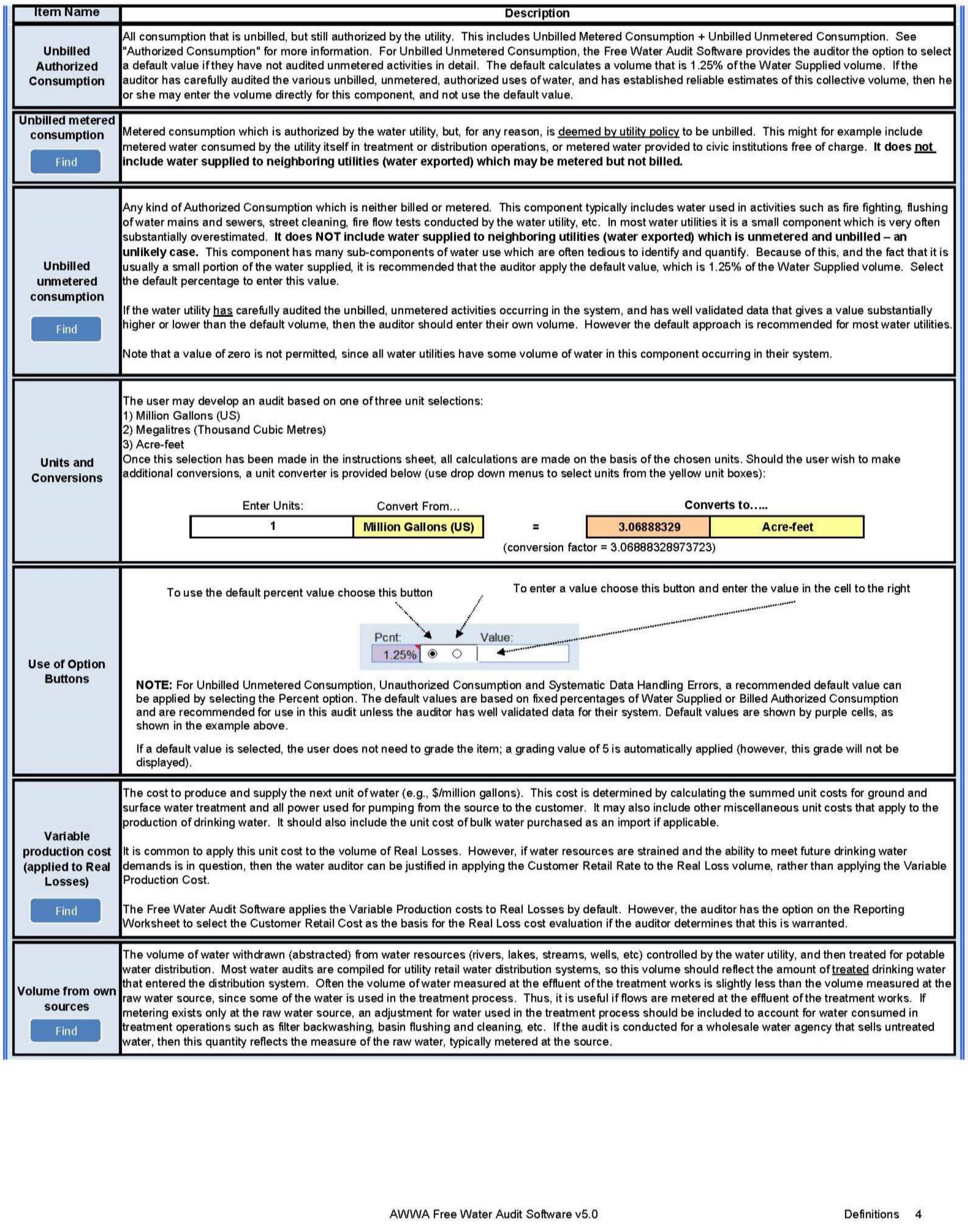
Item Name	Description
Customer metering inaccuracies Find	Apparent water losses caused by the collective under-registration of customer water meters. Many customer water meters gradually wear as large cumulative volumes of water are passed through them over time. This causes the meters to under-register the flow of water. This occurrence is common with smaller residential meters of sizes 5/8-inch and 3/4 inch after they have registered very large cumulative volumes of water, which generally occurs only after periods of years. For meters sized 1-inch and larger - typical of multi-unit residential, commercial and industrial accounts - meter under-registration can occur from wear or from the improper application of the meter; i.e. installing the wrong type of meter or the wrong size of meter, for the flow pattern (profile) of the consumer. For instance, many larger meters have reduced accuracy at low flows. If an oversized meter is installed, most of the time the routine flow will occur in the low flow range of the meter, and a significant portion of it may not be registered. It is important to properly select and install all meters, but particularly large customer meters, size 1-inch and larger. The auditor has two options for entering data for this component of the audit. The auditor can enter a percentage under-registration (typically an estimated value), this will apply the selected percentage to the two categories of metered consumption to determine the volume of water not recorded due to customer meter inaccuracy. Note that this percentage is a composite average inaccuracy for <u>all</u> customer meters in the entire meter population. The percentage will be multiplied by the sum of the volumes in the Billed Metered and Unbilled Metered components. Alternatively, if the auditor has substantial data from meter testing activities, he or she can calculate their own loss volumes, and this volume may be entered directly. Note that a value of zero will be accepted but an alert will appear asking if the customer population is unmetered. Since all metered systems have some degree of inaccuracy, a positive value should be entered. A value of zero in this component is valid only if the water utility does not meter its customer population.
Customer retail unit cost Find	The Customer Retail Unit Cost represents the charge that customers pay for water service. This unit cost is applied routinely to the components of Apparent Loss, since these losses represent water reaching customers but not (fully) paid for. Since most water utilities have a rate structure that includes a variety of different costs based upon class of customer, a weighted average of individual costs and number of customer accounts in each class can be calculated to determine a single composite cost that should be entered into this cell. Finally, the weighted average cost should also include additional charges for sewer, storm water or biosolids processing, <u>but only if</u> these charges are based upon the volume of potable water consumed. For water utilities in regions with limited water resources and a questionable ability to meet the drinking water demands in the future, the Customer Retail Unit Cost might also be applied to value the Real Losses; instead of applying the Variable Production Cost to Real Losses. In this way, it is assumed that every unit volume of leakage reduced by leakage management activities will be sold to a customer. Note: the Free Water Audit Software allows the user to select the units that are charged to customers (either $/1,000 gallons, $/hundred cubic feet, or $/1,000 litres) and automatically converts these units to the units that appear in the "WATER SUPPLIED" box. The monetary units are United States dollars, $.
Infrastructure Leakage Index (ILI) Find	The ratio of the Current Annual Real Losses (Real Losses) to the Unavoidable Annual Real Losses (UARL). The ILI is a highly effective performance indicator for comparing (benchmarking) the performance of utilities in operational management of real losses.
Length of mains Find	Length of all pipelines (except service connections) in the system starting from the point of system input metering (for example at the outlet of the treatment plant). It is also recommended to include in this measure the total length of fire hydrant lead pipe. Hydrant lead pipe is the pipe branching from the water main to the fire hydrant. Fire hydrant leads are typically of a sufficiently large size that is more representative of a pipeline than a service connection. The average length of hydrant leads across the entire system can be assumed if not known, and multiplied by the number of fire hydrants in the system, which can also be assumed if not known. This value can then be added to the total pipeline length. Total length of mains can therefore be calculated as: Length of Mains, miles = (total pipeline length, miles) + [{(average fire hydrant lead length, ft) x (number of fire hydrants)} / 5,280 ft/mile] or Length of Mains, kilometres = (total pipeline length, kilometres) + [{(average fire hydrant lead length, metres) x (number of fire hydrants)} / 1,000 metres/kilometre]
NON-REVENUE WATER Find	= Apparent Losses + Real Losses + Unbilled Metered Consumption + Unbilled Unmetered Consumption. This is water which does not provide revenue potential to the utility.
Number of <u>active AND inactive</u> service connections Find	Number of customer service connections, extending from the water main to supply water to a customer. Please note that this includes the actual number of distinct piping connections, including fire connections, whether active or inactive. This may differ substantially from the number of customers (or number of accounts). **Note: this number does not include the pipeline leads to fire hydrants - the total length of piping supplying fire hydrants should be included in the "Length of mains" parameter.**
Real Losses Find	Physical water losses from the pressurized system (water mains and customer service connections) and the utility's storage tanks, up to the point of customer consumption. In metered systems this is the customer meter, in unmetered situations this is the first point of consumption (stop tap/tap) within the property. The annual volume lost through all types of leaks, breaks and overflows depends on frequencies, flow rates, and average duration of individual leaks, breaks and overflows.
Revenue Water	Those components of System Input Volume that are billed and have the potential to produce revenue.
Service Connection Density Find	=number of customer service connections / length of mains

AWWA Free Water Audit Software v5.0 Definitions 2



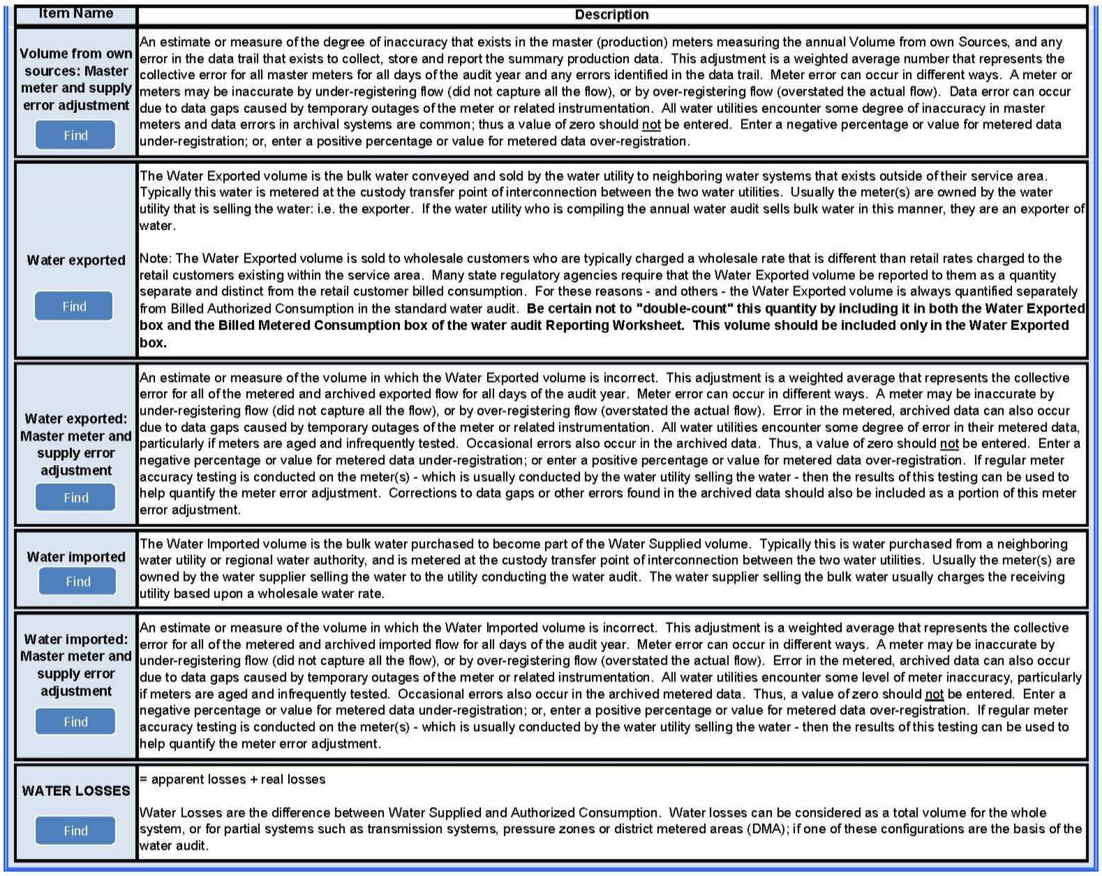
Item Name	Description
Systematic data handling errors Find	Apparent losses caused by accounting omissions, errant computer programming, gaps in policy, procedure, and permitting/activation of new accounts; and any type of data lapse that results in under-stated customer water consumption in summary billing reports. Systematic Data Handling Errors result in a direct loss of revenue potential. Water utilities can find "lost" revenue by keying on this component. Utilities typically measure water consumption registered by water meters at customer premises. The meter should be read routinely (ex: monthly) and the data transferred to the Customer Billing System, which generates and sends a bill to the customer. Data Transfer Errors result in the consumption value being less than the actual consumption, creating an apparent loss. Such error might occur from illegible and mis-recorded hand-written readings compiled by meter readers, inputting an incorrect meter register unit conversion factor in the automatic meter reading equipment, or a variety of similar errors. Apparent losses also occur from Data Analysis Errors in the archival and data reporting processes of the Customer Billing System. Inaccurate estimates used for accounts that fail to produce a meter reading are a common source of error. Billing adjustments may award customers a rightful monetary credit, but do so by creating a negative value of consumption, thus under-stating the actual consumption. Account activation lapses may allow new buildings to use water for months without meter readings and billing. Poor permitting and construction inspection practices can result in a new building lacking a billing account, a water meter and meter reading; i.e., the customer is unknown to the utility's billing system. Close auditing of the permitting, metering, meter reading, billing and reporting processes of the water consumption data trail can uncover data management gaps that create volumes of systematic data handling error. Utilities should routinely analyze customer billing records to detect data anomalies and quantify these losses. For example, a billing account that registers zero consumption for two or more billing cycles should be checked to explain why usage has seemingly halted. Given the revenue loss impacts of these losses, water utilities are well-justified in providing continuous oversight and timely correction of data transfer errors & data handling errors. If the water auditor has not yet gathered detailed data or assessment of systematic data handling error, it is recommended that the auditor apply the default value of 0.25% of the Billed Authorized Consumption volume. However, if the auditor has investigated the billing system and its controls, and has well validated data that indicates the volume from systematic data handling error is substantially higher or lower than that generated by the default value, then the auditor should enter a quantity that was derived from the utility investigations and select an appropriate grading. Note: negative values are not allowed for this audit component. If the auditor enters zero for this component then a grading of 1 will be automatically assigned.
Total annual cost of operating the water system Find	These costs include those for operations, maintenance and any annually incurred costs for long-term upkeep of the drinking water supply and distribution system. It should include the costs of day-to-day upkeep and long-term financing such as repayment of capital bonds for infrastructure expansion or improvement. Typical costs include employee salaries and benefits, materials, equipment, insurance, fees, administrative costs and all other costs that exist to sustain the drinking water supply. Depending upon water utility accounting procedures or regulatory agency requirements, it may be appropriate to include depreciation in the total of this cost. This cost should not include any costs to operate wastewater, biosolids or other systems outside of drinking water.
Unauthorized consumption Find	Includes water illegally withdrawn from fire hydrants, illegal connections, bypasses to customer consumption meters, or tampering with metering or meter reading equipment; as well as any other ways to receive water while thwarting the water utility's ability to collect revenue for the water. Unauthorized consumption results in uncaptured revenue and creates an error that understates customer consumption. In most water utilities this volume is low and, if the water auditor has not yet gathered detailed data for these loss occurrences, it is recommended that the auditor apply a default value of 0.25% of the volume of water supplied. However, if the auditor has investigated unauthorized occurrences, and has well validated data that indicates the volume from unauthorized consumption is substantially higher or lower than that generated by the default value, then the auditor should enter a quantity that was derived from the utility investigations. Note that a value of zero will not be accepted since all water utilities have some volume of unauthorized consumption occurring in their system. Note: if the auditor selects the default value for unauthorized consumption, a data grading of 5 is automatically assigned, but not displayed on the Reporting Worksheet.
Unavoidable Annual Real Losses (UARL) Find	UARL (gallons/day)=(5.41Lm + 0.15Nc + 7.5Lc) xP, or UARL (litres/day)=(18.0Lm + 0.8Nc + 25.0Lc) xP where: Lm = length of mains (miles or kilometres) Nc = number of customer service connections Lp = the average distance of customer service connection piping (feet or metres) (see the Worksheet "Service Connection Diagram" for guidance on deterring the value of Lp) Lc = total length of customer service connection piping (miles or km) Lc = Nc X Lp (miles or kilometres) P = Pressure (psi or metres) The UARL is a theoretical reference value representing the technical low limit of leakage that could be achieved if all of today's best technology could be successfully applied. It is a key variable in the calculation of the Infrastructure Leakage Index (ILI). Striving to reduce system leakage to a level close to the UARL is usually not needed unless the water supply is unusually expensive, scarce or both. NOTE: The UARL calculation has not yet been proven as fully valid for very small, or low pressure water distribution systems. If, in gallons per day: (Lm x 32) + Nc < 3000 or P <35psi in litres per day: (Lm x 20) + Nc < 3000 or P < 25m then the calculated UARL value may not be valid. The software does not display a value of UARL or ILI if either of these conditions is true.

AWWA Free Water Audit Software v5.0 Definitions 3



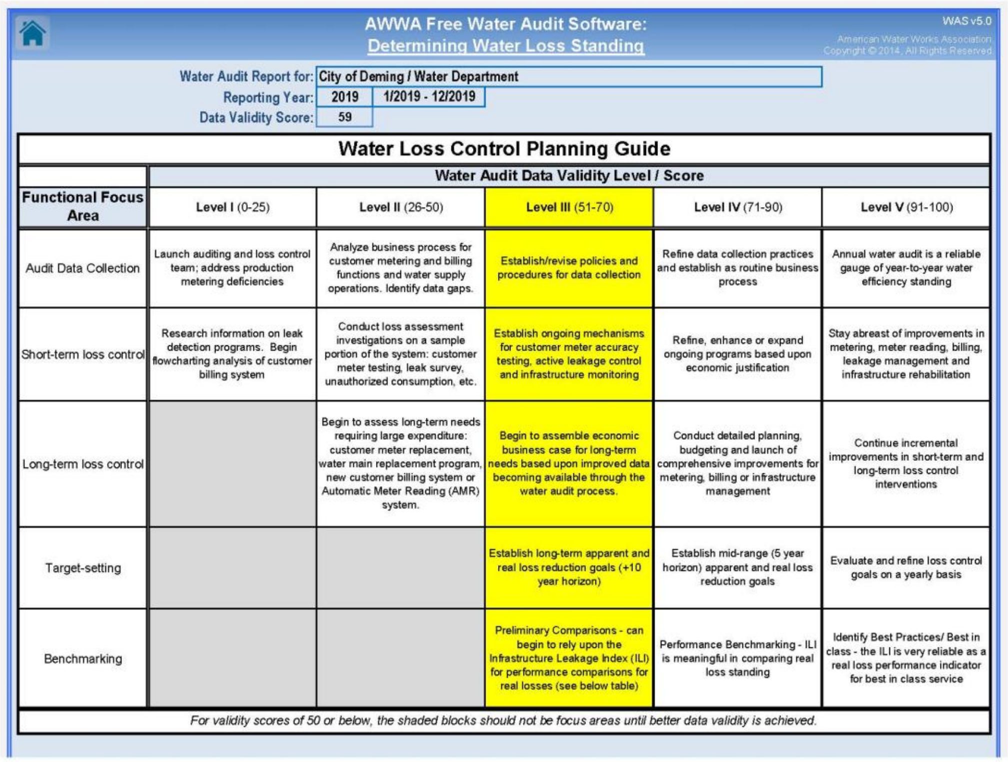
Item Name	Description
Unbilled Authorized Consumption	All consumption that is unbilled, but still authorized by the utility. This includes Unbilled Metered Consumption + Unbilled Unmetered Consumption. See "Authorized Consumption" for more information. For Unbilled Unmetered Consumption, the Free Water Audit Software provides the auditor the option to select a default value if they have not audited unmetered activities in detail. The default calculates a volume that is 1.25% of the Water Supplied volume. If the auditor has carefully audited the various unbilled, unmetered, authorized uses of water, and has established reliable estimates of this collective volume, then he or she may enter the volume directly for this component, and not use the default value.
Unbilled metered consumption Find	Metered consumption which is authorized by the water utility, but, for any reason, is deemed by utility policy to be unbilled. This might for example include metered water consumed by the utility itself in treatment or distribution operations, or metered water provided to civic institutions free of charge. **It does not include water supplied to neighboring utilities (water exported) which may be metered but not billed.**
Unbilled unmetered consumption Find	Any kind of Authorized Consumption which is neither billed or metered. This component typically includes water used in activities such as fire fighting, flushing of water mains and sewers, street cleaning, fire flow tests conducted by the water utility, etc. In most water utilities it is a small component which is very often substantially overestimated. **It does NOT include water supplied to neighboring utilities (water exported) which is unmetered and unbilled – an unlikely case.** This component has many sub-components of water use which are often tedious to identify and quantify. Because of this, and the fact that it is usually a small portion of the water supplied, it is recommended that the auditor apply the default value, which is 1.25% of the Water Supplied volume. Select the default percentage to enter this value. If the water utility has carefully audited the unbilled, unmetered activities occurring in the system, and has well validated data that gives a value substantially higher or lower than the default volume, then the auditor should enter their own volume. However the default approach is recommended for most water utilities. Note that a value of zero is not permitted, since all water utilities have some volume of water in this component occurring in their system.
Units and Conversions	The user may develop an audit based on one of three unit selections: 1) Million Gallons (US) 2) Megalitres (Thousand Cubic Metres) 3) Acre-feet Once this selection has been made in the instructions sheet, all calculations are made on the basis of the chosen units. Should the user wish to make additional conversions, a unit converter is provided below (use drop down menus to select units from the yellow unit boxes): Enter Units: 1 · Convert From... **Million Gallons (US)** = **Converts to.....** **3.06888329** **Acre-feet** (conversion factor = 3.06888328973723)
Use of Option Buttons	To use the default percent value choose this button To enter a value choose this button and enter the value in the cell to the right Pcnt: 1.25% ● ○ Value: **NOTE:** For Unbilled Unmetered Consumption, Unauthorized Consumption and Systematic Data Handling Errors, a recommended default value can be applied by selecting the Percent option. The default values are based on fixed percentages of Water Supplied or Billed Authorized Consumption and are recommended for use in this audit unless the auditor has well validated data for their system. Default values are shown by purple cells, as shown in the example above. If a default value is selected, the user does not need to grade the item; a grading value of 5 is automatically applied (however, this grade will not be displayed).
Variable production cost (applied to Real Losses) Find	The cost to produce and supply the next unit of water (e.g., $/million gallons). This cost is determined by calculating the summed unit costs for ground and surface water treatment and all power used for pumping from the source to the customer. It may also include other miscellaneous unit costs that apply to the production of drinking water. It should also include the unit cost of bulk water purchased as an import if applicable. It is common to apply this unit cost to the volume of Real Losses. However, if water resources are strained and the ability to meet future drinking water demands is in question, then the water auditor can be justified in applying the Customer Retail Rate to the Real Loss volume, rather than applying the Variable Production Cost. The Free Water Audit Software applies the Variable Production costs to Real Losses by default. However, the auditor has the option on the Reporting Worksheet to select the Customer Retail Cost as the basis for the Real Loss cost evaluation if the auditor determines that this is warranted.
Volume from own sources Find	The volume of water withdrawn (abstracted) from water resources (rivers, lakes, streams, wells, etc) controlled by the water utility, and then treated for potable water distribution. Most water audits are compiled for utility retail water distribution systems, so this volume should reflect the amount of treated drinking water that entered the distribution system. Often the volume of water measured at the effluent of the treatment works is slightly less than the volume measured at the raw water source, since some of the water is used in the treatment process. Thus, it is useful if flows are metered at the effluent of the treatment works. If metering exists only at the raw water source, an adjustment for water used in the treatment process should be included to account for water consumed in treatment operations such as filter backwashing, basin flushing and cleaning, etc. If the audit is conducted for a wholesale water agency that sells untreated water, then this quantity reflects the measure of the raw water, typically metered at the source.

AWWA Free Water Audit Software v5.0 Definitions 4



Item Name	Description
Volume from own sources: Master meter and supply error adjustment Find	An estimate or measure of the degree of inaccuracy that exists in the master (production) meters measuring the annual Volume from own Sources, and any error in the data trail that exists to collect, store and report the summary production data. This adjustment is a weighted average number that represents the collective error for all master meters for all days of the audit year and any errors identified in the data trail. Meter error can occur in different ways. A meter or meters may be inaccurate by under-registering flow (did not capture all the flow), or by over-registering flow (overstated the actual flow). Data error can occur due to data gaps caused by temporary outages of the meter or related instrumentation. All water utilities encounter some degree of inaccuracy in master meters and data errors in archival systems are common; thus a value of zero should not be entered. Enter a negative percentage or value for metered data under-registration; or, enter a positive percentage or value for metered data over-registration.
Water exported Find	The Water Exported volume is the bulk water conveyed and sold by the water utility to neighboring water systems that exists outside of their service area. Typically this water is metered at the custody transfer point of interconnection between the two water utilities. Usually the meter(s) are owned by the water utility that is selling the water: i.e. the exporter. If the water utility who is compiling the annual water audit sells bulk water in this manner, they are an exporter of water. Note: The Water Exported volume is sold to wholesale customers who are typically charged a wholesale rate that is different than retail rates charged to the retail customers existing within the service area. Many state regulatory agencies require that the Water Exported volume be reported to them as a quantity separate and distinct from the retail customer billed consumption. For these reasons - and others - the Water Exported volume is always quantified separately from Billed Authorized Consumption in the standard water audit. **Be certain not to "double-count" this quantity by including it in both the Water Exported box and the Billed Metered Consumption box of the water audit Reporting Worksheet. This volume should be included only in the Water Exported box.**
Water exported: Master meter and supply error adjustment Find	An estimate or measure of the volume in which the Water Exported volume is incorrect. This adjustment is a weighted average that represents the collective error for all of the metered and archived exported flow for all days of the audit year. Meter error can occur in different ways. A meter may be inaccurate by under-registering flow (did not capture all the flow), or by over-registering flow (overstated the actual flow). Error in the metered, archived data can also occur due to data gaps caused by temporary outages of the meter or related instrumentation. All water utilities encounter some degree of error in their metered data, particularly if meters are aged and infrequently tested. Occasional errors also occur in the archived data. Thus, a value of zero should not be entered. Enter a negative percentage or value for metered data under-registration; or enter a positive percentage or value for metered data over-registration. If regular meter accuracy testing is conducted on the meter(s) - which is usually conducted by the water utility selling the water - then the results of this testing can be used to help quantify the meter error adjustment. Corrections to data gaps or other errors found in the archived data should also be included as a portion of this meter error adjustment.
Water imported Find	The Water Imported volume is the bulk water purchased to become part of the Water Supplied volume. Typically this is water purchased from a neighboring water utility or regional water authority, and is metered at the custody transfer point of interconnection between the two water utilities. Usually the meter(s) are owned by the water supplier selling the water to the utility conducting the water audit. The water supplier selling the bulk water usually charges the receiving utility based upon a wholesale water rate.
Water imported: Master meter and supply error adjustment Find	An estimate or measure of the volume in which the Water Imported volume is incorrect. This adjustment is a weighted average that represents the collective error for all of the metered and archived imported flow for all days of the audit year. Meter error can occur in different ways. A meter may be inaccurate by under-registering flow (did not capture all the flow), or by over-registering flow (overstated the actual flow). Error in the metered, archived data can also occur due to data gaps caused by temporary outages of the meter or related instrumentation. All water utilities encounter some level of meter inaccuracy, particularly if meters are aged and infrequently tested. Occasional errors also occur in the archived metered data. Thus, a value of zero should not be entered. Enter a negative percentage or value for metered data under-registration; or, enter a positive percentage or value for metered data over-registration. If regular meter accuracy testing is conducted on the meter(s) - which is usually conducted by the water utility selling the water - then the results of this testing can be used to help quantify the meter error adjustment.
WATER LOSSES Find	= apparent losses + real losses Water Losses are the difference between Water Supplied and Authorized Consumption. Water losses can be considered as a total volume for the whole system, or for partial systems such as transmission systems, pressure zones or district metered areas (DMA); if one of these configurations are the basis of the water audit.

AWWA Free Water Audit Software v5.0 Definitions 5



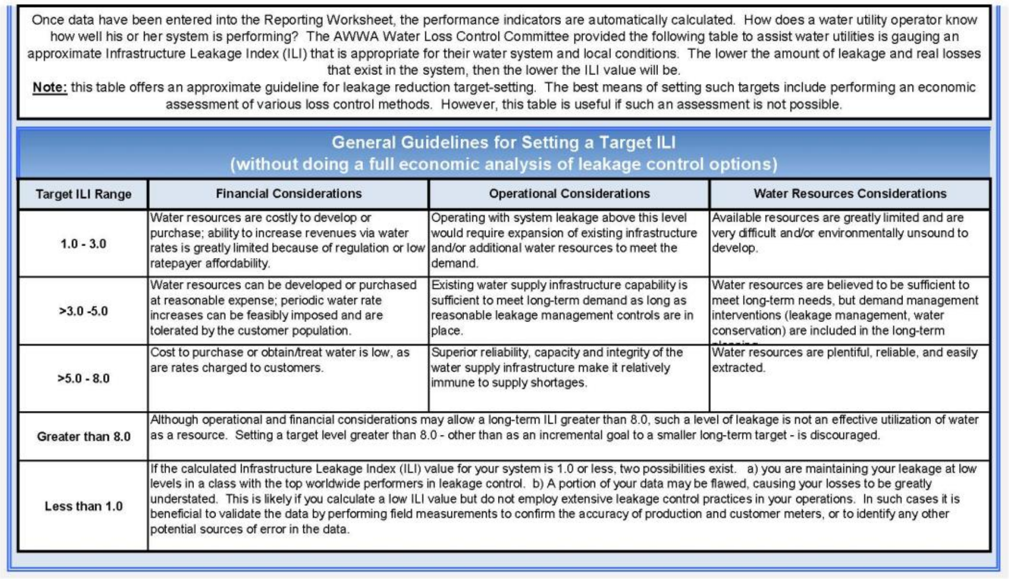
AWWA Free Water Audit Software:
Determining Water Loss Standing

Water Audit Report for: City of Deming / Water Department
Reporting Year: 2019 1/2019 - 12/2019
Data Validity Score: 59

Water Loss Control Planning Guide

	Water Audit Data Validity Level / Score				
Functional Focus Area	**Level I** (0-25)	**Level II** (26-50)	**Level III** (51-70)	**Level IV** (71-90)	**Level V** (91-100)
Audit Data Collection	Launch auditing and loss control team; address production metering deficiencies	Analyze business process for customer metering and billing functions and water supply operations. Identify data gaps.	Establish/revise policies and procedures for data collection	Refine data collection practices and establish as routine business process	Annual water audit is a reliable gauge of year-to-year water efficiency standing
Short-term loss control	Research information on leak detection programs. Begin flowcharting analysis of customer billing system	Conduct loss assessment investigations on a sample portion of the system: customer meter testing, leak survey, unauthorized consumption, etc.	Establish ongoing mechanisms for customer meter accuracy testing, active leakage control and infrastructure monitoring	Refine, enhance or expand ongoing programs based upon economic justification	Stay abreast of improvements in metering, meter reading, billing, leakage management and infrastructure rehabilitation
Long-term loss control		Begin to assess long-term needs requiring large expenditure: customer meter replacement, water main replacement program, new customer billing system or Automatic Meter Reading (AMR) system.	Begin to assemble economic business case for long-term needs based upon improved data becoming available through the water audit process.	Conduct detailed planning, budgeting and launch of comprehensive improvements for metering, billing or infrastructure management	Continue incremental improvements in short-term and long-term loss control interventions
Target-setting			Establish long-term apparent and real loss reduction goals (+10 year horizon)	Establish mid-range (5 year horizon) apparent and real loss reduction goals	Evaluate and refine loss control goals on a yearly basis
Benchmarking			Preliminary Comparisons - can begin to rely upon the Infrastructure Leakage Index (ILI) for performance comparisons for real losses (see below table)	Performance Benchmarking - ILI is meaningful in comparing real loss standing	Identify Best Practices/ Best in class - the ILI is very reliable as a real loss performance indicator for best in class service

For validity scores of 50 or below, the shaded blocks should not be focus areas until better data validity is achieved.



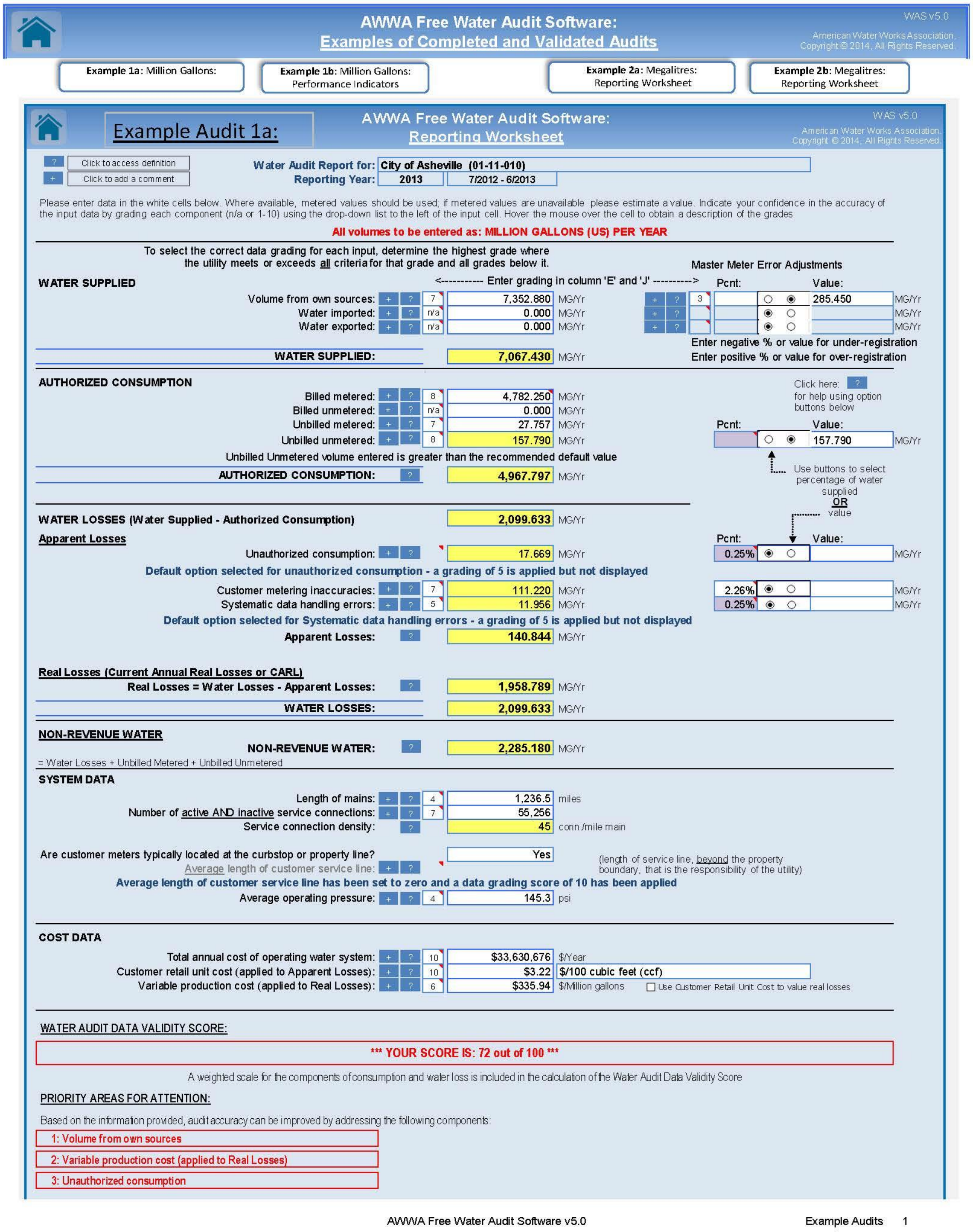
Once data have been entered into the Reporting Worksheet, the performance indicators are automatically calculated. How does a water utility operator know how well his or her system is performing? The AWWA Water Loss Control Committee provided the following table to assist water utilities is gauging an approximate Infrastructure Leakage Index (ILI) that is appropriate for their water system and local conditions. The lower the amount of leakage and real losses that exist in the system, then the lower the ILI value will be.

Note: this table offers an approximate guideline for leakage reduction target-setting. The best means of setting such targets include performing an economic assessment of various loss control methods. However, this table is useful if such an assessment is not possible.

General Guidelines for Setting a Target ILI
(without doing a full economic analysis of leakage control options)

Target ILI Range	Financial Considerations	Operational Considerations	Water Resources Considerations
1.0 - 3.0	Water resources are costly to develop or purchase; ability to increase revenues via water rates is greatly limited because of regulation or low ratepayer affordability.	Operating with system leakage above this level would require expansion of existing infrastructure and/or additional water resources to meet the demand.	Available resources are greatly limited and are very difficult and/or environmentally unsound to develop.
>3.0 -5.0	Water resources can be developed or purchased at reasonable expense; periodic water rate increases can be feasibly imposed and are tolerated by the customer population.	Existing water supply infrastructure capability is sufficient to meet long-term demand as long as reasonable leakage management controls are in place.	Water resources are believed to be sufficient to meet long-term needs, but demand management interventions (leakage management, water conservation) are included in the long-term
>5.0 - 8.0	Cost to purchase or obtain/treat water is low, as are rates charged to customers.	Superior reliability, capacity and integrity of the water supply infrastructure make it relatively immune to supply shortages.	Water resources are plentiful, reliable, and easily extracted.
Greater than 8.0	Although operational and financial considerations may allow a long-term ILI greater than 8.0, such a level of leakage is not an effective utilization of water as a resource. Setting a target level greater than 8.0 - other than as an incremental goal to a smaller long-term target - is discouraged.		
Less than 1.0	If the calculated Infrastructure Leakage Index (ILI) value for your system is 1.0 or less, two possibilities exist. a) you are maintaining your leakage at low levels in a class with the top worldwide performers in leakage control. b) A portion of your data may be flawed, causing your losses to be greatly understated. This is likely if you calculate a low ILI value but do not employ extensive leakage control practices in your operations. In such cases it is beneficial to validate the data by performing field measurements to confirm the accuracy of production and customer meters, or to identify any other potential sources of error in the data.		

AWWA Free Water Audit Software v5.0 Loss Control Planning 2



AWWA Free Water Audit Software:
Examples of Completed and Validated Audits

Example Audit 1a:

AWWA Free Water Audit Software:
Reporting Worksheet

Water Audit Report for: City of Asheville (01-11-010)
Reporting Year: 2013 7/2012 - 6/2013

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (n/a or 1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

To select the correct data grading for each input, determine the highest grade where the utility meets or exceeds all criteria for that grade and all grades below it.

<----------- Enter grading in column 'E' and 'J' ----------->

WATER SUPPLIED

					Master Meter Error Adjustments			
					Pcnt:		Value:	
Volume from own sources:	7	7,352.880	MG/Yr	3		○ ●	285.450	MG/Yr
Water imported:	n/a	0.000	MG/Yr			● ○		MG/Yr
Water exported:	n/a	0.000	MG/Yr			● ○		MG/Yr
WATER SUPPLIED:		7,067.430	MG/Yr					

Enter negative % or value for under-registration
Enter positive % or value for over-registration

AUTHORIZED CONSUMPTION

Click here: ? for help using option buttons below

				Pcnt:		Value:	
Billed metered:	8	4,782.250	MG/Yr				
Billed unmetered:	n/a	0.000	MG/Yr				
Unbilled metered:	7	27.757	MG/Yr				
Unbilled unmetered:	8	157.790	MG/Yr		○ ●	157.790	MG/Yr

Unbilled Unmetered volume entered is greater than the recommended default value

AUTHORIZED CONSUMPTION:		4,967.797	MG/Yr

Use buttons to select percentage of water supplied
OR
value

				Pcnt:		Value:	
WATER LOSSES (Water Supplied - Authorized Consumption)		2,099.633	MG/Yr				
Apparent Losses							
Unauthorized consumption:		17.669	MG/Yr	0.25%	● ○		MG/Yr

Default option selected for unauthorized consumption - a grading of 5 is applied but not displayed

Customer metering inaccuracies:	7	111.220	MG/Yr	2.26%	● ○		MG/Yr
Systematic data handling errors:	5	11.956	MG/Yr	0.25%	● ○		MG/Yr

Default option selected for Systematic data handling errors - a grading of 5 is applied but not displayed

Apparent Losses:		140.844	MG/Yr
Real Losses (Current Annual Real Losses or CARL)			
Real Losses = Water Losses - Apparent Losses:		1,958.789	MG/Yr
WATER LOSSES:		2,099.633	MG/Yr
NON-REVENUE WATER			
NON-REVENUE WATER:		2,285.180	MG/Yr

= Water Losses + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

Length of mains:	4	1,236.5	miles
Number of active AND inactive service connections:	7	55,256	
Service connection density:		45	conn./mile main
Are customer meters typically located at the curbstop or property line?		Yes	
Average length of customer service line:			(length of service line, beyond the property boundary, that is the responsibility of the utility)

Average length of customer service line has been set to zero and a data grading score of 10 has been applied

Average operating pressure:	4	145.3	psi

COST DATA

Total annual cost of operating water system:	10	$33,630,676	$/Year
Customer retail unit cost (applied to Apparent Losses):	10	$3.22	$/100 cubic feet (ccf)
Variable production cost (applied to Real Losses):	6	$335.94	$/Million gallons ☐ Use Customer Retail Unit Cost to value real losses

WATER AUDIT DATA VALIDITY SCORE:

*** YOUR SCORE IS: 72 out of 100 ***

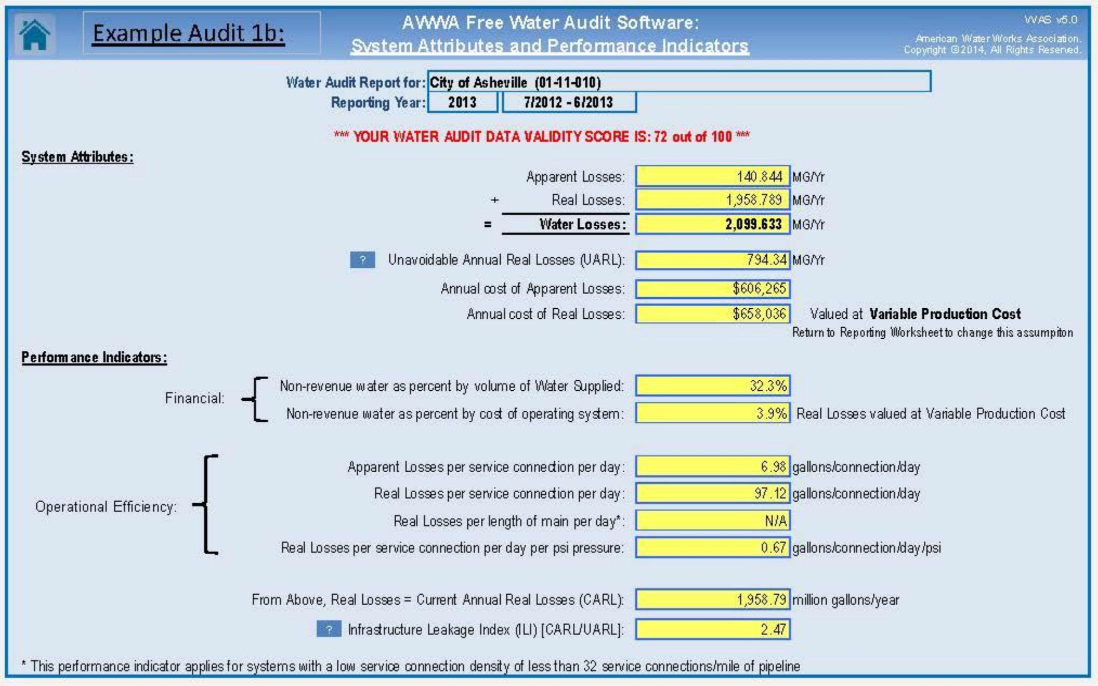
A weighted scale for the components of consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION:

Based on the information provided, audit accuracy can be improved by addressing the following components:

1: Volume from own sources
2: Variable production cost (applied to Real Losses)
3: Unauthorized consumption

AWWA Free Water Audit Software v5.0 Example Audits 1



Example Audit 1b:

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

Water Audit Report for: City of Asheville (01-11-010)
Reporting Year: 2013 7/2012 - 6/2013

***** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 72 out of 100 *****

System Attributes:

Apparent Losses:	140.844	MG/Yr
+ Real Losses:	1,958.789	MG/Yr
= **Water Losses:**	**2,099.633**	MG/Yr
? Unavoidable Annual Real Losses (UARL):	794.34	MG/Yr
Annual cost of Apparent Losses:	$606,265	
Annual cost of Real Losses:	$658,036	Valued at **Variable Production Cost** Return to Reporting Worksheet to change this assumpiton

Performance Indicators:

Financial:

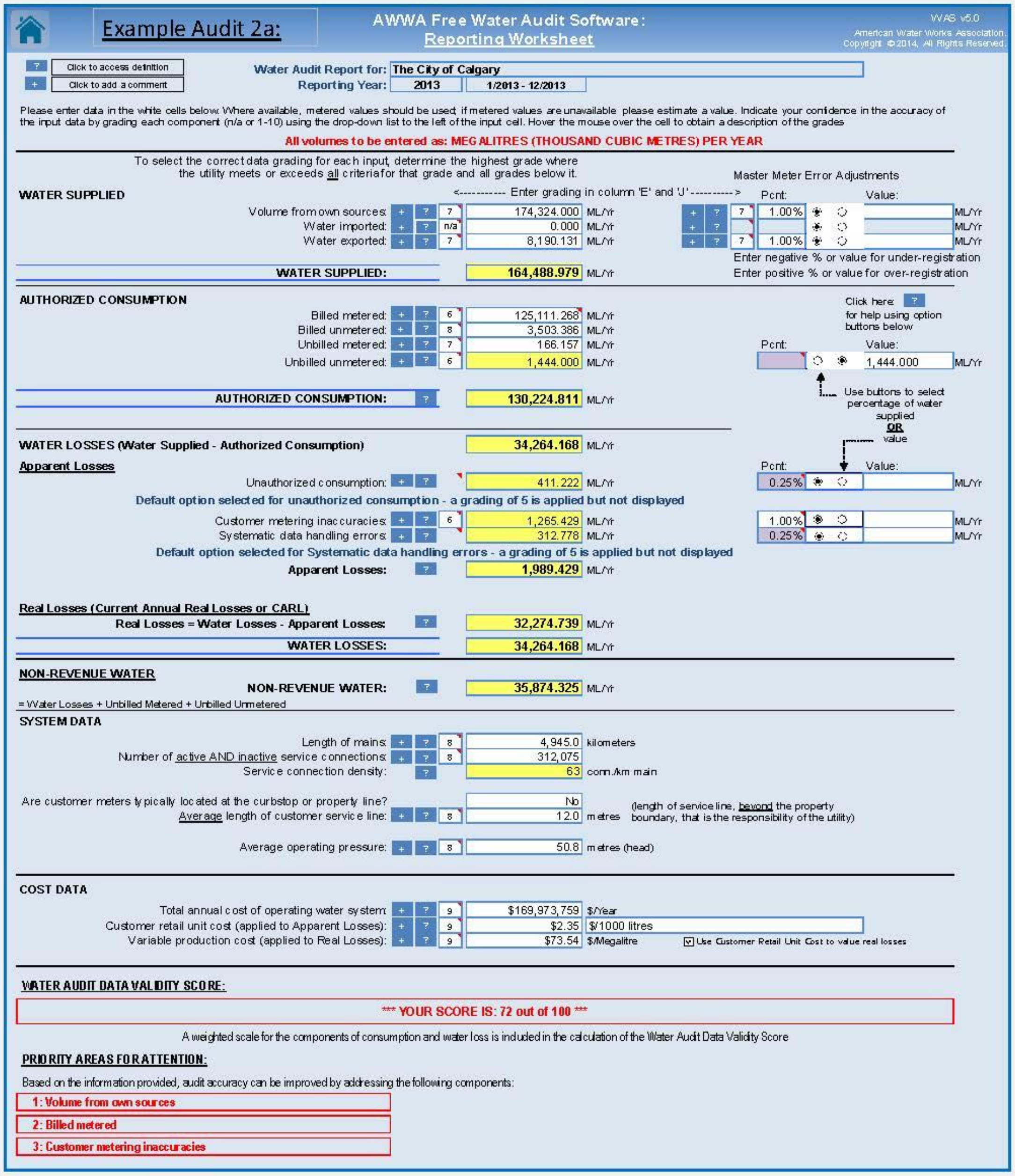
Non-revenue water as percent by volume of Water Supplied:	32.3%	
Non-revenue water as percent by cost of operating system:	3.9%	Real Losses valued at Variable Production Cost

Operational Efficiency:

Apparent Losses per service connection per day:	6.98	gallons/connection/day
Real Losses per service connection per day:	97.12	gallons/connection/day
Real Losses per length of main per day*:	N/A	
Real Losses per service connection per day per psi pressure:	0.67	gallons/connection/day/psi

From Above, Real Losses = Current Annual Real Losses (CARL):	1,958.79	million gallons/year
? Infrastructure Leakage Index (ILI) [CARL/UARL]:	2.47	

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline



Example Audit 2a:

AWWA Free Water Audit Software:
Reporting Worksheet

Water Audit Report for: The City of Calgary
Reporting Year: 2013 1/2013 - 12/2013

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (n/a or 1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

All volumes to be entered as: MEGALITRES (THOUSAND CUBIC METRES) PER YEAR

To select the correct data grading for each input, determine the highest grade where the utility meets or exceeds all criteria for that grade and all grades below it.

<----------- Enter grading in column 'E' and 'J' ---------->

WATER SUPPLIED

Master Meter Error Adjustments

					Pcnt:		Value:	
Volume from own sources:	7	174,324.000	ML/Yr	7	1.00%	● ○		ML/Yr
Water imported:	n/a	0.000	ML/Yr			● ○		ML/Yr
Water exported:	7	8,190.131	ML/Yr	7	1.00%	● ○		ML/Yr

Enter negative % or value for under-registration
Enter positive % or value for over-registration

WATER SUPPLIED: 164,488.979 ML/Yr

AUTHORIZED CONSUMPTION

Click here: ? for help using option buttons below

				Pcnt:		Value:	
Billed metered:	6	125,111.268	ML/Yr				
Billed unmetered:	8	3,503.386	ML/Yr				
Unbilled metered:	7	166.157	ML/Yr				
Unbilled unmetered:	6	1,444.000	ML/Yr		○ ●	1,444.000	ML/Yr

Use buttons to select percentage of water supplied
OR
value

AUTHORIZED CONSUMPTION: 130,224.811 ML/Yr

WATER LOSSES (Water Supplied - Authorized Consumption) 34,264.168 ML/Yr

Apparent Losses

				Pcnt:		Value:	
Unauthorized consumption:		411.222	ML/Yr	0.25%	● ○		ML/Yr

Default option selected for unauthorized consumption - a grading of 5 is applied but not displayed

Customer metering inaccuracies:	6	1,265.429	ML/Yr	1.00%	● ○		ML/Yr
Systematic data handling errors:		312.778	ML/Yr	0.25%	● ○		ML/Yr

Default option selected for Systematic data handling errors - a grading of 5 is applied but not displayed

Apparent Losses: 1,989.429 ML/Yr

Real Losses (Current Annual Real Losses or CARL)
Real Losses = Water Losses - Apparent Losses: 32,274.739 ML/Yr

WATER LOSSES: 34,264.168 ML/Yr

NON-REVENUE WATER
NON-REVENUE WATER: 35,874.325 ML/Yr
= Water Losses + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

Length of mains:	8	4,945.0	kilometers
Number of active AND inactive service connections:	8	312,075	
Service connection density:		63	conn./km main
Are customer meters typically located at the curbstop or property line?		No	
Average length of customer service line:	8	12.0	metres (length of service line, beyond the property boundary, that is the responsibility of the utility)
Average operating pressure:	8	50.8	metres (head)

COST DATA

Total annual cost of operating water system:	9	$169,973,759	$/Year
Customer retail unit cost (applied to Apparent Losses):	9	$2.35	$/1000 litres
Variable production cost (applied to Real Losses):	9	$73.54	$/Megalitre

☑ Use Customer Retail Unit Cost to value real losses

WATER AUDIT DATA VALIDITY SCORE:

***** YOUR SCORE IS: 72 out of 100 *****

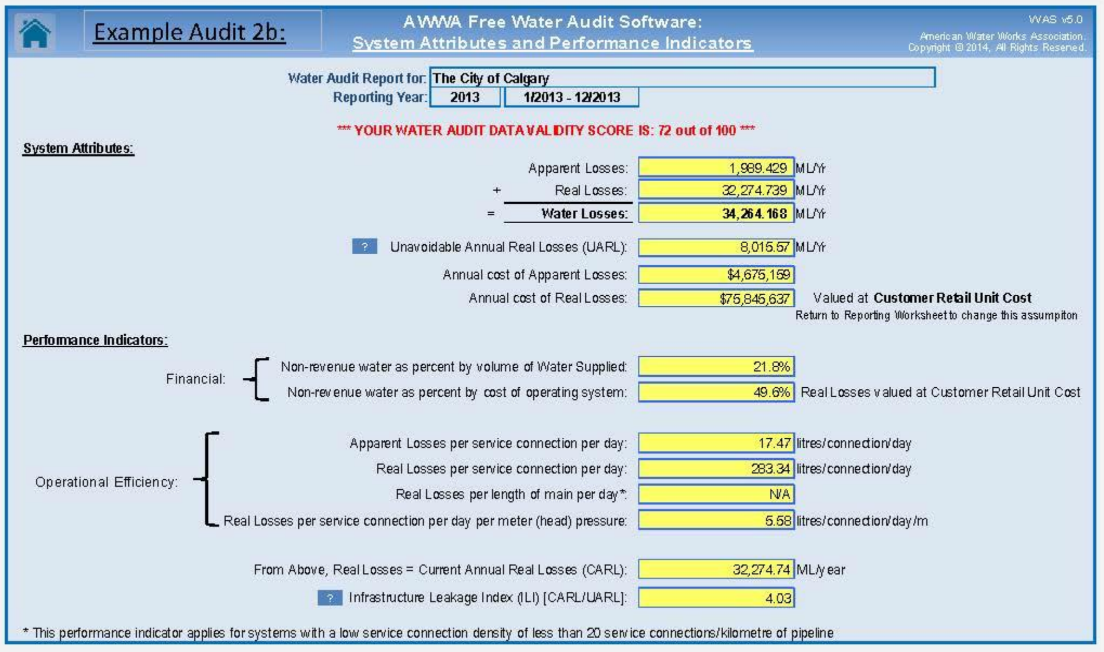
A weighted scale for the components of consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION:

Based on the information provided, audit accuracy can be improved by addressing the following components:

1: Volume from own sources
2: Billed metered
3: Customer metering inaccuracies

AWWA Free Water Audit Software v5.0 Example Audits 3



Example Audit 2b:

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

WAS v5.0
American Water Works Association.
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Water Audit Report for: The City of Calgary
Reporting Year: 2013 1/2013 - 12/2013

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 72 out of 100 ***

System Attributes:

Apparent Losses: 1,989.429 ML/Yr
\+ Real Losses: 32,274.739 ML/Yr
= **Water Losses: 34,264.168** ML/Yr

? Unavoidable Annual Real Losses (UARL): 8,015.57 ML/Yr

Annual cost of Apparent Losses: $4,675,159
Annual cost of Real Losses: $75,845,637 Valued at **Customer Retail Unit Cost**
Return to Reporting Worksheet to change this assumpiton

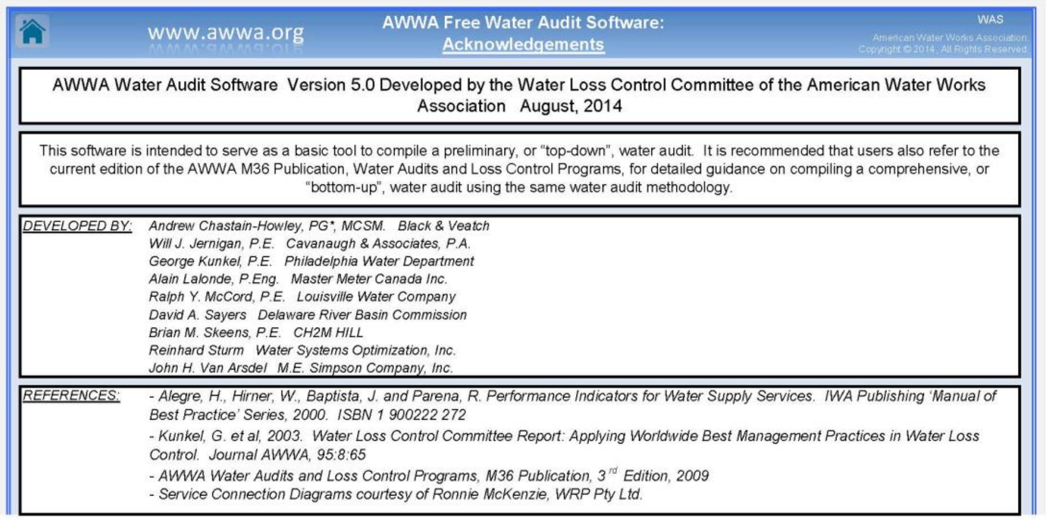
Perfomance Indicators:

Financial:
Non-revenue water as percent by volume of Water Supplied: 21.8%
Non-revenue water as percent by cost of operating system: 49.6% Real Losses valued at Customer Retail Unit Cost

Operational Efficiency:
Apparent Losses per service connection per day: 17.47 litres/connection/day
Real Losses per service connection per day: 283.34 litres/connection/day
Real Losses per length of main per day*: N/A
Real Losses per service connection per day per meter (head) pressure: 5.58 litres/connection/day/m

From Above, Real Losses = Current Annual Real Losses (CARL): 32,274.74 ML/year
? Infrastructure Leakage Index (ILI) [CARL/UARL]: 4.03

* This performance indicator applies for systems with a low service connection density of less than 20 service connections/kilometre of pipeline



AWWA Free Water Audit Software:
Acknowledgements

AWWA Water Audit Software Version 5.0 Developed by the Water Loss Control Committee of the American Water Works Association August, 2014

This software is intended to serve as a basic tool to compile a preliminary, or "top-down", water audit. It is recommended that users also refer to the current edition of the AWWA M36 Publication, Water Audits and Loss Control Programs, for detailed guidance on compiling a comprehensive, or "bottom-up", water audit using the same water audit methodology.

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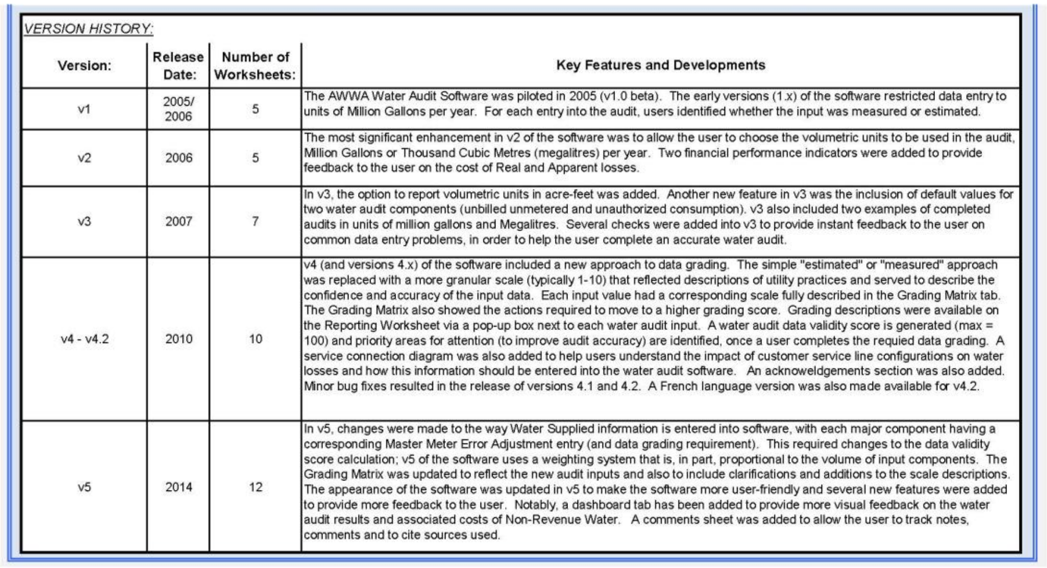
- *Alegre, H., Hirner, W., Baptista, J. and Parena, R. Performance Indicators for Water Supply Services. IWA Publishing 'Manual of Best Practice' Series, 2000. ISBN 1 900222 272*
- *Kunkel, G. et al, 2003. Water Loss Control Committee Report: Applying Worldwide Best Management Practices in Water Loss Control. Journal AWWA, 95:8:65*
- *AWWA Water Audits and Loss Control Programs, M36 Publication, 3rd Edition, 2009*
- *Service Connection Diagrams courtesy of Ronnie McKenzie, WRP Pty Ltd.*

AWWA Free Water Audit Software v5.0 Acknowledgements 1

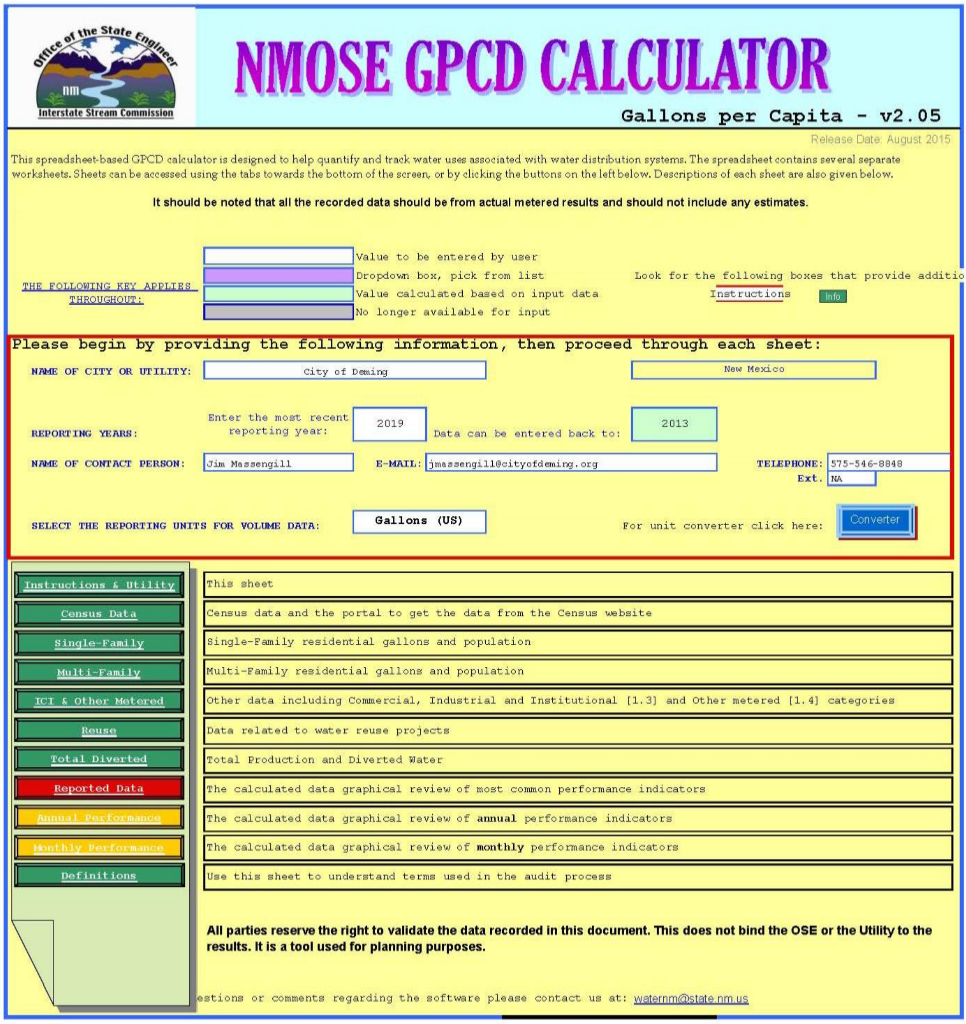


VERSION HISTORY:

Version:	Release Date:	Number of Worksheets:	Key Features and Developments
v1	2005/ 2006	5	The AWWA Water Audit Software was piloted in 2005 (v1.0 beta). The early versions (1.x) of the software restricted data entry to units of Million Gallons per year. For each entry into the audit, users identified whether the input was measured or estimated.
v2	2006	5	The most significant enhancement in v2 of the software was to allow the user to choose the volumetric units to be used in the audit, Million Gallons or Thousand Cubic Metres (megalitres) per year. Two financial performance indicators were added to provide feedback to the user on the cost of Real and Apparent losses.
v3	2007	7	In v3, the option to report volumetric units in acre-feet was added. Another new feature in v3 was the inclusion of default values for two water audit components (unbilled unmetered and unauthorized consumption). v3 also included two examples of completed audits in units of million gallons and Megalitres. Several checks were added into v3 to provide instant feedback to the user on common data entry problems, in order to help the user complete an accurate water audit.
v4 - v4.2	2010	10	v4 (and versions 4.x) of the software included a new approach to data grading. The simple "estimated" or "measured" approach was replaced with a more granular scale (typically 1-10) that reflected descriptions of utility practices and served to describe the confidence and accuracy of the input data. Each input value had a corresponding scale fully described in the Grading Matrix tab. The Grading Matrix also showed the actions required to move to a higher grading score. Grading descriptions were available on the Reporting Worksheet via a pop-up box next to each water audit input. A water audit data validity score is generated (max = 100) and priority areas for attention (to improve audit accuracy) are identified, once a user completes the requied data grading. A service connection diagram was also added to help users understand the impact of customer service line configurations on water losses and how this information should be entered into the water audit software. An acknoweldgements section was also added. Minor bug fixes resulted in the release of versions 4.1 and 4.2. A French language version was also made available for v4.2.
v5	2014	12	In v5, changes were made to the way Water Supplied information is entered into software, with each major component having a corresponding Master Meter Error Adjustment entry (and data grading requirement). This required changes to the data validity score calculation; v5 of the software uses a weighting system that is, in part, proportional to the volume of input components. The Grading Matrix was updated to reflect the new audit inputs and also to include clarifications and additions to the scale descriptions. The appearance of the software was updated in v5 to make the software more user-friendly and several new features were added to provide more feedback to the user. Notably, a dashboard tab has been added to provide more visual feedback on the water audit results and associated costs of Non-Revenue Water. A comments sheet was added to allow the user to track notes, comments and to cite sources used.

AWWA Free Water Audit Software v5.0 Acknowledgements 2

Appendix B Completed Gallons Per Capita Per Day (GPCD) Calculator



NMOSE GPCD CALCULATOR

Gallons per Capita - v2.05

Release Date: August 2015

This spreadsheet-based GPCD calculator is designed to help quantify and track water uses associated with water distribution systems. The spreadsheet contains several separate worksheets. Sheets can be accessed using the tabs towards the bottom of the screen, or by clicking the buttons on the left below. Descriptions of each sheet are also given below.

It should be noted that all the recorded data should be from actual metered results and should not include any estimates.

THE FOLLOWING KEY APPLIES THROUGHOUT:

☐	Value to be entered by user
🟪	Dropdown box, pick from list
🟩	Value calculated based on input data
▨	No longer available for input

Look for the following boxes that provide additior

Instructions Info

Please begin by providing the following information, then proceed through each sheet:

NAME OF CITY OR UTILITY: City of Deming New Mexico

REPORTING YEARS: Enter the most recent reporting year: 2019 Data can be entered back to: 2013

NAME OF CONTACT PERSON: Jim Massengill **E-MAIL:** jmassengill@cityofdeming.org **TELEPHONE:** 575-546-8848

Ext. NA

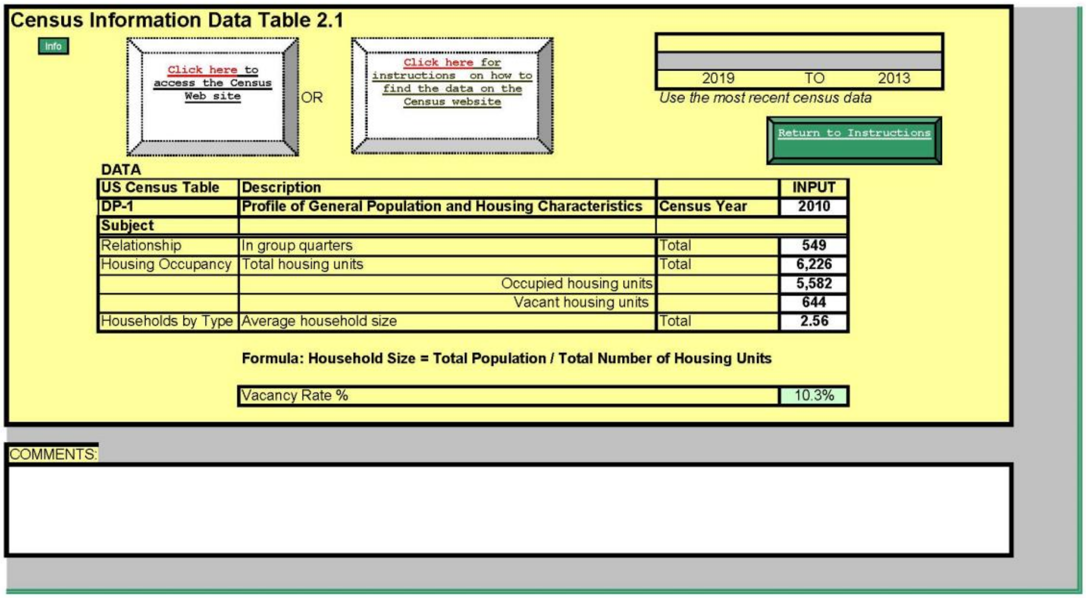
SELECT THE REPORTING UNITS FOR VOLUME DATA: **Gallons (US)** For unit converter click here: Converter

Instructions & Utility	This sheet
Census Data	Census data and the portal to get the data from the Census website
Single-Family	Single-Family residential gallons and population
Multi-Family	Multi-Family residential gallons and population
ICI & Other Metered	Other data including Commercial, Industrial and Institutional [1.3] and Other metered [1.4] categories
Reuse	Data related to water reuse projects
Total Diverted	Total Production and Diverted Water
Reported Data	The calculated data graphical review of most common performance indicators
Annual Performance	The calculated data graphical review of **annual** performance indicators
Monthly Performance	The calculated data graphical review of **monthly** performance indicators
Definitions	Use this sheet to understand terms used in the audit process

All parties reserve the right to validate the data recorded in this document. This does not bind the OSE or the Utility to the results. It is a tool used for planning purposes.

estions or comments regarding the software please contact us at: waternm@state.nm.us

NMOSE GPCD Calculator v2.02 1



Census Information Data Table 2.1

2019 TO 2013

Use the most recent census data

DATA

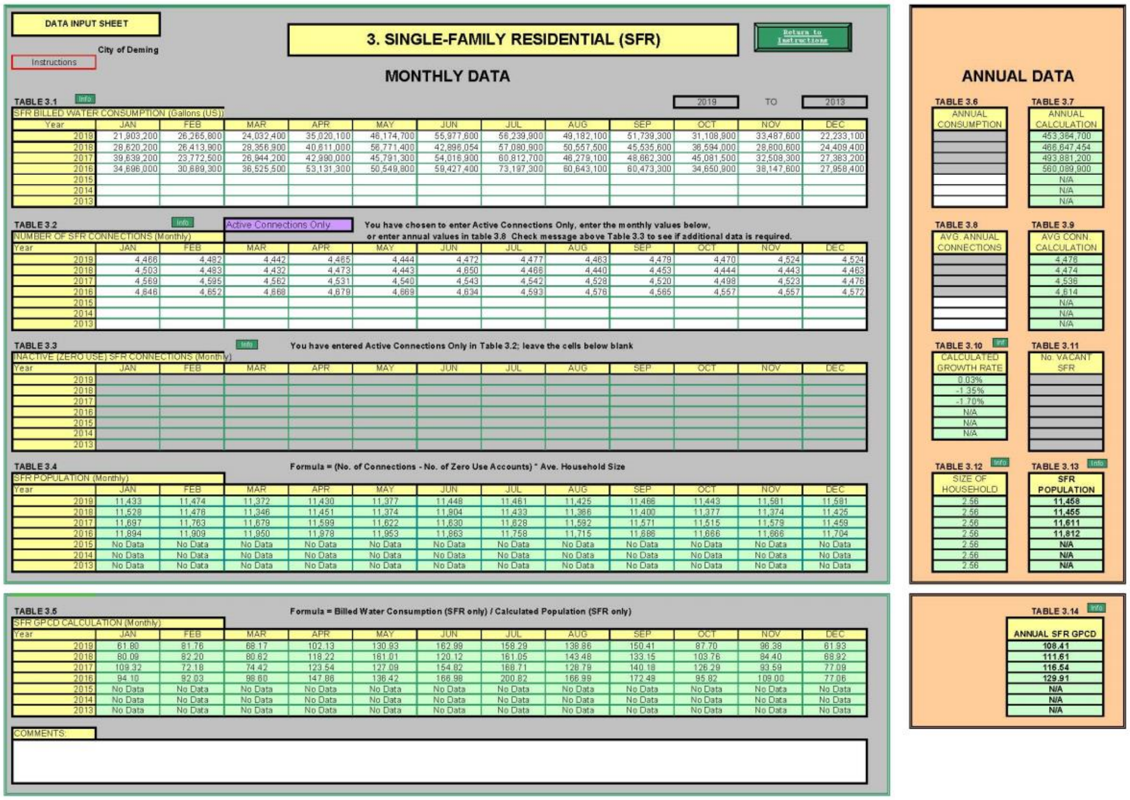
US Census Table	**Description**		**INPUT**
DP-1	**Profile of General Population and Housing Characteristics**	**Census Year**	**2010**
Subject			
Relationship	In group quarters	Total	**549**
Housing Occupancy	Total housing units	Total	**6,226**
	Occupied housing units		**5,582**
	Vacant housing units		**644**
Households by Type	Average household size	Total	**2.56**

Formula: Household Size = Total Population / Total Number of Housing Units

Vacancy Rate %	10.3%

COMMENTS:

NMOSE GPCD Calculator v2.02



DATA INPUT SHEET

City of Deming

Instructions

3. SINGLE-FAMILY RESIDENTIAL (SFR)

MONTHLY DATA

2019 TO 2013

TABLE 3.1

SFR BILLED WATER CONSUMPTION (Gallons (US))

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2019	21,803,200	26,265,800	24,032,400	35,020,100	46,174,700	55,977,600	56,239,900	49,182,100	51,739,300	31,108,900	33,487,600	22,233,100
2018	28,620,200	26,413,900	28,356,900	40,611,000	56,771,400	42,896,054	57,080,900	50,557,500	45,535,600	36,594,000	28,800,600	24,409,400
2017	39,639,200	23,772,500	26,944,200	42,990,000	45,791,300	54,016,900	60,812,700	46,279,100	48,662,300	45,081,500	32,508,300	27,383,200
2016	34,696,000	30,889,300	36,525,500	53,131,300	50,549,800	59,427,400	73,197,300	60,643,100	60,473,300	34,650,900	38,147,600	27,958,400
2015												
2014												
2013												

TABLE 3.2

Active Connections Only

You have chosen to enter Active Connections Only, enter the monthly values below, or enter annual values in table 3.8 Check message above Table 3.3 to see if additional data is required.

NUMBER OF SFR CONNECTIONS (Monthly)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2019	4,466	4,482	4,442	4,465	4,444	4,472	4,477	4,463	4,479	4,470	4,524	4,524
2018	4,503	4,483	4,432	4,473	4,443	4,650	4,466	4,440	4,453	4,444	4,443	4,463
2017	4,569	4,595	4,562	4,531	4,540	4,543	4,542	4,528	4,520	4,498	4,523	4,476
2016	4,646	4,652	4,668	4,679	4,669	4,634	4,593	4,576	4,565	4,557	4,557	4,572
2015												
2014												
2013												

TABLE 3.3

You have entered Active Connections Only in Table 3.2; leave the cells below blank

INACTIVE (ZERO USE) SFR CONNECTIONS (Monthly)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2019												
2018												
2017												
2016												
2015												
2014												
2013												

TABLE 3.4

Formula = (No. of Connections - No. of Zero Use Accounts) * Ave. Household Size

SFR POPULATION (Monthly)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2019	11,433	11,474	11,372	11,430	11,377	11,448	11,461	11,425	11,466	11,443	11,581	11,581
2018	11,528	11,476	11,346	11,451	11,374	11,904	11,433	11,366	11,400	11,377	11,374	11,425
2017	11,697	11,763	11,679	11,599	11,622	11,630	11,628	11,592	11,571	11,515	11,579	11,459
2016	11,894	11,909	11,950	11,978	11,953	11,863	11,758	11,715	11,686	11,666	11,666	11,704
2015	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2014	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2013	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data

TABLE 3.5

Formula = Billed Water Consumption (SFR only) / Calculated Population (SFR only)

SFR GPCD CALCULATION (Monthly)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2019	61.80	81.76	68.17	102.13	130.93	162.99	158.29	138.86	150.41	87.70	96.38	61.93
2018	80.09	82.20	80.62	118.22	161.01	120.12	161.05	143.48	133.15	103.76	84.40	68.92
2017	109.32	72.18	74.42	123.54	127.09	154.82	168.71	128.79	140.18	126.29	93.59	77.09
2016	94.10	92.03	98.60	147.86	136.42	166.98	200.82	166.99	172.49	95.82	109.00	77.06
2015	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2014	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2013	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data

COMMENTS:

ANNUAL DATA

TABLE 3.6

ANNUAL CONSUMPTION

TABLE 3.7

ANNUAL CALCULATION
453,384,700
466,647,454
493,881,200
560,089,900
N/A
N/A
N/A

TABLE 3.8

AVG. ANNUAL CONNECTIONS

TABLE 3.9

AVG CONN. CALCULATION
4,476
4,474
4,536
4,614
N/A
N/A
N/A

TABLE 3.10

CALCULATED GROWTH RATE
0.03%
-1.35%
-1.70%
N/A
N/A
N/A

TABLE 3.11

No. VACANT SFR

TABLE 3.12

SIZE OF HOUSEHOLD
2.56
2.56
2.56
2.56
2.56
2.56
2.56

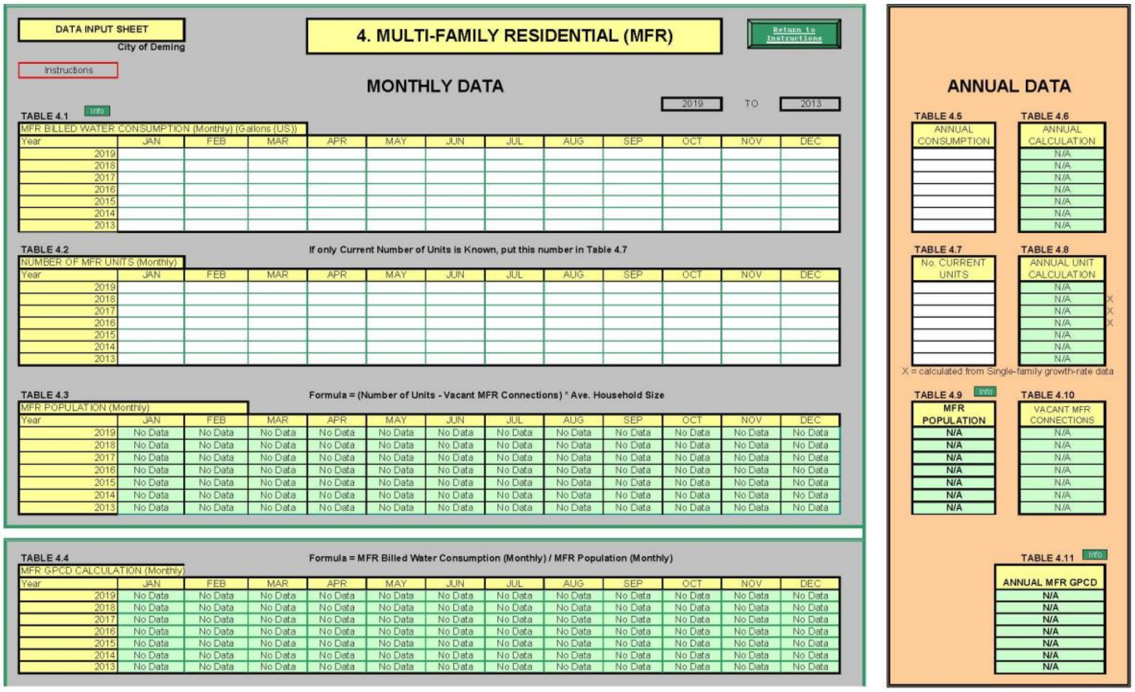
TABLE 3.13

SFR POPULATION
11,458
11,455
11,611
11,812
N/A
N/A
N/A

TABLE 3.14

ANNUAL SFR GPCD
108.41
111.61
116.54
129.91
N/A
N/A
N/A

NMOSE GPCD Calculator v2.02



DATA INPUT SHEET
City of Deming

Instructions

4. MULTI-FAMILY RESIDENTIAL (MFR)

MONTHLY DATA

2019 TO 2013

TABLE 4.1

MFR BILLED WATER CONSUMPTION (Monthly) (Gallons (US))

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2019												
2018												
2017												
2016												
2015												
2014												
2013												

TABLE 4.2

If only Current Number of Units is Known, put this number in Table 4.7

NUMBER OF MFR UNITS (Monthly)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2019												
2018												
2017												
2016												
2015												
2014												
2013												

TABLE 4.3

Formula = (Number of Units - Vacant MFR Connections) * Ave. Household Size

MFR POPULATION (Monthly)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2019	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2018	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2017	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2016	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2015	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2014	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2013	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data

TABLE 4.4

Formula = MFR Billed Water Consumption (Monthly) / MFR Population (Monthly)

MFR GPCD CALCULATION (Monthly)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2019	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2018	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2017	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2016	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2015	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2014	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2013	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data

ANNUAL DATA

TABLE 4.5

ANNUAL CONSUMPTION

TABLE 4.6

ANNUAL CALCULATION
N/A
N/A
N/A
N/A
N/A
N/A
N/A

TABLE 4.7

No. CURRENT UNITS

TABLE 4.8

ANNUAL UNIT CALCULATION	
N/A	
N/A	X
N/A	X
N/A	X
N/A	
N/A	
N/A	

X = calculated from Single-family growth-rate data

TABLE 4.9

MFR POPULATION
N/A
N/A
N/A
N/A
N/A
N/A
N/A

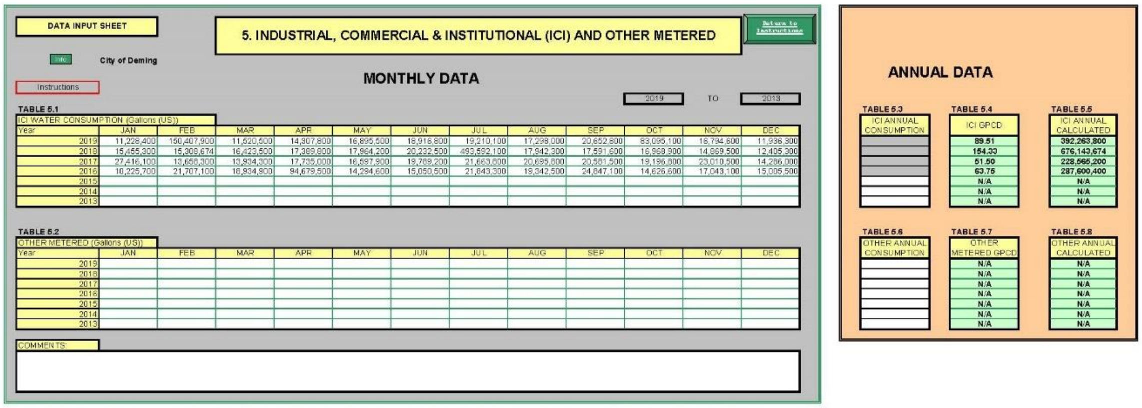
TABLE 4.10

VACANT MFR CONNECTIONS
N/A
N/A
N/A
N/A
N/A
N/A
N/A

TABLE 4.11

ANNUAL MFR GPCD
N/A
N/A
N/A
N/A
N/A
N/A
N/A

NMOSE GPCD Calculator v2.02



DATA INPUT SHEET

5. INDUSTRIAL, COMMERCIAL & INSTITUTIONAL (ICI) AND OTHER METERED

City of Deming

MONTHLY DATA

2019 TO 2013

TABLE 5.1

ICI WATER CONSUMPTION (Gallons (US))

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2019	11,228,400	150,407,900	11,520,500	14,307,800	16,895,500	18,916,800	19,210,100	17,298,000	20,652,800	83,095,100	16,794,600	11,936,300
2018	15,455,300	15,308,674	16,423,500	17,389,800	17,964,200	20,232,500	493,592,100	17,942,300	17,591,600	16,968,900	14,869,500	12,405,300
2017	27,416,100	13,656,300	13,934,300	17,735,000	16,597,900	19,769,200	21,663,600	20,695,800	20,561,500	19,196,800	23,010,500	14,286,000
2016	10,225,700	21,707,100	16,934,900	94,679,500	14,294,600	15,050,500	21,643,300	19,342,500	24,647,100	14,626,600	17,043,100	15,005,500
2015												
2014												
2013												

TABLE 5.2

OTHER METERED (Gallons (US))

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2019												
2018												
2017												
2016												
2015												
2014												
2013												

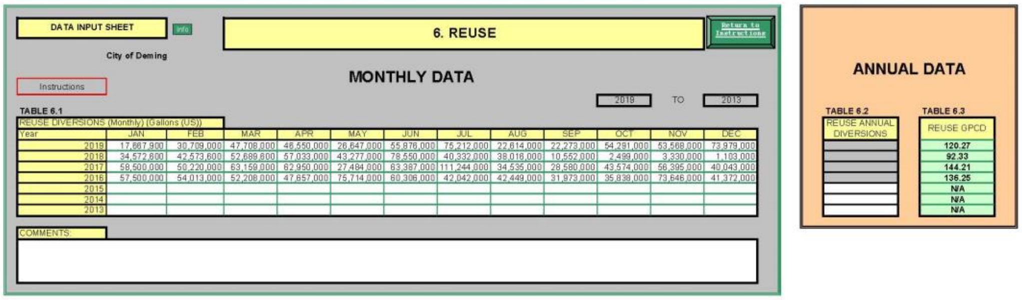
COMMENTS:

ANNUAL DATA

TABLE 5.3 ICI ANNUAL CONSUMPTION	TABLE 5.4 ICI GPCD	TABLE 5.5 ICI ANNUAL CALCULATED
	89.51	392,263,800
	154.33	676,143,674
	51.50	228,565,200
	63.75	287,600,400
	N/A	N/A
	N/A	N/A
	N/A	N/A

TABLE 5.6 OTHER ANNUAL CONSUMPTION	TABLE 5.7 OTHER METERED GPCD	TABLE 5.8 OTHER ANNUAL CALCULATED
	N/A	N/A
	N/A	N/A
	N/A	N/A
	N/A	N/A
	N/A	N/A
	N/A	N/A
	N/A	N/A

NMOSE GPCD Calculator v2.02



DATA INPUT SHEET

6. REUSE

City of Deming

MONTHLY DATA

2019 TO 2013

TABLE 6.1

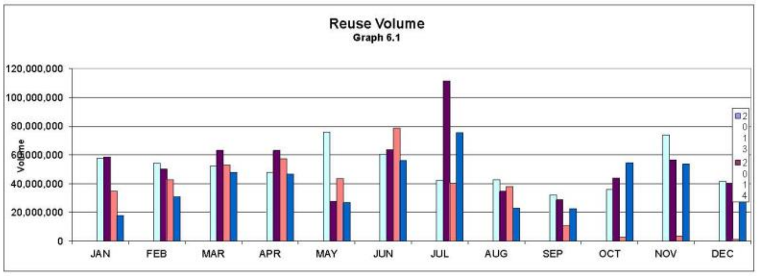
REUSE DIVERSIONS (Monthly) (Gallons (US))

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2019	17,667,900	30,709,000	47,708,000	46,550,000	26,647,000	55,876,000	75,212,000	22,614,000	22,273,000	54,291,000	53,568,000	73,979,000
2018	34,572,600	42,573,600	52,689,600	57,033,000	43,277,000	78,550,000	40,332,000	38,016,000	10,552,000	2,499,000	3,330,000	1,103,000
2017	58,500,000	50,220,000	63,159,000	62,950,000	27,484,000	63,387,000	111,244,000	34,535,000	28,580,000	43,574,000	56,395,000	40,043,000
2016	57,500,000	54,013,000	52,208,000	47,657,000	75,714,000	60,306,000	42,042,000	42,449,000	31,973,000	35,838,000	73,646,000	41,372,000
2015												
2014												
2013												

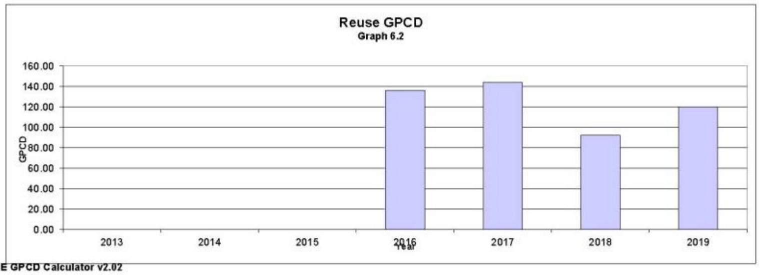
COMMENTS:

ANNUAL DATA

TABLE 6.2 REUSE ANNUAL DIVERSIONS	TABLE 6.3 REUSE GPCD
	120.27
	92.33
	144.21
	136.25
	N/A
	N/A
	N/A

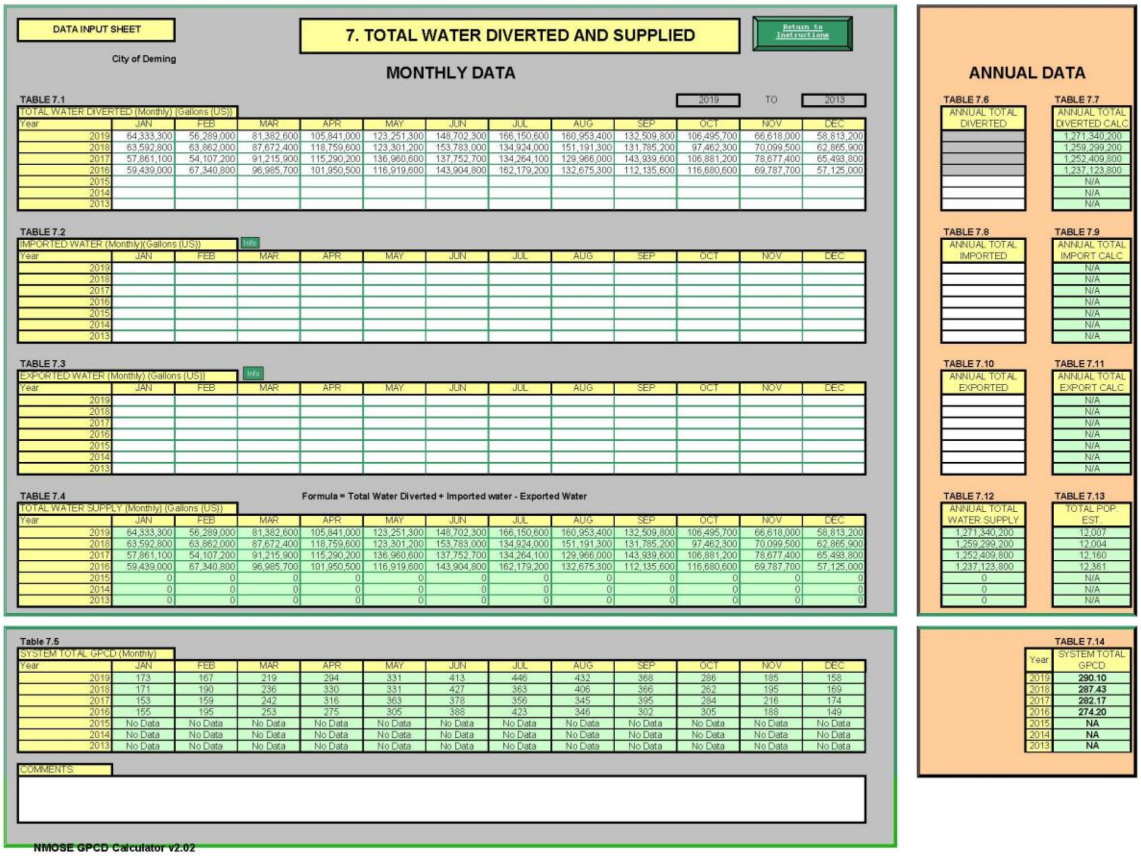


Reuse Volume
Graph 6.1



Reuse GPCD
Graph 6.2

NMOSE GPCD Calculator v2.02



DATA INPUT SHEET

7. TOTAL WATER DIVERTED AND SUPPLIED

City of Deming

MONTHLY DATA

2019 TO 2013

TABLE 7.1

TOTAL WATER DIVERTED (Monthly) (Gallons (US))

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2019	64,333,300	56,289,000	81,382,600	105,841,000	123,251,300	148,702,300	166,150,600	160,953,400	132,509,800	106,495,700	66,618,000	58,813,200
2018	63,592,800	63,862,000	87,672,400	118,759,600	123,301,200	153,783,000	134,924,000	151,191,300	131,785,200	97,462,300	70,099,500	62,865,900
2017	57,861,100	54,107,200	91,215,900	115,290,200	136,960,600	137,752,700	134,264,100	129,966,000	143,939,600	106,881,200	78,677,400	65,493,800
2016	59,439,000	67,340,800	96,985,700	101,950,500	116,919,600	143,904,800	162,179,200	132,675,300	112,135,600	116,680,600	69,787,700	57,125,000
2015												
2014												
2013												

TABLE 7.2

IMPORTED WATER (Monthly)(Gallons (US))

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2019												
2018												
2017												
2016												
2015												
2014												
2013												

TABLE 7.3

EXPORTED WATER (Monthly) (Gallons (US))

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2019												
2018												
2017												
2016												
2015												
2014												
2013												

TABLE 7.4

Formula = Total Water Diverted + Imported water - Exported Water

TOTAL WATER SUPPLY (Monthly) (Gallons (US))

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2019	64,333,300	56,289,000	81,382,600	105,841,000	123,251,300	148,702,300	166,150,600	160,953,400	132,509,800	106,495,700	66,618,000	58,813,200
2018	63,592,800	63,862,000	87,672,400	118,759,600	123,301,200	153,783,000	134,924,000	151,191,300	131,785,200	97,462,300	70,099,500	62,865,900
2017	57,861,100	54,107,200	91,215,900	115,290,200	136,960,600	137,752,700	134,264,100	129,966,000	143,939,600	106,881,200	78,677,400	65,493,800
2016	59,439,000	67,340,800	96,985,700	101,950,500	116,919,600	143,904,800	162,179,200	132,675,300	112,135,600	116,680,600	69,787,700	57,125,000
2015	0	0	0	0	0	0	0	0	0	0	0	0
2014	0	0	0	0	0	0	0	0	0	0	0	0
2013	0	0	0	0	0	0	0	0	0	0	0	0

ANNUAL DATA

TABLE 7.6

ANNUAL TOTAL DIVERTED

TABLE 7.7

ANNUAL TOTAL DIVERTED CALC
1,271,340,200
1,259,299,200
1,252,409,800
1,237,123,800
N/A
N/A
N/A

TABLE 7.8

ANNUAL TOTAL IMPORTED

TABLE 7.9

ANNUAL TOTAL IMPORT CALC
N/A
N/A
N/A
N/A
N/A
N/A
N/A

TABLE 7.10

ANNUAL TOTAL EXPORTED

TABLE 7.11

ANNUAL TOTAL EXPORT CALC
N/A
N/A
N/A
N/A
N/A
N/A
N/A

TABLE 7.12

ANNUAL TOTAL WATER SUPPLY
1,271,340,200
1,259,299,200
1,252,409,800
1,237,123,800
0
0
0

TABLE 7.13

TOTAL POP. EST.
12,007
12,004
12,160
12,361
N/A
N/A
N/A

Table 7.5

SYSTEM TOTAL GPCD (Monthly)

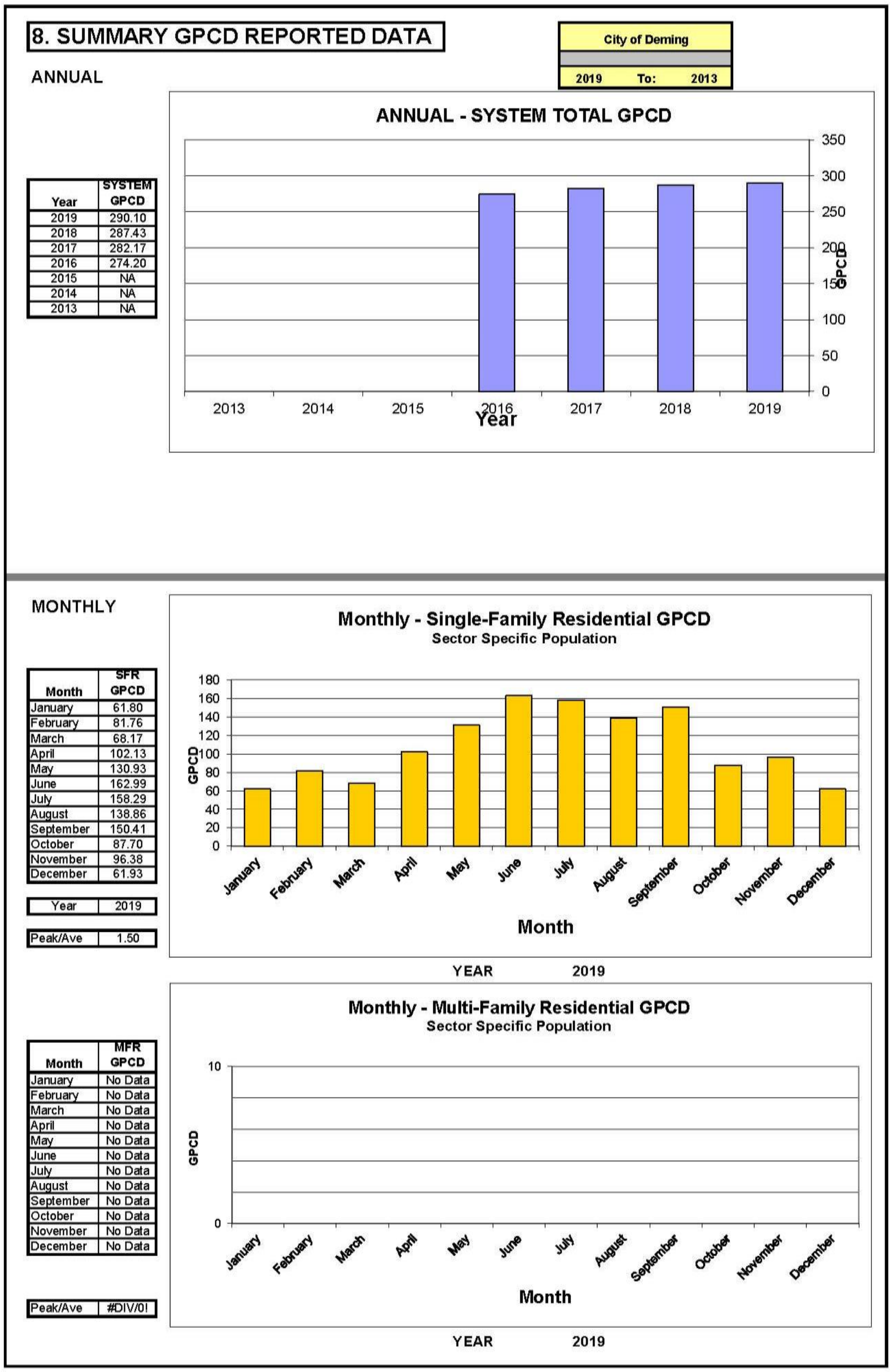
Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2019	173	167	219	294	331	413	446	432	368	286	185	158
2018	171	190	236	330	331	427	363	406	366	262	195	169
2017	153	159	242	316	363	378	356	345	395	284	216	174
2016	155	195	253	275	305	388	423	346	302	305	188	149
2015	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2014	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2013	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data

TABLE 7.14

Year	SYSTEM TOTAL GPCD
2019	**290.10**
2018	**287.43**
2017	**282.17**
2016	**274.20**
2015	**NA**
2014	**NA**
2013	**NA**

COMMENTS:

NMOSE GPCD Calculator v2.02



8. SUMMARY GPCD REPORTED DATA

City of Deming

2019 To: 2013

ANNUAL

Year	SYSTEM GPCD
2019	290.10
2018	287.43
2017	282.17
2016	274.20
2015	NA
2014	NA
2013	NA

ANNUAL - SYSTEM TOTAL GPCD

MONTHLY

Month	SFR GPCD
January	61.80
February	81.76
March	68.17
April	102.13
May	130.93
June	162.99
July	158.29
August	138.86
September	150.41
October	87.70
November	96.38
December	61.93

Year	2019

Peak/Ave	1.50

Monthly - Single-Family Residential GPCD

Sector Specific Population

YEAR 2019

Month	MFR GPCD
January	No Data
February	No Data
March	No Data
April	No Data
May	No Data
June	No Data
July	No Data
August	No Data
September	No Data
October	No Data
November	No Data
December	No Data

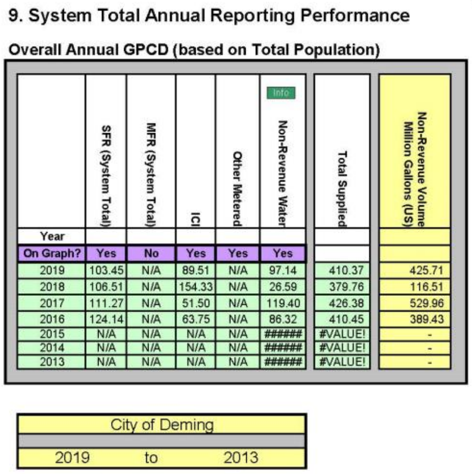
Peak/Ave	#DIV/0!

Monthly - Multi-Family Residential GPCD

Sector Specific Population

YEAR 2019

NMOSE GPCD Calculator v2.02



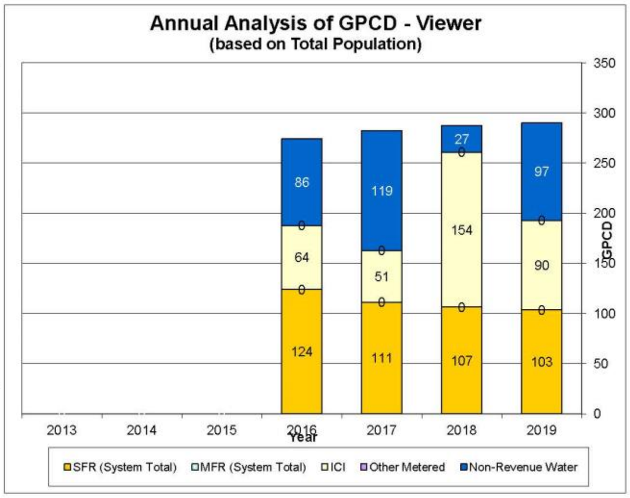
9. System Total Annual Reporting Performance

Overall Annual GPCD (based on Total Population)

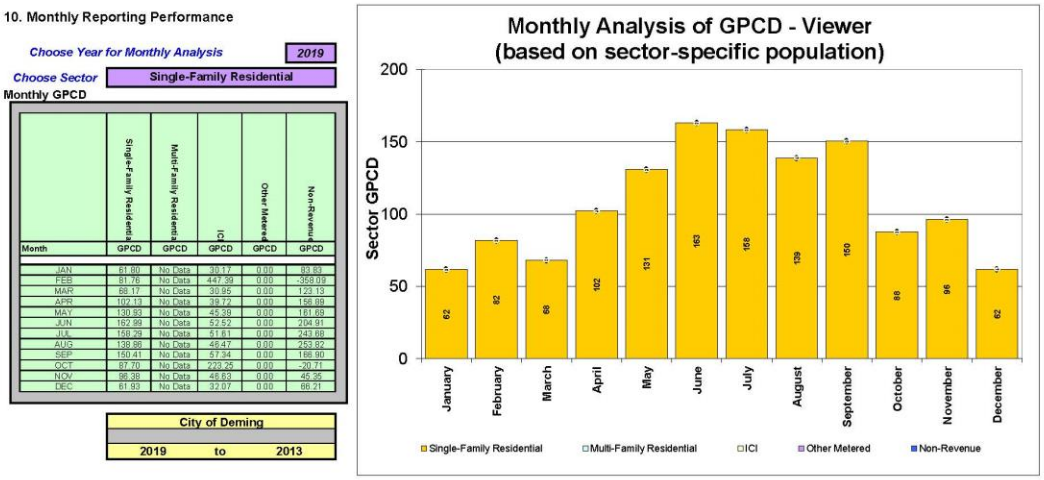
Year	SFR (System Total)	MFR (System Total)	ICI	Other Metered	Info Non-Revenue Water	Total Supplied	Non-Revenue Volume Million Gallons (US)
On Graph?	Yes	No	Yes	Yes	Yes		
2019	103.45	N/A	89.51	N/A	97.14	410.37	425.71
2018	106.51	N/A	154.33	N/A	26.59	379.76	116.51
2017	111.27	N/A	51.50	N/A	119.40	426.38	529.96
2016	124.14	N/A	63.75	N/A	86.32	410.45	389.43
2015	N/A	N/A	N/A	N/A	######	#VALUE!	-
2014	N/A	N/A	N/A	N/A	######	#VALUE!	-
2013	N/A	N/A	N/A	N/A	######	#VALUE!	-

City of Deming

2019 to 2013



NMOSE GPCD Calculator v2.02



10. Monthly Reporting Performance

Choose Year for Monthly Analysis *2019*

Choose Sector Single-Family Residential

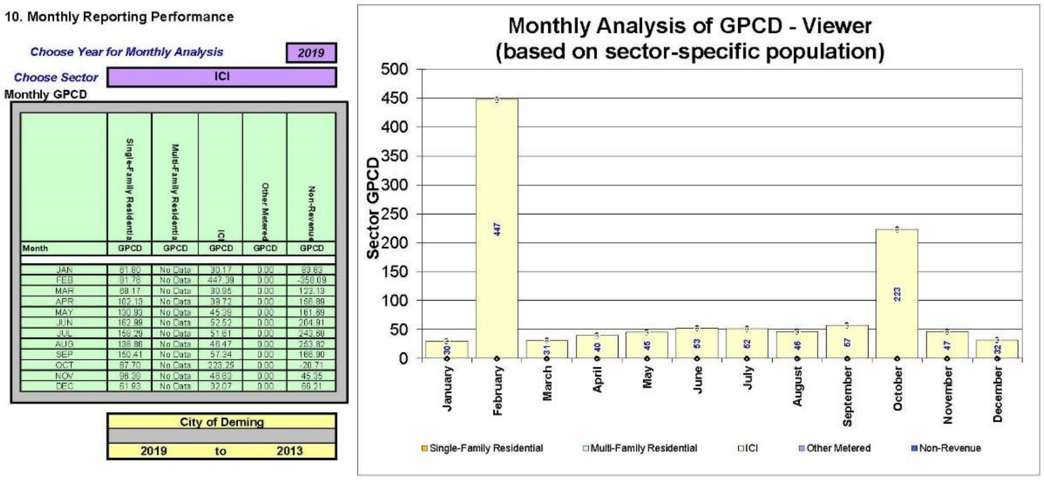
Monthly GPCD

	Single-Family Residentia	Multi-Family Residentia	ICI	Other Metered	Non-Revenu
Month	GPCD	GPCD	GPCD	GPCD	GPCD
JAN	61.80	No Data	30.17	0.00	83.83
FEB	81.76	No Data	447.39	0.00	-358.09
MAR	68.17	No Data	30.95	0.00	123.13
APR	102.13	No Data	39.72	0.00	156.89
MAY	130.93	No Data	45.39	0.00	161.69
JUN	162.99	No Data	52.52	0.00	204.91
JUL	158.29	No Data	51.61	0.00	243.68
AUG	138.86	No Data	46.47	0.00	253.82
SEP	150.41	No Data	57.34	0.00	166.90
OCT	87.70	No Data	223.25	0.00	-20.71
NOV	96.38	No Data	46.63	0.00	45.35
DEC	61.93	No Data	32.07	0.00	66.21

City of Deming

2019 to 2013

NMOSE GPCD Calculator v2.02



10. Monthly Reporting Performance

Choose Year for Monthly Analysis 2019

Choose Sector ICI

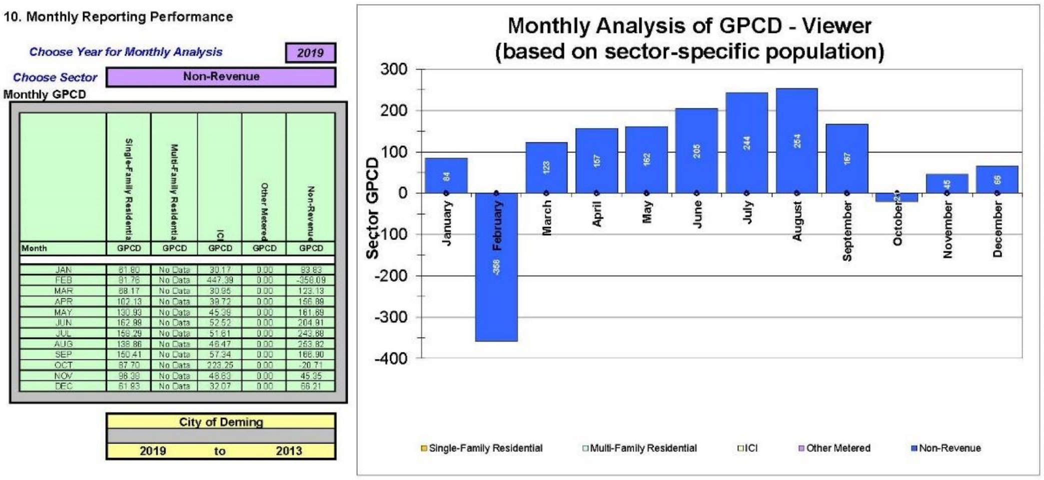
Monthly GPCD

Month	Single-Family Residentia GPCD	Multi-Family Residentia GPCD	ICI GPCD	Other Metered GPCD	Non-Revenue GPCD
JAN	81.80	No Data	30.17	0.00	83.83
FEB	81.76	No Data	447.39	0.00	-358.09
MAR	88.17	No Data	30.95	0.00	123.13
APR	102.13	No Data	39.72	0.00	156.89
MAY	130.93	No Data	45.39	0.00	161.69
JUN	162.99	No Data	52.52	0.00	204.91
JUL	158.29	No Data	51.61	0.00	243.68
AUG	138.86	No Data	46.47	0.00	253.82
SEP	150.41	No Data	57.34	0.00	166.90
OCT	87.70	No Data	223.25	0.00	-20.71
NOV	96.38	No Data	46.63	0.00	45.35
DEC	61.93	No Data	32.07	0.00	66.21

City of Deming

2019 to 2013

NMOSE GPCD Calculator v2.02



10. Monthly Reporting Performance

Choose Year for Monthly Analysis 2019

Choose Sector Non-Revenue

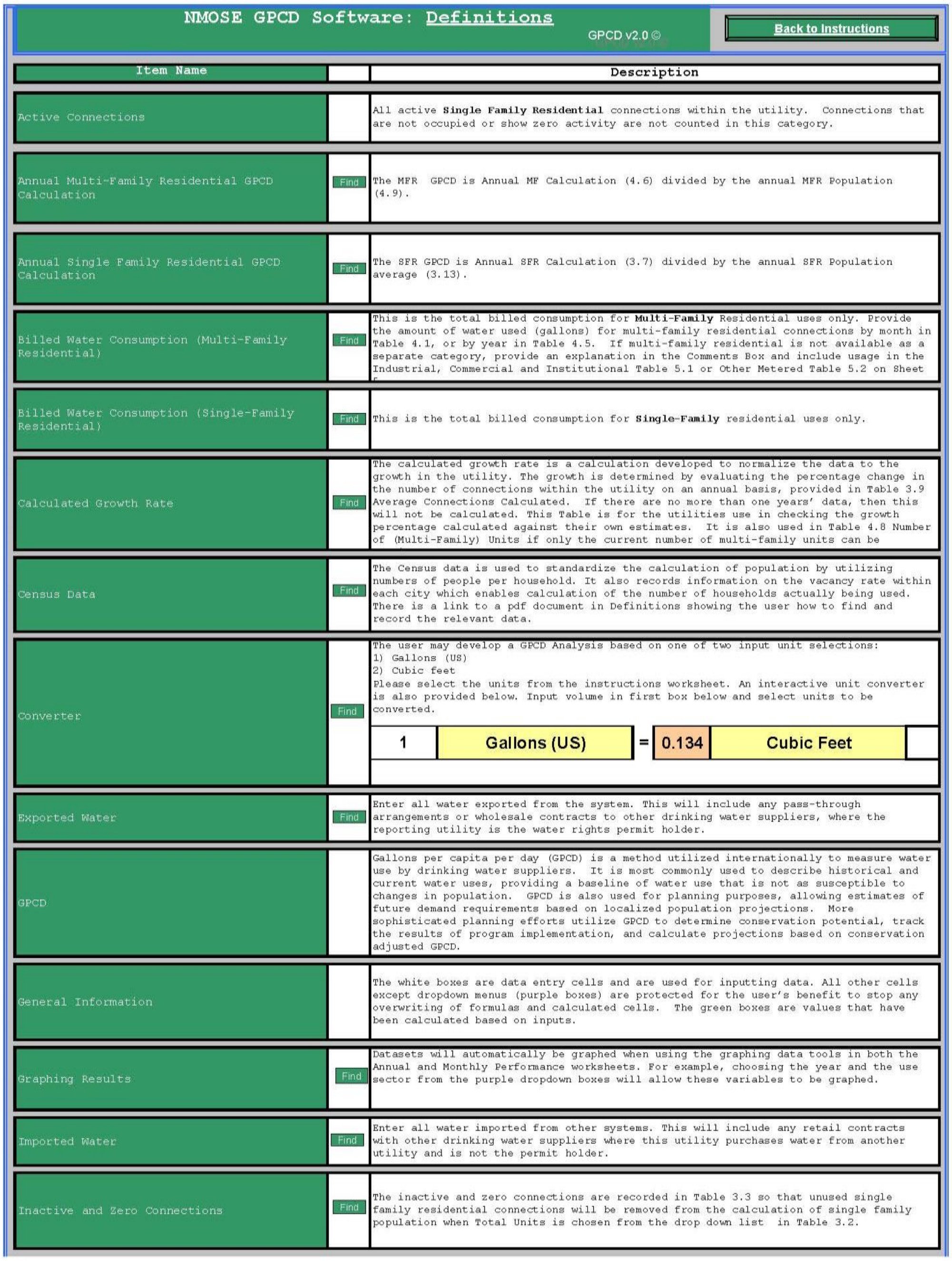
Monthly GPCD

	Single-Family Residentia	Multi-Family Residentia	ICI	Other Metered	Non-Revenue
Month	GPCD	GPCD	GPCD	GPCD	GPCD
JAN	61.80	No Data	30.17	0.00	83.83
FEB	81.76	No Data	447.39	0.00	-358.09
MAR	68.17	No Data	30.95	0.00	123.13
APR	102.13	No Data	39.72	0.00	156.89
MAY	130.93	No Data	45.39	0.00	161.69
JUN	162.99	No Data	52.52	0.00	204.91
JUL	158.29	No Data	51.61	0.00	243.68
AUG	138.86	No Data	46.47	0.00	253.82
SEP	150.41	No Data	57.34	0.00	166.90
OCT	87.70	No Data	223.25	0.00	-20.71
NOV	96.38	No Data	48.63	0.00	45.35
DEC	61.93	No Data	32.07	0.00	66.21

City of Deming

2019 to 2013

NMOSE GPCD Calculator v2.02

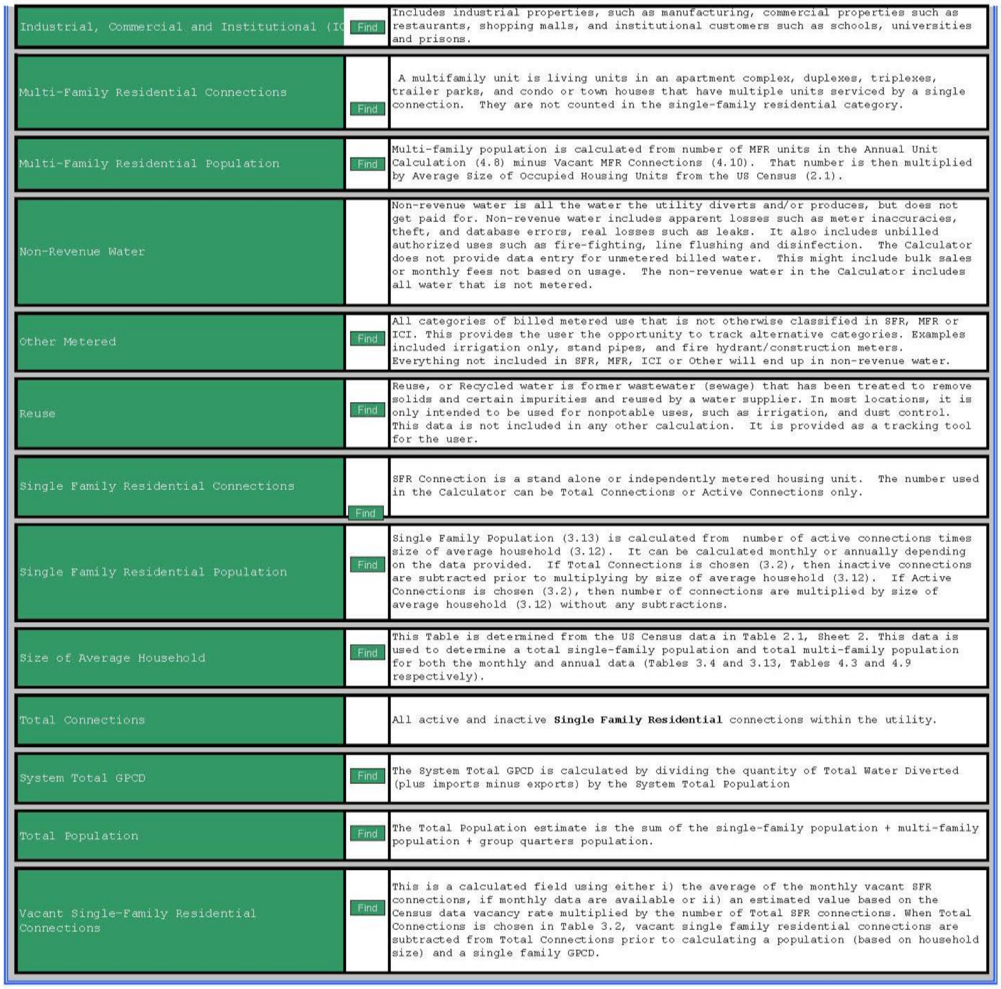


NMOSE GPCD Software: Definitions

GPCD v2.0 ©

Item Name		Description
Active Connections		All active **Single Family Residential** connections within the utility. Connections that are not occupied or show zero activity are not counted in this category.
Annual Multi-Family Residential GPCD Calculation	Find	The MFR GPCD is Annual MF Calculation (4.6) divided by the annual MFR Population (4.9).
Annual Single Family Residential GPCD Calculation	Find	The SFR GPCD is Annual SFR Calculation (3.7) divided by the annual SFR Population average (3.13).
Billed Water Consumption (Multi-Family Residential)	Find	This is the total billed consumption for **Multi-Family** Residential uses only. Provide the amount of water used (gallons) for multi-family residential connections by month in Table 4.1, or by year in Table 4.5. If multi-family residential is not available as a separate category, provide an explanation in the Comments Box and include usage in the Industrial, Commercial and Institutional Table 5.1 or Other Metered Table 5.2 on Sheet
Billed Water Consumption (Single-Family Residential)	Find	This is the total billed consumption for **Single-Family** residential uses only.
Calculated Growth Rate	Find	The calculated growth rate is a calculation developed to normalize the data to the growth in the utility. The growth is determined by evaluating the percentage change in the number of connections within the utility on an annual basis, provided in Table 3.9 Average Connections Calculated. If there are no more than one years' data, then this will not be calculated. This Table is for the utilities use in checking the growth percentage calculated against their own estimates. It is also used in Table 4.8 Number of (Multi-Family) Units if only the current number of multi-family units can be
Census Data	Find	The Census data is used to standardize the calculation of population by utilizing numbers of people per household. It also records information on the vacancy rate within each city which enables calculation of the number of households actually being used. There is a link to a pdf document in Definitions showing the user how to find and record the relevant data.
Converter	Find	The user may develop a GPCD Analysis based on one of two input unit selections: 1) Gallons (US) 2) Cubic feet Please select the units from the instructions worksheet. An interactive unit converter is also provided below. Input volume in first box below and select units to be converted. 1 Gallons (US) = 0.134 Cubic Feet
Exported Water	Find	Enter all water exported from the system. This will include any pass-through arrangements or wholesale contracts to other drinking water suppliers, where the reporting utility is the water rights permit holder.
GPCD		Gallons per capita per day (GPCD) is a method utilized internationally to measure water use by drinking water suppliers. It is most commonly used to describe historical and current water uses, providing a baseline of water use that is not as susceptible to changes in population. GPCD is also used for planning purposes, allowing estimates of future demand requirements based on localized population projections. More sophisticated planning efforts utilize GPCD to determine conservation potential, track the results of program implementation, and calculate projections based on conservation adjusted GPCD.
General Information		The white boxes are data entry cells and are used for inputting data. All other cells except dropdown menus (purple boxes) are protected for the user's benefit to stop any overwriting of formulas and calculated cells. The green boxes are values that have been calculated based on inputs.
Graphing Results	Find	Datasets will automatically be graphed when using the graphing data tools in both the Annual and Monthly Performance worksheets. For example, choosing the year and the use sector from the purple dropdown boxes will allow these variables to be graphed.
Imported Water	Find	Enter all water imported from other systems. This will include any retail contracts with other drinking water suppliers where this utility purchases water from another utility and is not the permit holder.
Inactive and Zero Connections	Find	The inactive and zero connections are recorded in Table 3.3 so that unused single family residential connections will be removed from the calculation of single family population when Total Units is chosen from the drop down list in Table 3.2.

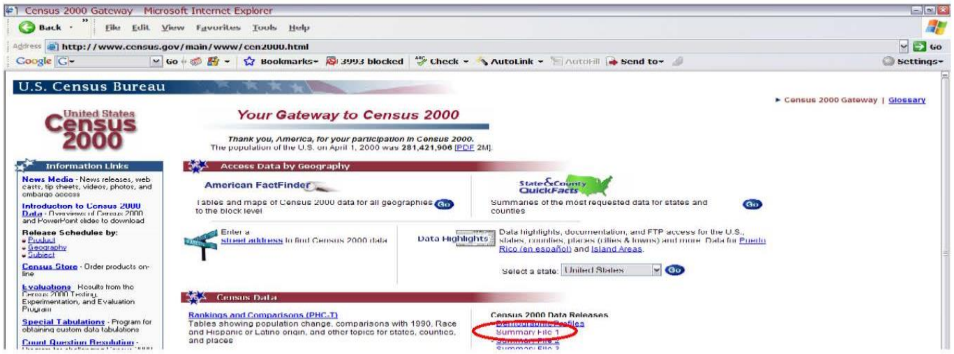
NMOSE GPCD Calculator v2.02 1



Industrial, Commercial and Institutional (IC	Find	Includes industrial properties, such as manufacturing, commercial properties such as restaurants, shopping malls, and institutional customers such as schools, universities and prisons.
Multi-Family Residential Connections	Find	A multifamily unit is living units in an apartment complex, duplexes, triplexes, trailer parks, and condo or town houses that have multiple units serviced by a single connection. They are not counted in the single-family residential category.
Multi-Family Residential Population	Find	Multi-family population is calculated from number of MFR units in the Annual Unit Calculation (4.8) minus Vacant MFR Connections (4.10). That number is then multiplied by Average Size of Occupied Housing Units from the US Census (2.1).
Non-Revenue Water		Non-revenue water is all the water the utility diverts and/or produces, but does not get paid for. Non-revenue water includes apparent losses such as meter inaccuracies, theft, and database errors, real losses such as leaks. It also includes unbilled authorized uses such as fire-fighting, line flushing and disinfection. The Calculator does not provide data entry for unmetered billed water. This might include bulk sales or monthly fees not based on usage. The non-revenue water in the Calculator includes all water that is not metered.
Other Metered	Find	All categories of billed metered use that is not otherwise classified in SFR, MFR or ICI. This provides the user the opportunity to track alternative categories. Examples included irrigation only, stand pipes, and fire hydrant/construction meters. Everything not included in SFR, MFR, ICI or Other will end up in non-revenue water.
Reuse	Find	Reuse, or Recycled water is former wastewater (sewage) that has been treated to remove solids and certain impurities and reused by a water supplier. In most locations, it is only intended to be used for nonpotable uses, such as irrigation, and dust control. This data is not included in any other calculation. It is provided as a tracking tool for the user.
Single Family Residential Connections	Find	SFR Connection is a stand alone or independently metered housing unit. The number used in the Calculator can be Total Connections or Active Connections only.
Single Family Residential Population	Find	Single Family Population (3.13) is calculated from number of active connections times size of average household (3.12). It can be calculated monthly or annually depending on the data provided. If Total Connections is chosen (3.2), then inactive connections are subtracted prior to multiplying by size of average household (3.12). If Active Connections is chosen (3.2), then number of connections are multiplied by size of average household (3.12) without any subtractions.
Size of Average Household	Find	This Table is determined from the US Census data in Table 2.1, Sheet 2. This data is used to determine a total single-family population and total multi-family population for both the monthly and annual data (Tables 3.4 and 3.13, Tables 4.3 and 4.9 respectively).
Total Connections		All active and inactive **Single Family Residential** connections within the utility.
System Total GPCD	Find	The System Total GPCD is calculated by dividing the quantity of Total Water Diverted (plus imports minus exports) by the System Total Population
Total Population	Find	The Total Population estimate is the sum of the single-family population + multi-family population + group quarters population.
Vacant Single-Family Residential Connections	Find	This is a calculated field using either i) the average of the monthly vacant SFR connections, if monthly data are available or ii) an estimated value based on the Census data vacancy rate multiplied by the number of Total SFR connections. When Total Connections is chosen in Table 3.2, vacant single family residential connections are subtracted from Total Connections prior to calculating a population (based on household size) and a single family GPCD.

How to find the data required for Census section

www.census.gov
click on [**Census 2000**]



Your Gateway to Census 2000

Thank you, America, for your participation in Census 2000.
The population of the U.S. on April 1, 2000 was **281,421,906** [PDF 2M].

News Media - News releases, web casts, tip sheets, videos, photos, and embargo access

Introduction to Census 2000 Data - Overviews of Census 2000 and PowerPoint slides to download

Release Schedules by:
- Product
- Geography
- Subject

Census Store - Order products on-line

Evaluations - Results from the Census 2000 Testing, Experimentation, and Evaluation Program

Special Tabulations - Program for obtaining custom data tabulations

Count Question Resolution -

Tables and maps of Census 2000 data for all geographies to the block level

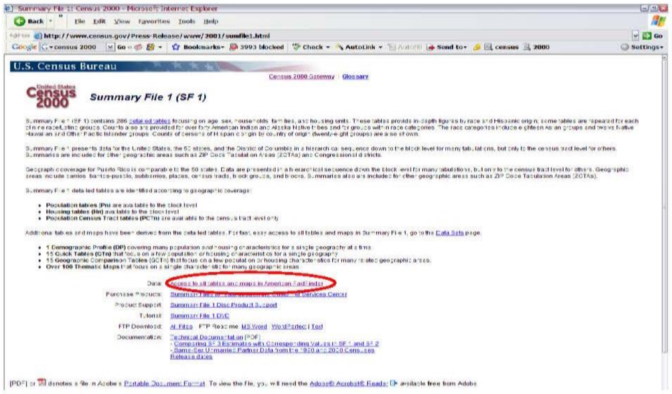
Summaries of the most requested data for states and counties

Enter a street address to find Census 2000 data

Data highlights, documentation, and FTP access for the U.S., states, counties, places (cities & towns) and more. Data for Puerto Rico (en español) and Island Areas.

Rankings and Comparisons (PHC-T)
Tables showing population change, comparisons with 1990, Race and Hispanic or Latino origin, and other topics for states, counties, and places

Click on [**Summary File 1**]



Summary File 1 (SF 1)

Summary File 1 (SF 1) contains 286 detailed tables focusing on age, sex, households, families, and housing units. These tables provide in-depth figures by race and Hispanic origin; some tables are repeated for each of nine race/Latino groups. Counts also are provided for over forty American Indian and Alaska Native tribes and for groups within race categories. The race categories include eighteen Asian groups and twelve Native Hawaiian and Other Pacific Islander groups. Counts of persons of Hispanic origin by country of origin (twenty-eight groups) are also shown.

Summary File 1 presents data for the United States, the 50 states, and the District of Columbia in a hierarchical sequence down to the block level for many tabulations, but only to the census tract level for others. Summaries are included for other geographic areas such as ZIP Code Tabulation Areas (ZCTAs) and Congressional districts.

Geographic coverage for Puerto Rico is comparable to the 50 states. Data are presented in a hierarchical sequence down the block level for many tabulations, but only to the census tract level for others. Geographic areas include barrios, barrios-pueblo, subbarrios, places, census tracts, block groups, and blocks. Summaries also are included for other geographic areas such as ZIP Code Tabulation Areas (ZCTAs).

Summary File 1 detailed tables are identified according to geographic coverage:

- **Population tables (Pn)** are available to the block level
- **Housing tables (Hn)** available to the block level
- **Population Census Tract tables (PCTn)** are available to the census tract level only

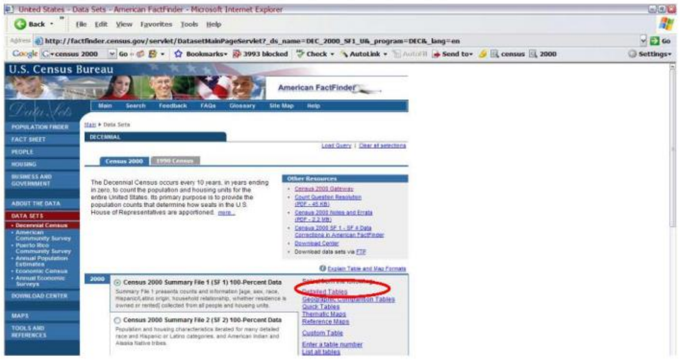
Additional tables and maps have been derived from the detailed tables. For fast, easy access to all tables and maps in Summary File 1, go to the Data Sets page.

- **1 Demographic Profile (DP)** covering many population and housing characteristics for a single geography at a time
- **15 Quick Tables (QTn)** that focus on a few population or housing characteristics for a single geography
- **15 Geographic Comparison Tables (GCTn)** that focus on a few population or housing characteristics for many related geographic areas.
- **Over 100 Thematic Maps** that focus on a single characteristic for many geographic areas

Data: Access to all tables and maps in American FactFinder
Purchase Products: Summary File [illegible] Services Center
Product Support: Summary File 1 Disc Product Support
Tutorial: Summary File 1 DVD
FTP Download: All Files FTP Readme MS Word WordPerfect | Text
Documentation: Technical Documentation [PDF]
- Comparing SF 3 Estimates with Corresponding Values in SF 1 and SF 2
- Same-Sex Unmarried Partner Data from the 1990 and 2000 Censuses
Release dates

[PDF] or denotes a file in Adobe's Portable Document Format. To view the file, you will need the Adobe® Acrobat® Reader available free from Adobe

Click on [**Access to all tables and maps in American FactFinder**]

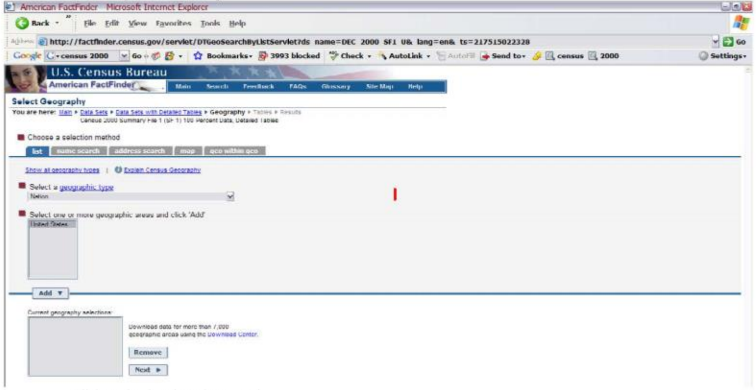


The Decennial Census occurs every 10 years, in years ending in zero, to count the population and housing units for the entire United States. Its primary purpose is to provide the population counts that determine how seats in the U.S. House of Representatives are apportioned. more...

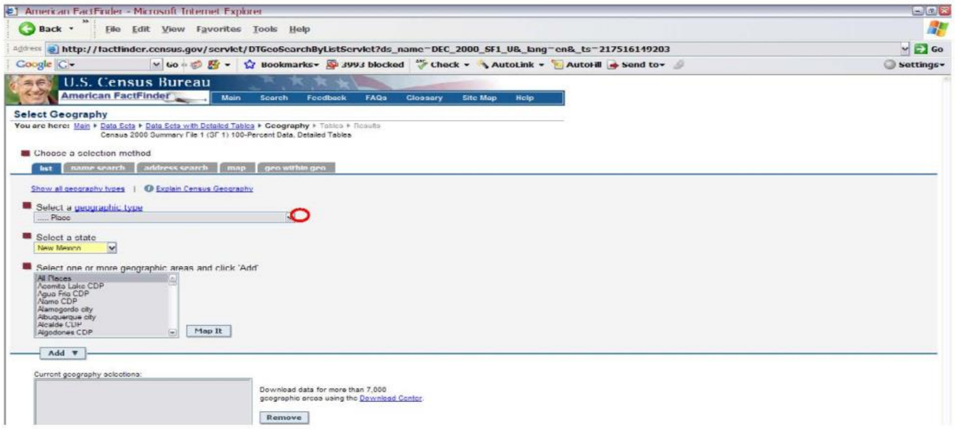
● Census 2000 Summary File 1 (SF 1) 100-Percent Data
Summary File 1 presents counts and information [age, sex, race, Hispanic/Latino origin, household relationship, whether residence is owned or rented] collected from all people and housing units.

○ Census 2000 Summary File 2 (SF 2) 100-Percent Data
Population and housing characteristics iterated for many detailed race and Hispanic or Latino categories, and American Indian and Alaska Native tribes.

Click on **[Detailed tables]**

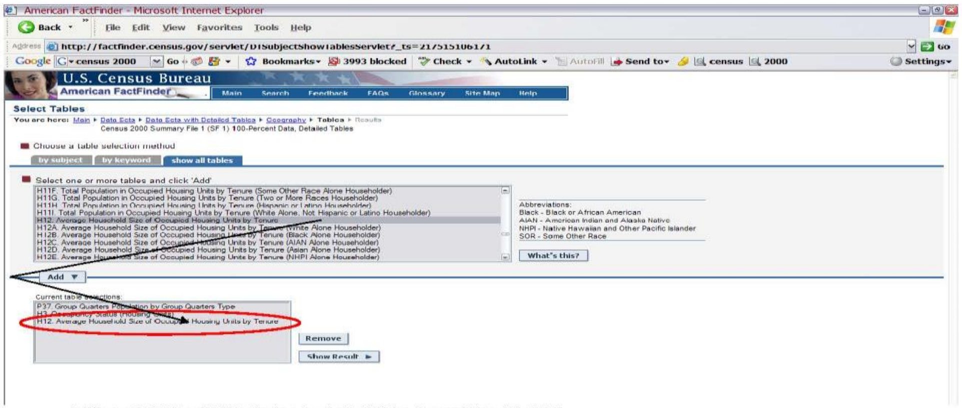


Click on the dropdown boxes and
Select **[Place]**
When “Select a State” box appears
Select **[New Mexico]**
Select Geographic area from drop down list that is the closest description of your service area
Add this to the base box as shown below



NMOSE GPCD Calculator v2.02 4

Click **[Next]**



Select Tables

You are here: Main ▸ Data Sets ▸ Data Sets with Detailed Tables ▸ Geography ▸ Tables ▸ Results
Census 2000 Summary File 1 (SF 1) 100-Percent Data, Detailed Tables

Choose a table selection method

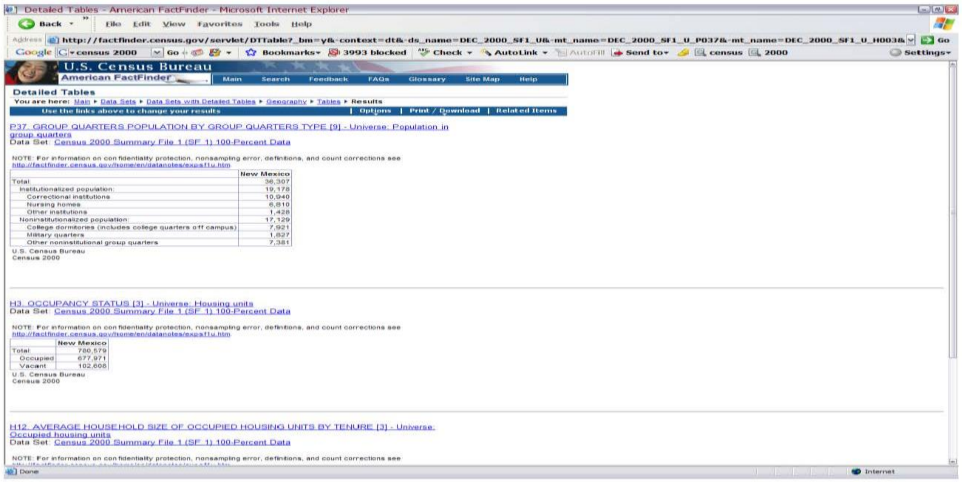
Select one or more tables and click 'Add'

- H11F. Total Population in Occupied Housing Units by Tenure (Some Other Race Alone Householder)
- H11G. Total Population in Occupied Housing Units by Tenure (Two or More Races Householder)
- H11H. Total Population in Occupied Housing Units by Tenure (Hispanic or Latino Householder)
- H11I. Total Population in Occupied Housing Units by Tenure (White Alone, Not Hispanic or Latino Householder)
- H12. Average Household Size of Occupied Housing Units by Tenure
- H12A. Average Household Size of Occupied Housing Units by Tenure (White Alone Householder)
- H12B. Average Household Size of Occupied Housing Units by Tenure (Black Alone Householder)
- H12C. Average Household Size of Occupied Housing Units by Tenure (AIAN Alone Householder)
- H12D. Average Household Size of Occupied Housing Units by Tenure (Asian Alone Householder)
- H12E. Average Household Size of Occupied Housing Units by Tenure (NHPI Alone Householder)

Abbreviations:
Black - Black or African American
AIAN - American Indian and Alaska Native
NHPI - Native Hawaiian and Other Pacific Islander
SOR - Some Other Race

Current table selections:
- P37. Group Quarters Population by Group Quarters Type
- H3. Occupancy Status (Housing Units)
- H12. Average Household Size of Occupied Housing Units by Tenure

Add boxes P37, H3, and H12 to the base box by highlighting them and then click **[Add]**
Once all the tables show in the base box click **[Show Result]**



Detailed Tables

You are here: Main ▸ Data Sets ▸ Data Sets with Detailed Tables ▸ Geography ▸ Tables ▸ Results

Use the links above to change your results

P37. GROUP QUARTERS POPULATION BY GROUP QUARTERS TYPE [9] - Universe: Population in group quarters
Data Set: Census 2000 Summary File 1 (SF 1) 100-Percent Data

NOTE: For information on confidentiality protection, nonsampling error, definitions, and count corrections see http://factfinder.census.gov/home/en/datanotes/expsf1u.htm.

	New Mexico
Total:	36,307
Institutionalized population:	19,178
Correctional institutions	10,940
Nursing homes	6,810
Other institutions	1,428
Noninstitutionalized population:	17,129
College dormitories (includes college quarters off campus)	7,921
Military quarters	1,827
Other noninstitutional group quarters	7,381

U.S. Census Bureau
Census 2000

H3. OCCUPANCY STATUS [3] - Universe: Housing units
Data Set: Census 2000 Summary File 1 (SF 1) 100-Percent Data

NOTE: For information on confidentiality protection, nonsampling error, definitions, and count corrections see http://factfinder.census.gov/home/en/datanotes/expsf1u.htm.

	New Mexico
Total:	780,579
Occupied	677,971
Vacant	102,608

U.S. Census Bureau
Census 2000

H12. AVERAGE HOUSEHOLD SIZE OF OCCUPIED HOUSING UNITS BY TENURE [3] - Universe: Occupied housing units
Data Set: Census 2000 Summary File 1 (SF 1) 100-Percent Data

NOTE: For information on confidentiality protection, nonsampling error, definitions, and count corrections see

Transfer results to spreadsheet

END

Beginning of Section

Appendix C City of Deming's 40-year Water Plan (2018)

City of Deming
40-Year Water Plan

December 28, 2018

Table of Contents

List of Figures

List of Tables

List of Appendices

1. Introduction

The City of Deming (City), located in Luna County in southwestern New Mexico (Figure 1-1), retained the services of Daniel B. Stephens & Associates, Inc. (DBS&A) to prepare this 40-year water development plan. The plan includes future water demand projections to ascertain the amount of water the City will need to meet projected demand over the 40-year planning period.

This 40-year water development plan addresses key regulatory requirements regarding water rights (NMSA 72-5-28(C)):

- Section 72-1-9 (B) of the New Mexico Water Code allows covered entities such as the City of Deming to legally appropriate and preserve water that they cannot currently use but will need in the future to meet projected water requirements for the service area.

- Municipalities are specifically exempt from forfeiture of unused water rights if those rights have been appropriated for the implementation of a water development plan or for preservation of water supplies (NMSA 72-12-8 (F)).

Thus, by preparing the water development plan—which documents existing demand, projects future demand, and identifies the water rights needed to meet demand—the City can acquire and retain water rights to meet future needs without putting them to immediate beneficial use. The City of Deming prepared a 40-year water plan in 1997, and in 2009 the City retained DBS&A to update the 1997 plan. To further facilitate long-range water resource planning for the City of Deming, the City again retained DBS&A to update the 2009 plan to account for current conditions.

This water development plan provides information on the City of Deming's water system (Section 2), water supply (Section 3), current and projected demand demonstrating the need for water rights (Section 4), and currently held water rights and legal constraints to water supply (Section 5). The long-term strategy, including a discussion of conservation, to address the water needs of the City is presented in Section 6.

S:\PROJECTS\DB17.1121_DEMING_40-YEAR_PLAN\GIS\MXDS\FIGURES\FIG1-1_LOCATION.MXD

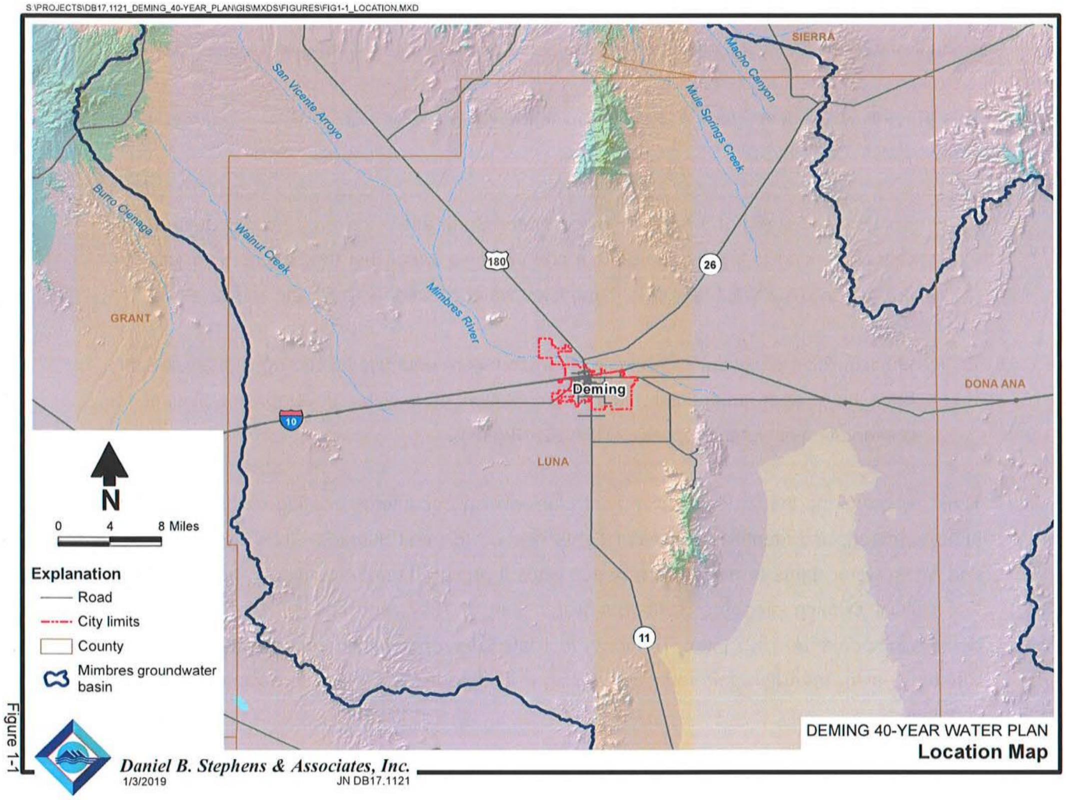


Figure 1-1

DEMING 40-YEAR WATER PLAN
Location Map

Daniel B. Stephens & Associates, Inc.
1/3/2019
JN DB17.1121

2. Deming Water System

The City of Deming is located in Luna County, New Mexico (Figure 1-1) and is the county seat and largest population center, with a population of about 14,000. Originally a settlement known as Mimbres Junction, Deming was founded in 1881. Deming was later incorporated in 1902. U.S. Army Camp Cody was established in Deming in 1916 during the First World War. In 1942 the Deming Army Airfield was established with over 12,000 bombardier cadets graduating between 1942 and 1946 when it was closed. Interstate 10 came to town in 1964, resulting in additional growth.

The predominant land use in Deming is single family residential (SFR), with the majority of SFR lying south of the railroad tracks/I-10 corridor (City of Deming, 2017). Other land uses identified are multi-family residential, mobile home park, agricultural, parks/open space, commercial, governmental/institutional, industrial, utility, and vacant land. The City is generally growing to the southeast. Country Club Estates is the largest residential development, comprising a 300-lot senior community in the southern part of the City.

Commercial development generally occurs in the downtown area, along Golf Avenue, Pine Street, and Silver Avenue, and includes retail, restaurant, office, auto sales and repair, gas stations, hotels, and RV parks.

Institutional development includes Deming Public Schools, Deming Municipal Airport, Mimbres Memorial Hospital, churches, and the courthouse. Industrial development includes the Deming Industrial Park, located south of the Deming Municipal Airport which includes hangars, and the Peru Mill Industrial Park

The City of Deming water system relies entirely on groundwater from the Mimbres Basin for its municipal water supply. The Deming well field has 12 active wells. The majority of these wells provide potable water services to the residents of the City, and the remaining wells (not currently connected to/or isolated from the distribution system) provide irrigation service to the City's golf course, cemeteries, and municipal parks. The City has multiple wells that are leased out to nearby farms.

The City's water storage and distribution system includes two 500,000-gallon elevated storage tanks, one 3,000,000-gallon ground-level storage tank, and 140 miles of distribution pipeline of various materials, ranging in diameter from 4 to 18 inches (DBS&A, 2017). There is only one pressure zone in Deming, as there are minimal changes in elevation in the area. Accordingly, the City experiences no pressure problems in the system. System capacity averages 7,500 gpm with a peak capacity of 10.8 million gallons per day (mgd). Winter use averages 2 mgd.

A Preliminary Engineering Report (PER) completed in 2017 (DBS&A, 2017) noted system deficiencies related to aging infrastructure, and recommended upgrades to address deficiencies and to improve storage to support future growth.

The current City of Deming wastewater treatment plant was built in 1982 and is located 3 miles east-southeast of the City center. The design capacity for the plant is 3 mgd. The wastewater treatment plant treats approximately 1.4 million gallons of wastewater per day (City of Deming 2017).

The City reuses treated wastewater effluent, thereby lowering the demand on the potable water system, particularly in months of high demand. The City reuses treated wastewater effluent at three locations: a storage pond for the Luna Energy power plant, the golf course, and farmland located near the wastewater treatment plant (WWTP) (SMA, 2013). In the future, the City plans to also reuse effluent at a planned multi-sport complex. The City wants to build a recreation area and fishing pond fed by treated effluent. The City owns a separate reuse line from the WWTP to the golf course pond. Additional information including volumes of water reused is provided in Section 4.

The treated effluent is distributed from the WWTP to the farm and golf course through approximately 15,000 linear feet of 10-inch PVC reuse line. A 6-inch distribution pipeline from the booster pumps at the golf course to the cemetery exists but is not yet in use. The cemetery is currently irrigated from a dedicated well, but there are plans to irrigate with treated wastewater effluent in the future (City of Deming, 2013).

3. Water Supply

This section discusses the water resources in the vicinity of the City of Deming, including the sources of water, available water supply, reasonable projections of future availability, and current and anticipated future water quality. Water availability is defined in this section in the hydrologic rather than legal sense; availability of water from a water rights perspective is discussed in Section 4.

Sections 3.1, 3.2 and 3.3 describe the geography and climate, groundwater, and surface water resources, respectively. Section 3.4 describes the quality of area groundwater, which is the current source of the City's supply.

3.1 Groundwater

The City of Deming is located within the Mimbres Groundwater Basin (Figure 3-1), which provides the only water source for the City of Deming (Longworth et al., 2013). The State Engineer's administratively defined limits for the declared Mimbres Groundwater Basin (Section 5) encompass parts of Grant, Sierra, Doña Ana, and Luna Counties.

3.1.1 Geography and Climate

The City of Deming is located in a valley between the Florida Mountains to the southeast and Cooke's Range to the north. Maximum elevations in these ranges are 7,295 feet above mean sea level (ft msl) at Florida Peak and 8,408 ft msl at Cooke's Peak (City of Deming, 2017).

The climate in Deming is characterized by large ranges in annual temperature, with low humidity and a high evaporation rate. Average total annual precipitation in Deming was 9.35 inches for the period of 1914 through 2005 (WRCC, 2018); most precipitation occurs as heavy thunderstorms during July through September.

The City of Deming and the Mimbres Basin are located within the Mexican Highland Section of the Basin and Range province. The Basin and Range province is the result of extensional

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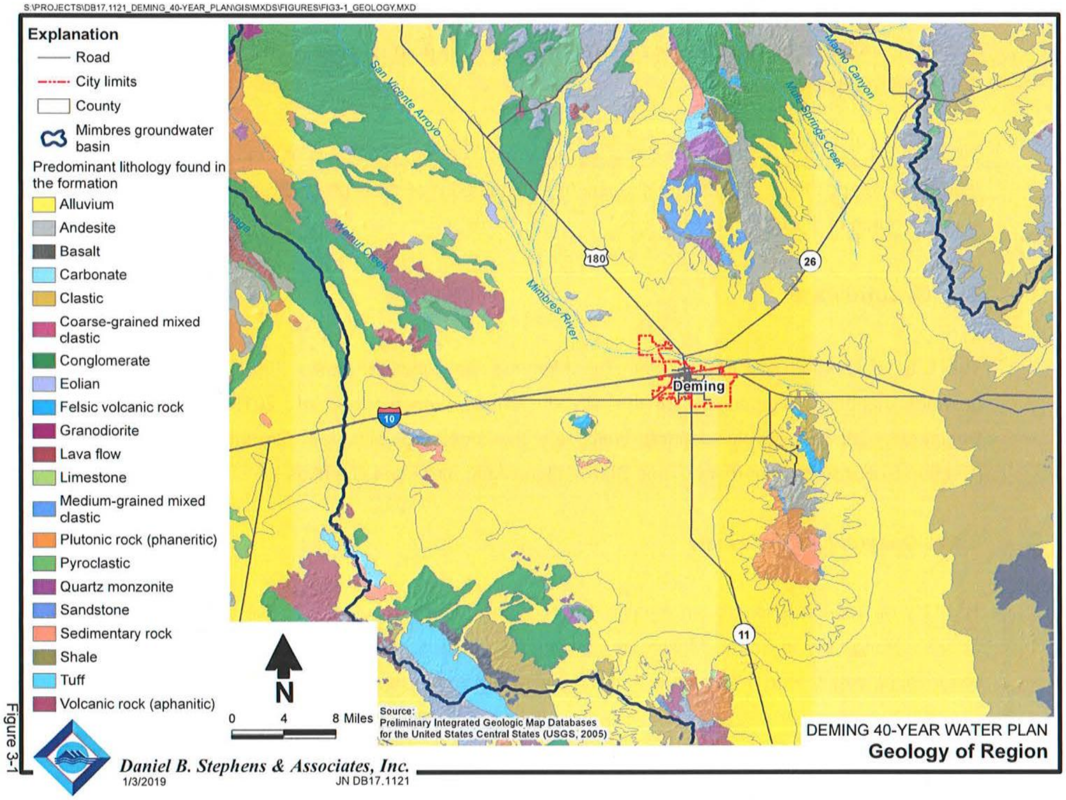

Source:
Preliminary Integrated Geologic Map Databases for the United States Central States (USGS, 2005)

DEMING 40-YEAR WATER PLAN
Geology of Region

Figure 3-1

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geotectonics that have occurred over the last 25 million years and is characterized by north-south trending mountain ranges separated by basins that have been partially filled with sediment eroded from the mountains. The mountains are comprised of bedrock and encompass approximately 20 percent of the Basin and Range province in New Mexico (Hawley et al., 2000). Basin fill includes several units of Quaternary alluvial and lacustrine deposits, as well as the Tertiary Gila Group. Within the Basin and Range province, the basin fill contains most of the readily available (i.e., economically viable) groundwater resources. The water table is generally within 200 feet of ground surface within the basin fill, aquifers are moderately to highly permeable, and the water is of good quality.

The Mimbres Basin is bounded on the north and west by the Continental Divide and on the east by the Lower Rio Grande Basin in Doña Ana County; to the south it extends into Mexico (Figure 3-2 [JSAI, 2006, Figure D7]). The overall province-scale geology of the Mimbres Basin is relatively complex (Figure 3-1); however, the geology that affects groundwater occurrence is limited mostly to near-surface basin fill. Intrabasin-scale structures divide the Mimbres Basin into seven different sub-basins that contain the vast majority of groundwater (Hawley et al., 2000):

- Upper Mimbres Sub-basin
- San Vicente Sub-basin
- Dwyer Sub-basin
- Florida Sub-basin
- Deming Sub-basin
- Hermanas Sub-basin
- Columbus Sub-basin

In the seven identified sub-basins, groundwater occurs primarily within basin fill materials comprised of Quaternary alluvium and the Tertiary Gila Group. Basaltic volcanics interbedded with basin fill can be locally important aquifers, mostly in the Upper Mimbres, Columbus, and San Vicente sub-basins. The thickness of the Mimbres Basin fill is 2,000 to 5,000 feet although productive water-bearing zones generally occur only in the upper 600 to 1,000 feet (Land, 2016). Figure 3-2 shows that the basin fill near Deming is several thousand feet thick.

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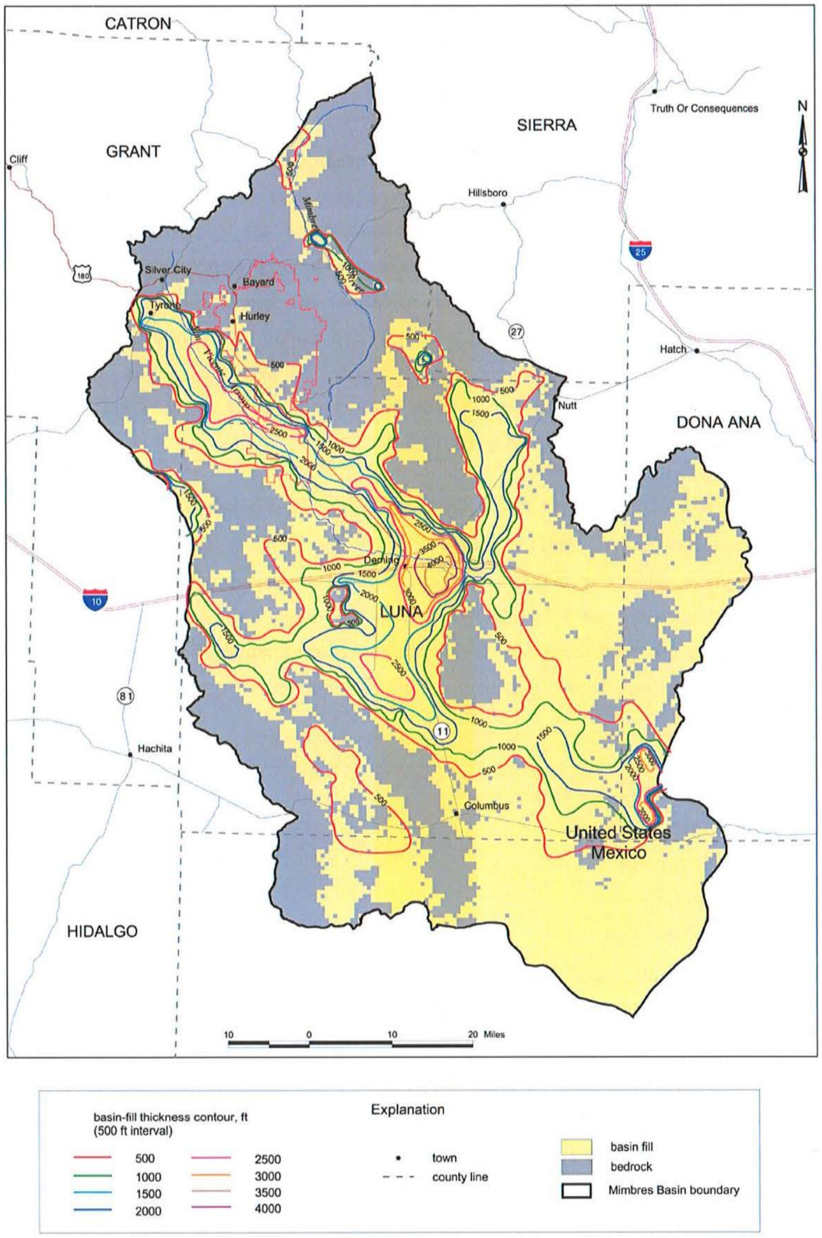

Source: JSAI, 2006, Figure D7

Figure 3-2

DEMING 40-YEAR WATER PLAN

Basin Fill Thickness

Mimbres Basin

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12/28/2018

The Mimbres Basin system contains unconfined, semiconfined, and confined aquifers, depending on location. Inter-sub-basin hydrologic interactions are not well understood, but the general groundwater flow direction is from the northern highlands toward the U.S.-Mexico border. Pre-development discharge across the border, from the U.S. into Mexico, is estimated to have been 6,500 acre-feet per year (ac-ft/yr) (Hanson et al., 1994). Recharge from precipitation is estimated to be no more than 2 percent of the precipitation that falls across the area (Hawley et al., 2000).

Specific capacity data compiled by Hanson et al. (1994) for 278 wells completed in the basin fill indicate that the aquifer is highly productive but that the productivity of the aquifer decreases with depth. In general, specific capacities are between 13 and 17 gallons per minute per foot (gpm/ft) in wells completed within 330 feet of ground surface, between 8 and 12 gpm/ft in wells completed between 330 and 660 feet below ground surface (ft bgs), and between 7 and 9 gpm/ft in wells completed below 660 ft bgs. Transmissivities range from 75 to 375,000 gallons per day per foot (gpd/ft) (10 to 50,100 square feet per day [ft^2/d]), but the lower end of this range may reflect poor test conditions rather than actual aquifer characteristics (Hawley et al., 2000). Data from aquifer tests in City wells indicate that the transmissivities of wells in the Deming well field are very high, ranging from 11,250 gpd/ft (1,500 ft^2/d) to 120,000 gpd/ft (16,000 ft^2/d) (Johnson et al., 2002).

An analysis of groundwater level changes (Rhinehart et al., 2015) indicated that while variability does occur, large water level declines south and southwest of Deming were evident in the 1970s and continued into the 1980s and 1990s. In the 1990s two large zones of water level decline were observed north of Deming. By the 2000s water levels were declining in all directions surrounding Deming. Water level declines near Deming are further discussed in Section 3.1.2.

Analysis of available water quality data indicated that additional brackish water resources may be present at depth in the southern Mimbres Basin, but those have not yet been sufficiently investigated (Land, 2015).

3.1.2 *Deming Well Field and Water Level Trends*

The Deming well field has 12 active wells and is located in the vicinity of some of the deepest basin fill deposits (over 4,200 feet) found in the Mimbres Basin (DBS&A, 2017; Johnson et al., 2002). Figure 3-3 shows the location of the wells within the City of Deming, and Table 3-1 lists the construction details of the wells. Most of the wells are about 500 feet deep with a depth to water of about 150 feet.

Table 3-1. Active Wells

City Well No.	City Well Name	NMOSE Well ID	Capacity (gpm)	Year Drilled
1	Water Plant	M-299-S-6	480	1977
2	North Zinc	M-299-S-7	450	1966
3 [a]	Poplar	M-299-S-2	450	1966
4 [a]	Donaldson	M-299-S-15	500	1968
5	Martin	M-299-S-5	420	1950
6	South Iron	M-299-S	400	1954
7	Boy Scout	M-299-S-8	400	1966
8	Fairgrounds	M-299-S-11	300	1985
9	Ash/Grand	M-299-S-12	700	1980
10	SWIG	M-299-S-10	540	1960
11	Florida	M-299-S-4	530	1963
12 [a]	Cemetery	M-299-S-13	350	1951
14	Luchsinger	M-214	300	1972
15	Peru	M-271	590	1961
17	Bilbo	M-49 M-109 M-127	1,080	1978
18 [a]	Keeler	M-290	750	1976

[a] Well not currently used for public water supply

NMOSE = Office of the State Engineer
gpm = Gallons per minute

The USGS has eight monitor wells within 4 miles of Deming (Figure 3-4), with water level data starting in 1940. Water levels in these USGS-monitored wells have decreased at an average rate of 0.63 feet per year (ft/yr) (Table 3-2).

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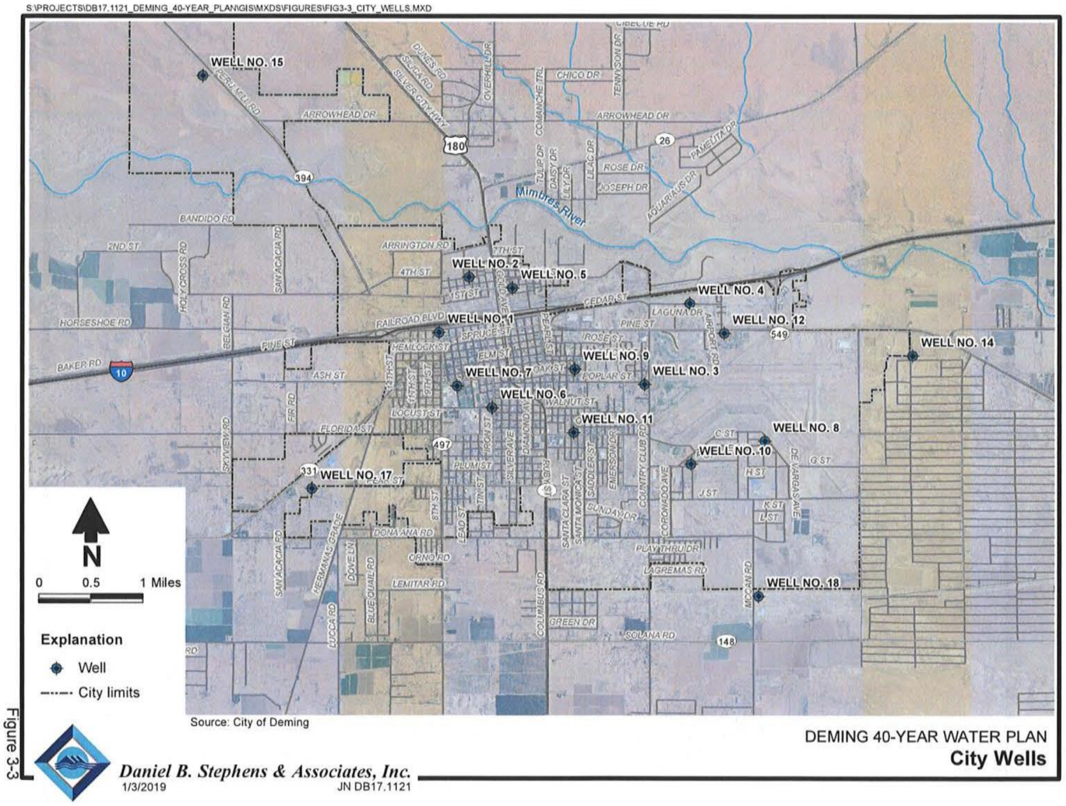

Source: City of Deming

DEMING 40-YEAR WATER PLAN
City Wells

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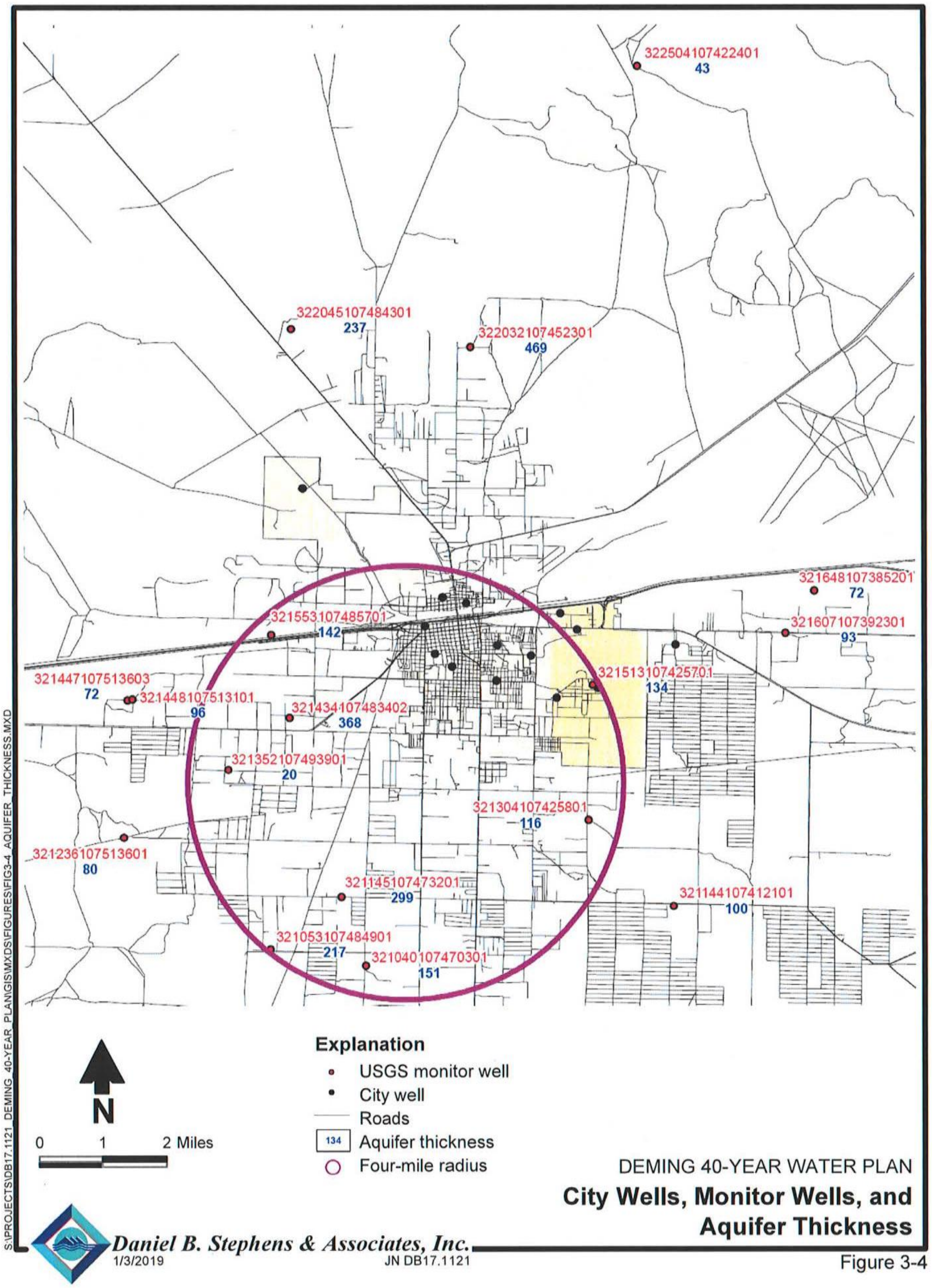
JN DB17.1121

Figure 3-3



City Wells, Monitor Wells, and Aquifer Thickness

Figure 3-4

Table 3-2. Change in Water Levels in USGS-Monitored Wells near Deming

		Change in Water Level			
		Period of Record		Amount [a] (feet)	Average Rate (ft/yr)
Aquifer	Well ID	Dates	No. of Years		
Alluvial	321145107473201	1958-1997	39	–36.20	–0.63
	321304107425801	1954-2002	48	–37.90	
	321352107493901	1939-2007	68	–35.56	
	321434107483402	1961-2012	51	–13.96	
	321513107425701	1942-2002	60	–48.59	
	321553107485701	1940-2012	72	–48.08	
	321607107392301	1931-2002	71	–46.02	
	321648107385201	1950-2002	52	–22.53	

Source: USGS, 2018

ft/yr = Feet per year

[a] Negative numbers signify a drop in water levels.

Groundwater flow models developed by the New Mexico Office of the State Engineer (NMOSE) predict much greater water level decline rates than those observed in the USGS monitor wells. The NMOSE drawdown estimates for 2020, 2040, and 2060 from the models indicate that the water table will decline on average approximately 1.75 ft/yr between 2000 and 2060 (Johnson et al., 2002). The NMOSE report concludes that estimated demand will exceed existing capacity of the Deming well field by the year 2015 and that Deming will therefore need to drill more wells to meet future demands. However, the NMOSE models simulated a higher rate of production than is currently predicted for future demand by the City of Deming: whereas the NMOSE model simulated well production of 16,442 ac-ft/yr in 2060, this planning document predicts a demand between 4,200 and 6,400 in 2060.

The Southwest New Mexico Regional Water Plan (NMISC/NMOSE, 2017) evaluated potential declines in groundwater resources based on model-predicted drawdown in a heavily stressed section within the area covered by the NMOSE Mimbres Basin model (Cuddy and Keyes, 2011). Decline in the Deming area was selected, as it was the maximum decline predicted by the model. Heavily stressed areas represent the locations most likely to be impacted in the future. While there is uncertainty in predicting the amount of drawdown, the plan recognized that there will be reductions in supply and that continued pumping at 2010 levels will not be likely without relocating wells to new sources of supply away from heavily stressed areas, subject to the NMOSE permitting process. Using this approach, the supply in a normal (i.e., no drought) year during decade 2060 for the Mimbres Basin in Luna County was calculated to be 14 percent less than the 2010 supply, reduced from 40,200 ac-ft/yr to 34,400 ac-ft/yr (NMISC/NMOSE, 2017).

Water levels in the vicinity of Deming are also impacted by local irrigation wells. Most of the wells in the vicinity of Deming are less than 500 feet deep (Figure 3-5). Longworth et al. (2013) reports that in 2010, 24,800 acres were irrigated in the Mimbres Basin within Luna County, diverting more than 33,000 ac-ft/yr from the aquifer.

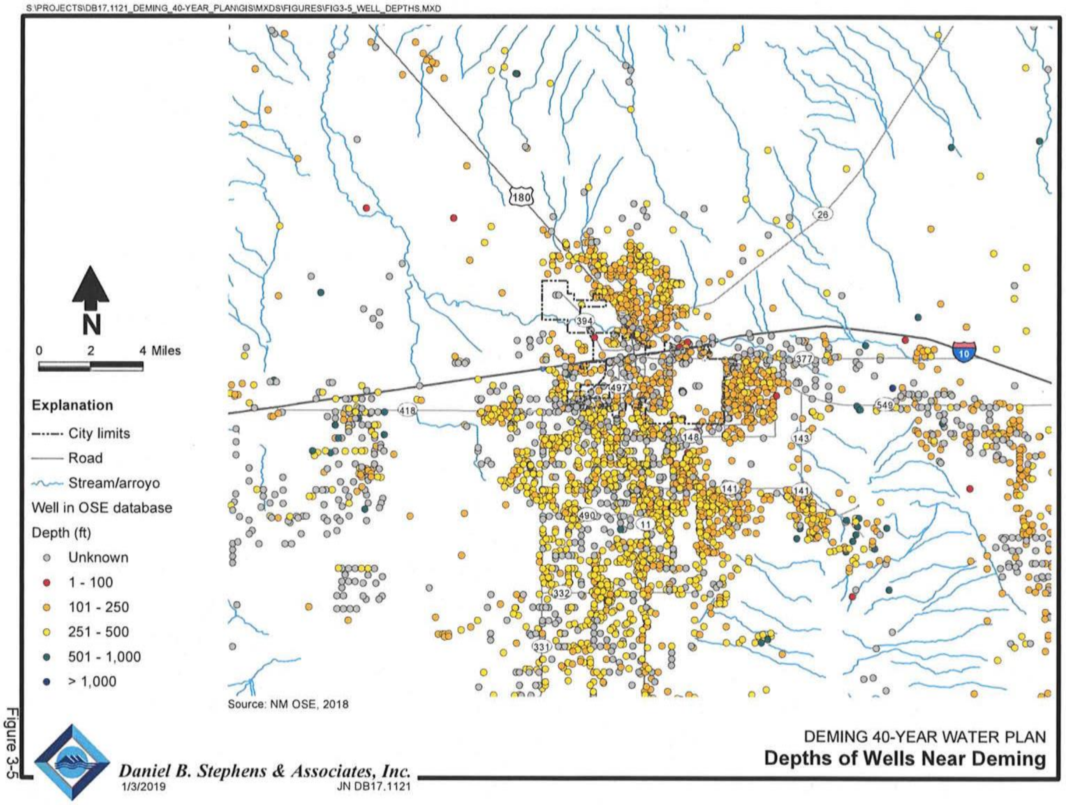
3.2 Surface Water

The City of Deming is located within the Mimbres River surface water basin. The Mimbres River is not a direct source of water supply for the City of Deming. The only perennial stream reach in the basin is part of the Mimbres River, which drains the Cooke's Range in the north and whose entire flow either evaporates, is transpired by plants, or recharges the Mimbres Basin. The Mimbres River is perennial only in its upper reaches; it is ephemeral below the USGS stream gage located at Faywood in northern Luna County, and surface water flow occurs in the Deming area (just north of Deming) only during periods of heavy rainfall. Mimbres River headwaters are located in Grant County, and the full river basin includes parts of Grant, Sierra, Doña Ana, and Luna Counties. The Mimbres River Basin is a closed basin, indicating that no surface water flows out from the basin.

3.3 Water Quality

Current and potential uses of Deming's water resources require that the groundwater be protected from contamination. Sources of contamination are of two types: (1) point sources, originating from a single location, or (2) nonpoint sources, originating over a more widespread or unspecified location. Additionally, there can be water quality issues due to naturally occurring constituents in the groundwater. Naturally occurring and anthropogenic contamination in Deming's city supply wells is discussed in Section 3.3.1. Point and nonpoint contamination sources in and near Deming are reviewed in Sections 3.3.2 and 3.3.3, respectively.

S:\PROJECTS\DB17.1121_DEMING_40-YEAR_PLAN\GIS\MXDS\FIGURES\FIG3-5_WELL_DEPTHS.MXD



Source: NM OSE, 2018

Figure 3-5

DEMING 40-YEAR WATER PLAN
Depths of Wells Near Deming

3.3.1 *Deming Drinking Water Quality*

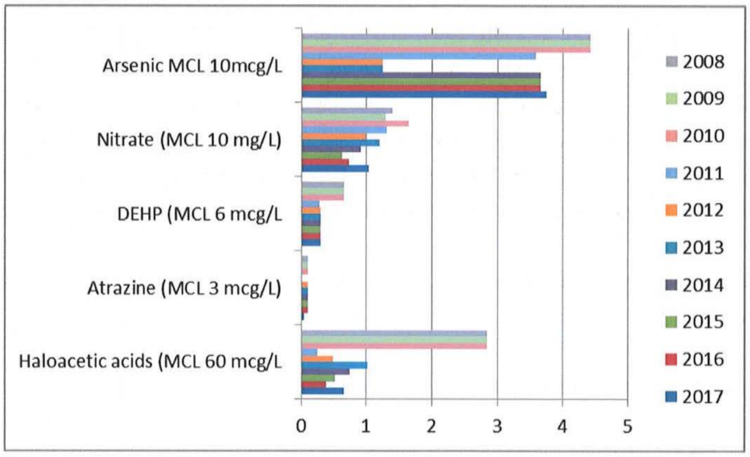
Deming production wells withdraw water from the Quaternary alluvium and Tertiary Gila Group in the Mimbres Groundwater Basin (Section 3.1.1). Hawley et al. (2000) indicated that the water quality of the alluvium in the vicinity of Deming was excellent, with total dissolved solids (TDS) values less than 250 milligrams per liter (mg/L) (aesthetic standard is 1,000 mg/L) and sulfate less than 25 mg/L (aesthetic standard is 600 mg/L)]). According to Hanson et al. (1994), however, groundwater quality concerns existed during the mid-1990s due to septic tanks and salinity in the area north of Deming. Those concerns were partially addressed by connecting that area to the County sewer system, but salinity is still present.

In addition, as discussed in Section 3.3.2.3, operations at Highway 549 Solvents, an active Superfund site 4 miles east of town, were suspected of contaminating groundwater with chlorinated solvents (NMWQCC, 2002). This site was investigated under the Superfund program, but due to its rural setting and the low population density, it did not meet the criteria for remedial action under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The New Mexico Environment Department (NMED) continues to monitor the area to determine if site conditions change such that additional action under CERCLA is warranted.

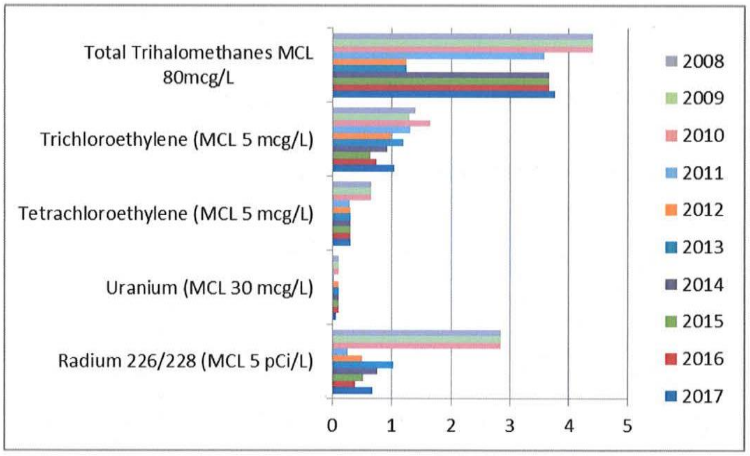
Water quality sample results are available from NMED Drinking Water Bureau (DWB) for New Mexico water systems, and data available for the Deming Municipal System were reviewed. A review of Deming contaminant analytical data indicates that water quality is good and water quality standard exceedances are rare. New Mexico Environmental Public Health Tracking data for the Deming Municipal Water System over the period 2008-2017 indicates recent improvements for several contaminant analytes (Figure 3-6). However, salinity of groundwater near Deming is expected to increase as the depth to groundwater increases, so Deming could face water quality issues in the future if groundwater levels decline.

Arsenic, an inorganic constituent that occurs naturally in groundwater, may be of particular concern to Deming in the future, due to a reduction in the U.S. Environmental Protection Agency (EPA) arsenic maximum contaminant level (MCL)—down to 10 micrograms per liter (µg/L) (0.010 mg/L)—that became effective in January 2006. The mean concentration of arsenic

a. Arsenic, Nitrate, Di(2-ethylhexyl)phthalate (DEHP), Atrazine, and Halocetic Acids



b. Total Trihalomethanes, Trichloroethylene, Tetrachloroethylene, Uranium, and Combined Radium 226 and 228



Source: NMEPHT, 2018

MCL = Maximum contaminant level (standard set by U.S. EPA [2009] for drinking water quality)

DEMING 40-YEAR WATER PLAN
Deming Drinking Water Quality 2008-2017

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Figure 3-6

P:_DB17-112\40-Year Plan.1-19\Figures\Fig 3-6_NMPHT Wtr Qual.docx decreased from 4.41 µg/L in 2008, 2009, and 2010, to 3.59 µg/L in 2011, and to 1.25 µg/L in 2012 and 2013, but it was again higher in 2015, 2016, and 2017 (Figure 3-6). The 2009 40-Year Water Plan noted that Well 16 was the only well where the arsenic concentration had exceeded the new drinking water quality standard (the standard for fluoride had also been exceeded in this well). Well 16, which was an old irrigation well purchased as part of a water right transaction, was never connected to the City system and had since been abandoned.

The City of Deming has a source water protection plan to ensure the future safety of its water supply.

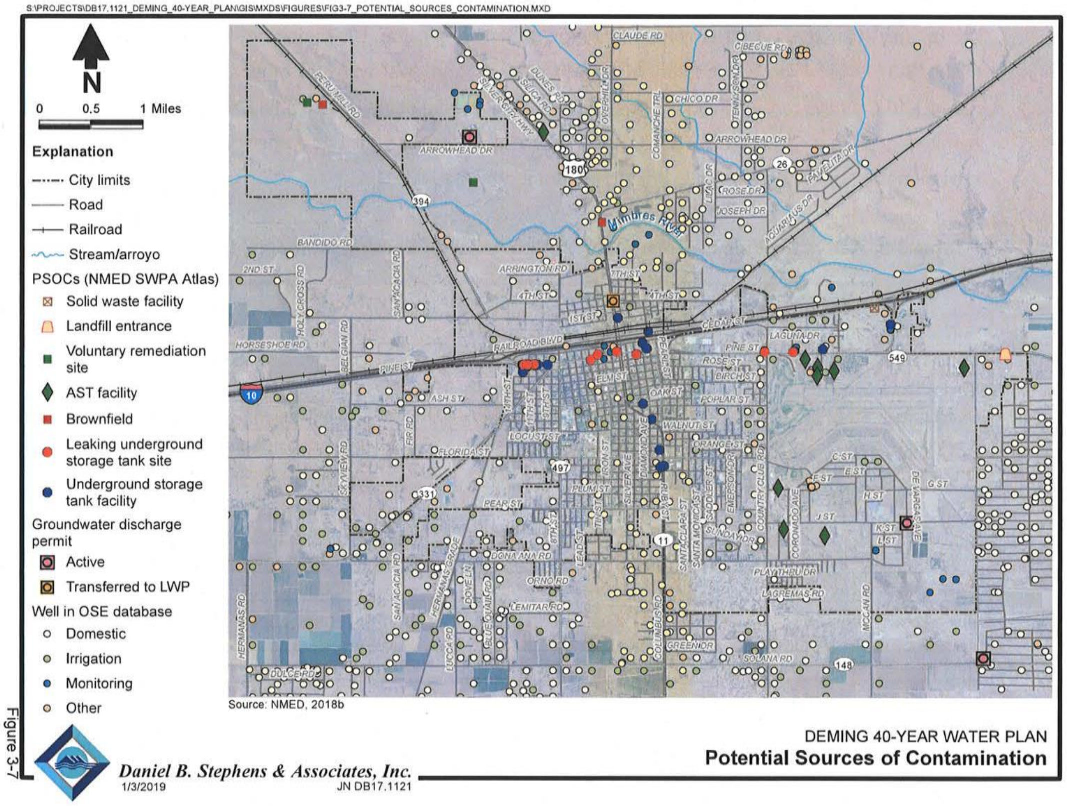
3.3.2 Point Sources of Groundwater Contamination

In 2002, the New Mexico Water Quality Control Commission (NMWQCC) reported the following statewide frequency of groundwater impacts from various point sources:

Underground (fuel) storage tanks (USTs)	58.5 percent
Oil and gas	13.7 percent
Miscellaneous industry	10.1 percent
Centralized sewage works	4.5 percent
Mining	3.7 percent
Aboveground (fuel) storage tanks/pipelines	3.4 percent
Dairies and meat packing	2.8 percent
Landfills	0.8 percent
Unknown/other	2.5 percent

Figure 3-7 shows potential sources of contamination within Deming city limits. These include:

- 9 aboveground storage tank (AST) sites
- 20 underground storage tank (UST) sites
- 9 leaking LUST sites
- 2 voluntary remediation program (VRP) sites
- 6 active groundwater discharge permits



Source: NMED, 2018b

Figure 3-7

DEMING 40-YEAR WATER PLAN

Potential Sources of Contamination

There are currently no abatement sites, animal feeding operations, National Pollutant Discharge Elimination System (NPDES), or active gas wells in Deming.

3.3.2.1 Underground Storage Tanks

Leaking USTs are one of the most significant point source contaminant threats to groundwater. As of July 12, 2018, NMED was reporting 12 active leaking USTs in the Deming area (Table 3-3), 9 of which are located within city limits (Figure 3-7) with the other 3 to the west along I-10. Active cases include those in the pre-investigation, investigation, cleanup, and monitoring phases (NMED PSTB, 2018). These UST facilities all pose possible risk to the environment, but are not currently being investigated by the NMED.

Table 3-3. Active Leaking Petroleum Sites Within City of Deming Municipal Boundaries

Release Name	RID	FID	Address	Status
Sun Mart 681	4600	51556	2319 E Motel Dr	Investigation, Responsible Party
Cano's Restaurant	4654	54744	1200 W Pine	Cleanup, Responsible Party
Savoy Truck Stop	3060	9762	14150 Highway 418 SW	Cleanup, Responsible Party
Savoy Truck Stop	4073	9762	14150 Highway 418 SW	Investigation, Responsible Party
Save Gas - No3	4089	27658	1312 W Pine	Cleanup, Responsible Party
On Sale Tire Co	3042	27082	101 W Pine St	Cleanup, Responsible Party
Deming Bulk Plant	4559	30038	2701 E Pine	Cleanup, Responsible Party
SAV-O-MAT C	3521	30493	321 W Pine St	Investigation, Responsible Party
TRIANGLE TRUCK STOP	3401	31200	1300 W Pine	Cleanup, Responsible Party
GONZALES SELF SERVE	2014	31494	422 W Pine	Cleanup, Responsible Party
Stuckeys Deming	2966	1843	15 Miles W of Deming ON I-10	Cleanup, Responsible Party
Snappy-Mart #258	2892	1805	306 E Pine	Investigation, Responsible Party

Source: NMED PSTB, 2018

RID = Release ID
FID = Facility ID

3.3.2.2 Groundwater Discharge Plans

The NMED Ground Water Quality Bureau (GWQB) regulates facilities with wastewater discharges that have a potential to impact groundwater quality. These facilities must comply with the NMWQCC regulations and obtain approval of a discharge plan, which provides for measures needed to prevent and detect groundwater contamination. In particular, NMWQCC regulations require cleanup of groundwater contamination detected under discharge plan monitoring requirements, as any contamination discharged by these facilities affects the quantity and availability of the water supply. A variety of facilities fall under the discharge plan requirements, including sewage dischargers, dairies, food processors, sludge and septage disposal, and other industries.

As of 2018, six facilities with active discharge plans (NMED GWQB, 2018) were present in the Deming area (Figure 3-7). Four of the discharge locations are part of the City's WWTP. The other two facilities include the Ben Archer Health Center and the Luna Energy Facility. Details indicating the status of these discharge plans, waste type, and treatment for individual permittees can be obtained from the NMED web site (http://www.nmenv.state.nm.us/gwb/New_Pages/docs_policy/web_dp_list.xls).

3.3.2.3 Superfund Sites

CERCLA was enacted by the U.S. Congress on December 11, 1980. This law created the Superfund program to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment. The EPA prepares a National Priorities List (NPL) that identifies, through a hazard ranking system, which Superfund sites warrant remedial action. Currently, no sites within Deming are included on the NPL (Table 3-4). Two Superfund sites in Deming are active (Figure 3-7); four more are archived (U.S. EPA, 2018a).

Table 3-4. Active Superfund Sites in Deming

EPA ID	Site Name	City	NPL Status
NM0000605167	Highway 549 Solvents	Deming	Not listed
NMD097119986	Peru Hill Mill	Deming	Not listed

Source: U.S. EPA, 2018a

EPA = U.S. Environmental Protection Agency
NPL = National Priorities List

Contamination at the Highway 549 Solvents site, located east of Deming near the junction of U.S. Highway 549 and State Road 377, was initially discovered in 1997 by a New Mexico Department of Health (DOH) water quality assessment of wells in southern New Mexico. Low levels of 1,1-dichloroethene (1,1-DCE) and 1,1,1-trichloroethane (1,1,1-TCA) were detected in samples collected from private domestic wells located approximately 2 miles east of the City.

NMED confirmed the results of the DOH investigation in 1998 and continued the investigation, sampling 41 drinking water wells. This investigation detected 1,1,1-TCA and 1,1-DCE in 11 of the sampled wells, 2 of which were found to be contaminated at concentrations exceeding the NMWQCC standards and federal MCL. Deming's water supply line was extended to serve those properties, and the domestic wells were abandoned (City of Deming, 2009). NMED's investigation under Superfund found that the site did not warrant listing on the NPL, due to the rural setting and its low population density. The site is listed as requiring no further remedial action (U.S. EPA, 2018b).

3.3.2.4 Landfills

Landfills used for disposal of municipal and industrial solid waste can contain a variety of potential contaminants that may impact groundwater quality. Landfills operated since 1989 are regulated under the New Mexico Solid Waste Management Regulations. Many small landfills throughout New Mexico closed before 1989 in order to avoid more stringent final closure requirements implemented in 1989.

The Butterfield Trail Regional Landfill is located 15 miles west of Deming, and it accepts contaminated soil, in addition to municipal solid waste and auto and truck tires. A waste transfer station is located on the east side of town. The Butterfield Trail Regional Landfill uses a liner to protect groundwater quality, and groundwater monitoring is being conducted.

3.3.2.5 Hazardous Waste

NMED provides regulatory oversight and management of hazardous waste in New Mexico under the federal Resource Conservation and Recovery Act (RCRA) of 1976. RCRA delegated authority to the U.S. EPA to control hazardous waste, including the generation, transportation, treatment, storage, and disposal of hazardous waste. Under RCRA, the NMED Hazardous Waste Bureau (HWB) provides regulatory oversight and technical guidance to hazardous waste generators and to treatment, storage, and disposal facilities in New Mexico. The objective of the HWB is to ensure protection of human health and the environment and to ensure that hazardous wastes are handled and disposed of and/or treated properly. No permitted hazardous waste facilities are located in the vicinity of Deming.

3.3.1 Nonpoint Sources of Groundwater Contamination

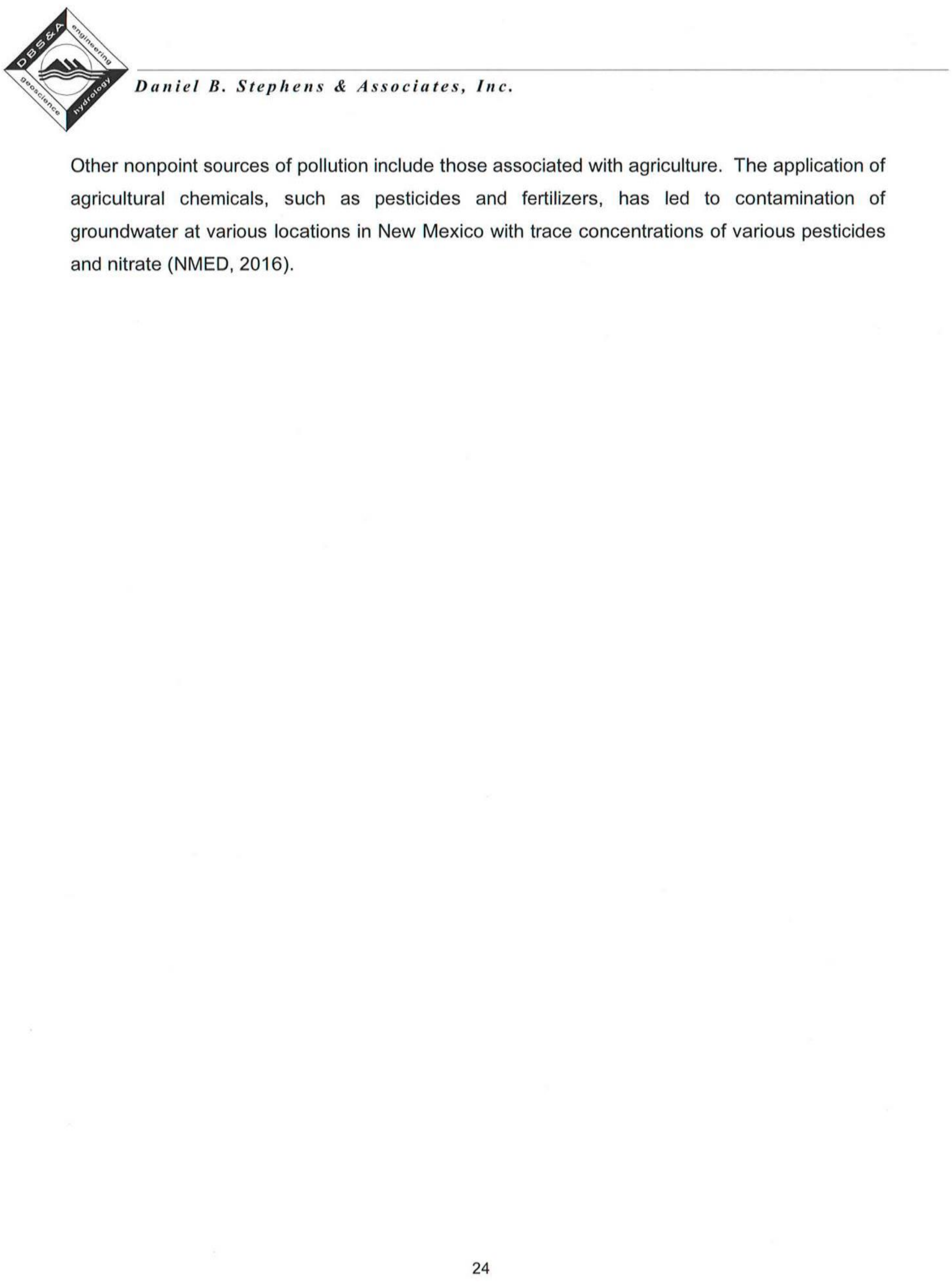
Nonpoint source pollution of groundwater is caused by widely dispersed sources of pollutants that often reach groundwater as the result of precipitation carrying pollutants from the land into sources of water. The principal contaminants contributed from this type of pollutant source are nutrients, sediments, toxic substances, organic matter, salts, metals, and petroleum and its byproducts.

A primary water quality concern in New Mexico is shallow groundwater contamination due to septic systems (NMED, 2016), because they are generally spread throughout rural and urban areas, are considered a nonpoint source. Most of the serious septic system impacts occur where groundwater is shallow. In these areas, septic system discharges can percolate rapidly to the underlying aquifer and increase concentrations of:

- Total dissolved solids (TDS)
- Iron, manganese, and sulfides (anoxic contamination)
- Nitrate
- Potentially toxic organic chemicals
- Bacteria, viruses, and parasites (microbiological contamination)

Collectively, septic systems and other on-site domestic wastewater disposal constitute the single largest known source of groundwater contamination in New Mexico (NMED, 2016). Many of these occurrences are in the shallow water table areas.

Protection of shallow groundwater quality in populous areas plays an important role in maintaining the available water resources in these areas. The NMED Liquid Waste (Septic Tank) Program regulates on-site disposal of liquid wastes, including septic tanks, under the Liquid Waste Disposal and Treatment Regulations, 20.7.3 NMAC (NMED, 2018a). A list of permitted liquid waste systems in and around Deming can be found on the NMED Liquid Waste (Septic Tank) Program web site (http://www.nmenv.state.nm.us/fod/LiquidWaste). More than 1,300 permitted septic tanks are present in and around Deming.



Other nonpoint sources of pollution include those associated with agriculture. The application of agricultural chemicals, such as pesticides and fertilizers, has led to contamination of groundwater at various locations in New Mexico with trace concentrations of various pesticides and nitrate (NMED, 2016).

4. Water Demand

This section discusses current and projected water demand that is supplied or anticipated to be supplied by the City of Deming water system.

4.1 Current Water Demand / Water Audit

In order to accurately evaluate current water demand, it is important to evaluate system efficiencies as well as metered and billed production. DBS&A used production and billing meter records to prepare a water audit of Deming water use during 2016 (Sections 4.1.1 and 4.1.2).

4.1.1 Water Demand by Sector

To analyze the City's metered water use, the accounts were divided into four demand sectors:

- *Residential:* Includes treated water sales to homes and trailers (residential per capita water use trends are discussed in Section 4.2).
- *Industrial, Commercial, and Institutional:* Includes treated water sales to local industry and businesses such as hotels, restaurants, and other commercial establishments including apartments and trailer parks, and to schools.
- *Bulk:* Includes metered use for temporary construction purposes.
- *Route 98 (Golf Course and Cemetery):* Includes unbilled metered water use for irrigation at City of Deming outdoor facilities.

The amount of water metered by month during 2016 for each of these sectors is provided in Table 4-1. The breakdown of billed water by demand sector in 2016 is provided in Figure 4-1, which shows that the residential sector used the majority of water in 2016 (58 percent).

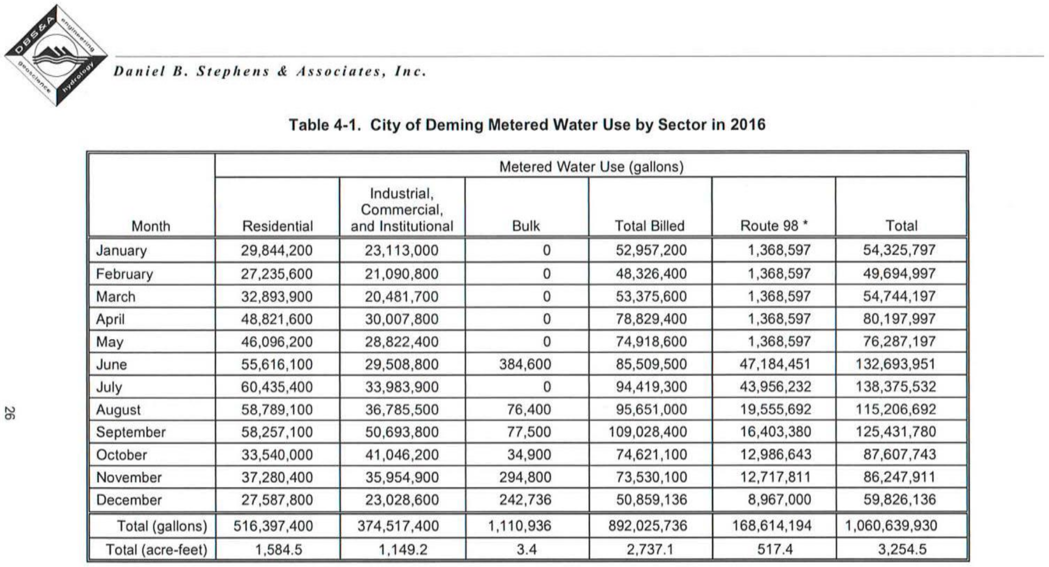


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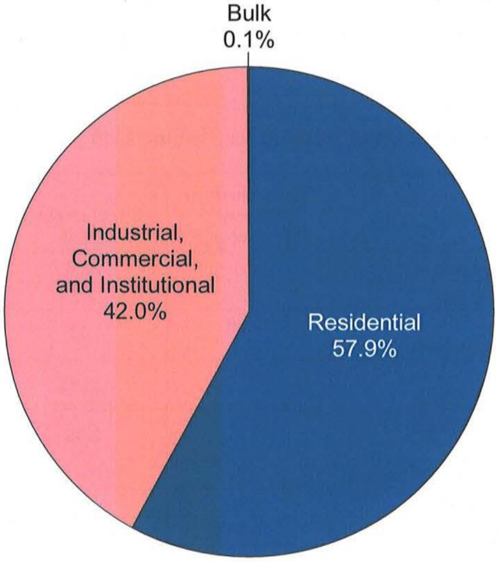
Table 4-1. City of Deming Metered Water Use by Sector in 2016

	Metered Water Use (gallons)					
Month	Residential	Industrial, Commercial, and Institutional	Bulk	Total Billed	Route 98 *	Total
January	29,844,200	23,113,000	0	52,957,200	1,368,597	54,325,797
February	27,235,600	21,090,800	0	48,326,400	1,368,597	49,694,997
March	32,893,900	20,481,700	0	53,375,600	1,368,597	54,744,197
April	48,821,600	30,007,800	0	78,829,400	1,368,597	80,197,997
May	46,096,200	28,822,400	0	74,918,600	1,368,597	76,287,197
June	55,616,100	29,508,800	384,600	85,509,500	47,184,451	132,693,951
July	60,435,400	33,983,900	0	94,419,300	43,956,232	138,375,532
August	58,789,100	36,785,500	76,400	95,651,000	19,555,692	115,206,692
September	58,257,100	50,693,800	77,500	109,028,400	16,403,380	125,431,780
October	33,540,000	41,046,200	34,900	74,621,100	12,986,643	87,607,743
November	37,280,400	35,954,900	294,800	73,530,100	12,717,811	86,247,911
December	27,587,800	23,028,600	242,736	50,859,136	8,967,000	59,826,136
Total (gallons)	516,397,400	374,517,400	1,110,936	892,025,736	168,614,194	1,060,639,930
Total (acre-feet)	1,584.5	1,149.2	3.4	2,737.1	517.4	3,254.5

26



Total billed water use:
892,025,736 gallons
(2,737.1 acre-feet)

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DEMING 40-YEAR WATER PLAN
City of Deming
Billed Water Use by Sector in 2016

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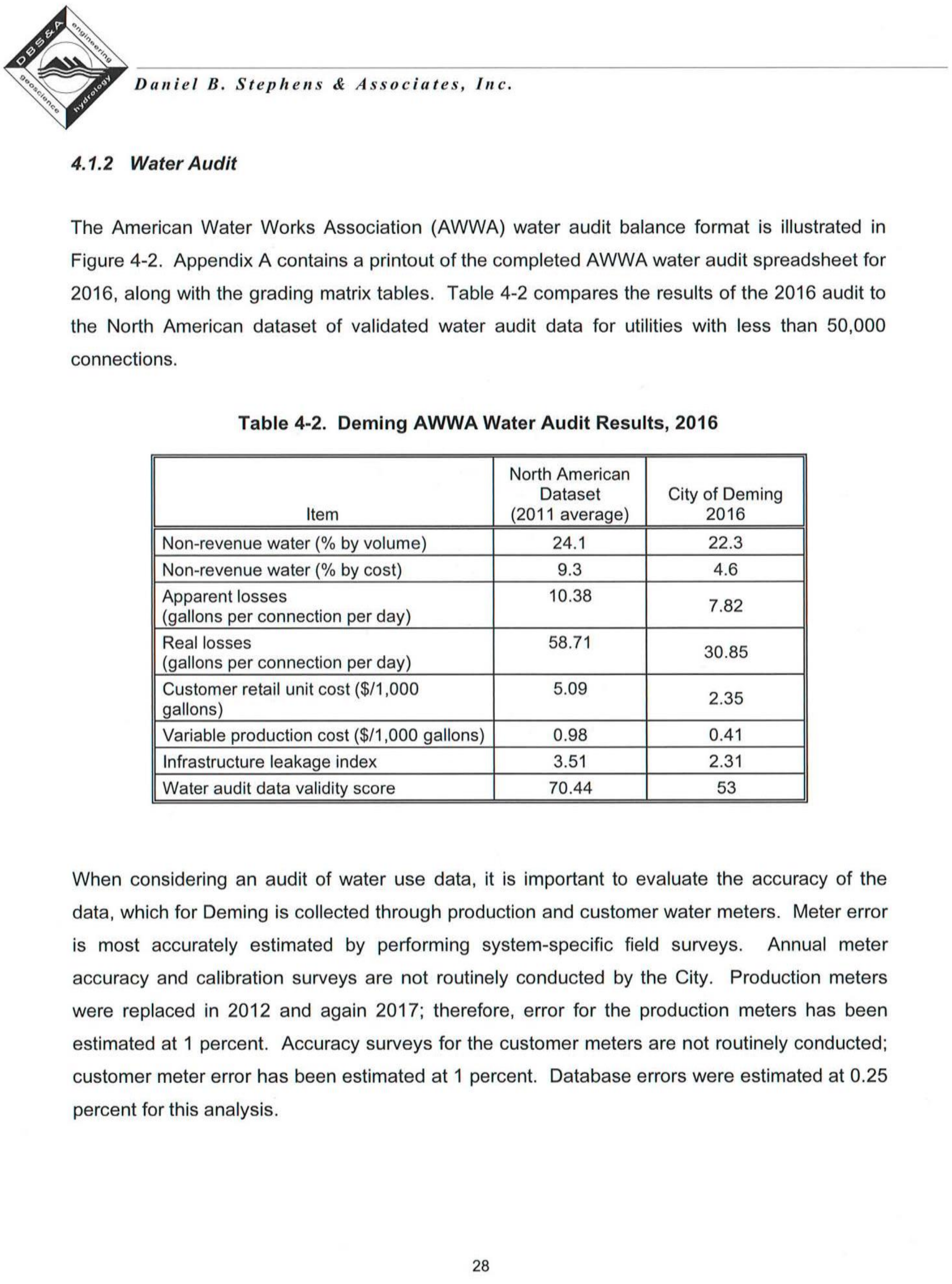
Figure 4-1



4.1.2 Water Audit

The American Water Works Association (AWWA) water audit balance format is illustrated in Figure 4-2. Appendix A contains a printout of the completed AWWA water audit spreadsheet for 2016, along with the grading matrix tables. Table 4-2 compares the results of the 2016 audit to the North American dataset of validated water audit data for utilities with less than 50,000 connections.

Table 4-2. Deming AWWA Water Audit Results, 2016

Item	North American Dataset (2011 average)	City of Deming 2016
Non-revenue water (% by volume)	24.1	22.3
Non-revenue water (% by cost)	9.3	4.6
Apparent losses (gallons per connection per day)	10.38	7.82
Real losses (gallons per connection per day)	58.71	30.85
Customer retail unit cost ($/1,000 gallons)	5.09	2.35
Variable production cost ($/1,000 gallons)	0.98	0.41
Infrastructure leakage index	3.51	2.31
Water audit data validity score	70.44	53

When considering an audit of water use data, it is important to evaluate the accuracy of the data, which for Deming is collected through production and customer water meters. Meter error is most accurately estimated by performing system-specific field surveys. Annual meter accuracy and calibration surveys are not routinely conducted by the City. Production meters were replaced in 2012 and again 2017; therefore, error for the production meters has been estimated at 1 percent. Accuracy surveys for the customer meters are not routinely conducted; customer meter error has been estimated at 1 percent. Database errors were estimated at 0.25 percent for this analysis.

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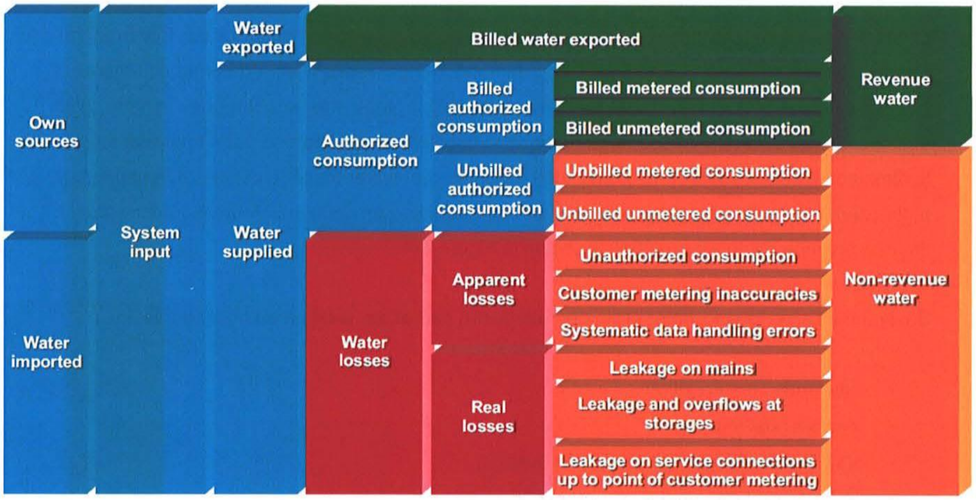

Figure 4-2

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DEMING 40-YEAR WATER PLAN
AWWA Water Audit Format

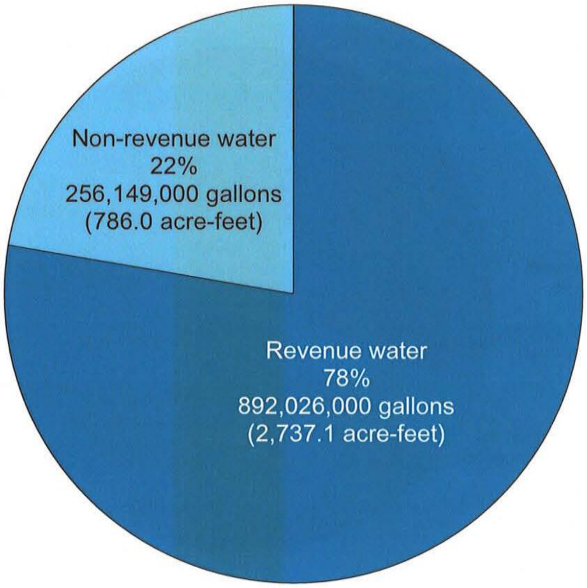
Because the production meter error, customer meter error, and database error were estimated for the audit, the values presented in Table 4-2 and Appendix A for total potential real water loss and total non-revenue water are also estimates. The AWWA water audit balance methodology includes estimates for real water losses, such as leaks, and for unaccounted-for water, such as water use that is not metered. In Deming there is authorized unbilled unmetered consumption that affects the water audit balance (estimated at 1.25 percent) and potentially unauthorized consumption (estimated at 0.25 percent).

Figure 4-3 shows the breakdown between revenue and non-revenue water for the City in 2016. Revenue water consists of billed water by demand sector (residential, industrial, commercial, institutional, and bulk sales) within the City of Deming. Non-revenue categories include total authorized unbilled metered use, total authorized unbilled unmetered use, total apparent losses (estimated customer meter error), and total potential real water loss (calculated by subtracting authorized consumption and apparent losses from adjusted production). A breakout for each of the non-revenue categories in 2016 is shown in Figure 4-4.

Several public works and water utility operations are part of the unbilled authorized use:

- City landscape irrigation
- Hydrant flushing
- Main line flushing or dead end line flushing
- Flushing and disinfection of water lines
- Other public works construction activities
- Street sweeping
- Cleaning the sanitary sewer system

Whether metered or unmetered, these activities contribute to the volume of non-revenue water. Further analysis of water use practices and data will allow the City to quantify these different types of water use.



DEMING 40-YEAR WATER PLAN

City of Deming
Revenue and Non-Revenue
Water Use in 2016

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Figure 4-3

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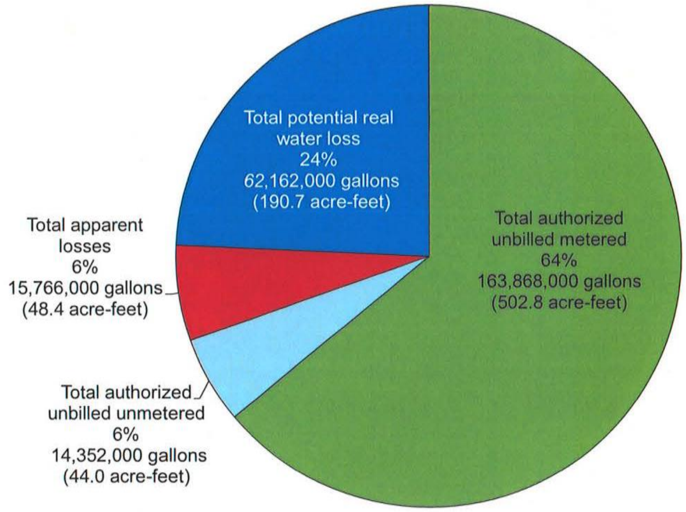

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DEMING 40-YEAR WATER PLAN
City of Deming
Non-Revenue Water in 2016

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Figure 4-4

4.2 Water Use Trends

Billed monthly water use by sector for 2016 is illustrated on Figure 4-5 , which demonstrates that residential water use is typically highest during the summer months, while industrial, commercial, and institutional water use is typically highest during the fall months, likely due to the chili harvest. Figure 4-6 shows unbilled monthly water use during 2016 and 2017. Data for January through May 2016 are the same value, possibly due to a meter or database error; therefore data for 2017 was obtained to conduct the seasonal analysis.

The increase in summer water use was calculated by subtracting the mean billed winter water use (January, February, and December) from the mean billed summer water use (June, July, and August) for each demand sector (Table 4-3). The largest increase in summer water use occurs in the residential sector Figure 4-7. The difference is traditionally attributed to outdoor uses such as irrigation and evaporative coolers.

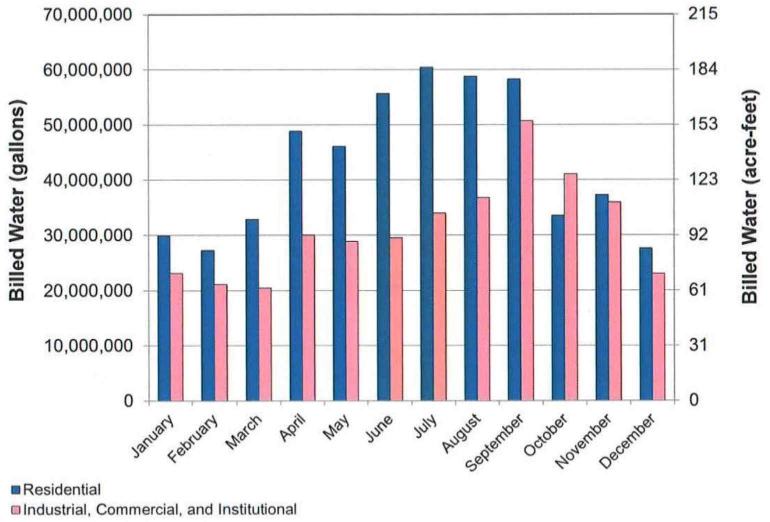
Table 4-3. Calculated Increase in Summer Water Use

	Metered Water Use Average, 2016 (gallons)				
Season	Residential	Industrial, Commercial, Institutional	Bulk	Route 98 [a]	Total
Winter mean	28,222,533	22,410,800	80,912	3,460,426	54,174,671
Summer mean	58,280,200	33,426,067	153,667	20,994,581	112,854,515
Increase in summer water use (gallons)	30,057,667	11,015,267	72,755	17,534,156	58,679,844
Increase in summer water use (acre-feet)	92.23	33.80	0.22	53.80	180.05

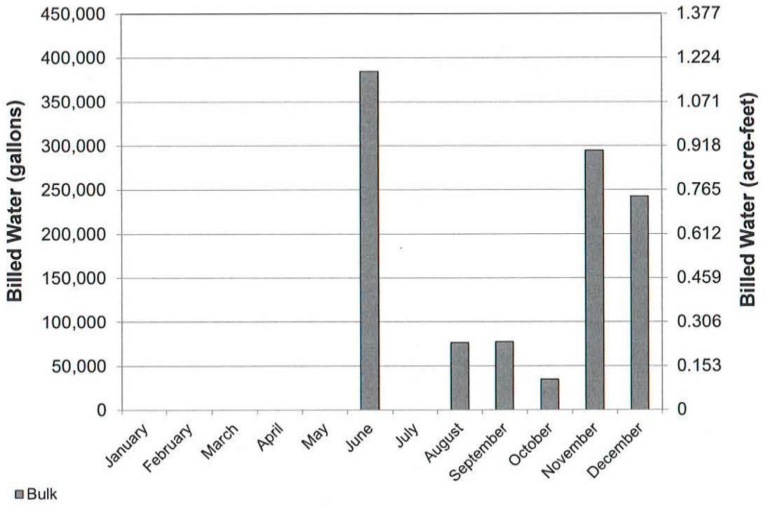
[a] Amounts based on 2017 monthly data.

The NMOSE has developed a GPCD (gallons per capita per day) calculation methodology to standardize per capita water use calculations in New Mexico. These values provide a baseline of water use that is not as susceptible to changes in population and can be used to evaluate water conservation potential and to track conservation programs' implementation results (NMOSE, 2015). The user inputs population, household size, and occupancy data from the most recent U.S. Census, as well as system-specific monthly data for as many as seven years at a time, and the GPCD calculator returns per capita values for several categories (NMOSE, 2015). The NMOSE GPCD calculator can be easily updated as more data become available, providing water suppliers with comparisons in per capita use over time.

a. Residential and Industrial / Commerical / Institutional



b. Bulk Sales



DEMING 40-YEAR WATER PLAN
City of Deming
Monthly Water Use in 2016

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12/28/2018

Figure 4-5

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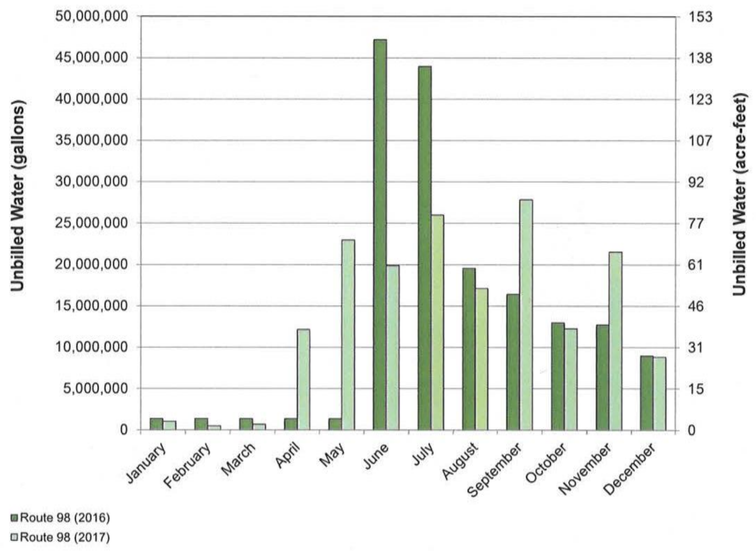

DEMING 40-YEAR WATER PLAN

City of Deming

Unbilled Water Use by Sector in 2016 and 2017

Figure 4-6

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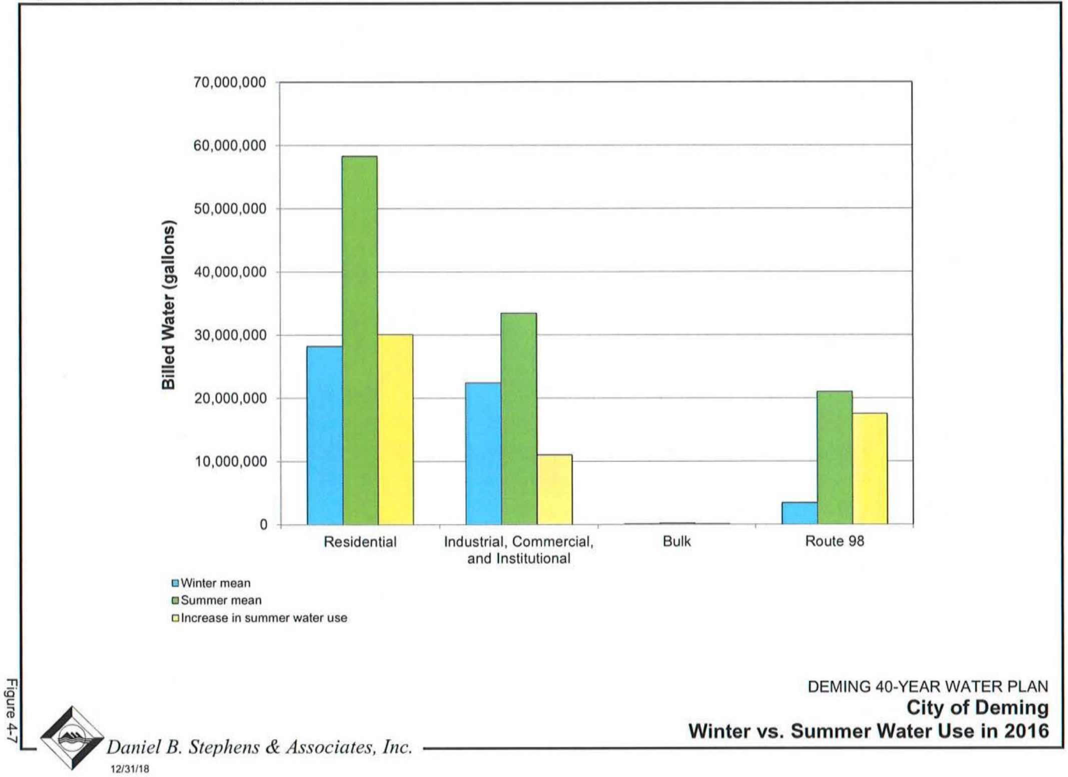

DEMING 40-YEAR WATER PLAN

City of Deming

Winter vs. Summer Water Use in 2016

Figure 4-7

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The GPCD calculator was used to calculate the City's per capita use for 2016 (Appendix B). Figure 4-8 shows the annual overall system per capita use by sector for the City of Deming during 2016. The GPCD calculator was also used to calculate the City's per capita use on a monthly basis for 2016. The 2016 monthly residential per capita values are shown in Table 4-4.

Table 4-4. City of Deming Monthly and Annual Residential Per Capita Water Use for 2016

Month	System Per Capita Residential Use [a] (gallons per day)
January	82
February	83
March	90
April	138
May	126
June	156
July	166
August	161
September	166
October	92
November	106
December	76
Annual Average	120

[a] Results derived using data in the NMOSE GPCD calculator (Appendix B; NMOSE, 2015).

Another simple method of calculating annual per capita use is to divide the total water produced by the population served. This method provides a good estimate of the relative magnitude of the per capita use when all of the monthly data needed for the NMOSE GPCD calculator are not available. Based on the estimated population in Deming during 2016 of 14,488 individuals, the City of Deming residential per capita demand averaged 98 gallons per capita per day (gpcd) during 2016. The average per capita demand for all sectors of water use was 236 gpcd during 2016.

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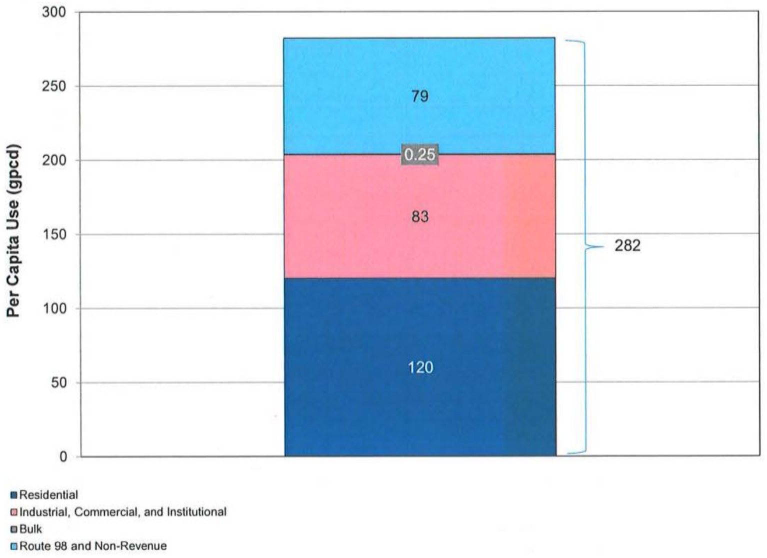

DEMING 40-YEAR WATER PLAN
City of Deming
Per Capita Water Use by Sector in 2016

Figure 4-8

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4.3 Analysis of Top Users

Evaluation of the largest water users can help the City target conservation efforts where they will have the greatest impact. In 2016, six accounts were billed for more than 4 million gallons of water each (Table 4-5), accounting for over 21 percent of the total billed metered water use.

Table 4-5. City of Deming Top Water Users in 2016

Customer Name	2016 Billed Total (gallons)	Identified Water Use Area
Mizkan America, Inc.	125,849,700	Border Foods Plant
Mizkan America, Inc.	29,269,800	Border Foods Plant (use during September through December)
Mizkan America, Inc.	19,337,700	Border Foods Plant
Luna County Detention Center	6,989,000	Jail facility
Kingdom of the Sun	4,567,400	Retirement center
Quality Inn	4,364,500	Hotel
Total	190,378,100	

The top three accounts combined include almost 175 million gallons for water delivered to the Border Foods Plant (Table 4-5).

4.4 Reuse

The City reuses treated wastewater effluent, thereby lowering the demand on the potable water system, particularly in months of high demand. As discussed in Section 2, the City currently uses reuse water at three locations: a storage pond for the Luna Energy power plant, the golf course, and farmland located near the WWTP (SMA, 2013). Monthly reuse water volumes for 2016 are provided in Table 4-6 and shown on Figure 4-9.

The largest wastewater effluent consumer would be Luna Energy if they used their contractual amount of 1 million gallons per day (mgd) of treated effluent. The 570-megawatt Luna Energy plant is located northwest of Deming and provides an annual schedule of proposed reuse water consumption to the City.

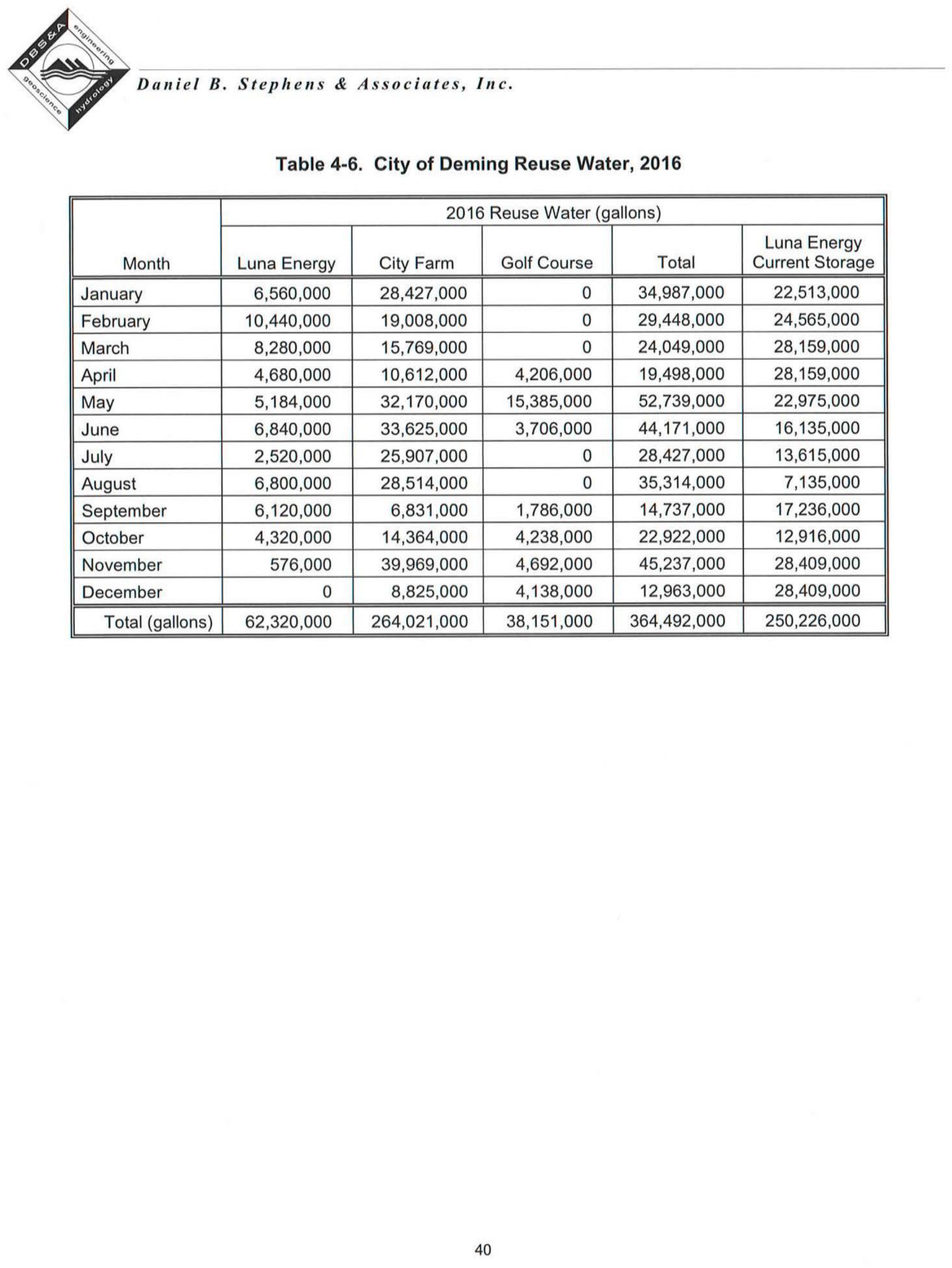

Table 4-6. City of Deming Reuse Water, 2016

Month	2016 Reuse Water (gallons)				
	Luna Energy	City Farm	Golf Course	Total	Luna Energy Current Storage
January	6,560,000	28,427,000	0	34,987,000	22,513,000
February	10,440,000	19,008,000	0	29,448,000	24,565,000
March	8,280,000	15,769,000	0	24,049,000	28,159,000
April	4,680,000	10,612,000	4,206,000	19,498,000	28,159,000
May	5,184,000	32,170,000	15,385,000	52,739,000	22,975,000
June	6,840,000	33,625,000	3,706,000	44,171,000	16,135,000
July	2,520,000	25,907,000	0	28,427,000	13,615,000
August	6,800,000	28,514,000	0	35,314,000	7,135,000
September	6,120,000	6,831,000	1,786,000	14,737,000	17,236,000
October	4,320,000	14,364,000	4,238,000	22,922,000	12,916,000
November	576,000	39,969,000	4,692,000	45,237,000	28,409,000
December	0	8,825,000	4,138,000	12,963,000	28,409,000
Total (gallons)	62,320,000	264,021,000	38,151,000	364,492,000	250,226,000

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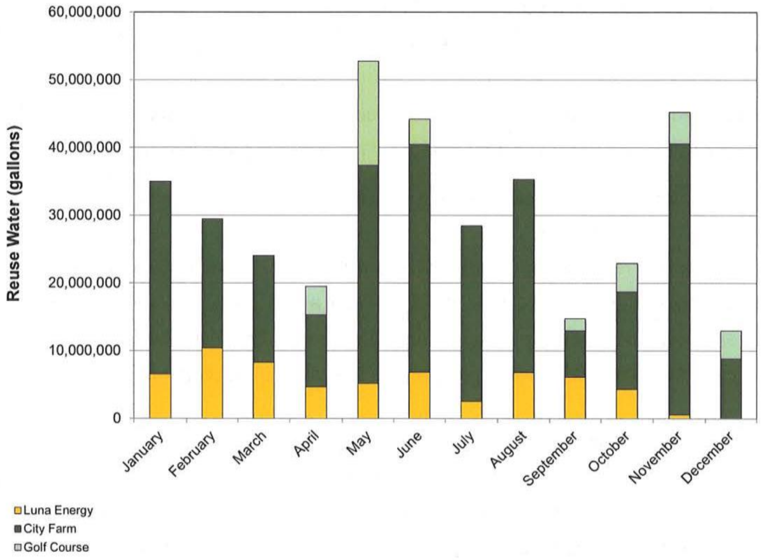

DEMING 40-YEAR WATER PLAN

City of Deming

Monthly Reuse Water Use in 2016

Figure 4-9

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In the future, the City plans to reuse effluent at a planned multi-sport complex. The City wants to build a recreation area and fishing pond fed by treated effluent. The cemetery is currently irrigated from a dedicated well, but there are plans to irrigate with treated wastewater effluent in the future.

4.5 Future Water Use Projections

Future demand for water from the City of Deming water system will be driven in large part by population growth and demand for water services. Future water use by the City will include:

- Continued service for existing uses, including residences, businesses, schools, and other commercial uses, and water for parks and other outdoor landscaping.
- Expansion to serve new residents, businesses, or other users coming into the area.

There is uncertainty regarding estimates of future use, which are dependent on population growth in the area (Sections 4.5.1 and 4.5.2) as well as on policy decisions yet to be made regarding expansion of the system to serve new customers. Therefore, DBS&A has developed a range of potential future water use projections as described in Section 4.5.3.

4.5.1 Population Growth

As part of the process of developing the population forecasts for this plan, DBS&A and Poster Enterprises evaluated past population growth rates and recent population projections and conducted interviews with local government and economic development and planning organizations in the Deming and Luna County area.

Deming has generally experienced steady population growth historically. Between the 2000 census and 2010 census, the City grew by 5.24 percent (Table 4-7). The U.S. Census Bureau (2018) reported that 14,855 people lived in Deming in 2010 and listed 5,582 occupied and 644 unoccupied housing units. Since 2010, the population has decreased slightly to 14,488 people (World Population Review, 2017).

Table 4-7. Historical Population and Growth Rates for Deming

Year	Population	Percentage Change (%)	Annual Growth Rate (%)
1900	1,100	—	—
1920	3,212	192.00	5.50
1930	3,377	5.14	0.50
1940	3,608	6.84	0.66
1950	5,672	57.21	4.63
1960	6,764	19.25	1.78
1970	8,343	23.34	2.12
1980	9,964	19.43	1.79
1990	10,970	10.10	0.97
2000	14,116	28.68	2.55
2010	14,855	5.24	0.51
2016	14,488	–2.47	–0.42

Source: World Population Review, 2017 — = Not applicable

4.5.1.1 Recent Population Forecasts

In updating the New Mexico regional water plans in 2016 and 2017, population and water use projections were prepared for each of the 16 water planning regions. The projection prepared for the *Southwest New Mexico Regional Water Plan* takes into consideration the variability in population growth the area has experienced by providing a forecast that anticipates a moderately optimistic and a less optimistic growth trend. The regional water plan includes projected population through 2060, based on two scenarios (low- and high-growth), for the planning region (NMISC/NMOSE, 2017). The plan summarized data gathered from local experts about the economic outlook to inform the projections. The 2012 Bureau of Business and Economic Research (BBER, 2012) statewide population projections through 2040 were used for the low population projection and extrapolated through 2060 for Luna County. The high projection is based on the 2012 Luna County comprehensive plan update: 1.0 percent annual growth through 2020 and 1.5 percent annual growth after 2020.

DBS&A evaluated and compared the regional water plan projections, the City's 2017 PER growth rate (0.56 percent annual growth), and historical growth rates for Deming (Figure 4-10). The reviewed datasets included the following (listed in order from largest to smallest growth rates):

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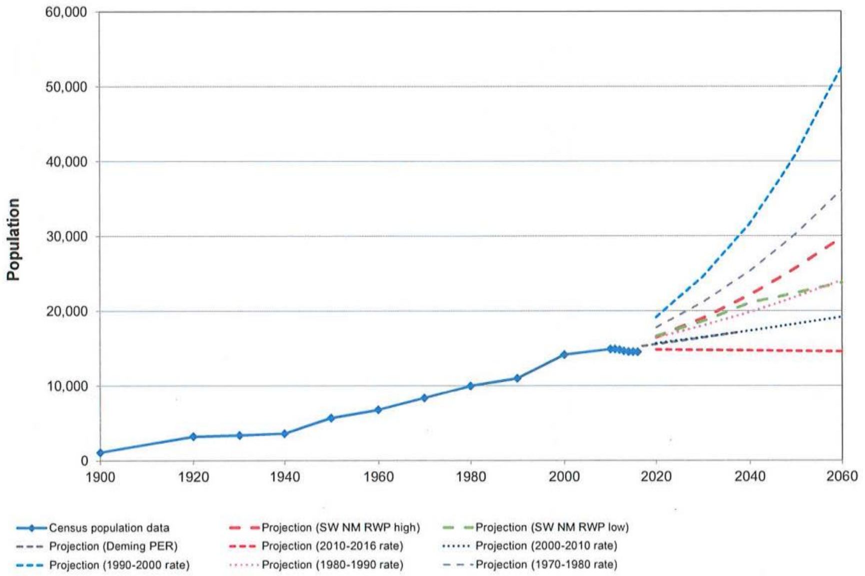

DEMING 40-YEAR WATER PLAN
City of Deming
Historical and Projected Future Population

Figure 4-10

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- 1990 to 2000 annual growth rate of 2.55 percent
- 1970 to 1980 annual growth rate of 1.79 percent
- *Southwest New Mexico Regional Water Plan* high-growth estimate (1 to 1.5 percent)
- *Southwest New Mexico Regional Water Plan* low-growth estimate (0.6 to 1.24 percent)
- 1980 to 1990 annual growth rate of 0.97 percent
- Deming PER annual growth rate of 0.56 percent
- 2000 to 2010 annual growth rate of 0.51 percent
- 2010 to 2016 annual growth rate of -0.42 percent

Based on this information and comparison of the different population forecasts available, DBS&A has selected the high-growth estimate used in the *Southwest New Mexico Regional Water Plan* and the recent 2000 to 2010 annual growth rate (similar to the recent Deming PER projection) to develop the population projections for the City of Deming.

4.5.2 Population Growth Projections for the City of Deming

The selected projected population growth rates (Table 4-8) were applied to the Deming population to project growth through 2060 (Table 4-9, Figure 4-11). The forecasts bracket a range of growth rates that allows the City to plan for a modest but steady growth under the high-growth scenario, as well as a much lower growth rate should the economic downturn continue.

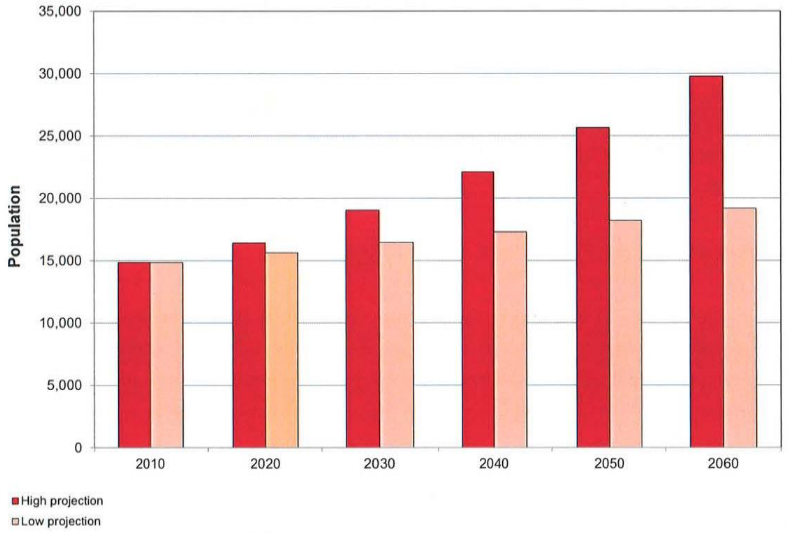
Table 4-8. Projected Annual Growth Rate
City of Deming

	Annual Growth Rate (%)				
Projection	2010-2020	2020-2030	2030-2040	2040-2050	2050-2060
High	1.00	1.50	1.50	1.50	1.50
Low	0.51	0.51	0.51	0.51	0.51

Table 4-9. Projected Population
City of Deming

	City of Deming Population [a]					
Projection	2010 [b]	2020	2030	2040	2050	2060
High	14,855	16,407	19,042	22,100	25,650	29,769
Low	14,855	15,633	16,451	17,312	18,219	19,172

[a] Estimated by applying annual growth rates (Table 4-8) to Deming population.
[b] Based on 2010 census data.



DEMING 40-YEAR WATER PLAN
City of Deming
Population Projections

Figure 4-11

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4.5.3 Future Water Demand

Population projections inform future water demand in most of the water use categories served by the City of Deming. To project future water requirements, current billed water usage amounts for most demand sectors (Section 4.1.1) were projected forward under both a low and high population growth scenario (Section 4.5.2).

The water use shown on Table 4-10 is based on monthly billing and meter records and well production reports. Total future water demand estimates are based on the amount of water the City must divert in order to meet customer demand. During 2016, the City diverted 3,488 ac-ft/yr in order to provide metered use of 3,254 acre-feet of water. Thus, the City must divert 7 percent more water than is delivered (metered or sold) to meet demand.

Table 4-10. Current Water Demand by Sector
City of Deming

Year	Metered Water by Sector (acre-feet)					Total Metered Production (acre-feet)
	Residential	ICI	Bulk	Route 98 [a]	Total	
2016	1,585	1,149	3	517	3,254	3,488
2016 plus 7% diversion requirement	1,695	1,230	4	554	3,482	▨

[a] = Includes unbilled metered use from City's municipal and irrigation wells
ICI = Industrial, commercial, and institutional

Using the recent water uses by sector shown on Table 4-10 as starting values, future water demands were projected forward using the following assumptions:

- Low and high residential demand projections were developed by multiplying the 2016 billed amount from Table 4-10 by the low and high population annual growth rates shown in Table 4-8.

- Industrial, commercial, and institutional demand was assumed to grow proportionally to population growth, so the low and high annual growth rates from Table 4-8 were multiplied by the 2016 billed amount in Table 4-10, to develop the low and high projections.

- For bulk sales, the low projection was assumed to remain at 2016 level, and the high projection was assumed to increase with the high annual growth rate of 1 to 1.5 percent. Use in this category is very low and does not have a significant impact on future demands for the City.

- For Route 98, the low projection was assumed to remain at the 2016 use level, and the high projection was assumed to increase at 1 percent per year from the 2017 use level. The increase accounts for possible additional outdoor park watering due to warmer temperatures or to new parks.

- Total projected future diversions were estimated at 7 percent more than the high and low total metered water projections.

The resulting projected demand under the low and high growth scenarios is shown on Figure 4-12 and Table 4-11. The projections indicate that metered water use is expected to range from about 3,300 to 3,400 acre-feet in 2020 and from about 3,900 to 6,000 acre-feet in 2060. Projected groundwater diversions to meet the metered water demand are expected to range from about 3,500 to 3,600 acre-feet in 2020 and from about 4,200 to 6,400 acre-feet in 2060 (Table 4-11).

As discussed previously, there is considerable uncertainty in the water use projections. The City will continue to evaluate its water use in comparison to projected demand and will update projections periodically to account for changed conditions. The range of projections presented is intended to provide a reasonable range of anticipated water needs.

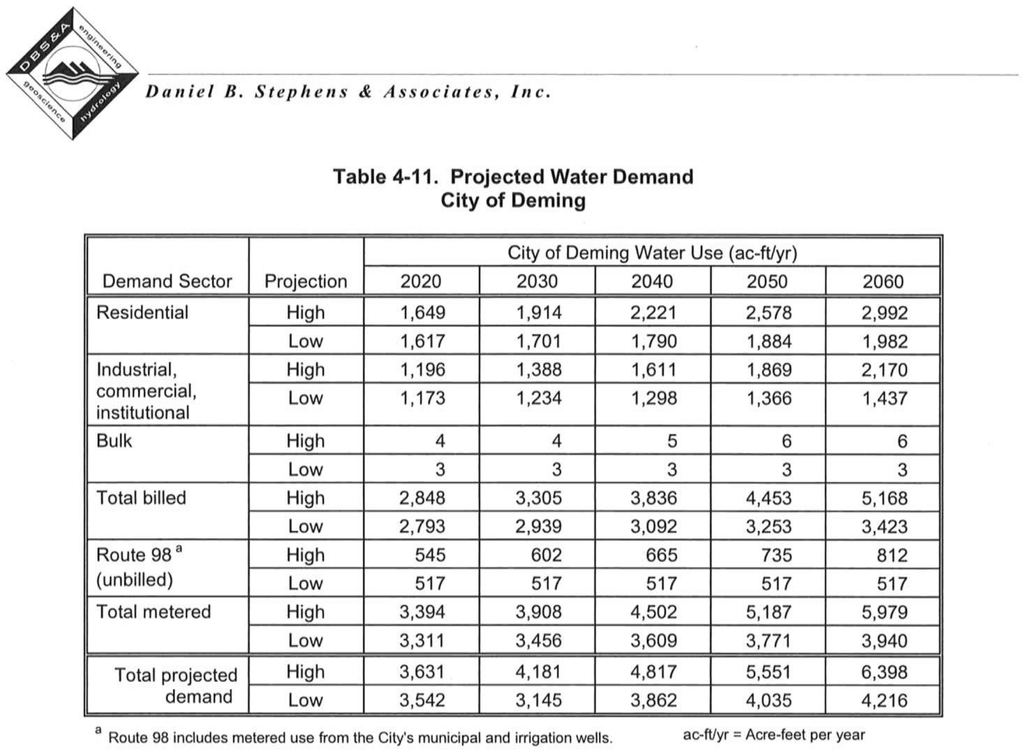

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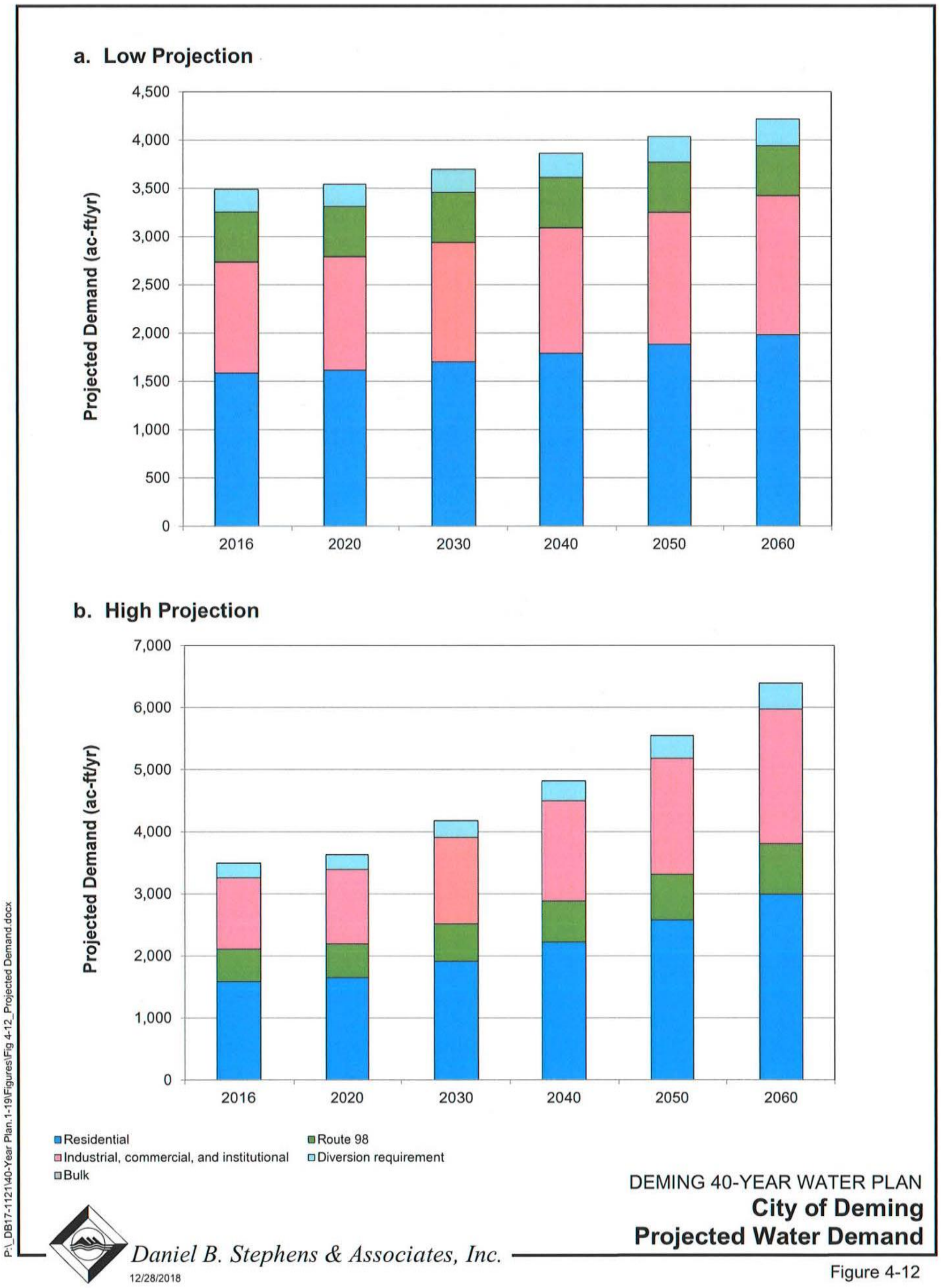
Table 4-11. Projected Water Demand
City of Deming

Demand Sector	Projection	City of Deming Water Use (ac-ft/yr)				
		2020	2030	2040	2050	2060
Residential	High	1,649	1,914	2,221	2,578	2,992
	Low	1,617	1,701	1,790	1,884	1,982
Industrial, commercial, institutional	High	1,196	1,388	1,611	1,869	2,170
	Low	1,173	1,234	1,298	1,366	1,437
Bulk	High	4	4	5	6	6
	Low	3	3	3	3	3
Total billed	High	2,848	3,305	3,836	4,453	5,168
	Low	2,793	2,939	3,092	3,253	3,423
Route 98 [a] (unbilled)	High	545	602	665	735	812
	Low	517	517	517	517	517
Total metered	High	3,394	3,908	4,502	5,187	5,979
	Low	3,311	3,456	3,609	3,771	3,940
Total projected demand	High	3,631	4,181	4,817	5,551	6,398
	Low	3,542	3,145	3,862	4,035	4,216

[a] Route 98 includes metered use from the City's municipal and irrigation wells.

ac-ft/yr = Acre-feet per year



a. Low Projection

b. High Projection

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DEMING 40-YEAR WATER PLAN
City of Deming
Projected Water Demand

Daniel B. Stephens & Associates, Inc.
12/28/2018

Figure 4-12

5. Water Rights

This section describes the legal framework and administration of water resources in the Deming area and summarizes the water rights currently owned by or in the process of being transferred to the City.

5.1 Current Legal Framework

The Mimbres Underground Water Basin (UWB) was declared on July 29, 1931 under State Engineer Order No. 1. Since that date, the NMOSE has issued seven orders extending the boundaries of the basin.

Guidelines for the Deming-Columbus Administrative Area (DCAA) within the Mimbres UWB were adopted on May 20, 2011. The DCAA guidelines replace the Mimbres Basin Administrative Criteria adopted in 1982. These guidelines do not apply to the permitting of applications filed under NMSA Section 72-12-1.1, 72-12-1.2, and 72-12-1.3. The guidelines apply to applications within the DCAA that propose production from the basin-fill alluvium, which is composed of gravel, sand, clay, silt and interbedded basalt flows. Applications proposing diversion from other geologic units, or outside the boundaries of the DCAA, will be processed on a case-by-case basis.

A critical management area was designated in the Deming area; no new appropriations are allowed in the area.

5.2 Existing Permits

The City of Deming owns a total of 6,363 acre-feet of municipal use water rights in the Mimbres Basin (Table 5-1) and an additional 2,892 acres of land with appurtenant irrigation rights (Table 5-2). Many of the irrigation rights have been purchased in the last few years and have not yet been transferred to municipal use. Some irrigation rights cannot be feasibly transferred to the City due to the remote location. For example, water rights held under files M-514, M-811, and M-971 (Murdock) are appurtenant to 686 acres that are located approximately 16 miles outside the City limits, too far to be piped into the City's municipal service area, and they therefore cannot be used to meet future demand within the City.

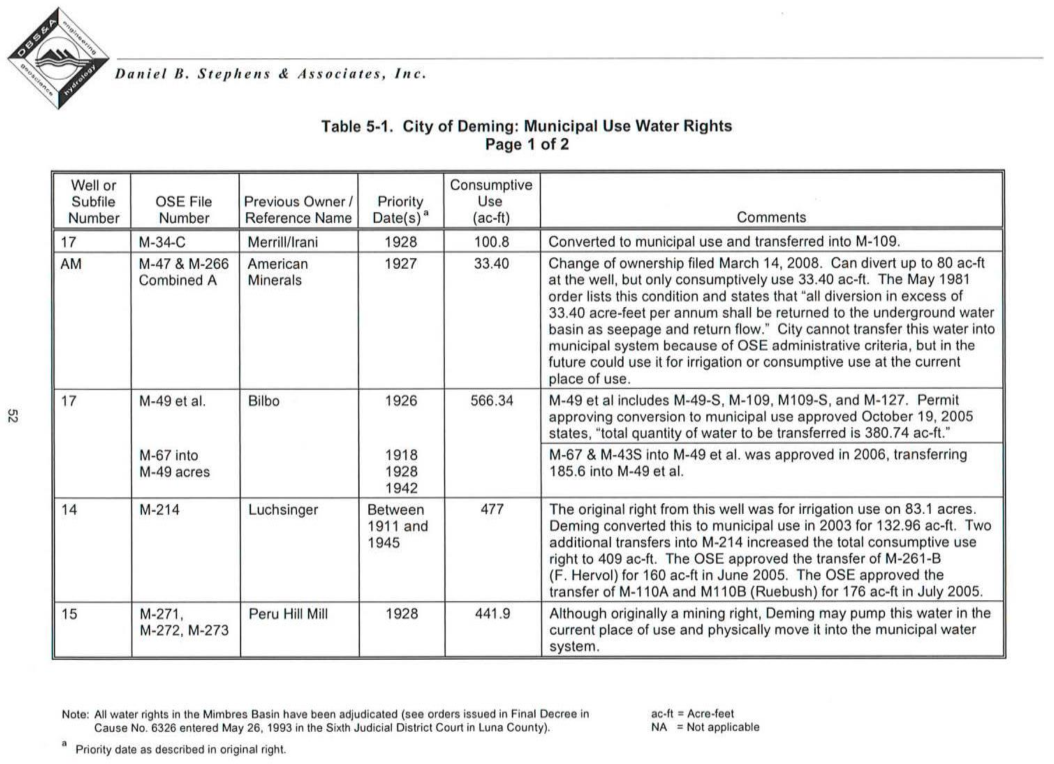

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Table 5-1. City of Deming: Municipal Use Water Rights
Page 1 of 2

Well or Subfile Number	OSE File Number	Previous Owner / Reference Name	Priority Date(s) [a]	Consumptive Use (ac-ft)	Comments
17	M-34-C	Merrill/Irani	1928	100.8	Converted to municipal use and transferred into M-109.
AM	M-47 & M-266 Combined A	American Minerals	1927	33.40	Change of ownership filed March 14, 2008. Can divert up to 80 ac-ft at the well, but only consumptively use 33.40 ac-ft. The May 1981 order lists this condition and states that "all diversion in excess of 33.40 acre-feet per annum shall be returned to the underground water basin as seepage and return flow." City cannot transfer this water into municipal system because of OSE administrative criteria, but in the future could use it for irrigation or consumptive use at the current place of use.
17	M-49 et al.	Bilbo	1926	566.34	M-49 et al includes M-49-S, M-109, M109-S, and M-127. Permit approving conversion to municipal use approved October 19, 2005 states, "total quantity of water to be transferred is 380.74 ac-ft."
	M-67 into M-49 acres		1918 1928 1942		M-67 & M-43S into M-49 et al. was approved in 2006, transferring 185.6 into M-49 et al.
14	M-214	Luchsinger	Between 1911 and 1945	477	The original right from this well was for irrigation use on 83.1 acres. Deming converted this to municipal use in 2003 for 132.96 ac-ft. Two additional transfers into M-214 increased the total consumptive use right to 409 ac-ft. The OSE approved the transfer of M-261-B (F. Hervol) for 160 ac-ft in June 2005. The OSE approved the transfer of M-110A and M110B (Ruebush) for 176 ac-ft in July 2005.
15	M-271, M-272, M-273	Peru Hill Mill	1928	441.9	Although originally a mining right, Deming may pump this water in the current place of use and physically move it into the municipal water system.

Note: All water rights in the Mimbres Basin have been adjudicated (see orders issued in Final Decree in Cause No. 6326 entered May 26, 1993 in the Sixth Judicial District Court in Luna County).

ac-ft = Acre-feet
NA = Not applicable

[a] Priority date as described in original right.

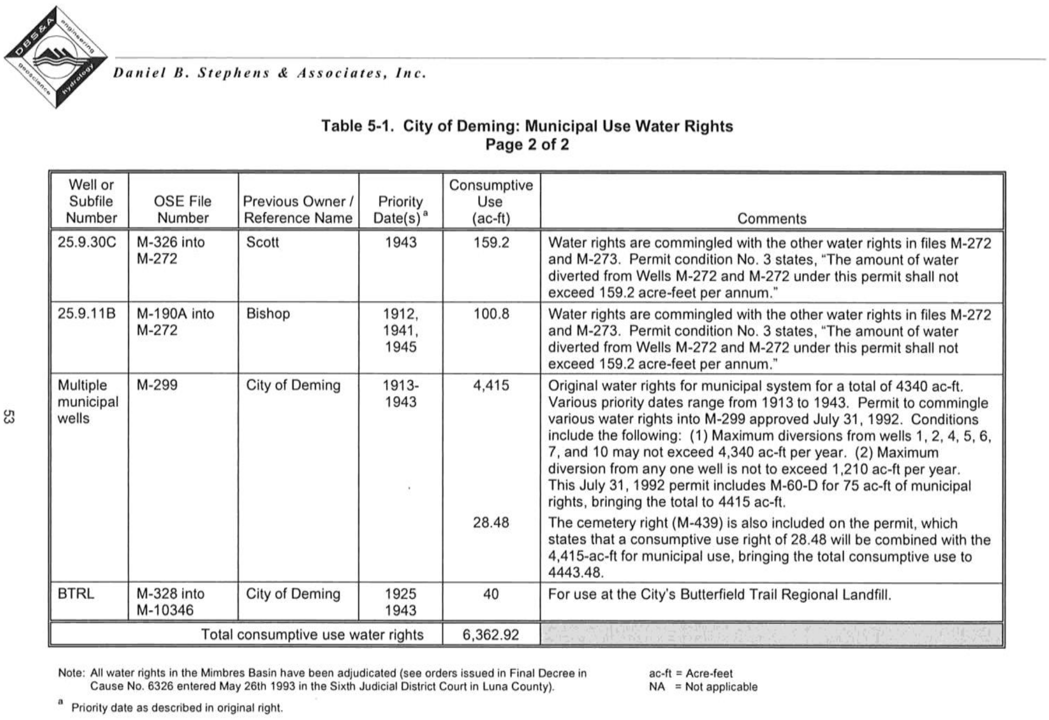

Table 5-1. City of Deming: Municipal Use Water Rights
Page 2 of 2

Well or Subfile Number	OSE File Number	Previous Owner / Reference Name	Priority Date(s) [a]	Consumptive Use (ac-ft)	Comments
25.9.30C	M-326 into M-272	Scott	1943	159.2	Water rights are commingled with the other water rights in files M-272 and M-273. Permit condition No. 3 states, "The amount of water diverted from Wells M-272 and M-272 under this permit shall not exceed 159.2 acre-feet per annum."
25.9.11B	M-190A into M-272	Bishop	1912, 1941, 1945	100.8	Water rights are commingled with the other water rights in files M-272 and M-273. Permit condition No. 3 states, "The amount of water diverted from Wells M-272 and M-272 under this permit shall not exceed 159.2 acre-feet per annum."
Multiple municipal wells	M-299	City of Deming	1913-1943	4,415	Original water rights for municipal system for a total of 4340 ac-ft. Various priority dates range from 1913 to 1943. Permit to commingle various water rights into M-299 approved July 31, 1992. Conditions include the following: (1) Maximum diversions from wells 1, 2, 4, 5, 6, 7, and 10 may not exceed 4,340 ac-ft per year. (2) Maximum diversion from any one well is not to exceed 1,210 ac-ft per year. This July 31, 1992 permit includes M-60-D for 75 ac-ft of municipal rights, bringing the total to 4415 ac-ft.
				28.48	The cemetery right (M-439) is also included on the permit, which states that a consumptive use right of 28.48 will be combined with the 4,415-ac-ft for municipal use, bringing the total consumptive use to 4443.48.
BTRL	M-328 into M-10346	City of Deming	1925 1943	40	For use at the City's Butterfield Trail Regional Landfill.
Total consumptive use water rights				6,362.92	

Note: All water rights in the Mimbres Basin have been adjudicated (see orders issued in Final Decree in Cause No. 6326 entered May 26th 1993 in the Sixth Judicial District Court in Luna County).

ac-ft = Acre-feet
NA = Not applicable

[a] Priority date as described in original right.

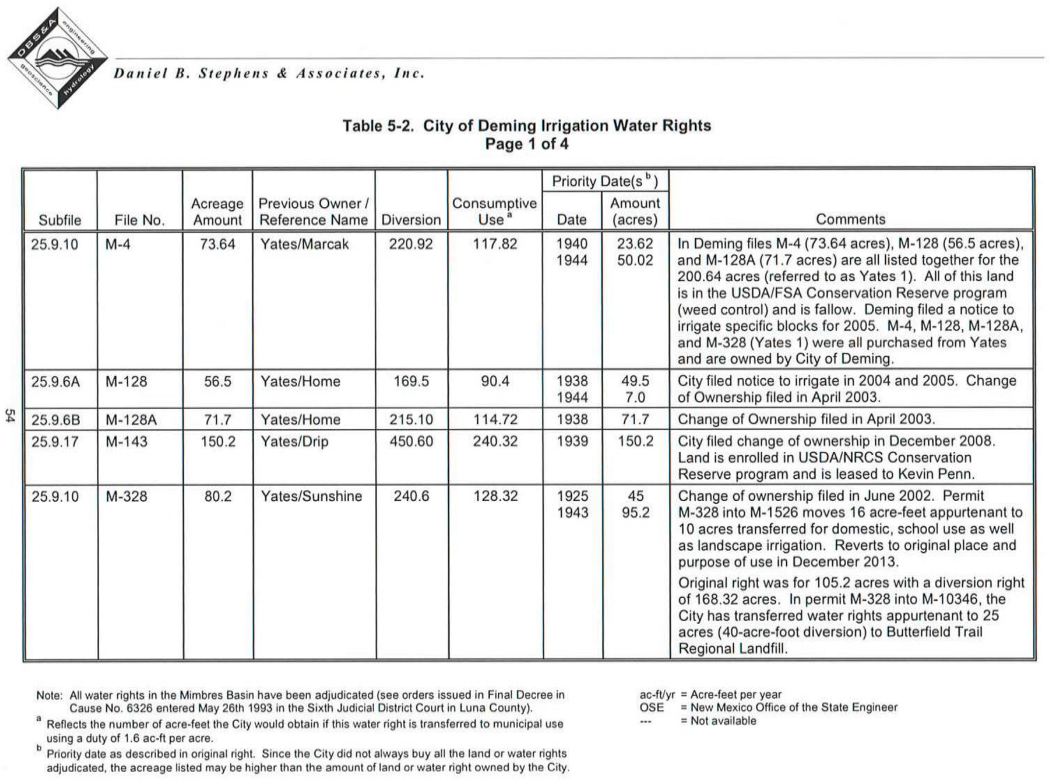

Table 5-2. City of Deming Irrigation Water Rights
Page 1 of 4

Subfile	File No.	Acreage Amount	Previous Owner / Reference Name	Diversion	Consumptive Use [a]	Priority Date(s [b])		Comments
						Date	Amount (acres)	
25.9.10	M-4	73.64	Yates/Marcak	220.92	117.82	1940 1944	23.62 50.02	In Deming files M-4 (73.64 acres), M-128 (56.5 acres), and M-128A (71.7 acres) are all listed together for the 200.64 acres (referred to as Yates 1). All of this land is in the USDA/FSA Conservation Reserve program (weed control) and is fallow. Deming filed a notice to irrigate specific blocks for 2005. M-4, M-128, M-128A, and M-328 (Yates 1) were all purchased from Yates and are owned by City of Deming.
25.9.6A	M-128	56.5	Yates/Home	169.5	90.4	1938 1944	49.5 7.0	City filed notice to irrigate in 2004 and 2005. Change of Ownership filed in April 2003.
25.9.6B	M-128A	71.7	Yates/Home	215.10	114.72	1938	71.7	Change of Ownership filed in April 2003.
25.9.17	M-143	150.2	Yates/Drip	450.60	240.32	1939	150.2	City filed change of ownership in December 2008. Land is enrolled in USDA/NRCS Conservation Reserve program and is leased to Kevin Penn.
25.9.10	M-328	80.2	Yates/Sunshine	240.6	128.32	1925 1943	45 95.2	Change of ownership filed in June 2002. Permit M-328 into M-1526 moves 16 acre-feet appurtenant to 10 acres transferred for domestic, school use as well as landscape irrigation. Reverts to original place and purpose of use in December 2013. Original right was for 105.2 acres with a diversion right of 168.32 acres. In permit M-328 into M-10346, the City has transferred water rights appurtenant to 25 acres (40-acre-foot diversion) to Butterfield Trail Regional Landfill.

Note: All water rights in the Mimbres Basin have been adjudicated (see orders issued in Final Decree in Cause No. 6326 entered May 26th 1993 in the Sixth Judicial District Court in Luna County).

[a] Reflects the number of acre-feet the City would obtain if this water right is transferred to municipal use using a duty of 1.6 ac-ft per acre.

[b] Priority date as described in original right. Since the City did not always buy all the land or water rights adjudicated, the acreage listed may be higher than the amount of land or water right owned by the City.

ac-ft/yr = Acre-feet per year
OSE = New Mexico Office of the State Engineer
--- = Not available

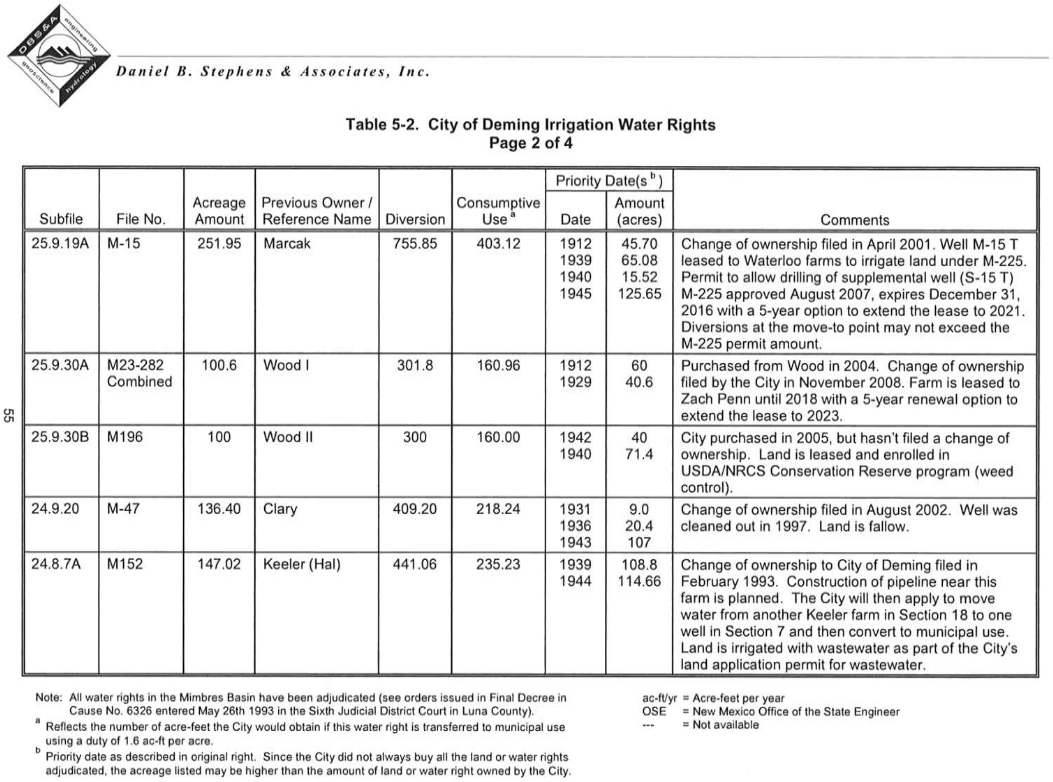

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Table 5-2. City of Deming Irrigation Water Rights
Page 2 of 4

Subfile	File No.	Acreage Amount	Previous Owner / Reference Name	Diversion	Consumptive Use [a]	Priority Date(s [b])		Comments
						Date	Amount (acres)	
25.9.19A	M-15	251.95	Marcak	755.85	403.12	1912 1939 1940 1945	45.70 65.08 15.52 125.65	Change of ownership filed in April 2001. Well M-15 T leased to Waterloo farms to irrigate land under M-225. Permit to allow drilling of supplemental well (S-15 T) M-225 approved August 2007, expires December 31, 2016 with a 5-year option to extend the lease to 2021. Diversions at the move-to point may not exceed the M-225 permit amount.
25.9.30A	M23-282 Combined	100.6	Wood I	301.8	160.96	1912 1929	60 40.6	Purchased from Wood in 2004. Change of ownership filed by the City in November 2008. Farm is leased to Zach Penn until 2018 with a 5-year renewal option to extend the lease to 2023.
25.9.30B	M196	100	Wood II	300	160.00	1942 1940	40 71.4	City purchased in 2005, but hasn't filed a change of ownership. Land is leased and enrolled in USDA/NRCS Conservation Reserve program (weed control).
24.9.20	M-47	136.40	Clary	409.20	218.24	1931 1936 1943	9.0 20.4 107	Change of ownership filed in August 2002. Well was cleaned out in 1997. Land is fallow.
24.8.7A	M152	147.02	Keeler (Hal)	441.06	235.23	1939 1944	108.8 114.66	Change of ownership to City of Deming filed in February 1993. Construction of pipeline near this farm is planned. The City will then apply to move water from another Keeler farm in Section 18 to one well in Section 7 and then convert to municipal use. Land is irrigated with wastewater as part of the City's land application permit for wastewater.

Note: All water rights in the Mimbres Basin have been adjudicated (see orders issued in Final Decree in Cause No. 6326 entered May 26th 1993 in the Sixth Judicial District Court in Luna County).

[a] Reflects the number of acre-feet the City would obtain if this water right is transferred to municipal use using a duty of 1.6 ac-ft per acre.

[b] Priority date as described in original right. Since the City did not always buy all the land or water rights adjudicated, the acreage listed may be higher than the amount of land or water right owned by the City.

ac-ft/yr = Acre-feet per year
OSE = New Mexico Office of the State Engineer
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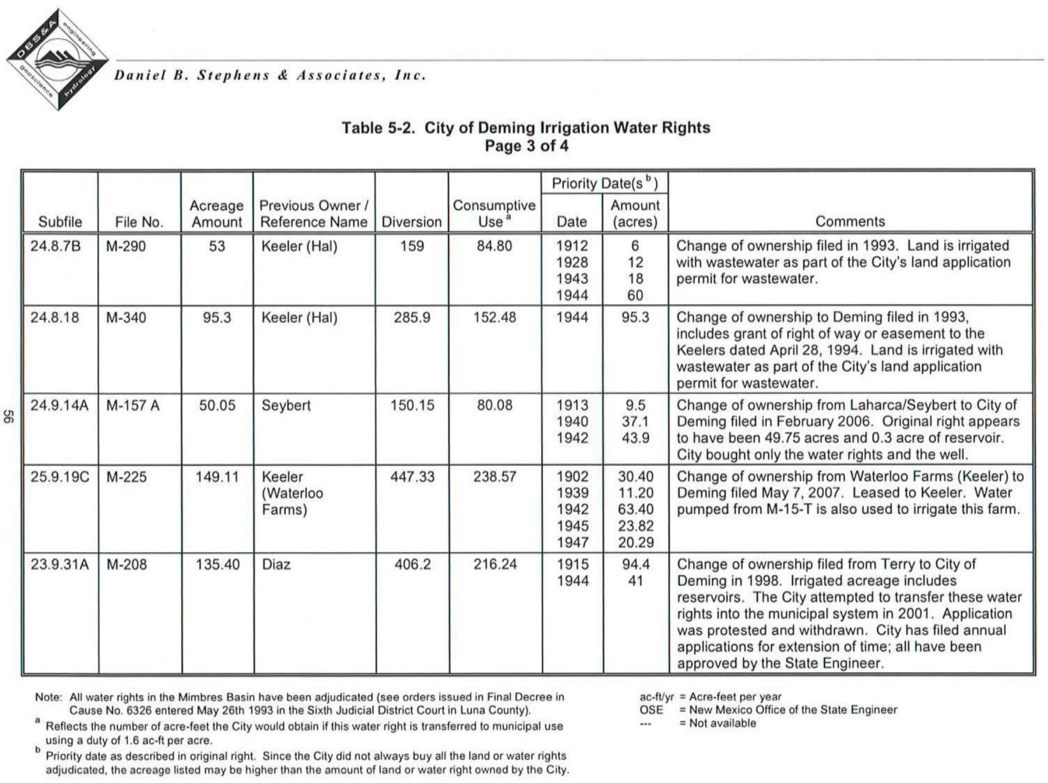

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Table 5-2. City of Deming Irrigation Water Rights
Page 3 of 4

						Priority Date(s[b])		
Subfile	File No.	Acreage Amount	Previous Owner / Reference Name	Diversion	Consumptive Use[a]	Date	Amount (acres)	Comments
24.8.7B	M-290	53	Keeler (Hal)	159	84.80	1912 1928 1943 1944	6 12 18 60	Change of ownership filed in 1993. Land is irrigated with wastewater as part of the City's land application permit for wastewater.
24.8.18	M-340	95.3	Keeler (Hal)	285.9	152.48	1944	95.3	Change of ownership to Deming filed in 1993, includes grant of right of way or easement to the Keelers dated April 28, 1994. Land is irrigated with wastewater as part of the City's land application permit for wastewater.
24.9.14A	M-157 A	50.05	Seybert	150.15	80.08	1913 1940 1942	9.5 37.1 43.9	Change of ownership from Laharca/Seybert to City of Deming filed in February 2006. Original right appears to have been 49.75 acres and 0.3 acre of reservoir. City bought only the water rights and the well.
25.9.19C	M-225	149.11	Keeler (Waterloo Farms)	447.33	238.57	1902 1939 1942 1945 1947	30.40 11.20 63.40 23.82 20.29	Change of ownership from Waterloo Farms (Keeler) to Deming filed May 7, 2007. Leased to Keeler. Water pumped from M-15-T is also used to irrigate this farm.
23.9.31A	M-208	135.40	Diaz	406.2	216.24	1915 1944	94.4 41	Change of ownership filed from Terry to City of Deming in 1998. Irrigated acreage includes reservoirs. The City attempted to transfer these water rights into the municipal system in 2001. Application was protested and withdrawn. City has filed annual applications for extension of time; all have been approved by the State Engineer.

Note: All water rights in the Mimbres Basin have been adjudicated (see orders issued in Final Decree in Cause No. 6326 entered May 26th 1993 in the Sixth Judicial District Court in Luna County).

[a] Reflects the number of acre-feet the City would obtain if this water right is transferred to municipal use using a duty of 1.6 ac-ft per acre.

[b] Priority date as described in original right. Since the City did not always buy all the land or water rights adjudicated, the acreage listed may be higher than the amount of land or water right owned by the City.

ac-ft/yr = Acre-feet per year

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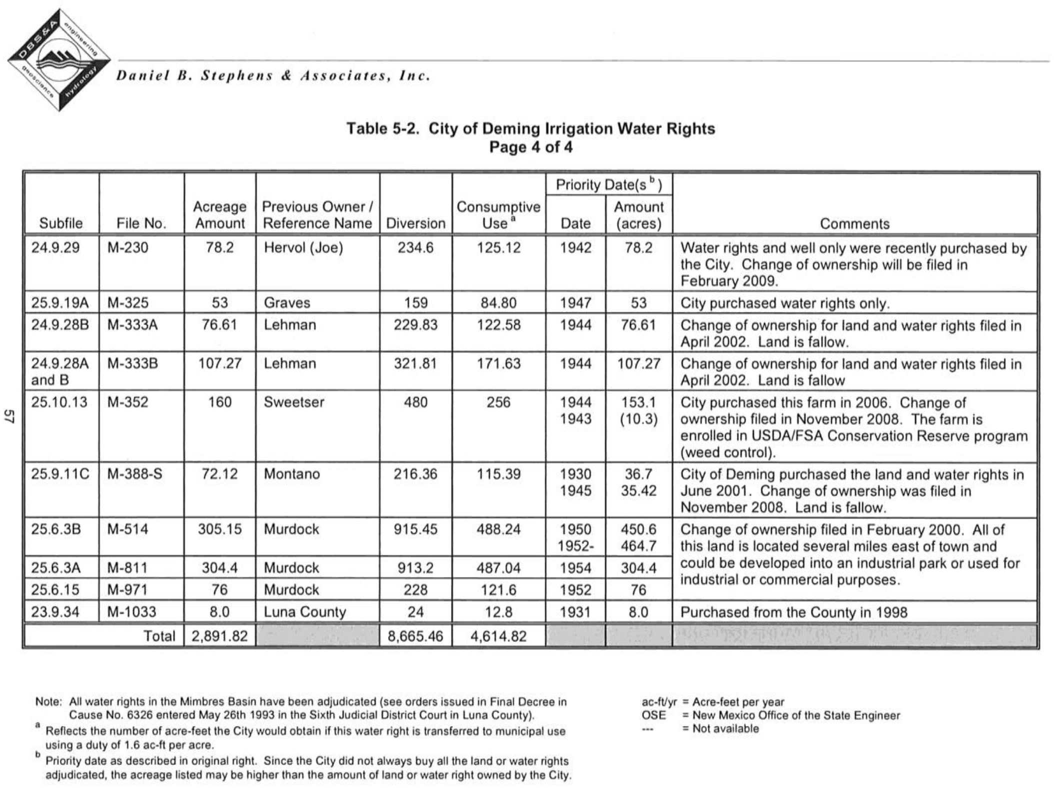

Table 5-2. City of Deming Irrigation Water Rights
Page 4 of 4

Subfile	File No.	Acreage Amount	Previous Owner / Reference Name	Diversion	Consumptive Use [a]	Priority Date(s [b])		Comments
						Date	Amount (acres)	
24.9.29	M-230	78.2	Hervol (Joe)	234.6	125.12	1942	78.2	Water rights and well only were recently purchased by the City. Change of ownership will be filed in February 2009.
25.9.19A	M-325	53	Graves	159	84.80	1947	53	City purchased water rights only.
24.9.28B	M-333A	76.61	Lehman	229.83	122.58	1944	76.61	Change of ownership for land and water rights filed in April 2002. Land is fallow.
24.9.28A and B	M-333B	107.27	Lehman	321.81	171.63	1944	107.27	Change of ownership for land and water rights filed in April 2002. Land is fallow
25.10.13	M-352	160	Sweetser	480	256	1944 1943	153.1 (10.3)	City purchased this farm in 2006. Change of ownership filed in November 2008. The farm is enrolled in USDA/FSA Conservation Reserve program (weed control).
25.9.11C	M-388-S	72.12	Montano	216.36	115.39	1930 1945	36.7 35.42	City of Deming purchased the land and water rights in June 2001. Change of ownership was filed in November 2008. Land is fallow.
25.6.3B	M-514	305.15	Murdock	915.45	488.24	1950 1952-	450.6 464.7	Change of ownership filed in February 2000. All of this land is located several miles east of town and could be developed into an industrial park or used for industrial or commercial purposes.
25.6.3A	M-811	304.4	Murdock	913.2	487.04	1954	304.4	
25.6.15	M-971	76	Murdock	228	121.6	1952	76	
23.9.34	M-1033	8.0	Luna County	24	12.8	1931	8.0	Purchased from the County in 1998
Total		2,891.82		8,665.46	4,614.82			

Note: All water rights in the Mimbres Basin have been adjudicated (see orders issued in Final Decree in Cause No. 6326 entered May 26th 1993 in the Sixth Judicial District Court in Luna County).

[a] Reflects the number of acre-feet the City would obtain if this water right is transferred to municipal use using a duty of 1.6 ac-ft per acre.

[b] Priority date as described in original right. Since the City did not always buy all the land or water rights adjudicated, the acreage listed may be higher than the amount of land or water right owned by the City.

ac-ft/yr = Acre-feet per year
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5.3 Future Water Rights Needs

Based on the future water demand projections shown in Table 4-11, the maximum anticipated demand for water from the City is 6,398 ac-ft/yr, which is only 5 acre-feet more than the City currently has permitted in its municipal wells. The low water demand projection is 4,216 ac-ft/yr. Therefore, the City of Deming has sufficient municipal water rights to meet the high and low demand projections through 2060. Additionally, transfer of the City's irrigation water rights to municipal use would allow the City to meet demand that exceeds the future demand projection.

Transfer of irrigation rights, however, raises two issues that may affect the feasibility of this option:

- It may not be economically feasible to convert some of the irrigation rights located several miles southeast of the City, due to the distance the water would have to be piped.

- The City may encounter difficulty converting irrigation water rights to municipal use due to protests from existing users and to limitations placed by the NMOSE in applying the DCAA Guidelines (administrative criteria).

Therefore, it cannot be assumed that all the City's irrigation water rights will be converted and available for future municipal use.

5.4 Water Use and Conservation

The City of Deming set forth its policy on water use through the *City of Deming Comprehensive Plan Update* (Sites Southwest, 2010) and regulates water use through its City Code.

The current Comprehensive Plan supplemented these policies and also recognizes that a new production source will be required to meet future water demand and provide for growth. Accordingly, the City of Deming has the following water policy goals: (1) ensure that water and wastewater systems are expanded or improved to accommodate future growth, (2) continue to obtain water rights for future growth, (3) require that subdivisions have an adequate supply of water for each lot for at least 70 years, and (4) enhance the quality of life by providing safe, efficient, affordable, and responsible use of water by encouraging voluntary water conservation and expanding uses of wastewater effluent irrigation.

The Deming City code restricts water use through Section 9-4-7 of the Code. That section includes outdoor water conservation measures (§9-4-7(D)), time of day and day of week watering restrictions (§9-4-7(C)), waste of water prohibition (§9-4-7(E)), and restrictions on water use during water emergencies (§9-4-7(H)). In addition, Section 13-4-5 of the Code requires that subdivisions have an adequate supply of water (§13-4-5).

6. Water Supply Priorities and Strategies

The City of Deming will continue to expand and implement several initiatives as part of its long-term water supply strategy. Based on the analysis provided in Sections 2 through 5, DBS&A recommends that the City of Deming consider the actions detailed below.

6.1 Water System

This 40-year water development plan did not include an independent evaluation of water system infrastructure. However, to be prepared to meet future water needs of the community, it is important for the City of Deming to continue with implementation of infrastructure upgrades as recommended in the 2017 PER (DBS&A, 2017):

- Expanding the supervisory control and data acquisition system (SCADA) to 6 wells, 2 tanks, and the Bilbo booster station.
- Rehabilitating 6 wells, including cleaning and acidizing, test pumping, and video surveys of existing wells.
- Replacing piping, including aged and failing cast iron and undersized piping that cannot provide fire flow.
- Installing additional piping to provide fire flow.
- Constructing a new closed-loop booster station at Peru Mill to provide service in the Industrial Park.
- Adding 1.5 million gallons of water storage.

Further recommendations based on the results of the water audit include:

- Establish/revised policies and procedures for data collection.
- Establish ongoing mechanisms for customer meter accuracy testing, active leakage control, and infrastructure monitoring.

- Begin to assemble the economic business case for long-term needs based upon improved data becoming available through the water audit process.
- Establish long-term apparent and real loss reduction goals with at least a 10-year horizon.

The City should also continue to implement infrastructure upgrades recommended in the 2017 Comprehensive Plan (City of Deming, 2017).

6.2 Water Supply and Quality

Recommendations for preserving and enhancing water supply and quality include:

- Continue collecting depth to water measurements to monitor any changes in water levels and available physical supply.
- Evaluate potential locations for future well field development to replace the city's production wells currently located in the critical management area. Consider water quality (source water protection) and infrastructure when evaluating potential locations.
- Continue collecting water quality samples, paying particular attention to the levels of arsenic, fluoride, nitrate, TDS, sulfate, and volatile organic compounds (VOCs) in the Deming drinking water supply.
- Continue implementing the City's source water/wellhead protection program to ensure the future safety of the City's water supply.
- Continue participation in regional source water quality monitoring and watershed protection planning to improve water quality.

6.3 Future Water Demand

To ensure that adequate water supplies for available to meet future demands, the City should review population projections every 5 years to determine if the projections in the current plan are still valid and evaluate whether increases in demand are trending toward the high- or low-water-use projections. Should a higher trend be identified, the City should implement a targeted water rights acquisition program as recommended in Section 6.4.

An updated review of water conservation measures was not included in the scope of this plan. The City of Deming has water conservation ordinances in place to address shortages due to drought or system failure, and the City values conservation and will continue with implementation of the recommendations from its existing Water Conservation Plan (included in the 2009 40-Year Water Development Plan [DBS&A, 2009]) as follows:

- Continue the current water conservation program management and staffing by the Public Works Department.
- Expand the existing public education component to support the City's water conservation goals.
- Make residential water conservation a priority, since the majority of use occurs in this sector and the potential savings are higher than in other sectors.
- Work with the largest users in the commercial and industrial sectors to identify how water can be conserved by those customers.
- Continue tracking water use efficiency by conducting annual AWWA water audits and updating the NMOSE GPCD calculator annually.
- Work with public works and water utility operations staff to better quantify unbilled authorized uses within the water treatment and wastewater treatment plants and public works.
- Continue to maximize opportunities for wastewater reuse for outdoor watering.
- Adopt stricter codes regulating domestic outdoor watering methods and allocated times for watering.

- Continue to implement the customer water meter replacement program.
- Continue to conduct leak detection surveys and standards for water line construction.
- Develop an updated comprehensive conservation plan to improve water use efficiency. An updated plan should include quantitative assessments of water savings from various water conservation measures already implemented, as well as recommendations for additional measures that have the greatest potential for minimizing water use.

6.4 Water Rights

To ensure that the City has sufficient water rights to meet future water demand, the following priorities are recommended:

- Complete necessary paperwork to ensure that water right permit requirements continue to be met. For example, the City may be required to file requests for extensions of time to prove beneficial use and, for certain rights, notices of intent to irrigate. This system should also document which water rights require other paperwork preparation such as change of ownership forms.
- Develop a water rights tracking spreadsheet for all water right offers made to the City. Include evaluation of the water right, (owner, priority, location relative to the critical management areas, price) and the decision whether to purchase. Document water rights that have been evaluated for purchase, even if the City opted not to purchase the water right.
- Implement a program to reserve water rights in trust for certain water rights owners who may wish to transfer water rights to the City in the future. Identify opportunities to lease these water rights.
- Continue to evaluate agricultural water rights that are offered to the City for purchase, in accordance with the Deming Water Rights Acquisition Policy.

- Evaluate water right permit limitations to determine whether pumping limits on wells will affect total water availability for municipal use.

- Transfer irrigation rights to municipal use as applicable, and complete pending water rights transfers to move irrigation water rights into the municipal system.

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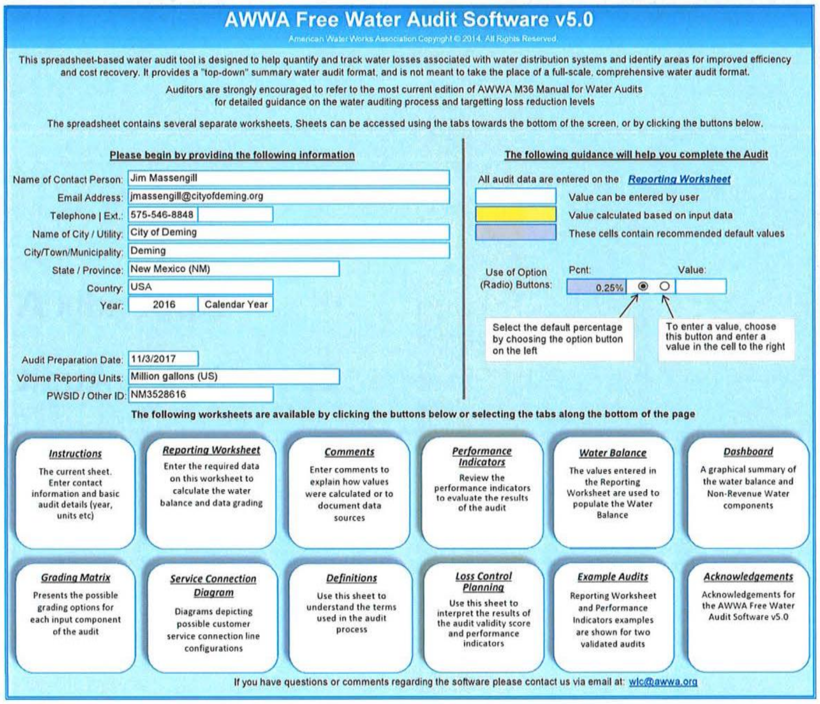
Appendix A

2016 AWWA Audit



AWWA Free Water Audit Software v5.0

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This spreadsheet-based water audit tool is designed to help quantify and track water losses associated with water distribution systems and identify areas for improved efficiency and cost recovery. It provides a "top-down" summary water audit format, and is not meant to take the place of a full-scale, comprehensive water audit format.

Auditors are strongly encouraged to refer to the most current edition of AWWA M36 Manual for Water Audits for detailed guidance on the water auditing process and targetting loss reduction levels

The spreadsheet contains several separate worksheets. Sheets can be accessed using the tabs towards the bottom of the screen, or by clicking the buttons below.

Please begin by providing the following information

Name of Contact Person: Jim Massengill
Email Address: jmassengill@cityofdeming.org
Telephone | Ext.: 575-546-8848
Name of City / Utility: City of Deming
City/Town/Municipality: Deming
State / Province: New Mexico (NM)
Country: USA
Year: 2016 Calendar Year

Audit Preparation Date: 11/3/2017
Volume Reporting Units: Million gallons (US)
PWSID / Other ID: NM3528616

The following guidance will help you complete the Audit

All audit data are entered on the *Reporting Worksheet*

☐	Value can be entered by user
🟨	Value calculated based on input data
▨	These cells contain recommended default values

Use of Option (Radio) Buttons: Pcnt: 0.25% ● ○ Value:

Select the default percentage by choosing the option button on the left

To enter a value, choose this button and enter a value in the cell to the right

The following worksheets are available by clicking the buttons below or selecting the tabs along the bottom of the page

Instructions The current sheet. Enter contact information and basic audit details (year, units etc)

Reporting Worksheet Enter the required data on this worksheet to calculate the water balance and data grading

Comments Enter comments to explain how values were calculated or to document data sources

Performance Indicators Review the performance indicators to evaluate the results of the audit

Water Balance The values entered in the Reporting Worksheet are used to populate the Water Balance

Dashboard A graphical summary of the water balance and Non-Revenue Water components

Grading Matrix Presents the possible grading options for each input component of the audit

Service Connection Diagram Diagrams depicting possible customer service connection line configurations

Definitions Use this sheet to understand the terms used in the audit process

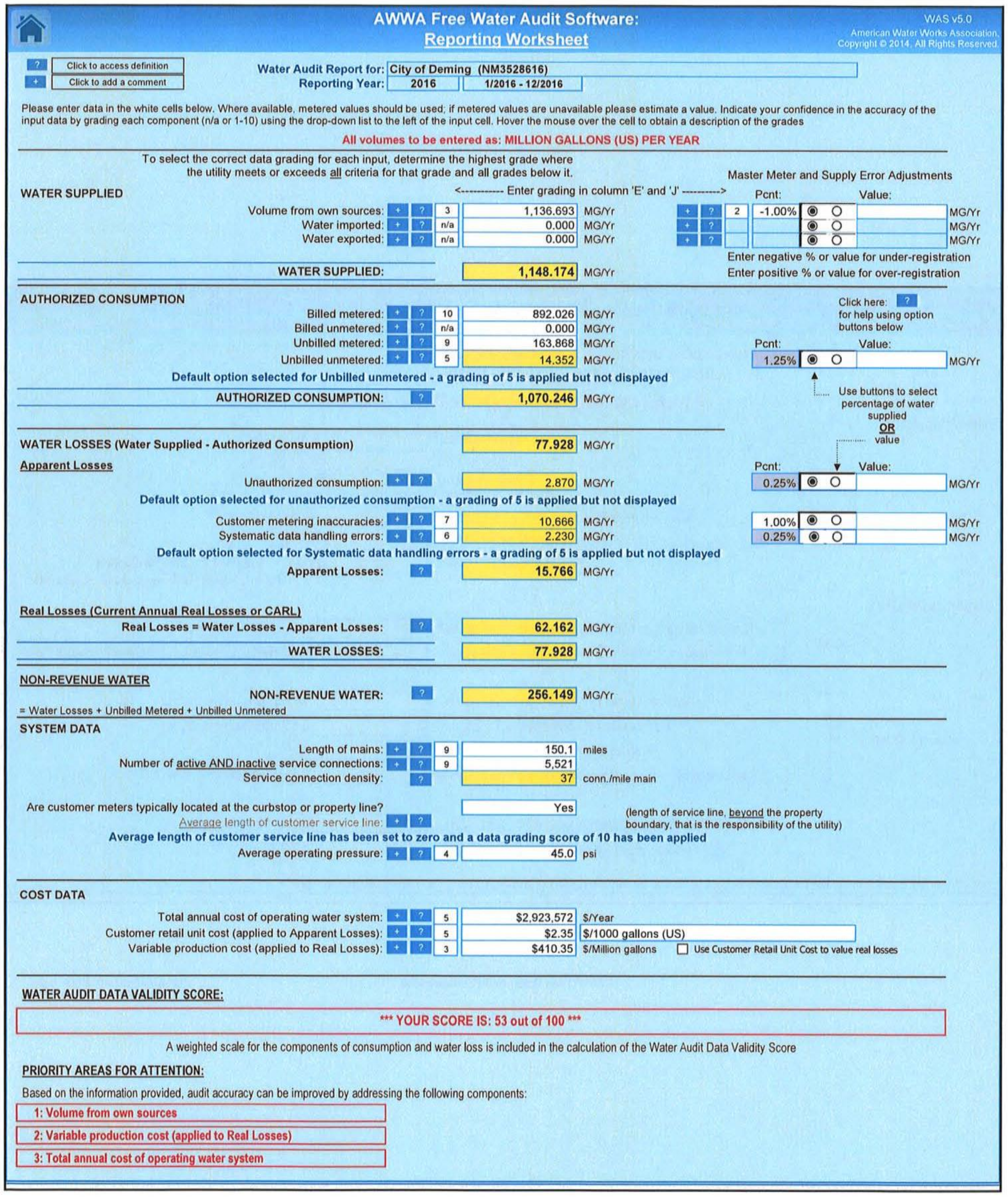
Loss Control Planning Use this sheet to interpret the results of the audit validity score and performance indicators

Example Audits Reporting Worksheet and Performance Indicators examples are shown for two validated audits

Acknowledgements Acknowledgements for the AWWA Free Water Audit Software v5.0

If you have questions or comments regarding the software please contact us via email at: wlc@awwa.org

AWWA Free Water Audit Software v5.0 Instructions 1



AWWA Free Water Audit Software: Reporting Worksheet

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American Water Works Association.
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? Click to access definition
\+ Click to add a comment

Water Audit Report for: City of Deming (NM3528616)
Reporting Year: 2016 1/2016 - 12/2016

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (n/a or 1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

To select the correct data grading for each input, determine the highest grade where the utility meets or exceeds all criteria for that grade and all grades below it.

<------------ Enter grading in column 'E' and 'J' ---------->

WATER SUPPLIED

					Master Meter and Supply Error Adjustments			
	Grade	Value	Unit	Grade	Pcnt:		Value:	
Volume from own sources:	3	1,136.693	MG/Yr	2	-1.00%	● ○		MG/Yr
Water imported:	n/a	0.000	MG/Yr			● ○		MG/Yr
Water exported:	n/a	0.000	MG/Yr			● ○		MG/Yr

Enter negative % or value for under-registration
Enter positive % or value for over-registration

WATER SUPPLIED: 1,148.174 MG/Yr

AUTHORIZED CONSUMPTION

				Pcnt:		Value:	
Billed metered:	10	892.026	MG/Yr				
Billed unmetered:	n/a	0.000	MG/Yr				
Unbilled metered:	9	163.868	MG/Yr				
Unbilled unmetered:	5	14.352	MG/Yr	1.25%	● ○		MG/Yr

Click here: ? for help using option buttons below

Default option selected for Unbilled unmetered - a grading of 5 is applied but not displayed

AUTHORIZED CONSUMPTION: 1,070.246 MG/Yr

Use buttons to select percentage of water supplied OR value

WATER LOSSES (Water Supplied - Authorized Consumption)

77.928 MG/Yr

Apparent Losses

				Pcnt:		Value:	
Unauthorized consumption:		2.870	MG/Yr	0.25%	● ○		MG/Yr

Default option selected for unauthorized consumption - a grading of 5 is applied but not displayed

Customer metering inaccuracies:	7	10.666	MG/Yr	1.00%	● ○		MG/Yr
Systematic data handling errors:	6	2.230	MG/Yr	0.25%	● ○		MG/Yr

Default option selected for Systematic data handling errors - a grading of 5 is applied but not displayed

Apparent Losses: 15.766 MG/Yr

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses: 62.162 MG/Yr

WATER LOSSES: 77.928 MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 256.149 MG/Yr

= Water Losses + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

Length of mains:	9	150.1	miles
Number of active AND inactive service connections:	9	5,521	
Service connection density:		37	conn./mile main

Are customer meters typically located at the curbstop or property line? Yes

Average length of customer service line: (length of service line, beyond the property boundary, that is the responsibility of the utility)

Average length of customer service line has been set to zero and a data grading score of 10 has been applied

Average operating pressure: 4 45.0 psi

COST DATA

Total annual cost of operating water system:	5	$2,923,572	$/Year
Customer retail unit cost (applied to Apparent Losses):	5	$2.35	$/1000 gallons (US)
Variable production cost (applied to Real Losses):	3	$410.35	$/Million gallons ☐ Use Customer Retail Unit Cost to value real losses

WATER AUDIT DATA VALIDITY SCORE:

***** YOUR SCORE IS: 53 out of 100 *****

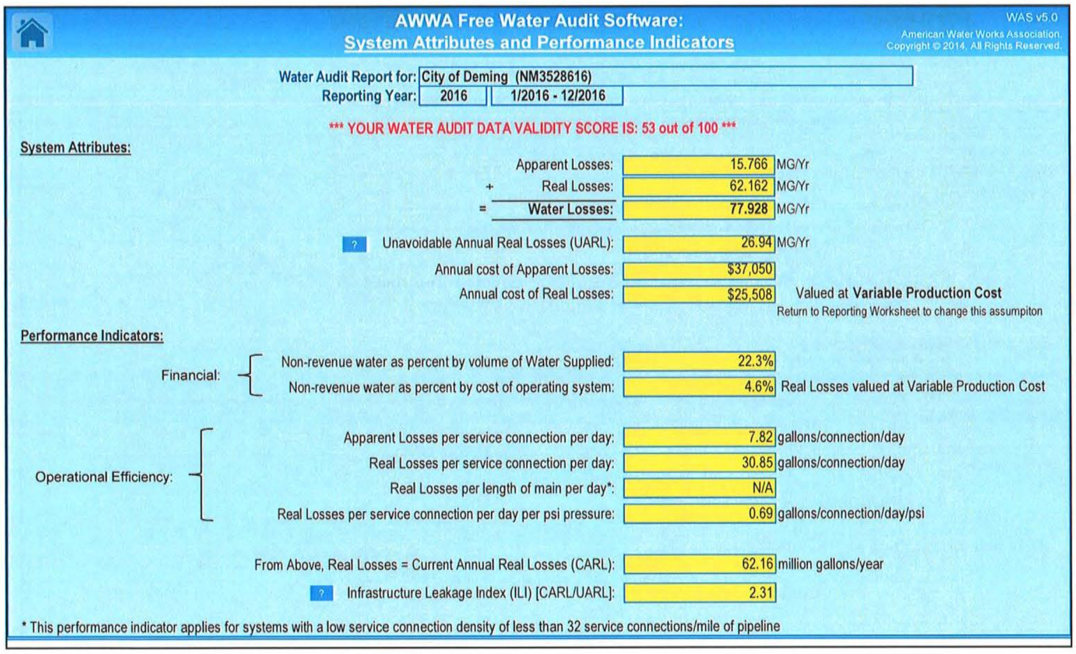
A weighted scale for the components of consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION:

Based on the information provided, audit accuracy can be improved by addressing the following components:

1: Volume from own sources
2: Variable production cost (applied to Real Losses)
3: Total annual cost of operating water system

AWWA Free Water Audit Software v5.0 Reporting Worksheet 2



AWWA Free Water Audit Software:
System Attributes and Performance Indicators

WAS v5.0
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Water Audit Report for: City of Deming (NM3528616)
Reporting Year: 2016 1/2016 - 12/2016

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 53 out of 100 ***

System Attributes:

Apparent Losses: 15.766 MG/Yr
+ Real Losses: 62.162 MG/Yr
= **Water Losses:** **77.928** MG/Yr

? Unavoidable Annual Real Losses (UARL): 26.94 MG/Yr
Annual cost of Apparent Losses: $37,050
Annual cost of Real Losses: $25,508 Valued at **Variable Production Cost**
Return to Reporting Worksheet to change this assumpiton

Performance Indicators:

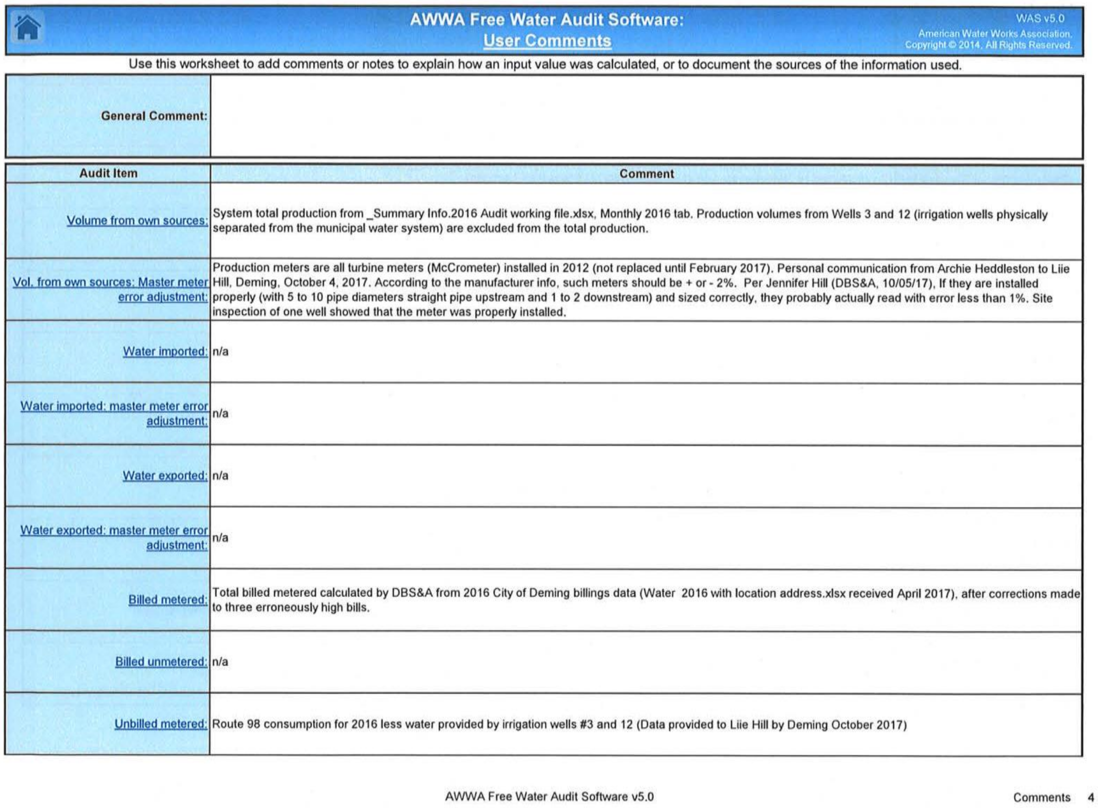
Financial:
Non-revenue water as percent by volume of Water Supplied: 22.3%
Non-revenue water as percent by cost of operating system: 4.6% Real Losses valued at Variable Production Cost

Operational Efficiency:
Apparent Losses per service connection per day: 7.82 gallons/connection/day
Real Losses per service connection per day: 30.85 gallons/connection/day
Real Losses per length of main per day*: N/A
Real Losses per service connection per day per psi pressure: 0.69 gallons/connection/day/psi

From Above, Real Losses = Current Annual Real Losses (CARL): 62.16 million gallons/year
? Infrastructure Leakage Index (ILI) [CARL/UARL]: 2.31

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

AWWA Free Water Audit Software v5.0 Performance Indicators 3



AWWA Free Water Audit Software:

User Comments

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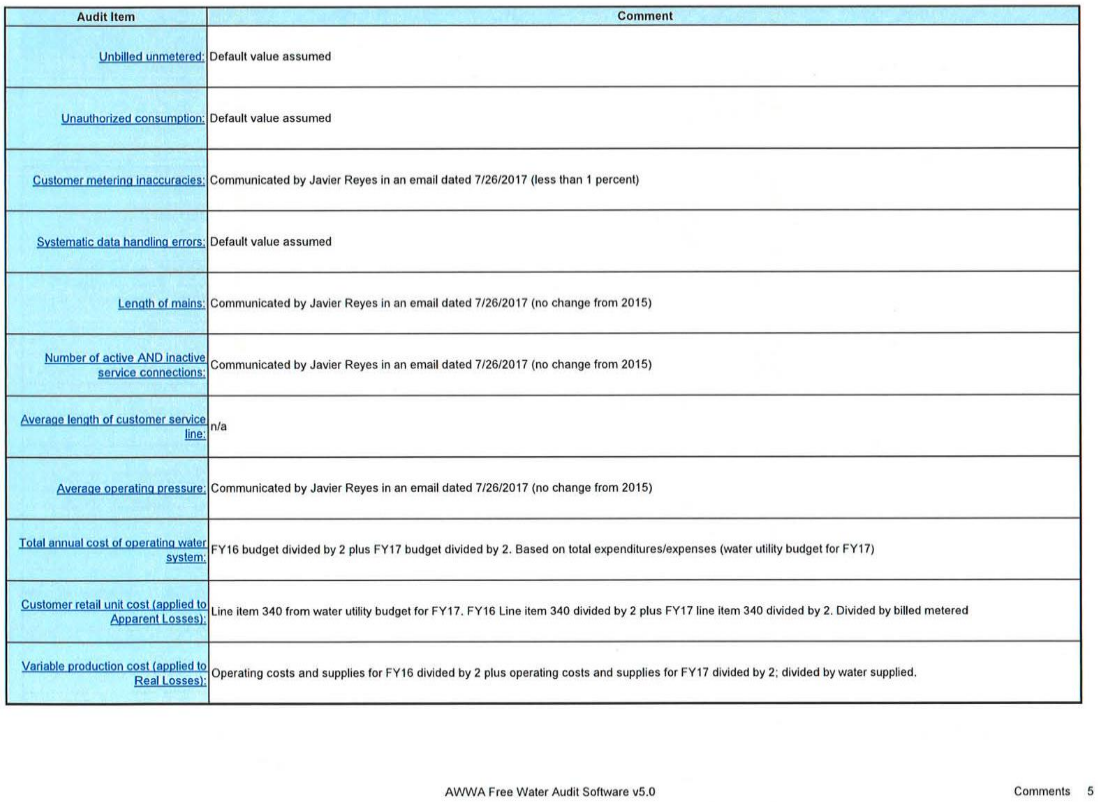
Use this worksheet to add comments or notes to explain how an input value was calculated, or to document the sources of the information used.

General Comment:	

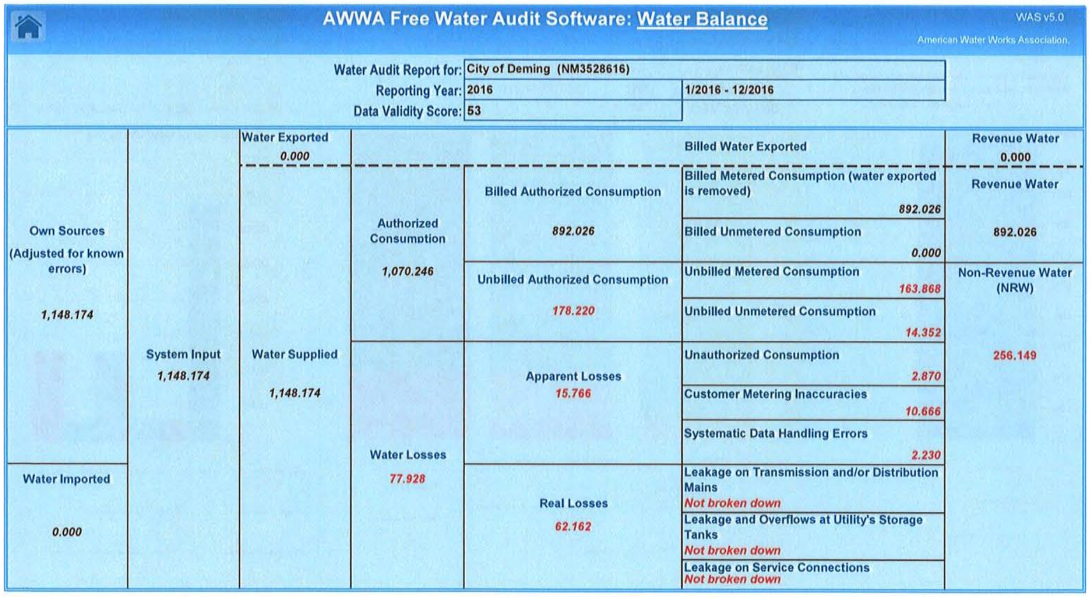
Audit Item	Comment
Volume from own sources:	System total production from _Summary Info.2016 Audit working file.xlsx, Monthly 2016 tab. Production volumes from Wells 3 and 12 (irrigation wells physically separated from the municipal water system) are excluded from the total production.
Vol. from own sources: Master meter error adjustment:	Production meters are all turbine meters (McCrometer) installed in 2012 (not replaced until February 2017). Personal communication from Archie Heddleston to Liie Hill, Deming, October 4, 2017. According to the manufacturer info, such meters should be + or - 2%. Per Jennifer Hill (DBS&A, 10/05/17), If they are installed properly (with 5 to 10 pipe diameters straight pipe upstream and 1 to 2 downstream) and sized correctly, they probably actually read with error less than 1%. Site inspection of one well showed that the meter was properly installed.
Water imported:	n/a
Water imported: master meter error adjustment:	n/a
Water exported:	n/a
Water exported: master meter error adjustment:	n/a
Billed metered:	Total billed metered calculated by DBS&A from 2016 City of Deming billings data (Water 2016 with location address.xlsx received April 2017), after corrections made to three erroneously high bills.
Billed unmetered:	n/a
Unbilled metered:	Route 98 consumption for 2016 less water provided by irrigation wells #3 and 12 (Data provided to Liie Hill by Deming October 2017)

AWWA Free Water Audit Software v5.0 Comments 4



Audit Item	Comment
Unbilled unmetered:	Default value assumed
Unauthorized consumption:	Default value assumed
Customer metering inaccuracies:	Communicated by Javier Reyes in an email dated 7/26/2017 (less than 1 percent)
Systematic data handling errors:	Default value assumed
Length of mains:	Communicated by Javier Reyes in an email dated 7/26/2017 (no change from 2015)
Number of active AND inactive service connections:	Communicated by Javier Reyes in an email dated 7/26/2017 (no change from 2015)
Average length of customer service line:	n/a
Average operating pressure:	Communicated by Javier Reyes in an email dated 7/26/2017 (no change from 2015)
Total annual cost of operating water system:	FY16 budget divided by 2 plus FY17 budget divided by 2. Based on total expenditures/expenses (water utility budget for FY17)
Customer retail unit cost (applied to Apparent Losses):	Line item 340 from water utility budget for FY17. FY16 Line item 340 divided by 2 plus FY17 line item 340 divided by 2. Divided by billed metered
Variable production cost (applied to Real Losses):	Operating costs and supplies for FY16 divided by 2 plus operating costs and supplies for FY17 divided by 2; divided by water supplied.

AWWA Free Water Audit Software v5.0 Comments 5



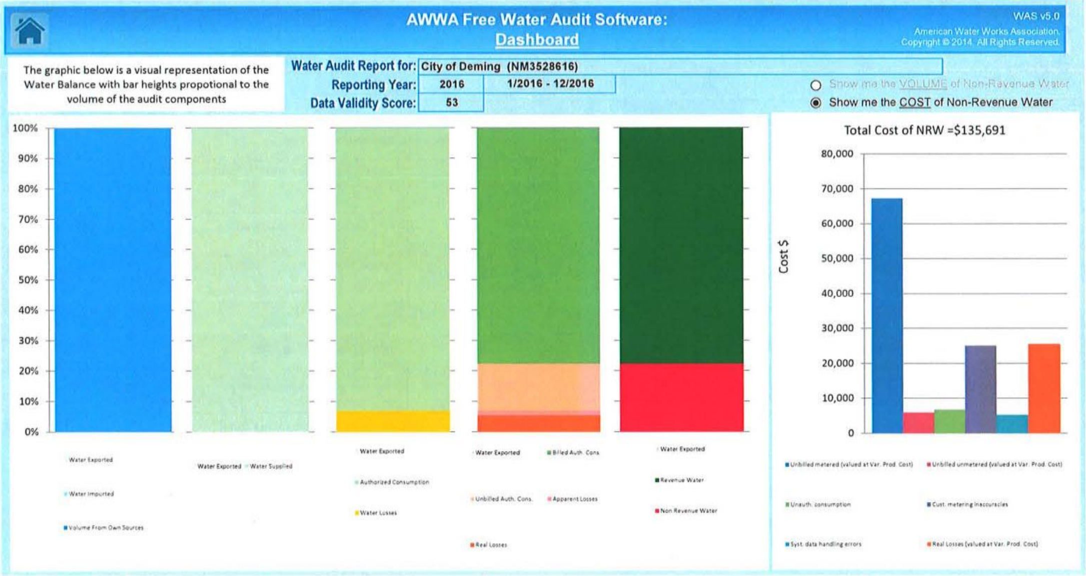
AWWA Free Water Audit Software: Water Balance

WAS v5.0
American Water Works Association.

Water Audit Report for: City of Deming (NM3528616)
Reporting Year: 2016 1/2016 - 12/2016
Data Validity Score: 53

		Water Exported 0.000			Billed Water Exported	Revenue Water 0.000
Own Sources (Adjusted for known errors) 1,148.174	System Input 1,148.174	Water Supplied 1,148.174	Authorized Consumption 1,070.246	Billed Authorized Consumption 892.026	Billed Metered Consumption (water exported is removed) 892.026	Revenue Water 892.026
					Billed Unmetered Consumption 0.000	
				Unbilled Authorized Consumption 178.220	Unbilled Metered Consumption 163.868	Non-Revenue Water (NRW) 256.149
					Unbilled Unmetered Consumption 14.352	
			Water Losses 77.928	Apparent Losses 15.766	Unauthorized Consumption 2.870	
					Customer Metering Inaccuracies 10.666	
					Systematic Data Handling Errors 2.230	
Water Imported 0.000				Real Losses 62.162	Leakage on Transmission and/or Distribution Mains Not broken down	
					Leakage and Overflows at Utility's Storage Tanks Not broken down	
					Leakage on Service Connections Not broken down	

AWWA Free Water Audit Software v5.0 Water Balance 6



AWWA Free Water Audit Software:
Dashboard

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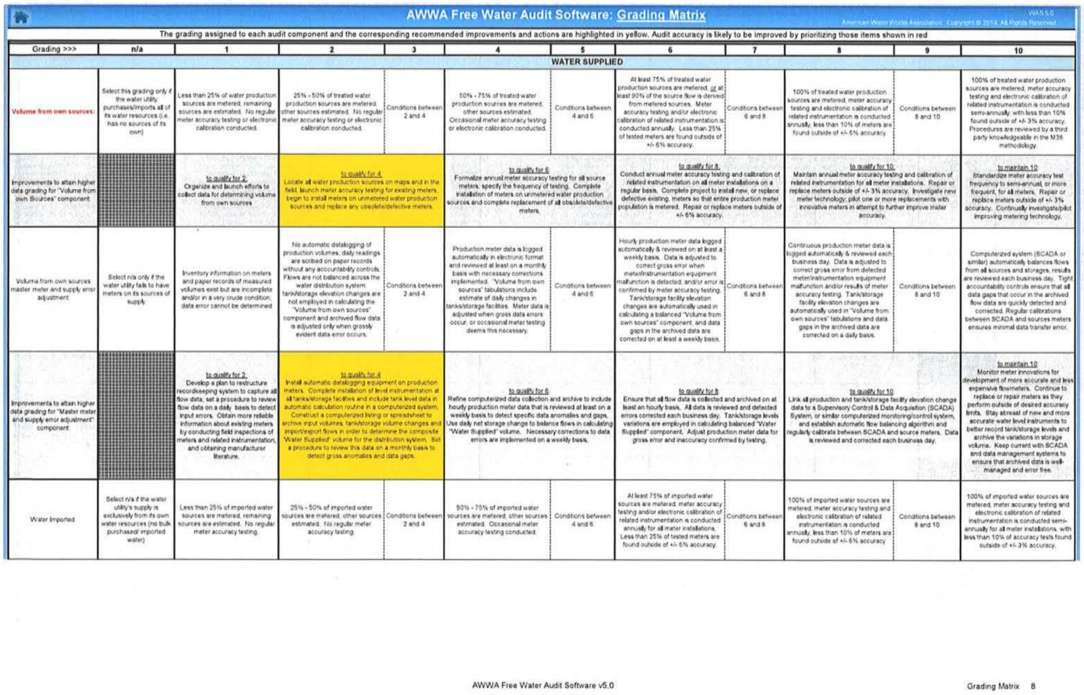
The graphic below is a visual representation of the Water Balance with bar heights propotional to the volume of the audit components

Water Audit Report for: City of Deming (NM3528616)
Reporting Year: 2016 1/2016 - 12/2016
Data Validity Score: 53

○ Show me the VOLUME of Non-Revenue Water
● Show me the COST of Non-Revenue Water

AWWA Free Water Audit Software v5.0 Dashboard 7



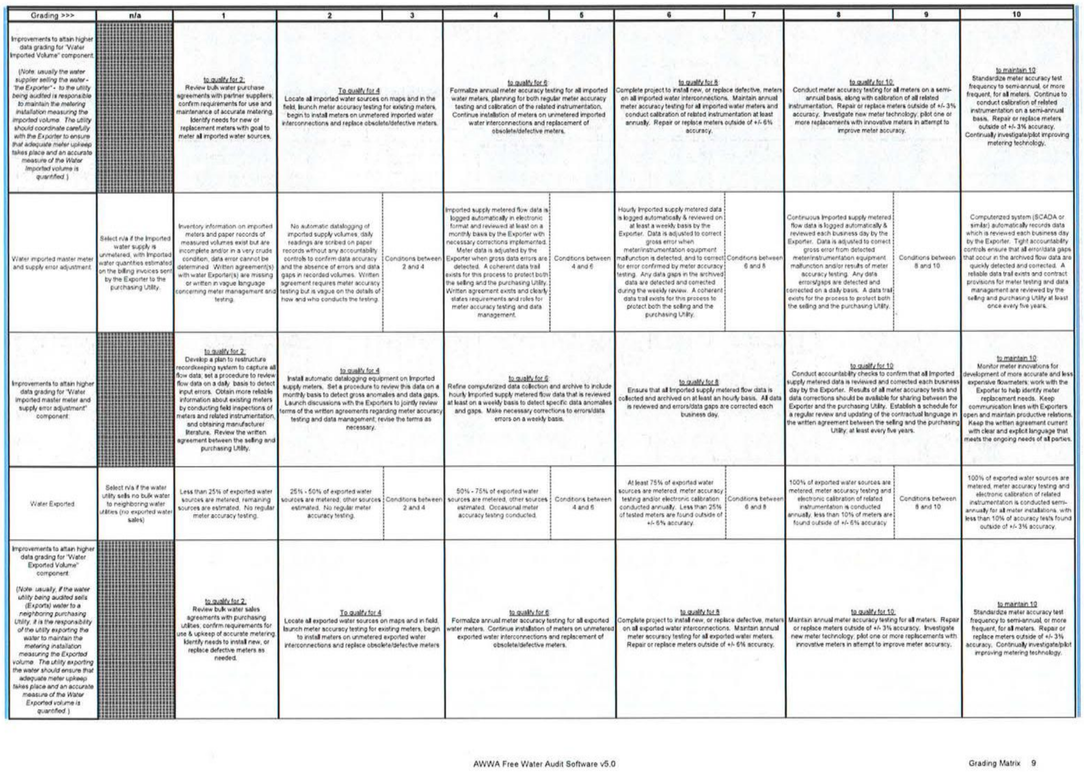
AWWA Free Water Audit Software: Grading Matrix

WAS 5.0

The grading assigned to each audit component and the corresponding recommended improvements and actions are highlighted in yellow. Audit accuracy is likely to be improved by prioritizing those items shown in red

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
WATER SUPPLIED											
Volume from own sources:	Select this grading only if the water utility purchases/imports all of its water resources (i.e. has no sources of its own)	Less than 25% of water production sources are metered, remaining sources are estimated. No regular meter accuracy testing or electronic calibration conducted.	25% - 50% of treated water production sources are metered, other sources estimated. No regular meter accuracy testing or electronic calibration conducted.	Conditions between 2 and 4	50% - 75% of treated water production sources are metered, other sources estimated. Occasional meter accuracy testing or electronic calibration conducted.	Conditions between 4 and 6	At least 75% of treated water production sources are metered, or at least 90% of the source flow is derived from metered sources. Meter accuracy testing and/or electronic calibration of related instrumentation is conducted annually. Less than 25% of tested meters are found outside of +/- 6% accuracy.	Conditions between 6 and 8	100% of treated water production sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted annually, less than 10% of meters are found outside of +/- 6% accuracy	Conditions between 8 and 10	100% of treated water production sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually, with less than 10% found outside of +/- 3% accuracy. Procedures are reviewed by a third party knowledgeable in the M36 methodology.
Improvements to attain higher data grading for "Volume from own Sources" component:	▩	to qualify for 2: Organize and launch efforts to collect data for determining volume from own sources	to qualify for 4: Locate all water production sources on maps and in the field, launch meter accuracy testing for existing meters, begin to install meters on unmetered water production sources and replace any obsolete/defective meters.		to qualify for 6: Formalize annual meter accuracy testing for all source meters; specify the frequency of testing. Complete installation of meters on unmetered water production sources and complete replacement of all obsolete/defective meters.		to qualify for 8: Conduct annual meter accuracy testing and calibration of related instrumentation on all meter installations on a regular basis. Complete project to install new, or replace defective existing, meters so that entire production meter population is metered. Repair or replace meters outside of +/- 6% accuracy.		to qualify for 10: Maintain annual meter accuracy testing and calibration of related instrumentation for all meter installations. Repair or replace meters outside of +/- 3% accuracy. Investigate new meter technology; pilot one or more replacements with innovative meters in attempt to further improve meter accuracy.		to maintain 10: Standardize meter accuracy test frequency to semi-annual, or more frequent, for all meters. Repair or replace meters outside of +/- 3% accuracy. Continually investigate/pilot improving metering technology.
Volume from own sources master meter and supply error adjustment:	Select n/a only if the water utility fails to have meters on its sources of supply	Inventory information on meters and paper records of measured volumes exist but are incomplete and/or in a very crude condition; data error cannot be determined	No automatic datalogging of production volumes; daily readings are scribed on paper records without any accountability controls. Flows are not balanced across the water distribution system: tank/storage elevation changes are not employed in calculating the "Volume from own sources" component and archived flow data is adjusted only when grossly evident data error occurs.	Conditions between 2 and 4	Production meter data is logged automatically in electronic format and reviewed at least on a monthly basis with necessary corrections implemented. "Volume from own sources" tabulations include estimate of daily changes in tanks/storage facilities. Meter data is adjusted when gross data errors occur, or occasional meter testing deems this necessary.	Conditions between 4 and 6	Hourly production meter data logged automatically & reviewed on at least a weekly basis. Data is adjusted to correct gross error when meter/instrumentation equipment malfunction is detected; and/or error is confirmed by meter accuracy testing. Tank/storage facility elevation changes are automatically used in calculating a balanced "Volume from own sources" component, and data gaps in the archived data are corrected on at least a weekly basis.	Conditions between 6 and 8	Continuous production meter data is logged automatically & reviewed each business day. Data is adjusted to correct gross error from detected meter/instrumentation equipment malfunction and/or results of meter accuracy testing. Tank/storage facility elevation changes are automatically used in "Volume from own sources" tabulations and data gaps in the archived data are corrected on a daily basis.	Conditions between 8 and 10	Computerized system (SCADA or similar) automatically balances flows from all sources and storages; results are reviewed each business day. Tight accountability controls ensure that all data gaps that occur in the archived flow data are quickly detected and corrected. Regular calibrations between SCADA and sources meters ensures minimal data transfer error.
Improvements to attain higher data grading for "Master meter and supply error adjustment" component:	▩	to qualify for 2: Develop a plan to restructure recordkeeping system to capture all flow data; set a procedure to review flow data on a daily basis to detect input errors. Obtain more reliable information about existing meters by conducting field inspections of meters and related instrumentation, and obtaining manufacturer literature.	to qualify for 4: Install automatic datalogging equipment on production meters. Complete installation of level instrumentation at all tanks/storage facilities and include tank level data in automatic calculation routine in a computerized system. Construct a computerized listing or spreadsheet to archive input volumes, tank/storage volume changes and import/export flows in order to determine the composite "Water Supplied" volume for the distribution system. Set a procedure to review this data on a monthly basis to detect gross anomalies and data gaps.		to qualify for 6: Refine computerized data collection and archive to include hourly production meter data that is reviewed at least on a weekly basis to detect specific data anomalies and gaps. Use daily net storage change to balance flows in calculating "Water Supplied" volume. Necessary corrections to data errors are implemented on a weekly basis.		to qualify for 8: Ensure that all flow data is collected and archived on at least an hourly basis. All data is reviewed and detected errors corrected each business day. Tank/storage levels variations are employed in calculating balanced "Water Supplied" component. Adjust production meter data for gross error and inaccuracy confirmed by testing.		to qualify for 10: Link all production and tank/storage facility elevation change data to a Supervisory Control & Data Acquisition (SCADA) System, or similar computerized monitoring/control system, and establish automatic flow balancing algorithm and regularly calibrate between SCADA and source meters. Data is reviewed and corrected each business day.		to maintain 10: Monitor meter innovations for development of more accurate and less expensive flowmeters. Continue to replace or repair meters as they perform outside of desired accuracy limits. Stay abreast of new and more accurate water level instruments to better record tank/storage levels and archive the variations in storage volume. Keep current with SCADA and data management systems to ensure that archived data is well-managed and error free.
Water Imported	Select n/a if the water utility's supply is exclusively from its own water resources (no bulk purchased/ imported water)	Less than 25% of imported water sources are metered, remaining sources are estimated. No regular meter accuracy testing.	25% - 50% of imported water sources are metered; other sources estimated. No regular meter accuracy testing.	Conditions between 2 and 4	50% - 75% of imported water sources are metered, other sources estimated. Occasional meter accuracy testing conducted.	Conditions between 4 and 6	At least 75% of imported water sources are metered, meter accuracy testing and/or electronic calibration of related instrumentation is conducted annually for all meter installations. Less than 25% of tested meters are found outside of +/- 6% accuracy.	Conditions between 6 and 8	100% of imported water sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted annually, less than 10% of meters are found outside of +/- 6% accuracy	Conditions between 8 and 10	100% of imported water sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually for all meter installations, with less than 10% of accuracy tests found outside of +/- 3% accuracy.

AWWA Free Water Audit Software v5.0 Grading Matrix 8



Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Improvements to attain higher data grading for "Water Imported Volume" component. *(Note: usually the water supplier selling the water - "the Exporter" - to the utility being audited is responsible to maintain the metering installation measuring the imported volume. The utility should coordinate carefully with the Exporter to ensure that adequate meter upkeep takes place and an accurate measure of the Water Imported volume is quantified.)*		<u>to qualify for 2:</u> Review bulk water purchase agreements with partner suppliers; confirm requirements for use and maintenance of accurate metering. Identify needs for new or replacement meters with goal to meter all imported water sources.	<u>To qualify for 4</u> Locate all imported water sources on maps and in the field, launch meter accuracy testing for existing meters, begin to install meters on unmetered imported water interconnections and replace obsolete/defective meters.		<u>to qualify for 6:</u> Formalize annual meter accuracy testing for all imported water meters, planning for both regular meter accuracy testing and calibration of the related instrumentation. Continue installation of meters on unmetered imported water interconnections and replacement of obsolete/defective meters.		<u>to qualify for 8:</u> Complete project to install new, or replace defective, meters on all imported water interconnections. Maintain annual meter accuracy testing for all imported water meters and conduct calibration of related instrumentation at least annually. Repair or replace meters outside of +/- 6% accuracy.		<u>to qualify for 10:</u> Conduct meter accuracy testing for all meters on a semi-annual basis, along with calibration of all related instrumentation. Repair or replace meters outside of +/- 3% accuracy. Investigate new meter technology; pilot one or more replacements with innovative meters in attempt to improve meter accuracy.		<u>to maintain 10:</u> Standardize meter accuracy test frequency to semi-annual, or more frequent, for all meters. Continue to conduct calibration of related instrumentation on a semi-annual basis. Repair or replace meters outside of +/- 3% accuracy. Continually investigate/pilot improving metering technology.
Water imported master meter and supply error adjustment.	Select n/a if the Imported water supply is unmetered, with Imported water quantities estimated on the billing invoices sent by the Exporter to the purchasing Utility.	Inventory information on imported meters and paper records of measured volumes exist but are incomplete and/or in a very crude condition; data error cannot be determined. Written agreement(s) with water Exporter(s) are missing or written in vague language concerning meter management and testing.	No automatic datalogging of imported supply volumes; daily readings are scribed on paper records without any accountability controls to confirm data accuracy and the absence of errors and data gaps in recorded volumes. Written agreement requires meter accuracy testing but is vague on the details of how and who conducts the testing.	Conditions between 2 and 4	Imported supply metered flow data is logged automatically in electronic format and reviewed at least on a monthly basis by the Exporter with necessary corrections implemented. Meter data is adjusted by the Exporter when gross data errors are detected. A coherent data trail exists for this process to protect both the selling and the purchasing Utility. Written agreement exists and clearly states requirements and roles for meter accuracy testing and data management.	Conditions between 4 and 6	Hourly Imported supply metered data is logged automatically & reviewed on at least a weekly basis by the Exporter. Data is adjusted to correct gross error when meter/instrumentation equipment malfunction is detected, and to correct for error confirmed by meter accuracy testing. Any data gaps in the archived data are detected and corrected during the weekly review. A coherent data trail exists for this process to protect both the selling and the purchasing Utility.	Conditions between 6 and 8	Continuous Imported supply metered flow data is logged automatically & reviewed each business day by the Exporter. Data is adjusted to correct gross error from detected meter/instrumentation equipment malfunction and/or results of meter accuracy testing. Any data errors/gaps are detected and corrected on a daily basis. A data trail exists for the process to protect both the selling and the purchasing Utility.	Conditions between 8 and 10	Computerized system (SCADA or similar) automatically records data which is reviewed each business day by the Exporter. Tight accountability controls ensure that all error/data gaps that occur in the archived flow data are quickly detected and corrected. A reliable data trail exists and contract provisions for meter testing and data management are reviewed by the selling and purchasing Utility at least once every five years.
Improvements to attain higher data grading for "Water imported master meter and supply error adjustment" component:		<u>to qualify for 2:</u> Develop a plan to restructure recordkeeping system to capture all flow data; set a procedure to review flow data on a daily basis to detect input errors. Obtain more reliable information about existing meters by conducting field inspections of meters and related instrumentation, and obtaining manufacturer literature. Review the written agreement between the selling and purchasing Utility.	<u>to qualify for 4</u> Install automatic datalogging equipment on Imported supply meters. Set a procedure to review this data on a monthly basis to detect gross anomalies and data gaps. Launch discussions with the Exporters to jointly review terms of the written agreements regarding meter accuracy testing and data management; revise the terms as necessary.		<u>to qualify for 6:</u> Refine computerized data collection and archive to include hourly Imported supply metered flow data that is reviewed at least on a weekly basis to detect specific data anomalies and gaps. Make necessary corrections to errors/data errors on a weekly basis.		<u>to qualify for 8:</u> Ensure that all Imported supply metered flow data is collected and archived on at least an hourly basis. All data is reviewed and errors/data gaps are corrected each business day.		<u>to qualify for 10:</u> Conduct accountability checks to confirm that all Imported supply metered data is reviewed and corrected each business day by the Exporter. Results of all meter accuracy tests and data corrections should be available for sharing between the Exporter and the purchasing Utility. Establish a schedule for a regular review and updating of the contractual language in the written agreement between the selling and the purchasing Utility; at least every five years.		<u>to maintain 10:</u> Monitor meter innovations for development of more accurate and less expensive flowmeters; work with the Exporter to help identify meter replacement needs. Keep communication lines with Exporters open and maintain productive relations. Keep the written agreement current with clear and explicit language that meets the ongoing needs of all parties.
Water Exported	Select n/a if the water utility sells no bulk water to neighboring water utilities (no exported water sales)	Less than 25% of exported water sources are metered, remaining sources are estimated. No regular meter accuracy testing.	25% - 50% of exported water sources are metered; other sources estimated. No regular meter accuracy testing.	Conditions between 2 and 4	50% - 75% of exported water sources are metered, other sources estimated. Occasional meter accuracy testing conducted.	Conditions between 4 and 6	At least 75% of exported water sources are metered, meter accuracy testing and/or electronic calibration conducted annually. Less than 25% of tested meters are found outside of +/- 6% accuracy.	Conditions between 6 and 8	100% of exported water sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted annually, less than 10% of meters are found outside of +/- 6% accuracy	Conditions between 8 and 10	100% of exported water sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually for all meter installations, with less than 10% of accuracy tests found outside of +/- 3% accuracy.
Improvements to attain higher data grading for "Water Exported Volume" component: *(Note: usually, if the water utility being audited sells (Exports) water to a neighboring purchasing Utility, it is the responsibility of the utility exporting the water to maintain the metering installation measuring the Exported volume. The utility exporting the water should ensure that adequate meter upkeep takes place and an accurate measure of the Water Exported volume is quantified.)*		<u>to qualify for 2:</u> Review bulk water sales agreements with purchasing utilities; confirm requirements for use & upkeep of accurate metering. Identify needs to install new, or replace defective meters as needed.	<u>To qualify for 4</u> Locate all exported water sources on maps and in field, launch meter accuracy testing for existing meters, begin to install meters on unmetered exported water interconnections and replace obsolete/defective meters		<u>to qualify for 6:</u> Formalize annual meter accuracy testing for all exported water meters. Continue installation of meters on unmetered exported water interconnections and replacement of obsolete/defective meters.		<u>to qualify for 8:</u> Complete project to install new, or replace defective, meters on all exported water interconnections. Maintain annual meter accuracy testing for all exported water meters. Repair or replace meters outside of +/- 6% accuracy.		<u>to qualify for 10:</u> Maintain annual meter accuracy testing for all meters. Repair or replace meters outside of +/- 3% accuracy. Investigate new meter technology; pilot one or more replacements with innovative meters in attempt to improve meter accuracy.		<u>to maintain 10:</u> Standardize meter accuracy test frequency to semi-annual, or more frequent, for all meters. Repair or replace meters outside of +/- 3% accuracy. Continually investigate/pilot improving metering technology.

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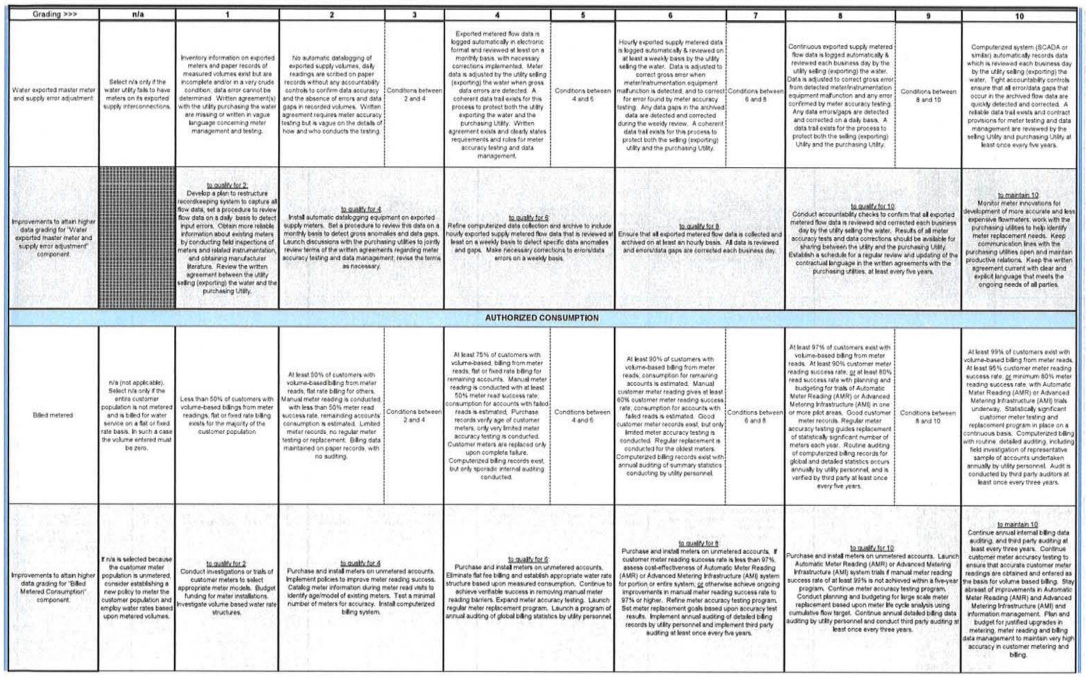
Grading Matrix 9



Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Water exported master meter and supply error adjustment	Select n/a only if the water utility fails to have meters on its exported supply interconnections.	Inventory information on exported meters and paper records of measured volumes exist but are incomplete and/or in a very crude condition; data error cannot be determined. Written agreement(s) with the utility purchasing the water are missing or written in vague language concerning meter management and testing.	No automatic datalogging of exported supply volumes, daily readings are scribed on paper records without any accountability controls to confirm data accuracy and the absence of errors and data gaps in recorded volumes. Written agreement requires meter accuracy testing but is vague on the details of how and who conducts the testing.	Conditions between 2 and 4	Exported metered flow data is logged automatically in electronic format and reviewed at least on a monthly basis, with necessary corrections implemented. Meter data is adjusted by the utility selling (exporting) the water when gross data errors are detected. A coherent data trail exists for this process to protect both the utility exporting the water and the purchasing Utility. Written agreement exists and clearly states requirements and roles for meter accuracy testing and data management.	Conditions between 4 and 6	Hourly exported supply metered data is logged automatically & reviewed on at least a weekly basis by the utility selling the water. Data is adjusted to correct gross error when meter/instrumentation equipment malfunction is detected, and to correct for error found by meter accuracy testing. Any data gaps in the archived data are detected and corrected during the weekly review. A coherent data trail exists for this process to protect both the selling (exporting) utility and the purchasing Utility.	Conditions between 6 and 8	Continuous exported supply metered flow data is logged automatically & reviewed each business day by the utility selling (exporting) the water. Data is adjusted to correct gross error from detected meter/instrumentation equipment malfunction and any error confirmed by meter accuracy testing. Any data errors/gaps are detected and corrected on a daily basis. A data trail exists for the process to protect both the selling (exporting) Utility and the purchasing Utility.	Conditions between 8 and 10	Computerized system (SCADA or similar) automatically records data which is reviewed each business day by the utility selling (exporting) the water. Tight accountability controls ensure that all error/data gaps that occur in the archived flow data are quickly detected and corrected. A reliable data trail exists and contract provisions for meter testing and data management are reviewed by the selling Utility and purchasing Utility at least once every five years.
Improvements to attain higher data grading for "Water exported master meter and supply error adjustment" component:		to qualify for 2: Develop a plan to restructure recordkeeping system to capture all flow data; set a procedure to review flow data on a daily basis to detect input errors. Obtain more reliable information about existing meters by conducting field inspections of meters and related instrumentation, and obtaining manufacturer literature. Review the written agreement between the utility selling (exporting) the water and the purchasing Utility.	to qualify for 4: Install automatic datalogging equipment on exported supply meters. Set a procedure to review this data on a monthly basis to detect gross anomalies and data gaps. Launch discussions with the purchasing utilities to jointly review terms of the written agreements regarding meter accuracy testing and data management; revise the terms as necessary.		to qualify for 6: Refine computerized data collection and archive to include hourly exported supply metered flow data that is reviewed at least on a weekly basis to detect specific data anomalies and gaps. Make necessary corrections to errors/data errors on a weekly basis.		to qualify for 8: Ensure that all exported metered flow data is collected and archived on at least an hourly basis. All data is reviewed and errors/data gaps are corrected each business day.		to qualify for 10: Conduct accountability checks to confirm that all exported metered flow data is reviewed and corrected each business day by the utility selling the water. Results of all meter accuracy tests and data corrections should be available for sharing between the utility and the purchasing Utility. Establish a schedule for a regular review and updating of the contractual language in the written agreements with the purchasing utilities; at least every five years.		to maintain 10: Monitor meter innovations for development of more accurate and less expensive flowmeters; work with the purchasing utilities to help identify meter replacement needs. Keep communication lines with the purchasing utilities open and maintain productive relations. Keep the written agreement current with clear and explicit language that meets the ongoing needs of all parties.
AUTHORIZED CONSUMPTION											
Billed metered	n/a (not applicable). Select n/a only if the entire customer population is not metered and is billed for water service on a flat or fixed rate basis. In such a case the volume entered must be zero.	Less than 50% of customers with volume-based billings from meter readings; flat or fixed rate billing exists for the majority of the customer population	At least 50% of customers with volume-based billing from meter reads; flat rate billing for others. Manual meter reading is conducted, with less than 50% meter read success rate, remainding accounts' consumption is estimated. Limited meter records, no regular meter testing or replacement. Billing data maintained on paper records, with no auditing.	Conditions between 2 and 4	At least 75% of customers with volume-based, billing from meter reads; flat or fixed rate billing for remaining accounts. Manual meter reading is conducted with at least 50% meter read success rate; consumption for accounts with failed reads is estimated. Purchase records verify age of customer meters; only very limited meter accuracy testing is conducted. Customer meters are replaced only upon complete failure. Computerized billing records exist, but only sporadic internal auditing conducted.	Conditions between 4 and 6	At least 90% of customers with volume-based billing from meter reads; consumption for remaining accounts is estimated. Manual customer meter reading gives at least 60% customer meter reading success rate; consumption for accounts with failed reads is estimated. Good customer meter records exist, but only limited meter accuracy testing is conducted. Regular replacement is conducted for the oldest meters. Computerized billing records exist with annual auditing of summary statistics conducting by utility personnel.	Conditions between 6 and 8	At least 97% of customers exist with volume-based billing from meter reads. At least 90% customer meter reading success rate; or at least 80% read success rate with planning and budgeting for trials of Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) in one or more pilot areas. Good customer meter records. Regular meter accuracy testing guides replacement of statistically significant number of meters each year. Routine auditing of computerized billing records for global and detailed statistics occurs annually by utility personnel, and is verified by third party at least once every five years.	Conditions between 8 and 10	At least 99% of customers exist with volume-based billing from meter reads. At least 95% customer meter reading success rate; or minimum 80% meter reading success rate, with Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) trials underway. Statistically significant customer meter testing and replacement program in place on a continuous basis. Computerized billing with routine, detailed auditing, including field investigation of representative sample of accounts undertaken annually by utility personnel. Audit is conducted by third party auditors at least once every three years.
Improvements to attain higher data grading for "Billed Metered Consumption" component:	If n/a is selected because the customer meter population is unmetered, consider establishing a new policy to meter the customer population and employ water rates based upon metered volumes.	to qualify for 2: Conduct investigations or trials of customer meters to select appropriate meter models. Budget funding for meter installations. Investigate volume based water rate structures.	to qualify for 4: Purchase and install meters on unmetered accounts. Implement policies to improve meter reading success. Catalog meter information during meter read visits to identify age/model of existing meters. Test a minimal number of meters for accuracy. Install computerized billing system.		to qualify for 6: Purchase and install meters on unmetered accounts. Eliminate flat fee billing and establish appropriate water rate structure based upon measured consumption. Continue to achieve verifiable success in removing manual meter reading barriers. Expand meter accuracy testing. Launch regular meter replacement program. Launch a program of annual auditing of global billing statistics by utility personnel.		to qualify for 8: Purchase and install meters on unmetered accounts. If customer meter reading success rate is less than 97%, assess cost-effectiveness of Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) system for portion or entire system; or otherwise achieve ongoing improvements in manual meter reading success rate to 97% or higher. Refine meter accuracy testing program. Set meter replacement goals based upon accuracy test results. Implement annual auditing of detailed billing records by utility personnel and implement third party auditing at least once every five years.		to qualify for 10: Purchase and install meters on unmetered accounts. Launch Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) system trials if manual meter reading success rate of at least 99% is not achieved within a five-year program. Continue meter accuracy testing program. Conduct planning and budgeting for large scale meter replacement based upon meter life cycle analysis using cumulative flow target. Continue annual detailed billing data auditing by utility personnel and conduct third party auditing at least once every three years.		to maintain 10: Continue annual internal billing data auditing, and third party auditing at least every three years. Continue customer meter accuracy testing to ensure that accurate customer meter readings are obtained and entered as the basis for volume based billing. Stay abreast of improvements in Automatic Meter Reading (AMR) and Advanced Metering Infrastructure (AMI) and information management. Plan and budget for justified upgrades in metering, meter reading and billing data management to maintain very high accuracy in customer metering and billing.

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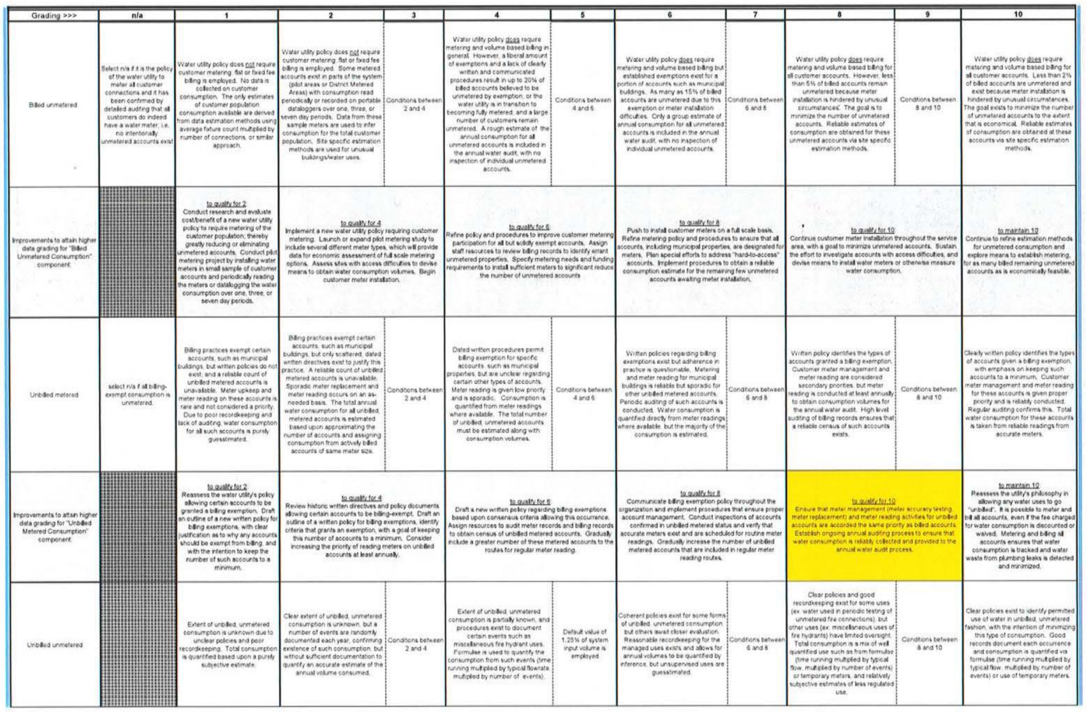
Grading Matrix 10



Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Billed unmetered	Select n/a if it is the policy of the water utility to meter all customer connections and it has been confirmed by detailed auditing that all customers do indeed have a water meter, i.e. no intentionally unmetered accounts exist	Water utility policy does not require customer metering; flat or fixed fee billing is employed. No data is collected on customer consumption. The only estimates of customer population consumption available are derived from data estimation methods using average fixture count multiplied by number of connections, or similar approach.	Water utility policy does not require customer metering; flat or fixed fee billing is employed. Some metered accounts exist in parts of the system (pilot areas or District Metered Areas) with consumption read periodically or recorded on portable dataloggers over one, three, or seven day periods. Data from these sample meters are used to infer consumption for the total customer population. Site specific estimation methods are used for unusual buildings/water uses.	Conditions between 2 and 4	Water utility policy does require metering and volume based billing in general. However, a liberal amount of exemptions and a lack of clearly written and communicated procedures result in up to 20% of billed accounts believed to be unmetered by exemption; or the water utility is in transition to becoming fully metered, and a large number of customers remain unmetered. A rough estimate of the annual consumption for all unmetered accounts is included in the annual water audit, with no inspection of individual unmetered accounts.	Conditions between 4 and 6	Water utility policy does require metering and volume based billing but established exemptions exist for a portion of accounts such as municipal buildings. As many as 15% of billed accounts are unmetered due to this exemption or meter installation difficulties. Only a group estimate of annual consumption for all unmetered accounts is included in the annual water audit, with no inspection of individual unmetered accounts.	Conditions between 6 and 8	Water utility policy does require metering and volume based billing for all customer accounts. However, less than 5% of billed accounts remain unmetered because meter installation is hindered by unusual circumstances. The goal is to minimize the number of unmetered accounts. Reliable estimates of consumption are obtained for these unmetered accounts via site specific estimation methods.	Conditions between 8 and 10	Water utility policy does require metering and volume based billing for all customer accounts. Less than 2% of billed accounts are unmetered and exist because meter installation is hindered by unusual circumstances. The goal exists to minimize the number of unmetered accounts to the extent that is economical. Reliable estimates of consumption are obtained at these accounts via site specific estimation methods.
Improvements to attain higher data grading for "Billed Unmetered Consumption" component:	▨	to qualify for 2: Conduct research and evaluate cost/benefit of a new water utility policy to require metering of the customer population; thereby greatly reducing or eliminating unmetered accounts. Conduct pilot metering project by installing water meters in small sample of customer accounts and periodically reading the meters or datalogging the water consumption over one, three, or seven day periods.	to qualify for 4: Implement a new water utility policy requiring customer metering. Launch or expand pilot metering study to include several different meter types, which will provide data for economic assessment of full scale metering options. Assess sites with access difficulties to devise means to obtain water consumption volumes. Begin customer meter installation.		to qualify for 6: Refine policy and procedures to improve customer metering participation for all but solidly exempt accounts. Assign staff resources to review billing records to identify errant unmetered properties. Specify metering needs and funding requirements to install sufficient meters to significant reduce the number of unmetered accounts		to qualify for 8: Push to install customer meters on a full scale basis. Refine metering policy and procedures to ensure that all accounts, including municipal properties, are designated for meters. Plan special efforts to address "hard-to-access" accounts. Implement procedures to obtain a reliable consumption estimate for the remaining few unmetered accounts awaiting meter installation.		to qualify for 10: Continue customer meter installation throughout the service area, with a goal to minimize unmetered accounts. Sustain the effort to investigate accounts with access difficulties, and devise means to install water meters or otherwise measure water consumption.		to maintain 10: Continue to refine estimation methods for unmetered consumption and explore means to establish metering, for as many billed remaining unmetered accounts as is economically feasible.
Unbilled metered	select n/a if all billing-exempt consumption is unmetered.	Billing practices exempt certain accounts, such as municipal buildings, but written policies do not exist; and a reliable count of unbilled metered accounts is unavailable. Meter upkeep and meter reading on these accounts is rare and not considered a priority. Due to poor recordkeeping and lack of auditing, water consumption for all such accounts is purely guesstimated.	Billing practices exempt certain accounts, such as municipal buildings, but only scattered, dated written directives exist to justify this practice. A reliable count of unbilled metered accounts is unavailable. Sporadic meter replacement and meter reading occurs on an as-needed basis. The total annual water consumption for all unbilled, metered accounts is estimated based upon approximating the number of accounts and assigning consumption from actively billed accounts of same meter size.	Conditions between 2 and 4	Dated written procedures permit billing exemption for specific accounts, such as municipal properties, but are unclear regarding certain other types of accounts. Meter reading is given low priority and is sporadic. Consumption is quantified from meter readings where available. The total number of unbilled, unmetered accounts must be estimated along with consumption volumes.	Conditions between 4 and 6	Written policies regarding billing exemptions exist but adherence in practice is questionable. Metering and meter reading for municipal buildings is reliable but sporadic for other unbilled metered accounts. Periodic auditing of such accounts is conducted. Water consumption is quantified directly from meter readings where available, but the majority of the consumption is estimated.	Conditions between 6 and 8	Written policy identifies the types of accounts granted a billing exemption. Customer meter management and meter reading are considered secondary priorities, but meter reading is conducted at least annually to obtain consumption volumes for the annual water audit. High level auditing of billing records ensures that a reliable census of such accounts exists.	Conditions between 8 and 10	Clearly written policy identifies the types of accounts given a billing exemption, with emphasis on keeping such accounts to a minimum. Customer meter management and meter reading for these accounts is given proper priority and is reliably conducted. Regular auditing confirms this. Total water consumption for these accounts is taken from reliable readings from accurate meters.
Improvements to attain higher data grading for "Unbilled Metered Consumption" component:	▨	to qualify for 2: Reassess the water utility's policy allowing certain accounts to be granted a billing exemption. Draft an outline of a new written policy for billing exemptions, with clear justification as to why any accounts should be exempt from billing, and with the intention to keep the number of such accounts to a minimum.	to qualify for 4: Review historic written directives and policy documents allowing certain accounts to be billing-exempt. Draft an outline of a written policy for billing exemptions, identify criteria that grants an exemption, with a goal of keeping this number of accounts to a minimum. Consider increasing the priority of reading meters on unbilled accounts at least annually.		to qualify for 6: Draft a new written policy regarding billing exemptions based upon consensus criteria allowing this occurrence. Assign resources to audit meter records and billing records to obtain census of unbilled metered accounts. Gradually include a greater number of these metered accounts to the routes for regular meter reading.		to qualify for 8: Communicate billing exemption policy throughout the organization and implement procedures that ensure proper account management. Conduct inspections of accounts confirmed in unbilled metered status and verify that accurate meters exist and are scheduled for routine meter readings. Gradually increase the number of unbilled metered accounts that are included in regular meter reading routes.		to qualify for 10: Ensure that meter management (meter accuracy testing, meter replacement) and meter reading activities for unbilled accounts are accorded the same priority as billed accounts. Establish ongoing annual auditing process to ensure that water consumption is reliably collected and provided to the annual water audit process.		to maintain 10: Reassess the utility's philosophy in allowing any water uses to go "unbilled". It is possible to meter and bill all accounts, even if the fee charged for water consumption is discounted or waived. Metering and billing all accounts ensures that water consumption is tracked and water waste from plumbing leaks is detected and minimized.
Unbilled unmetered	▨	Extent of unbilled, unmetered consumption is unknown due to unclear policies and poor recordkeeping. Total consumption is quantified based upon a purely subjective estimate.	Clear extent of unbilled, unmetered consumption is unknown, but a number of events are randomly documented each year, confirming existence of such consumption, but without sufficient documentation to quantify an accurate estimate of the annual volume consumed.	Conditions between 2 and 4	Extent of unbilled, unmetered consumption is partially known, and procedures exist to document certain events such as miscellaneous fire hydrant uses. Formulae is used to quantify the consumption from such events (time running multiplied by typical flowrate, multiplied by number of events).	Default value of 1.25% of system input volume is employed	Coherent policies exist for some forms of unbilled, unmetered consumption but others await closer evaluation. Reasonable recordkeeping for the managed uses exists and allows for annual volumes to be quantified by inference, but unsupervised uses are guesstimated.	Conditions between 6 and 8	Clear policies and good recordkeeping exist for some uses (ex: water used in periodic testing of unmetered fire connections), but other uses (ex: miscellaneous uses of fire hydrants) have limited oversight. Total consumption is a mix of well quantified use such as from formulae (time running multiplied by typical flow, multiplied by number of events) or temporary meters, and relatively subjective estimates of less regulated use.	Conditions between 8 and 10	Clear policies exist to identify permitted use of water in unbilled, unmetered fashion, with the intention of minimizing this type of consumption. Good records document each occurrence and consumption is quantified via formulae (time running multiplied by typical flow, multiplied by number of events) or use of temporary meters.

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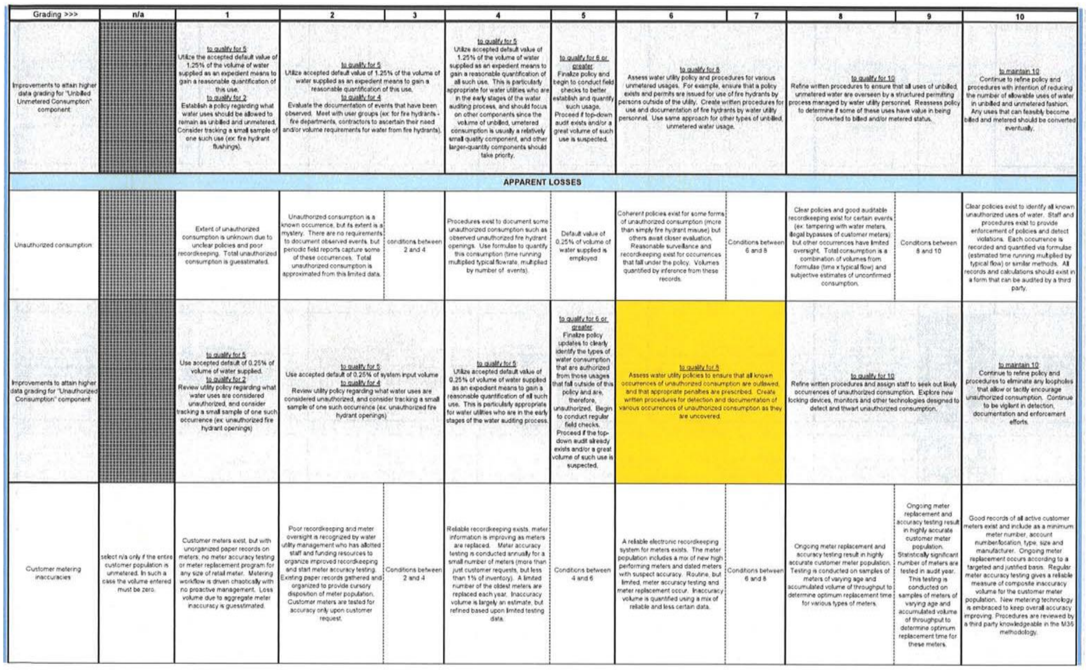
Grading Matrix 11



Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Improvements to attain higher data grading for "Unbilled Unmetered Consumption" component:		<u>to qualify for 5</u>: Utilize the accepted default value of 1.25% of the volume of water supplied as an expedient means to gain a reasonable quantification of this use. <u>to qualify for 2</u>: Establish a policy regarding what water uses should be allowed to remain as unbilled and unmetered. Consider tracking a small sample of one such use (ex: fire hydrant flushings).	<u>to qualify for 5</u>: Utilize accepted default value of 1.25% of the volume of water supplied as an expedient means to gain a reasonable quantification of this use. <u>to qualify for 4</u>: Evaluate the documentation of events that have been observed. Meet with user groups (ex: for fire hydrants - fire departments, contractors to ascertain their need and/or volume requirements for water from fire hydrants).		<u>to qualify for 5</u>: Utilize accepted default value of 1.25% of the volume of water supplied as an expedient means to gain a reasonable quantification of all such use. This is particularly appropriate for water utilities who are in the early stages of the water auditing process, and should focus on other components since the volume of unbilled, umetered consumption is usually a relatively small quality component, and other larger-quantity components should take priority.	<u>to qualify for 6 or greater</u>: Finalize policy and begin to conduct field checks to better establish and quantify such usage. Proceed if top-down audit exists and/or a great volume of such use is suspected.	<u>to qualify for 8</u>: Assess water utility policy and procedures for various unmetered usages. For example, ensure that a policy exists and permits are issued for use of fire hydrants by persons outside of the utility. Create written procedures for use and documentation of fire hydrants by water utility personnel. Use same approach for other types of unbilled, unmetered water usage.		<u>to qualify for 10</u>: Refine written procedures to ensure that all uses of unbilled, unmetered water are overseen by a structured permitting process managed by water utility personnel. Reassess policy to determine if some of these uses have value in being converted to billed and/or metered status.		<u>to maintain 10</u>: Continue to refine policy and procedures with intention of reducing the number of allowable uses of water in unbilled and unmetered fashion. Any uses that can feasibly become billed and metered should be converted eventually.
APPARENT LOSSES											
Unauthorized consumption		Extent of unauthorized consumption is unknown due to unclear policies and poor recordkeeping. Total unauthorized consumption is guesstimated.	Unauthorized consumption is a known occurrence, but its extent is a mystery. There are no requirements to document observed events, but periodic field reports capture some of these occurrences. Total unauthorized consumption is approximated from this limited data.	conditions between 2 and 4	Procedures exist to document some unauthorized consumption such as observed unauthorized fire hydrant openings. Use formulae to quantify this consumption (time running multiplied typical flowrate, multiplied by number of events).	Default value of 0.25% of volume of water supplied is employed	Coherent policies exist for some forms of unauthorized consumption (more than simply fire hydrant misuse) but others await closer evaluation. Reasonable surveillance and recordkeeping exist for occurrences that fall under the policy. Volumes quantified by inference from these records.	Conditions between 6 and 8	Clear policies and good auditable recordkeeping exist for certain events (ex: tampering with water meters, illegal bypasses of customer meters); but other occurrences have limited oversight. Total consumption is a combination of volumes from formulae (time x typical flow) and subjective estimates of unconfirmed consumption.	Conditions between 8 and 10	Clear policies exist to identify all known unauthorized uses of water. Staff and procedures exist to provide enforcement of policies and detect violations. Each occurrence is recorded and quantified via formulae (estimated time running multiplied by typical flow) or similar methods. All records and calculations should exist in a form that can be audited by a third party.
Improvements to attain higher data grading for "Unauthorized Consumption" component:		<u>to qualify for 5</u>: Use accepted default of 0.25% of volume of water supplied. <u>to qualify for 2</u>: Review utility policy regarding what water uses are considered unauthorized, and consider tracking a small sample of one such occurrence (ex: unauthorized fire hydrant openings)	<u>to qualify for 5</u>: Use accepted default of 0.25% of system input volume <u>to qualify for 4</u>: Review utility policy regarding what water uses are considered unauthorized, and consider tracking a small sample of one such occurrence (ex: unauthorized fire hydrant openings)		<u>to qualify for 5</u>: Utilize accepted default value of 0.25% of volume of water supplied as an expedient means to gain a reasonable quantification of all such use. This is particularly appropriate for water utilities who are in the early stages of the water auditing process.	<u>to qualify for 6 or greater</u>: Finalize policy updates to clearly identify the types of water consumption that are authorized from those usages that fall outside of this policy and are, therefore, unauthorized. Begin to conduct regular field checks. Proceed if the top-down audit already exists and/or a great volume of such use is suspected.	<u>to qualify for 8</u>: Assess water utility policies to ensure that all known occurrences of unauthorized consumption are outlawed, and that appropriate penalties are prescribed. Create written procedures for detection and documentation of various occurrences of unauthorized consumption as they are uncovered.		<u>to qualify for 10</u>: Refine written procedures and assign staff to seek out likely occurrences of unauthorized consumption. Explore new locking devices, monitors and other technologies designed to detect and thwart unauthorized consumption.		<u>to maintain 10</u>: Continue to refine policy and procedures to eliminate any loopholes that allow or tacitly encourage unauthorized consumption. Continue to be vigilant in detection, documentation and enforcement efforts.
Customer metering inaccuracies	select n/a only if the entire customer population is unmetered. In such a case the volume entered must be zero.	Customer meters exist, but with unorganized paper records on meters; no meter accuracy testing or meter replacement program for any size of retail meter. Metering workflow is driven chaotically with no proactive management. Loss volume due to aggregate meter inaccuracy is guesstimated.	Poor recordkeeping and meter oversight is recognized by water utility management who has allotted staff and funding resources to organize improved recordkeeping and start meter accuracy testing. Existing paper records gathered and organized to provide cursory disposition of meter population. Customer meters are tested for accuracy only upon customer request.	Conditions between 2 and 4	Reliable recordkeeping exists, meter information is improving as meters are replaced. Meter accuracy testing is conducted annually for a small number of meters (more than just customer requests, but less than 1% of inventory). A limited number of the oldest meters are replaced each year. Inaccuracy volume is largely an estimate, but refined based upon limited testing data.	Conditions between 4 and 6	A reliable electronic recordkeeping system for meters exists. The meter population includes a mix of new high performing meters and dated meters with suspect accuracy. Routine, but limited, meter accuracy testing and meter replacement occur. Inaccuracy volume is quantified using a mix of reliable and less certain data.	Conditions between 6 and 8	Ongoing meter replacement and accuracy testing result in highly accurate customer meter population. Testing is conducted on samples of meters of varying age and accumulated volume of throughput to determine optimum replacement time for various types of meters.	Ongoing meter replacement and accuracy testing result in highly accurate customer meter population. Statistically significant number of meters are tested in audit year. This testing is conducted on samples of meters of varying age and accumulated volume of throughput to determine optimum replacement time for these meters.	Good records of all active customer meters exist and include as a minimum: meter number, account number/location, type, size and manufacturer. Ongoing meter replacement occurs according to a targeted and justified basis. Regular meter accuracy testing gives a reliable measure of composite inaccuracy volume for the customer meter population. New metering technology is embraced to keep overall accuracy improving. Procedures are reviewed by a third party knowledgeable in the M36 methodology.

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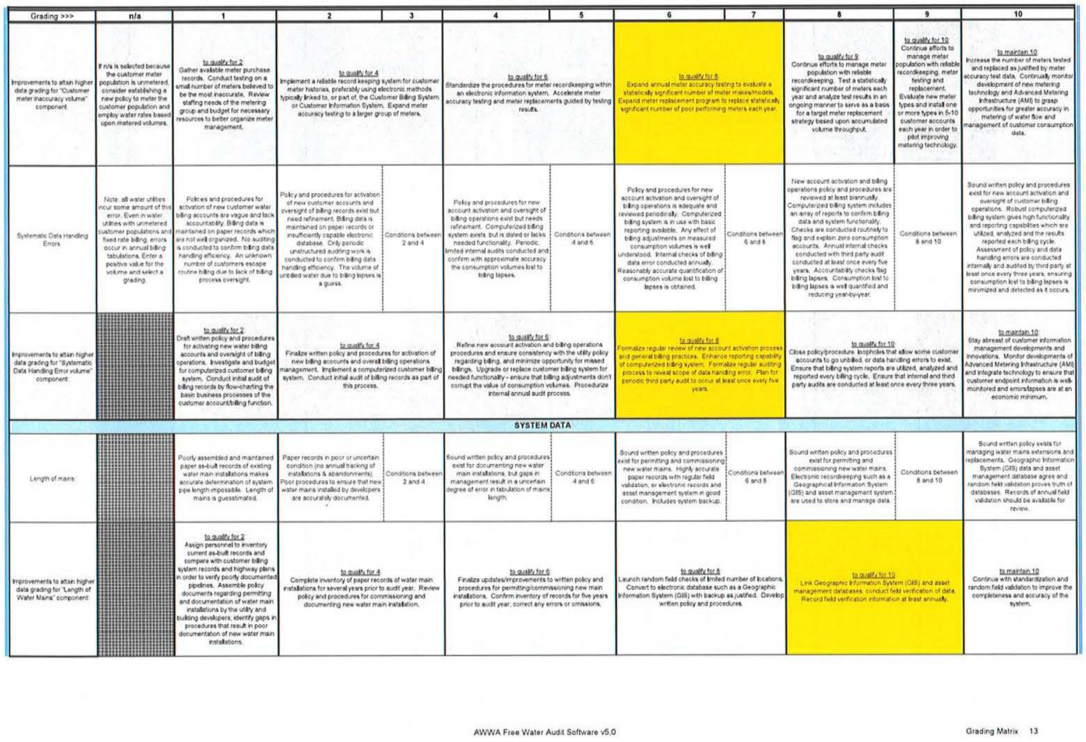
Grading Matrix 12



Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Improvements to attain higher data grading for "Customer meter inaccuracy volume" component	If n/a is selected because the customer meter population is unmetered, consider establishing a new policy to meter the customer population and employ water rates based upon metered volumes.	to qualify for 2: Gather available meter purchase records. Conduct testing on a small number of meters believed to be the most inaccurate. Review staffing needs of the metering group and budget for necessary resources to better organize meter management.	to qualify for 4: Implement a reliable record keeping system for customer meter histories, preferably using electronic methods typically linked to, or part of, the Customer Billing System or Customer Information System. Expand meter accuracy testing to a larger group of meters.		to qualify for 6: Standardize the procedures for meter recordkeeping within an electronic information system. Accelerate meter accuracy testing and meter replacements guided by testing results.		to qualify for 8: Expand annual meter accuracy testing to evaluate a statistically significant number of meter makes/models. Expand meter replacement program to replace statistically significant number of poor performing meters each year.		to qualify for 9: Continue efforts to manage meter population with reliable recordkeeping. Test a statistically significant number of meters each year and analyze test results in an ongoing manner to serve as a basis for a target meter replacement strategy based upon accumulated volume throughput.	to qualify for 10: Continue efforts to manage meter population with reliable recordkeeping, meter testing and replacement. Evaluate new meter types and install one or more types in 5-10 customer accounts each year in order to pilot improving metering technology.	to maintain 10: Increase the number of meters tested and replaced as justified by meter accuracy test data. Continually monitor development of new metering technology and Advanced Metering Infrastructure (AMI) to grasp opportunities for greater accuracy in metering of water flow and management of customer consumption data.
Systematic Data Handling Errors	Note: all water utilities incur some amount of this error. Even in water utilities with unmetered customer populations and fixed rate billing, errors occur in annual billing tabulations. Enter a positive value for the volume and select a grading.	Policies and procedures for activation of new customer water billing accounts are vague and lack accountability. Billing data is maintained on paper records which are not well organized. No auditing is conducted to confirm billing data handling efficiency. An unknown number of customers escape routine billing due to lack of billing process oversight.	Policy and procedures for activation of new customer accounts and oversight of billing records exist but need refinement. Billing data is maintained on paper records or insufficiently capable electronic database. Only periodic unstructured auditing work is conducted to confirm billing data handling efficiency. The volume of unbilled water due to billing lapses is a guess.	Conditions between 2 and 4	Policy and procedures for new account activation and oversight of billing operations exist but needs refinement. Computerized billing system exists, but is dated or lacks needed functionality. Periodic, limited internal audits conducted and confirm with approximate accuracy the consumption volumes lost to billing lapses.	Conditions between 4 and 6	Policy and procedures for new account activation and oversight of billing operations is adequate and reviewed periodically. Computerized billing system is in use with basic reporting available. Any effect of billing adjustments on measured consumption volumes is well understood. Internal checks of billing data error conducted annually. Reasonably accurate quantification of consumption volume lost to billing lapses is obtained.	Conditions between 6 and 8	New account activation and billing operations policy and procedures are reviewed at least biannually. Computerized billing system includes an array of reports to confirm billing data and system functionality. Checks are conducted routinely to flag and explain zero consumption accounts. Annual internal checks conducted with third party audit conducted at least once every five years. Accountability checks flag billing lapses. Consumption lost to billing lapses is well quantified and reducing year-by-year.	Conditions between 8 and 10	Sound written policy and procedures exist for new account activation and oversight of customer billing operations. Robust computerized billing system gives high functionality and reporting capabilities which are utilized, analyzed and the results reported each billing cycle. Assessment of policy and data handling errors are conducted internally and audited by third party at least once every three years, ensuring consumption lost to billing lapses is minimized and detected as it occurs.
Improvements to attain higher data grading for "Systematic Data Handling Error volume" component:	▨	to qualify for 2: Draft written policy and procedures for activating new water billing accounts and oversight of billing operations. Investigate and budget for computerized customer billing system. Conduct initial audit of billing records by flow-charting the basic business processes of the customer account/billing function.	to qualify for 4: Finalize written policy and procedures for activation of new billing accounts and overall billing operations management. Implement a computerized customer billing system. Conduct initial audit of billing records as part of this process.		to qualify for 6: Refine new account activation and billing operations procedures and ensure consistency with the utility policy regarding billing, and minimize opportunity for missed billings. Upgrade or replace customer billing system for needed functionality - ensure that billing adjustments don't corrupt the value of consumption volumes. Procedurize internal annual audit process.		to qualify for 8: Formalize regular review of new account activation process and general billing practices. Enhance reporting capability of computerized billing system. Formalize regular auditing process to reveal scope of data handling error. Plan for periodic third party audit to occur at least once every five years.		to qualify for 10: Close policy/procedure loopholes that allow some customer accounts to go unbilled, or data handling errors to exist. Ensure that billing system reports are utilized, analyzed and reported every billing cycle. Ensure that internal and third party audits are conducted at least once every three years.		to maintain 10: Stay abreast of customer information management developments and innovations. Monitor developments of Advanced Metering Infrastructure (AMI) and integrate technology to ensure that customer endpoint information is well-monitored and errors/lapses are at an economic minimum.
SYSTEM DATA											
Length of mains:	▨	Poorly assembled and maintained paper as-built records of existing water main installations makes accurate determination of system pipe length impossible. Length of mains is guesstimated.	Paper records in poor or uncertain condition (no annual tracking of installations & abandonments). Poor procedures to ensure that new water mains installed by developers are accurately documented.	Conditions between 2 and 4	Sound written policy and procedures exist for documenting new water main installations, but gaps in management result in a uncertain degree of error in tabulation of mains length.	Conditions between 4 and 6	Sound written policy and procedures exist for permitting and commissioning new water mains. Highly accurate paper records with regular field validation, or electronic records and asset management system in good condition. Includes system backup.	Conditions between 6 and 8	Sound written policy and procedures exist for permitting and commissioning new water mains. Electronic recordkeeping such as a Geographical Information System (GIS) and asset management system are used to store and manage data.	Conditions between 8 and 10	Sound written policy exists for managing water mains extensions and replacements. Geographic Information System (GIS) data and asset management database agree and random field validation proves truth of databases. Records of annual field validation should be available for review.
Improvements to attain higher data grading for "Length of Water Mains" component:	▨	to qualify for 2: Assign personnel to inventory current as-built records and compare with customer billing system records and highway plans in order to verify poorly documented pipelines. Assemble policy documents regarding permitting and documentation of water main installations by the utility and building developers; identify gaps in procedures that result in poor documentation of new water main installations.	to qualify for 4: Complete inventory of paper records of water main installations for several years prior to audit year. Review policy and procedures for commissioning and documenting new water main installation.		to qualify for 6: Finalize updates/improvements to written policy and procedures for permitting/commissioning new main installations. Confirm inventory of records for five years prior to audit year; correct any errors or omissions.		to qualify for 8: Launch random field checks of limited number of locations. Convert to electronic database such as a Geographic Information System (GIS) with backup as justified. Develop written policy and procedures.		to qualify for 10: Link Geographic Information System (GIS) and asset management databases, conduct field verification of data. Record field verification information at least annually.		to maintain 10: Continue with standardization and random field validation to improve the completeness and accuracy of the system.

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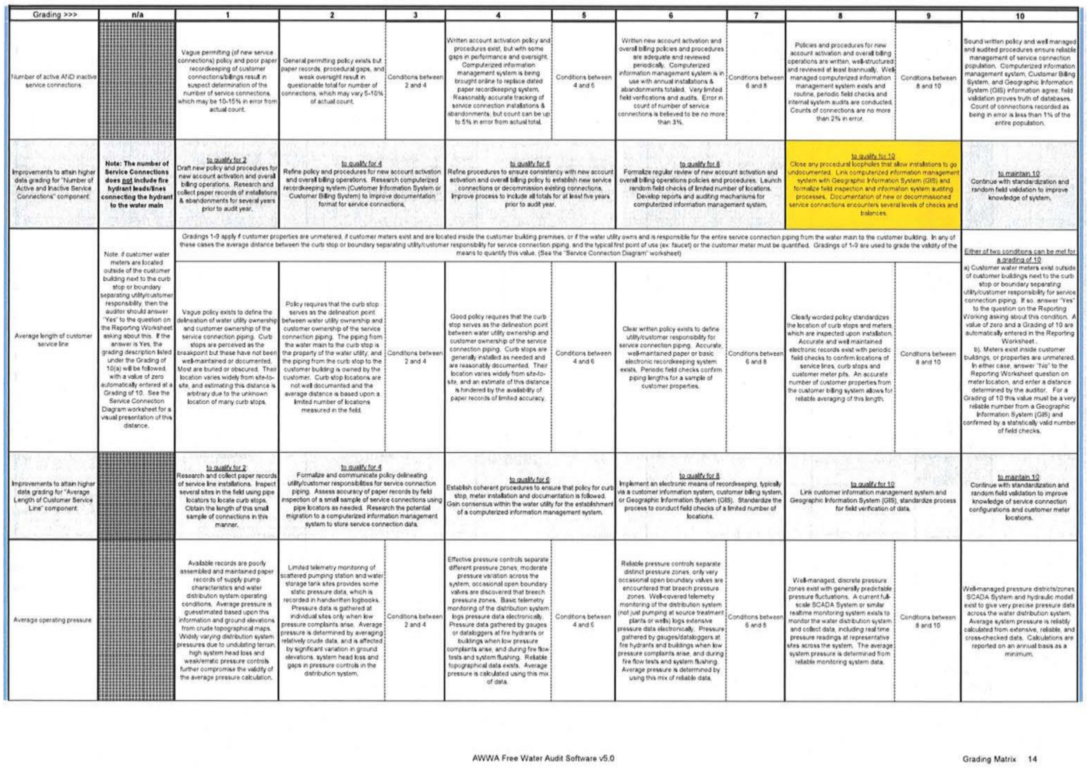
Grading Matrix 13



Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Number of active AND inactive service connections		Vague permitting (of new service connections) policy and poor paper recordkeeping of customer connections/billings result in suspect determination of the number of service connections, which may be 10-15% in error from actual count.	General permitting policy exists but paper records, procedural gaps, and weak oversight result in questionable total for number of connections, which may vary 5-10% of actual count.	Conditions between 2 and 4	Written account activation policy and procedures exist, but with some gaps in performance and oversight. Computerized information management system is being brought online to replace dated paper recordkeeping system. Reasonably accurate tracking of service connection installations & abandonments; but count can be up to 5% in error from actual total.	Conditions between 4 and 6	Written new account activation and overall billing policies and procedures are adequate and reviewed periodically. Computerized information management system is in use with annual installations & abandonments totaled. Very limited field verifications and audits. Error in count of number of service connections is believed to be no more than 3%.	Conditions between 6 and 8	Policies and procedures for new account activation and overall billing operations are written, well-structured and reviewed at least biannually. Well-managed computerized information management system exists and routine, periodic field checks and internal system audits are conducted. Counts of connections are no more than 2% in error.	Conditions between 8 and 10	Sound written policy and well managed and audited procedures ensure reliable management of service connection population. Computerized information management system, Customer Billing System, and Geographic Information System (GIS) information agree; field validation proves truth of databases. Count of connections recorded as being in error is less than 1% of the entire population.
Improvements to attain higher data grading for "Number of Active and Inactive Service Connections" component:	**Note: The number of Service Connections does <u>not</u> include fire hydrant leads/lines connecting the hydrant to the water main**	<u>to qualify for 2</u>: Draft new policy and procedures for new account activation and overall billing operations. Research and collect paper records of installations & abandonments for several years prior to audit year.	<u>to qualify for 4</u>: Refine policy and procedures for new account activation and overall billing operations. Research computerized recordkeeping system (Customer Information System or Customer Billing System) to improve documentation format for service connections.		<u>to qualify for 6</u>: Refine procedures to ensure consistency with new account activation and overall billing policy to establish new service connections or decommission existing connections. Improve process to include all totals for at least five years prior to audit year.		<u>to qualify for 8</u>: Formalize regular review of new account activation and overall billing operations policies and procedures. Launch random field checks of limited number of locations. Develop reports and auditing mechanisms for computerized information management system.		<u>to qualify for 10</u>: Close any procedural loopholes that allow installations to go undocumented. Link computerized information management system with Geographic Information System (GIS) and formalize field inspection and information system auditing processes. Documentation of new or decommissioned service connections encounters several levels of checks and balances.		<u>to maintain 10</u>: Continue with standardization and random field validation to improve knowledge of system.
Average length of customer service line	Note: if customer water meters are located outside of the customer building next to the curb stop or boundary separating utility/customer responsibility, then the auditor should answer "Yes" to the question on the Reporting Worksheet asking about this. If the answer is Yes, the grading description listed under the Grading of 10(a) will be followed, with a value of zero automatically entered at a Grading of 10. See the Service Connection Diagram worksheet for a visual presentation of this distance.	Gradings 1-9 apply if customer properties are unmetered, if customer meters exist and are located inside the customer building premises, or if the water utility owns and is responsible for the entire service connection piping from the water main to the customer building. In any of these cases the average distance between the curb stop or boundary separating utility/customer responsibility for service connection piping, and the typical first point of use (ex: faucet) or the customer meter must be quantified. Gradings of 1-9 are used to grade the validity of the means to quantify this value. (See the "Service Connection Diagram" worksheet)									<u>Either of two conditions can be met for a grading of 10</u>: a) Customer water meters exist outside of customer buildings next to the curb stop or boundary separating utility/customer responsibility for service connection piping. If so, answer "Yes" to the question on the Reporting Working asking about this condition. A value of zero and a Grading of 10 are automatically entered in the Reporting Worksheet . b). Meters exist inside customer buildings, or properties are unmetered. In either case, answer "No" to the Reporting Worksheet question on meter location, and enter a distance determined by the auditor. For a Grading of 10 this value must be a very reliable number from a Geographic Information System (GIS) and confirmed by a statistically valid number of field checks.
		Vague policy exists to define the delineation of water utility ownership and customer ownership of the service connection piping. Curb stops are perceived as the breakpoint but these have not been well-maintained or documented. Most are buried or obscured. Their location varies widely from site-to-site, and estimating this distance is arbitrary due to the unknown location of many curb stops.	Policy requires that the curb stop serves as the delineation point between water utility ownership and customer ownership of the service connection piping. The piping from the water main to the curb stop is the property of the water utility; and the piping from the curb stop to the customer building is owned by the customer. Curb stop locations are not well documented and the average distance is based upon a limited number of locations measured in the field.	Conditions between 2 and 4	Good policy requires that the curb stop serves as the delineation point between water utility ownership and customer ownership of the service connection piping. Curb stops are generally installed as needed and are reasonably documented. Their location varies widely from site-to-site, and an estimate of this distance is hindered by the availability of paper records of limited accuracy.	Conditions between 4 and 6	Clear written policy exists to define utility/customer responsibility for service connection piping. Accurate, well-maintained paper or basic electronic recordkeeping system exists. Periodic field checks confirm piping lengths for a sample of customer properties.	Conditions between 6 and 8	Clearly worded policy standardizes the location of curb stops and meters, which are inspected upon installation. Accurate and well maintained electronic records exist with periodic field checks to confirm locations of service lines, curb stops and customer meter pits. An accurate number of customer properties from the customer billing system allows for reliable averaging of this length.	Conditions between 8 and 10	
Improvements to attain higher data grading for "Average Length of Customer Service Line" component:		<u>to qualify for 2</u>: Research and collect paper records of service line installations. Inspect several sites in the field using pipe locators to locate curb stops. Obtain the length of this small sample of connections in this manner.	<u>to qualify for 4</u>: Formalize and communicate policy delineating utility/customer responsibilities for service connection piping. Assess accuracy of paper records by field inspection of a small sample of service connections using pipe locators as needed. Research the potential migration to a computerized information management system to store service connection data.		<u>to qualify for 6</u>: Establish coherent procedures to ensure that policy for curb stop, meter installation and documentation is followed. Gain consensus within the water utility for the establishment of a computerized information management system.		<u>to qualify for 8</u>: Implement an electronic means of recordkeeping, typically via a customer information system, customer billing system, or Geographic Information System (GIS). Standardize the process to conduct field checks of a limited number of locations.		<u>to qualify for 10</u>: Link customer information management system and Geographic Information System (GIS), standardize process for field verification of data.		<u>to maintain 10</u>: Continue with standardization and random field validation to improve knowledge of service connection configurations and customer meter locations.
Average operating pressure		Available records are poorly assembled and maintained paper records of supply pump characteristics and water distribution system operating conditions. Average pressure is guesstimated based upon this information and ground elevations from crude topographical maps. Widely varying distribution system pressures due to undulating terrain, high system head loss and weak/erratic pressure controls further compromise the validity of the average pressure calculation.	Limited telemetry monitoring of scattered pumping station and water storage tank sites provides some static pressure data, which is recorded in handwritten logbooks. Pressure data is gathered at individual sites only when low pressure complaints arise. Average pressure is determined by averaging relatively crude data, and is affected by significant variation in ground elevations, system head loss and gaps in pressure controls in the distribution system.	Conditions between 2 and 4	Effective pressure controls separate different pressure zones; moderate pressure variation across the system, occasional open boundary valves are discovered that breech pressure zones. Basic telemetry monitoring of the distribution system logs pressure data electronically. Pressure data gathered by gauges or dataloggers at fire hydrants or buildings when low pressure complaints arise, and during fire flow tests and system flushing. Reliable topographical data exists. Average pressure is calculated using this mix of data.	Conditions between 4 and 6	Reliable pressure controls separate distinct pressure zones; only very occasional open boundary valves are encountered that breech pressure zones. Well-covered telemetry monitoring of the distribution system (not just pumping at source treatment plants or wells) logs extensive pressure data electronically. Pressure gathered by gauges/dataloggers at fire hydrants and buildings when low pressure complaints arise, and during fire flow tests and system flushing. Average pressure is determined by using this mix of reliable data.	Conditions between 6 and 8	Well-managed, discrete pressure zones exist with generally predictable pressure fluctuations. A current full-scale SCADA System or similar realtime monitoring system exists to monitor the water distribution system and collect data, including real time pressure readings at representative sites across the system. The average system pressure is determined from reliable monitoring system data.	Conditions between 8 and 10	Well-managed pressure districts/zones, SCADA System and hydraulic model exist to give very precise pressure data across the water distribution system. Average system pressure is reliably calculated from extensive, reliable, and cross-checked data. Calculations are reported on an annual basis as a minimum.

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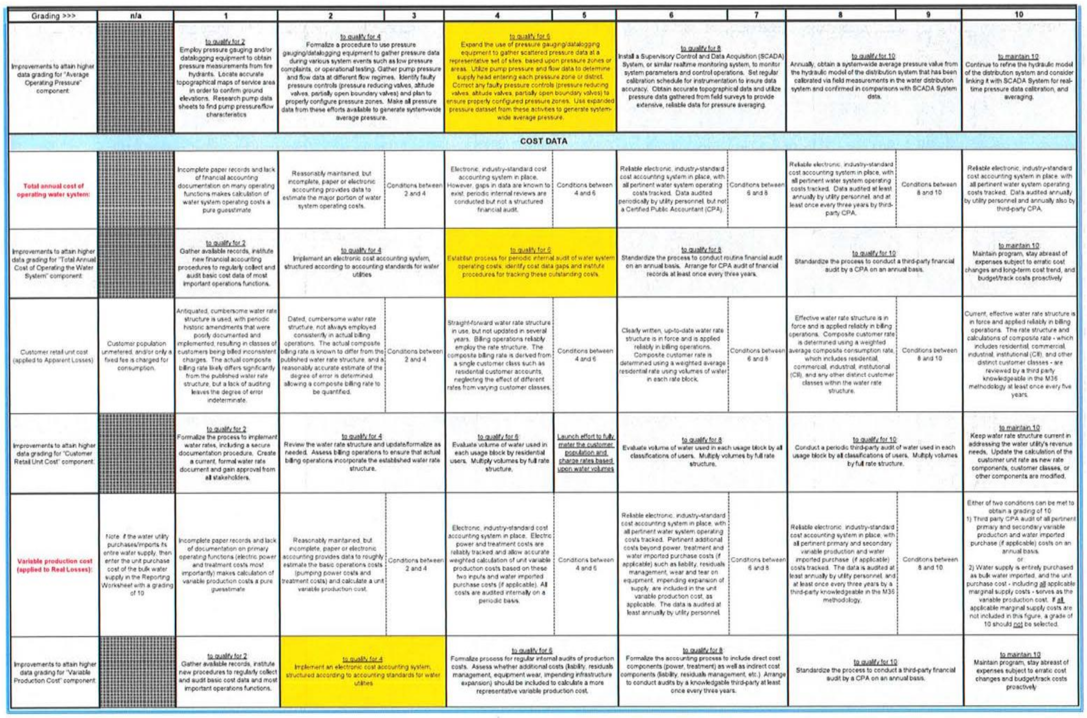
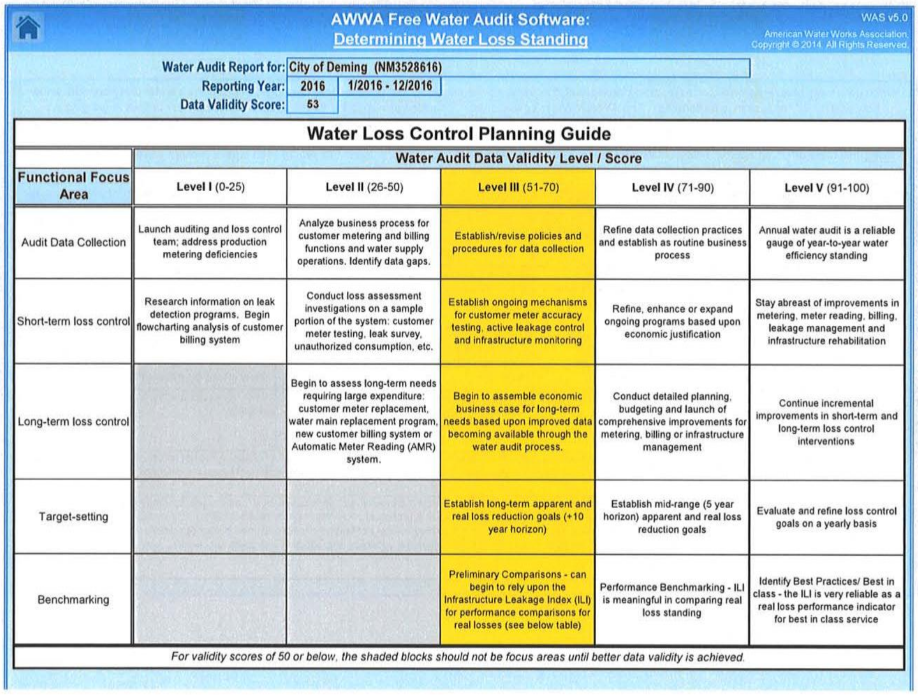
Grading Matrix 14



Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Improvements to attain higher data grading for "Average Operating Pressure" component:		to qualify for 2 Employ pressure gauging and/or datalogging equipment to obtain pressure measurements from fire hydrants. Locate accurate topographical maps of service area in order to confirm ground elevations. Research pump data sheets to find pump pressure/flow characteristics	to qualify for 4 Formalize a procedure to use pressure gauging/datalogging equipment to gather pressure data during various system events such as low pressure complaints, or operational testing. Gather pump pressure and flow data at different flow regimes. Identify faulty pressure controls (pressure reducing valves, altitude valves, partially open boundary valves) and plan to properly configure pressure zones. Make all pressure data from these efforts available to generate system-wide average pressure.		to qualify for 6 Expand the use of pressure gauging/datalogging equipment to gather scattered pressure data at a representative set of sites, based upon pressure zones or areas. Utilize pump pressure and flow data to determine supply head entering each pressure zone or district. Correct any faulty pressure controls (pressure reducing valves, altitude valves, partially open boundary valves) to ensure properly configured pressure zones. Use expanded pressure dataset from these activities to generate system-wide average pressure.		to qualify for 8 Install a Supervisory Control and Data Acquisition (SCADA) System, or similar realtime monitoring system, to monitor system parameters and control operations. Set regular calibration schedule for instrumentation to insure data accuracy. Obtain accurate topographical data and utilize pressure data gathered from field surveys to provide extensive, reliable data for pressure averaging.		to qualify for 10 Annually, obtain a system-wide average pressure value from the hydraulic model of the distribution system that has been calibrated via field measurements in the water distribution system and confirmed in comparisons with SCADA System data.		to maintain 10 Continue to refine the hydraulic model of the distribution system and consider linking it with SCADA System for real-time pressure data calibration, and averaging.
COST DATA											
Total annual cost of operating water system:		Incomplete paper records and lack of financial accounting documentation on many operating functions makes calculation of water system operating costs a pure guesstimate	Reasonably maintained, but incomplete, paper or electronic accounting provides data to estimate the major portion of water system operating costs.	Conditions between 2 and 4	Electronic, industry-standard cost accounting system in place. However, gaps in data are known to exist, periodic internal reviews are conducted but not a structured financial audit.	Conditions between 4 and 6	Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked. Data audited periodically by utility personnel, but not a Certified Public Accountant (CPA).	Conditions between 6 and 8	Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked. Data audited at least annually by utility personnel, and at least once every three years by third-party CPA.	Conditions between 8 and 10	Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked. Data audited annually by utility personnel and annually also by third-party CPA.
Improvements to attain higher data grading for "Total Annual Cost of Operating the Water System" component:		to qualify for 2 Gather available records, institute new financial accounting procedures to regularly collect and audit basic cost data of most important operations functions.	to qualify for 4 Implement an electronic cost accounting system, structured according to accounting standards for water utilities		to qualify for 6 Establish process for periodic internal audit of water system operating costs; identify cost data gaps and institute procedures for tracking these outstanding costs.		to qualify for 8 Standardize the process to conduct routine financial audit on an annual basis. Arrange for CPA audit of financial records at least once every three years.		to qualify for 10 Standardize the process to conduct a third-party financial audit by a CPA on an annual basis.		to maintain 10 Maintain program, stay abreast of expenses subject to erratic cost changes and long-term cost trend, and budget/track costs proactively
Customer retail unit cost (applied to Apparent Losses):	Customer population unmetered, and/or only a fixed fee is charged for consumption.	Antiquated, cumbersome water rate structure is used, with periodic historic amendments that were poorly documented and implemented, resulting in classes of customers being billed inconsistent charges. The actual composite billing rate likely differs significantly from the published water rate structure, but a lack of auditing leaves the degree of error indeterminate.	Dated, cumbersome water rate structure, not always employed consistently in actual billing operations. The actual composite billing rate is known to differ from the published water rate structure, and a reasonably accurate estimate of the degree of error is determined, allowing a composite billing rate to be quantified.	Conditions between 2 and 4	Straight-forward water rate structure in use, but not updated in several years. Billing operations reliably employ the rate structure. The composite billing rate is derived from a single customer class such as residential customer accounts, neglecting the effect of different rates from varying customer classes.	Conditions between 4 and 6	Clearly written, up-to-date water rate structure is in force and is applied reliably in billing operations. Composite customer rate is determined using a weighted average residential rate using volumes of water in each rate block.	Conditions between 6 and 8	Effective water rate structure is in force and is applied reliably in billing operations. Composite customer rate is determined using a weighted average composite consumption rate, which includes residential, commercial, industrial, institutional (CII), and any other distinct customer classes within the water rate structure.	Conditions between 8 and 10	Current, effective water rate structure is in force and applied reliably in billing operations. The rate structure and calculations of composite rate - which includes residential, commercial, industrial, institutional (CII), and other distinct customer classes - are reviewed by a third party knowledgeable in the M36 methodology at least once every five years.
Improvements to attain higher data grading for "Customer Retail Unit Cost" component:		to qualify for 2 Formalize the process to implement water rates, including a secure documentation procedure. Create a current, formal water rate document and gain approval from all stakeholders.	to qualify for 4 Review the water rate structure and update/formalize as needed. Assess billing operations to ensure that actual billing operations incorporate the established water rate structure.		to qualify for 6: Evaluate volume of water used in each usage block by residential users. Multiply volumes by full rate structure.	Launch effort to fully meter the customer population and charge rates based upon water volumes	to qualify for 8: Evaluate volume of water used in each usage block by all classifications of users. Multiply volumes by full rate structure.		to qualify for 10 Conduct a periodic third-party audit of water used in each usage block by all classifications of users. Multiply volumes by full rate structure.		to maintain 10 Keep water rate structure current in addressing the water utility's revenue needs. Update the calculation of the customer unit rate as new rate components, customer classes, or other components are modified.
Variable production cost (applied to Real Losses):	Note: if the water utility purchases/imports its entire water supply, then enter the unit purchase cost of the bulk water supply in the Reporting Worksheet with a grading of 10	Incomplete paper records and lack of documentation on primary operating functions (electric power and treatment costs most importantly) makes calculation of variable production costs a pure guesstimate	Reasonably maintained, but incomplete, paper or electronic accounting provides data to roughly estimate the basic operations costs (pumping power costs and treatment costs) and calculate a unit variable production cost.	Conditions between 2 and 4	Electronic, industry-standard cost accounting system in place. Electric power and treatment costs are reliably tracked and allow accurate weighted calculation of unit variable production costs based on these two inputs and water imported purchase costs (if applicable). All costs are audited internally on a periodic basis.	Conditions between 4 and 6	Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked. Pertinent additional costs beyond power, treatment and water imported purchase costs (if applicable) such as liability, residuals management, wear and tear on equipment, impending expansion of supply, are included in the unit variable production cost, as applicable. The data is audited at least annually by utility personnel.	Conditions between 6 and 8	Reliable electronic, industry-standard cost accounting system in place, with all pertinent primary and secondary variable production and water imported purchase (if applicable) costs tracked. The data is audited at least annually by utility personnel, and at least once every three years by a third-party knowledgeable in the M36 methodology.	Conditions between 8 and 10	Either of two conditions can be met to obtain a grading of 10: 1) Third party CPA audit of all pertinent primary and secondary variable production and water imported purchase (if applicable) costs on an annual basis. or 2) Water supply is entirely purchased as bulk water imported, and the unit purchase cost - including all applicable marginal supply costs - serves as the variable production cost. If all applicable marginal supply costs are not included in this figure, a grade of 10 should not be selected.
Improvements to attain higher data grading for "Variable Production Cost" component:		to qualify for 2 Gather available records, institute new procedures to regularly collect and audit basic cost data and most important operations functions.	to qualify for 4 Implement an electronic cost accounting system, structured according to accounting standards for water utilities		to qualify for 6 Formalize process for regular internal audits of production costs. Assess whether additional costs (liability, residuals management, equipment wear, impending infrastructure expansion) should be included to calculate a more representative variable production cost.		to qualify for 8 Formalize the accounting process to include direct cost components (power, treatment) as well as indirect cost components (liability, residuals management, etc.) Arrange to conduct audits by a knowledgable third-party at least once every three years.		to qualify for 10 Standardize the process to conduct a third-party financial audit by a CPA on an annual basis.		to maintain 10 Maintain program, stay abreast of expenses subject to erratic cost changes and budget/track costs proactively

AWWA Free Water Audit Software v5.0

Grading Matrix 15



AWWA Free Water Audit Software:
Determining Water Loss Standing

WAS v5.0
American Water Works Association.
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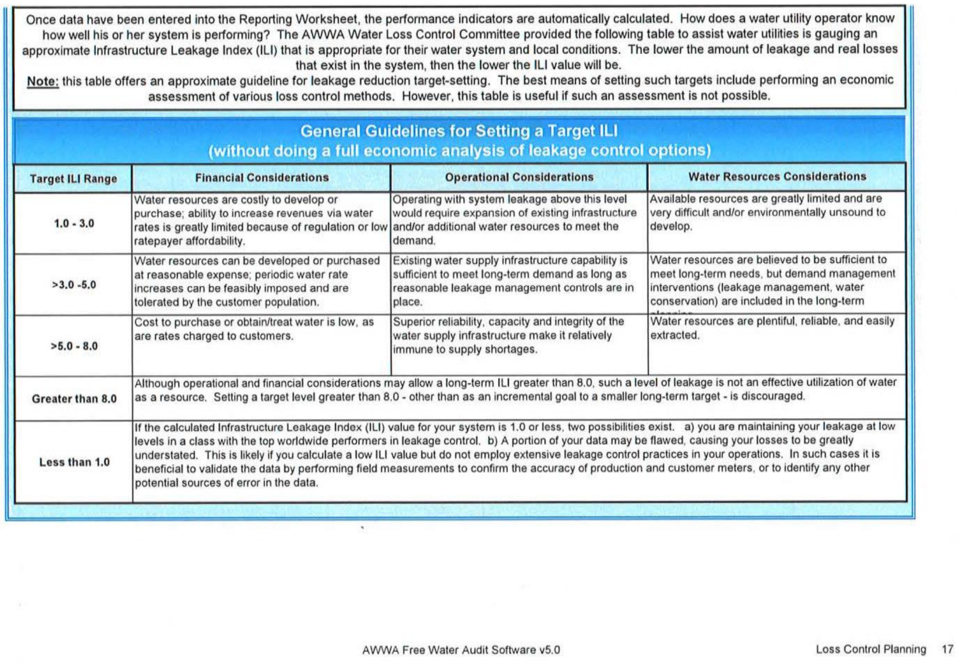
Water Audit Report for: City of Deming (NM3528616)
Reporting Year: 2016 1/2016 - 12/2016
Data Validity Score: 53

Water Loss Control Planning Guide

	Water Audit Data Validity Level / Score				
Functional Focus Area	**Level I** (0-25)	**Level II** (26-50)	**Level III** (51-70)	**Level IV** (71-90)	**Level V** (91-100)
Audit Data Collection	Launch auditing and loss control team; address production metering deficiencies	Analyze business process for customer metering and billing functions and water supply operations. Identify data gaps.	Establish/revise policies and procedures for data collection	Refine data collection practices and establish as routine business process	Annual water audit is a reliable gauge of year-to-year water efficiency standing
Short-term loss control	Research information on leak detection programs. Begin flowcharting analysis of customer billing system	Conduct loss assessment investigations on a sample portion of the system: customer meter testing, leak survey, unauthorized consumption, etc.	Establish ongoing mechanisms for customer meter accuracy testing, active leakage control and infrastructure monitoring	Refine, enhance or expand ongoing programs based upon economic justification	Stay abreast of improvements in metering, meter reading, billing, leakage management and infrastructure rehabilitation
Long-term loss control		Begin to assess long-term needs requiring large expenditure: customer meter replacement, water main replacement program, new customer billing system or Automatic Meter Reading (AMR) system.	Begin to assemble economic business case for long-term needs based upon improved data becoming available through the water audit process.	Conduct detailed planning, budgeting and launch of comprehensive improvements for metering, billing or infrastructure management	Continue incremental improvements in short-term and long-term loss control interventions
Target-setting			Establish long-term apparent and real loss reduction goals (+10 year horizon)	Establish mid-range (5 year horizon) apparent and real loss reduction goals	Evaluate and refine loss control goals on a yearly basis
Benchmarking			Preliminary Comparisons - can begin to rely upon the Infrastructure Leakage Index (ILI) for performance comparisons for real losses (see below table)	Performance Benchmarking - ILI is meaningful in comparing real loss standing	Identify Best Practices/ Best in class - the ILI is very reliable as a real loss performance indicator for best in class service

For validity scores of 50 or below, the shaded blocks should not be focus areas until better data validity is achieved.



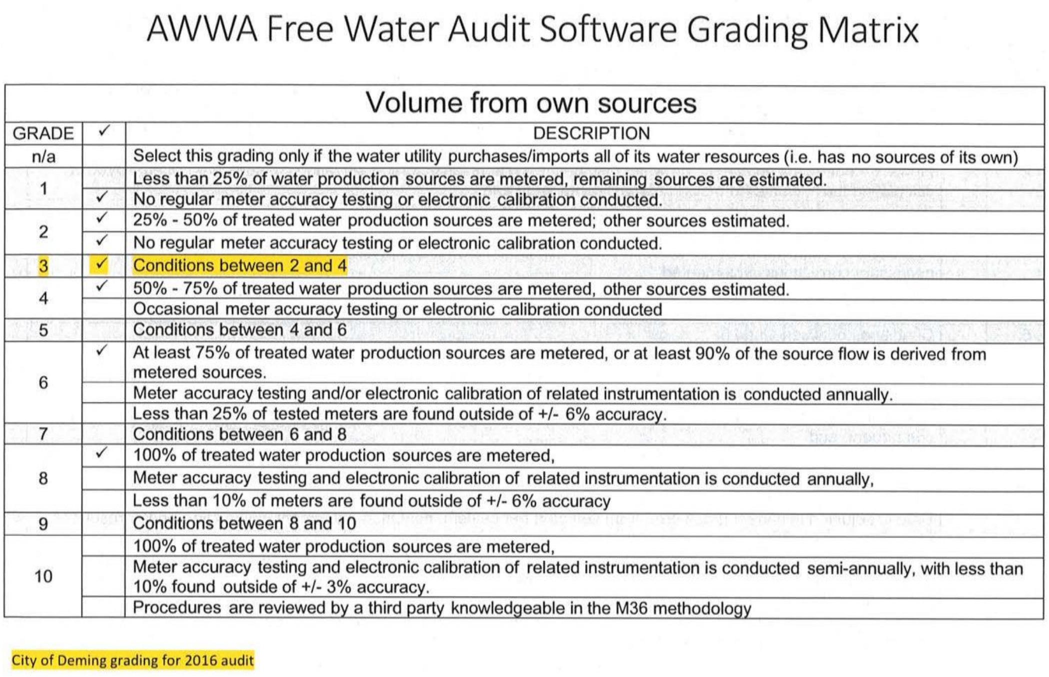
Once data have been entered into the Reporting Worksheet, the performance indicators are automatically calculated. How does a water utility operator know how well his or her system is performing? The AWWA Water Loss Control Committee provided the following table to assist water utilities is gauging an approximate Infrastructure Leakage Index (ILI) that is appropriate for their water system and local conditions. The lower the amount of leakage and real losses that exist in the system, then the lower the ILI value will be.

Note: this table offers an approximate guideline for leakage reduction target-setting. The best means of setting such targets include performing an economic assessment of various loss control methods. However, this table is useful if such an assessment is not possible.

General Guidelines for Setting a Target ILI
(without doing a full economic analysis of leakage control options)

Target ILI Range	Financial Considerations	Operational Considerations	Water Resources Considerations
1.0 - 3.0	Water resources are costly to develop or purchase; ability to increase revenues via water rates is greatly limited because of regulation or low ratepayer affordability.	Operating with system leakage above this level would require expansion of existing infrastructure and/or additional water resources to meet the demand.	Available resources are greatly limited and are very difficult and/or environmentally unsound to develop.
>3.0 -5.0	Water resources can be developed or purchased at reasonable expense; periodic water rate increases can be feasibly imposed and are tolerated by the customer population.	Existing water supply infrastructure capability is sufficient to meet long-term demand as long as reasonable leakage management controls are in place.	Water resources are believed to be sufficient to meet long-term needs, but demand management interventions (leakage management, water conservation) are included in the long-term
>5.0 - 8.0	Cost to purchase or obtain/treat water is low, as are rates charged to customers.	Superior reliability, capacity and integrity of the water supply infrastructure make it relatively immune to supply shortages.	Water resources are plentiful, reliable, and easily extracted.
Greater than 8.0	Although operational and financial considerations may allow a long-term ILI greater than 8.0, such a level of leakage is not an effective utilization of water as a resource. Setting a target level greater than 8.0 - other than as an incremental goal to a smaller long-term target - is discouraged.		
Less than 1.0	If the calculated Infrastructure Leakage Index (ILI) value for your system is 1.0 or less, two possibilities exist. a) you are maintaining your leakage at low levels in a class with the top worldwide performers in leakage control. b) A portion of your data may be flawed, causing your losses to be greatly understated. This is likely if you calculate a low ILI value but do not employ extensive leakage control practices in your operations. In such cases it is beneficial to validate the data by performing field measurements to confirm the accuracy of production and customer meters, or to identify any other potential sources of error in the data.		

AWWA Free Water Audit Software v5.0 Loss Control Planning 17

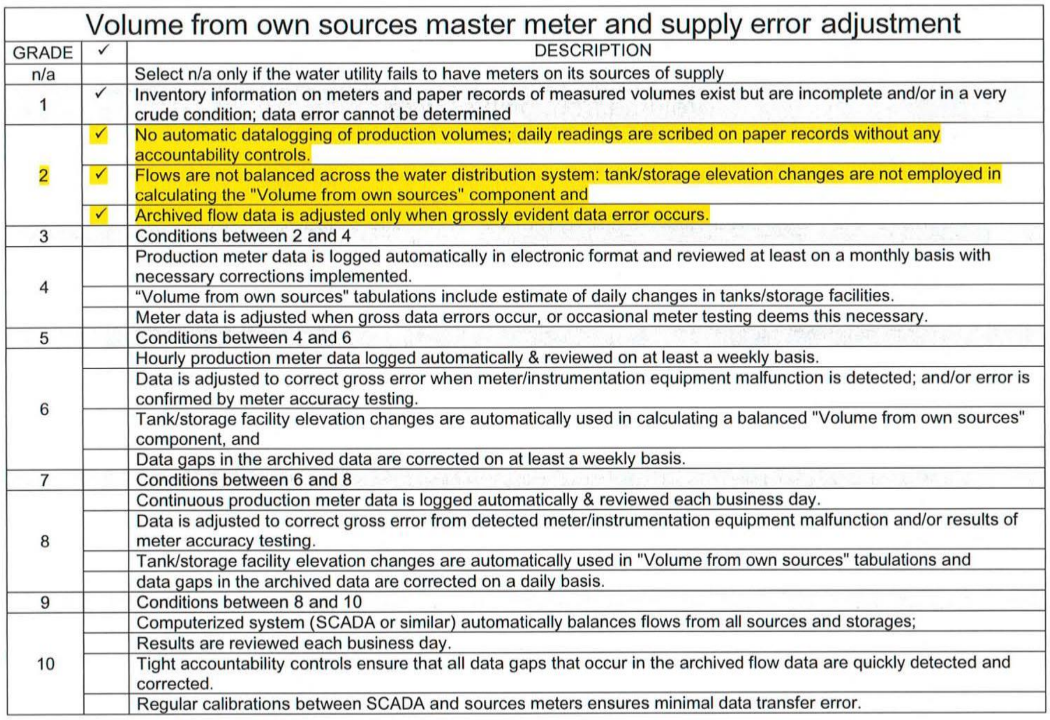


AWWA Free Water Audit Software Grading Matrix

Volume from own sources

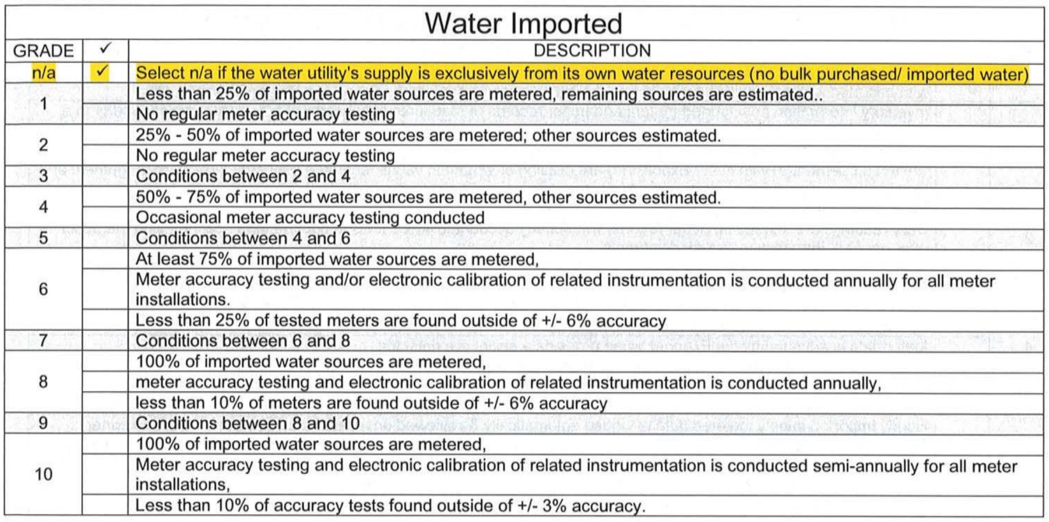
GRADE	✓	DESCRIPTION
n/a		Select this grading only if the water utility purchases/imports all of its water resources (i.e. has no sources of its own)
1		Less than 25% of water production sources are metered, remaining sources are estimated.
	✓	No regular meter accuracy testing or electronic calibration conducted.
2	✓	25% - 50% of treated water production sources are metered; other sources estimated.
	✓	No regular meter accuracy testing or electronic calibration conducted.
3	✓	Conditions between 2 and 4
4	✓	50% - 75% of treated water production sources are metered, other sources estimated.
		Occasional meter accuracy testing or electronic calibration conducted
5		Conditions between 4 and 6
6	✓	At least 75% of treated water production sources are metered, or at least 90% of the source flow is derived from metered sources.
		Meter accuracy testing and/or electronic calibration of related instrumentation is conducted annually.
		Less than 25% of tested meters are found outside of +/- 6% accuracy.
7		Conditions between 6 and 8
8	✓	100% of treated water production sources are metered,
		Meter accuracy testing and electronic calibration of related instrumentation is conducted annually,
		Less than 10% of meters are found outside of +/- 6% accuracy
9		Conditions between 8 and 10
10		100% of treated water production sources are metered,
		Meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually, with less than 10% found outside of +/- 3% accuracy.
		Procedures are reviewed by a third party knowledgeable in the M36 methodology

City of Deming grading for 2016 audit



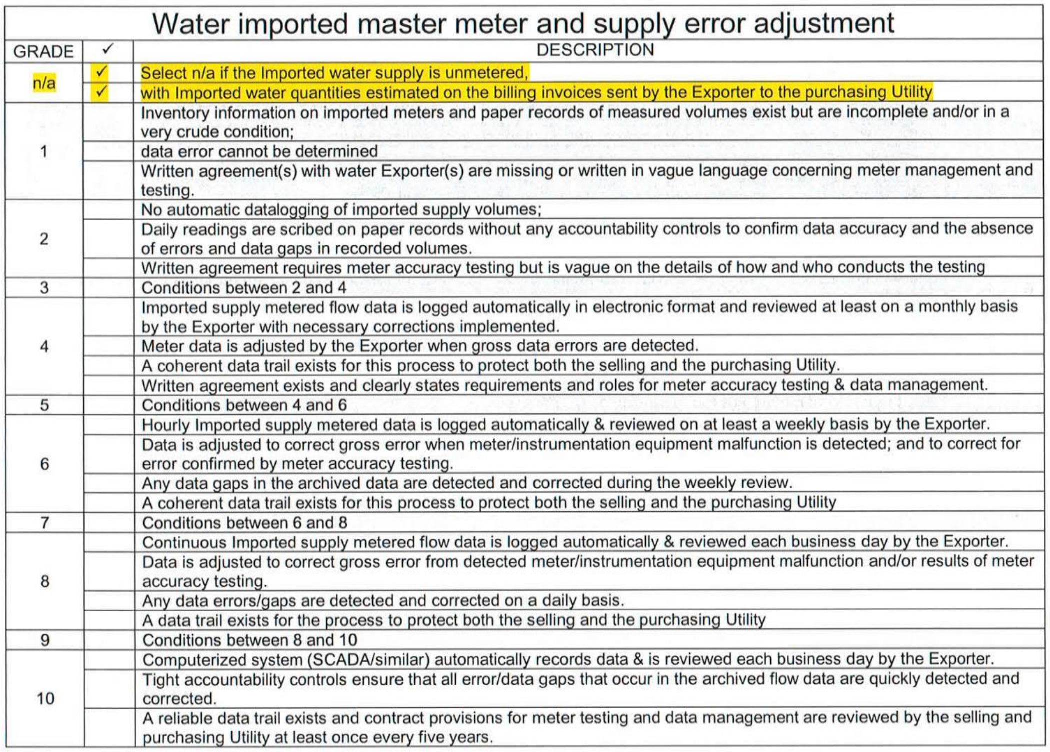
Volume from own sources master meter and supply error adjustment

GRADE	✓	DESCRIPTION
n/a		Select n/a only if the water utility fails to have meters on its sources of supply
1	✓	Inventory information on meters and paper records of measured volumes exist but are incomplete and/or in a very crude condition; data error cannot be determined
2	✓	No automatic datalogging of production volumes; daily readings are scribed on paper records without any accountability controls.
	✓	Flows are not balanced across the water distribution system: tank/storage elevation changes are not employed in calculating the "Volume from own sources" component and
	✓	Archived flow data is adjusted only when grossly evident data error occurs.
3		Conditions between 2 and 4
4		Production meter data is logged automatically in electronic format and reviewed at least on a monthly basis with necessary corrections implemented.
		"Volume from own sources" tabulations include estimate of daily changes in tanks/storage facilities.
		Meter data is adjusted when gross data errors occur, or occasional meter testing deems this necessary.
5		Conditions between 4 and 6
6		Hourly production meter data logged automatically & reviewed on at least a weekly basis.
		Data is adjusted to correct gross error when meter/instrumentation equipment malfunction is detected; and/or error is confirmed by meter accuracy testing.
		Tank/storage facility elevation changes are automatically used in calculating a balanced "Volume from own sources" component, and
		Data gaps in the archived data are corrected on at least a weekly basis.
7		Conditions between 6 and 8
8		Continuous production meter data is logged automatically & reviewed each business day.
		Data is adjusted to correct gross error from detected meter/instrumentation equipment malfunction and/or results of meter accuracy testing.
		Tank/storage facility elevation changes are automatically used in "Volume from own sources" tabulations and
		data gaps in the archived data are corrected on a daily basis.
9		Conditions between 8 and 10
10		Computerized system (SCADA or similar) automatically balances flows from all sources and storages;
		Results are reviewed each business day.
		Tight accountability controls ensure that all data gaps that occur in the archived flow data are quickly detected and corrected.
		Regular calibrations between SCADA and sources meters ensures minimal data transfer error.



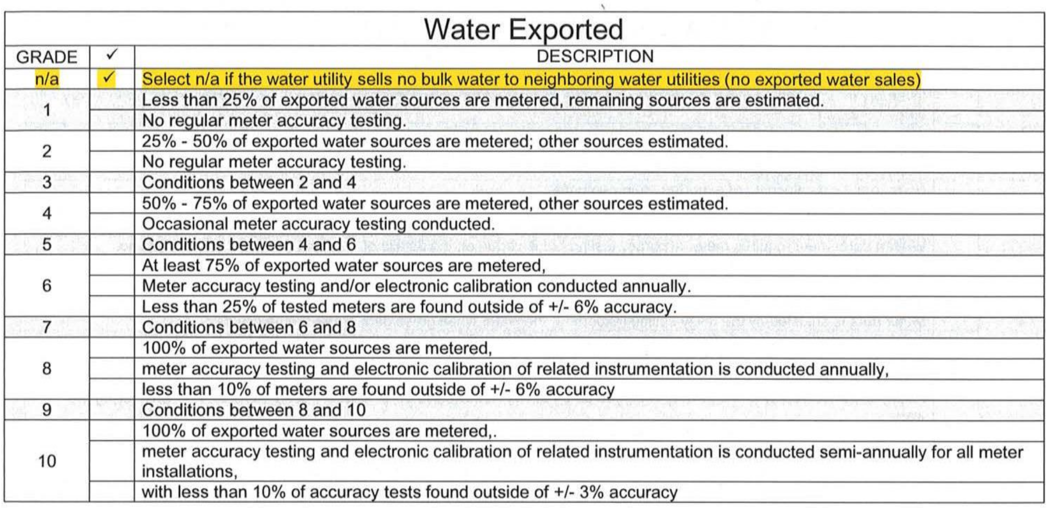
Water Imported

GRADE	✓	DESCRIPTION
n/a	✓	Select n/a if the water utility's supply is exclusively from its own water resources (no bulk purchased/ imported water)
1		Less than 25% of imported water sources are metered, remaining sources are estimated..
		No regular meter accuracy testing
2		25% - 50% of imported water sources are metered; other sources estimated.
		No regular meter accuracy testing
3		Conditions between 2 and 4
4		50% - 75% of imported water sources are metered, other sources estimated.
		Occasional meter accuracy testing conducted
5		Conditions between 4 and 6
6		At least 75% of imported water sources are metered,
		Meter accuracy testing and/or electronic calibration of related instrumentation is conducted annually for all meter installations.
		Less than 25% of tested meters are found outside of +/- 6% accuracy
7		Conditions between 6 and 8
8		100% of imported water sources are metered,
		meter accuracy testing and electronic calibration of related instrumentation is conducted annually,
		less than 10% of meters are found outside of +/- 6% accuracy
9		Conditions between 8 and 10
10		100% of imported water sources are metered,
		Meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually for all meter installations,
		Less than 10% of accuracy tests found outside of +/- 3% accuracy.



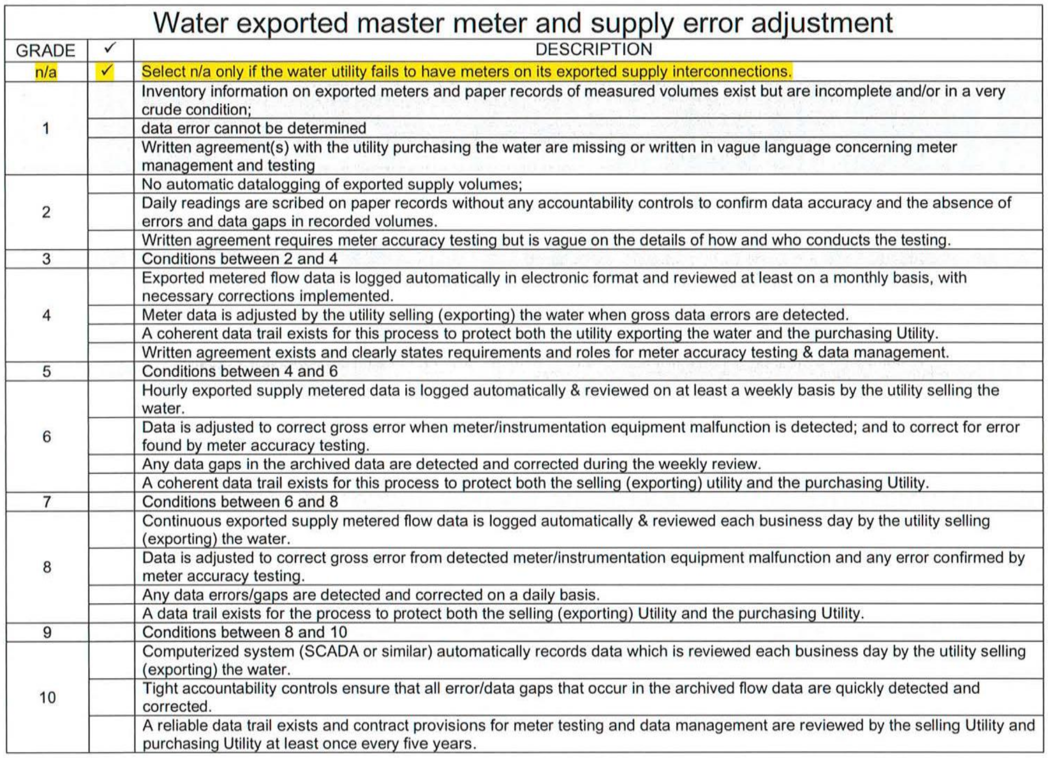
Water imported master meter and supply error adjustment

GRADE	✓	DESCRIPTION
n/a	✓	Select n/a if the Imported water supply is unmetered,
	✓	with Imported water quantities estimated on the billing invoices sent by the Exporter to the purchasing Utility
1		Inventory information on imported meters and paper records of measured volumes exist but are incomplete and/or in a very crude condition;
		data error cannot be determined
		Written agreement(s) with water Exporter(s) are missing or written in vague language concerning meter management and testing.
2		No automatic datalogging of imported supply volumes;
		Daily readings are scribed on paper records without any accountability controls to confirm data accuracy and the absence of errors and data gaps in recorded volumes.
		Written agreement requires meter accuracy testing but is vague on the details of how and who conducts the testing
3		Conditions between 2 and 4
4		Imported supply metered flow data is logged automatically in electronic format and reviewed at least on a monthly basis by the Exporter with necessary corrections implemented.
		Meter data is adjusted by the Exporter when gross data errors are detected.
		A coherent data trail exists for this process to protect both the selling and the purchasing Utility.
		Written agreement exists and clearly states requirements and roles for meter accuracy testing & data management.
5		Conditions between 4 and 6
6		Hourly Imported supply metered data is logged automatically & reviewed on at least a weekly basis by the Exporter.
		Data is adjusted to correct gross error when meter/instrumentation equipment malfunction is detected; and to correct for error confirmed by meter accuracy testing.
		Any data gaps in the archived data are detected and corrected during the weekly review.
		A coherent data trail exists for this process to protect both the selling and the purchasing Utility
7		Conditions between 6 and 8
8		Continuous Imported supply metered flow data is logged automatically & reviewed each business day by the Exporter.
		Data is adjusted to correct gross error from detected meter/instrumentation equipment malfunction and/or results of meter accuracy testing.
		Any data errors/gaps are detected and corrected on a daily basis.
		A data trail exists for the process to protect both the selling and the purchasing Utility
9		Conditions between 8 and 10
10		Computerized system (SCADA/similar) automatically records data & is reviewed each business day by the Exporter.
		Tight accountability controls ensure that all error/data gaps that occur in the archived flow data are quickly detected and corrected.
		A reliable data trail exists and contract provisions for meter testing and data management are reviewed by the selling and purchasing Utility at least once every five years.



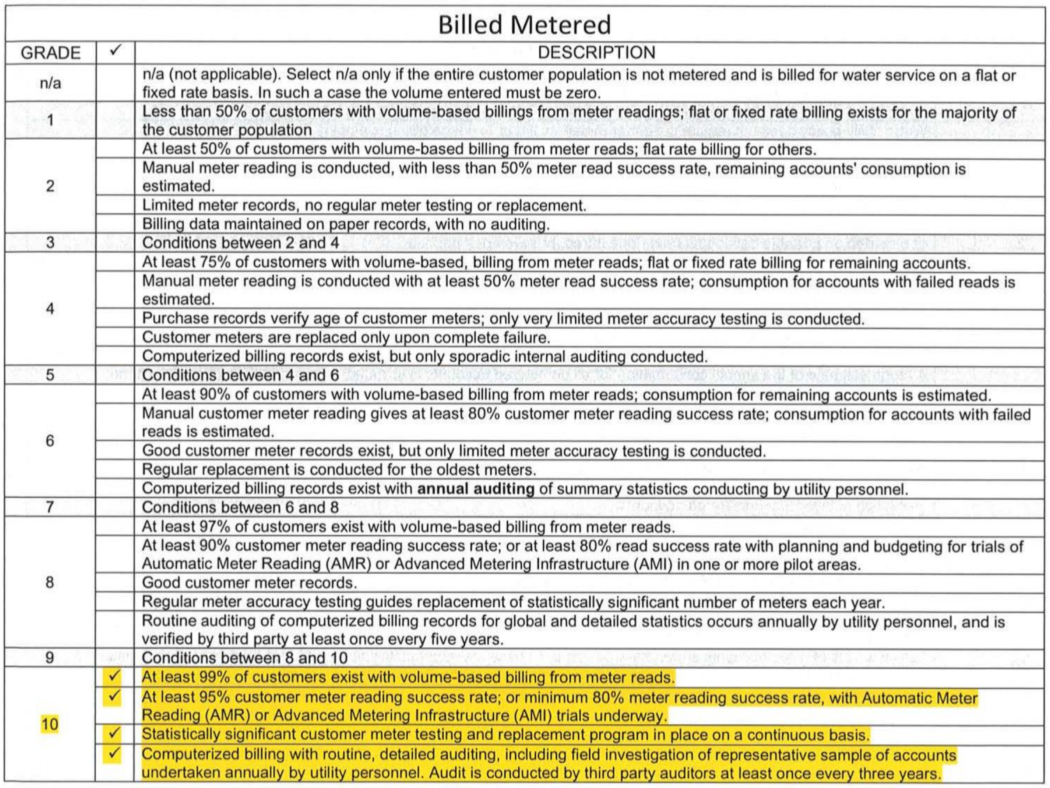
Water Exported

GRADE	✓	DESCRIPTION
n/a	✓	Select n/a if the water utility sells no bulk water to neighboring water utilities (no exported water sales)
1		Less than 25% of exported water sources are metered, remaining sources are estimated.
		No regular meter accuracy testing.
2		25% - 50% of exported water sources are metered; other sources estimated.
		No regular meter accuracy testing.
3		Conditions between 2 and 4
4		50% - 75% of exported water sources are metered, other sources estimated.
		Occasional meter accuracy testing conducted.
5		Conditions between 4 and 6
6		At least 75% of exported water sources are metered,
		Meter accuracy testing and/or electronic calibration conducted annually.
		Less than 25% of tested meters are found outside of +/- 6% accuracy.
7		Conditions between 6 and 8
8		100% of exported water sources are metered,
		meter accuracy testing and electronic calibration of related instrumentation is conducted annually,
		less than 10% of meters are found outside of +/- 6% accuracy
9		Conditions between 8 and 10
10		100% of exported water sources are metered,.
		meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually for all meter installations,
		with less than 10% of accuracy tests found outside of +/- 3% accuracy



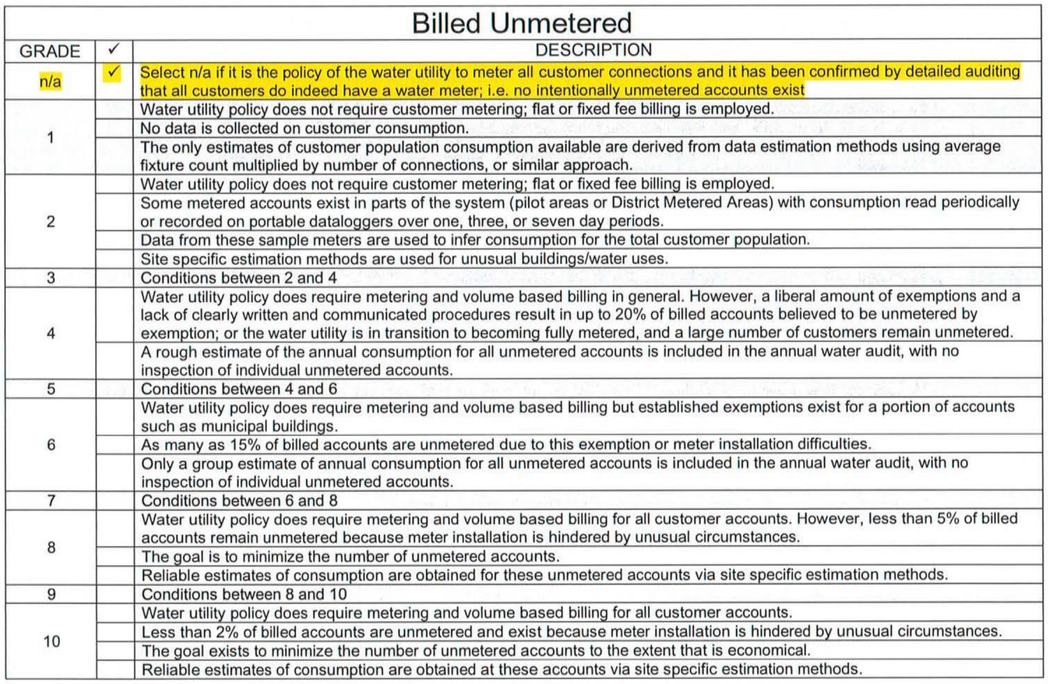
Water exported master meter and supply error adjustment

GRADE	✓	DESCRIPTION
n/a	✓	Select n/a only if the water utility fails to have meters on its exported supply interconnections.
1		Inventory information on exported meters and paper records of measured volumes exist but are incomplete and/or in a very crude condition;
		data error cannot be determined
		Written agreement(s) with the utility purchasing the water are missing or written in vague language concerning meter management and testing
2		No automatic datalogging of exported supply volumes;
		Daily readings are scribed on paper records without any accountability controls to confirm data accuracy and the absence of errors and data gaps in recorded volumes.
		Written agreement requires meter accuracy testing but is vague on the details of how and who conducts the testing.
3		Conditions between 2 and 4
4		Exported metered flow data is logged automatically in electronic format and reviewed at least on a monthly basis, with necessary corrections implemented.
		Meter data is adjusted by the utility selling (exporting) the water when gross data errors are detected.
		A coherent data trail exists for this process to protect both the utility exporting the water and the purchasing Utility.
		Written agreement exists and clearly states requirements and roles for meter accuracy testing & data management.
5		Conditions between 4 and 6
6		Hourly exported supply metered data is logged automatically & reviewed on at least a weekly basis by the utility selling the water.
		Data is adjusted to correct gross error when meter/instrumentation equipment malfunction is detected; and to correct for error found by meter accuracy testing.
		Any data gaps in the archived data are detected and corrected during the weekly review.
		A coherent data trail exists for this process to protect both the selling (exporting) utility and the purchasing Utility.
7		Conditions between 6 and 8
8		Continuous exported supply metered flow data is logged automatically & reviewed each business day by the utility selling (exporting) the water.
		Data is adjusted to correct gross error from detected meter/instrumentation equipment malfunction and any error confirmed by meter accuracy testing.
		Any data errors/gaps are detected and corrected on a daily basis.
		A data trail exists for the process to protect both the selling (exporting) Utility and the purchasing Utility.
9		Conditions between 8 and 10
10		Computerized system (SCADA or similar) automatically records data which is reviewed each business day by the utility selling (exporting) the water.
		Tight accountability controls ensure that all error/data gaps that occur in the archived flow data are quickly detected and corrected.
		A reliable data trail exists and contract provisions for meter testing and data management are reviewed by the selling Utility and purchasing Utility at least once every five years.



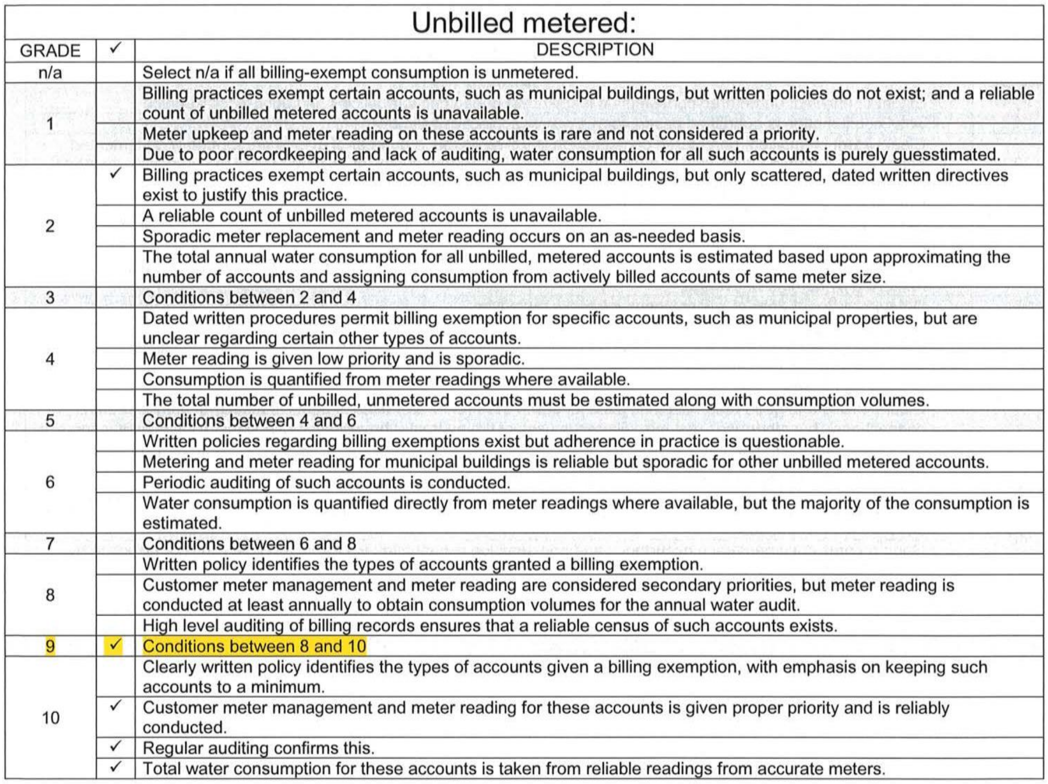
Billed Metered

GRADE	✓	DESCRIPTION
n/a		n/a (not applicable). Select n/a only if the entire customer population is not metered and is billed for water service on a flat or fixed rate basis. In such a case the volume entered must be zero.
1		Less than 50% of customers with volume-based billings from meter readings; flat or fixed rate billing exists for the majority of the customer population
2		At least 50% of customers with volume-based billing from meter reads; flat rate billing for others.
		Manual meter reading is conducted, with less than 50% meter read success rate, remaining accounts' consumption is estimated.
		Limited meter records, no regular meter testing or replacement.
		Billing data maintained on paper records, with no auditing.
3		Conditions between 2 and 4
4		At least 75% of customers with volume-based, billing from meter reads; flat or fixed rate billing for remaining accounts.
		Manual meter reading is conducted with at least 50% meter read success rate; consumption for accounts with failed reads is estimated.
		Purchase records verify age of customer meters; only very limited meter accuracy testing is conducted.
		Customer meters are replaced only upon complete failure.
		Computerized billing records exist, but only sporadic internal auditing conducted.
5		Conditions between 4 and 6
6		At least 90% of customers with volume-based billing from meter reads; consumption for remaining accounts is estimated.
		Manual customer meter reading gives at least 80% customer meter reading success rate; consumption for accounts with failed reads is estimated.
		Good customer meter records exist, but only limited meter accuracy testing is conducted.
		Regular replacement is conducted for the oldest meters.
		Computerized billing records exist with **annual auditing** of summary statistics conducting by utility personnel.
7		Conditions between 6 and 8
8		At least 97% of customers exist with volume-based billing from meter reads.
		At least 90% customer meter reading success rate; or at least 80% read success rate with planning and budgeting for trials of Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) in one or more pilot areas.
		Good customer meter records.
		Regular meter accuracy testing guides replacement of statistically significant number of meters each year.
		Routine auditing of computerized billing records for global and detailed statistics occurs annually by utility personnel, and is verified by third party at least once every five years.
9		Conditions between 8 and 10
10	✓	At least 99% of customers exist with volume-based billing from meter reads.
	✓	At least 95% customer meter reading success rate; or minimum 80% meter reading success rate, with Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) trials underway.
	✓	Statistically significant customer meter testing and replacement program in place on a continuous basis.
	✓	Computerized billing with routine, detailed auditing, including field investigation of representative sample of accounts undertaken annually by utility personnel. Audit is conducted by third party auditors at least once every three years.



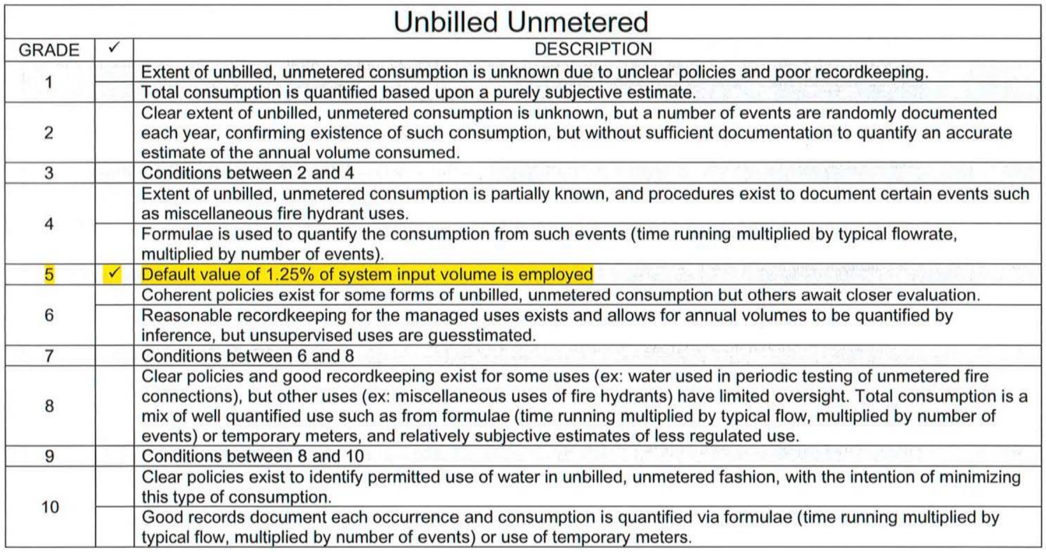
Billed Unmetered

GRADE	✓	DESCRIPTION
n/a	✓	Select n/a if it is the policy of the water utility to meter all customer connections and it has been confirmed by detailed auditing that all customers do indeed have a water meter; i.e. no intentionally unmetered accounts exist
1		Water utility policy does not require customer metering; flat or fixed fee billing is employed.
		No data is collected on customer consumption.
		The only estimates of customer population consumption available are derived from data estimation methods using average fixture count multiplied by number of connections, or similar approach.
2		Water utility policy does not require customer metering; flat or fixed fee billing is employed.
		Some metered accounts exist in parts of the system (pilot areas or District Metered Areas) with consumption read periodically or recorded on portable dataloggers over one, three, or seven day periods.
		Data from these sample meters are used to infer consumption for the total customer population.
		Site specific estimation methods are used for unusual buildings/water uses.
3		Conditions between 2 and 4
4		Water utility policy does require metering and volume based billing in general. However, a liberal amount of exemptions and a lack of clearly written and communicated procedures result in up to 20% of billed accounts believed to be unmetered by exemption; or the water utility is in transition to becoming fully metered, and a large number of customers remain unmetered.
		A rough estimate of the annual consumption for all unmetered accounts is included in the annual water audit, with no inspection of individual unmetered accounts.
5		Conditions between 4 and 6
6		Water utility policy does require metering and volume based billing but established exemptions exist for a portion of accounts such as municipal buildings.
		As many as 15% of billed accounts are unmetered due to this exemption or meter installation difficulties.
		Only a group estimate of annual consumption for all unmetered accounts is included in the annual water audit, with no inspection of individual unmetered accounts.
7		Conditions between 6 and 8
8		Water utility policy does require metering and volume based billing for all customer accounts. However, less than 5% of billed accounts remain unmetered because meter installation is hindered by unusual circumstances.
		The goal is to minimize the number of unmetered accounts.
		Reliable estimates of consumption are obtained for these unmetered accounts via site specific estimation methods.
9		Conditions between 8 and 10
10		Water utility policy does require metering and volume based billing for all customer accounts.
		Less than 2% of billed accounts are unmetered and exist because meter installation is hindered by unusual circumstances.
		The goal exists to minimize the number of unmetered accounts to the extent that is economical.
		Reliable estimates of consumption are obtained at these accounts via site specific estimation methods.



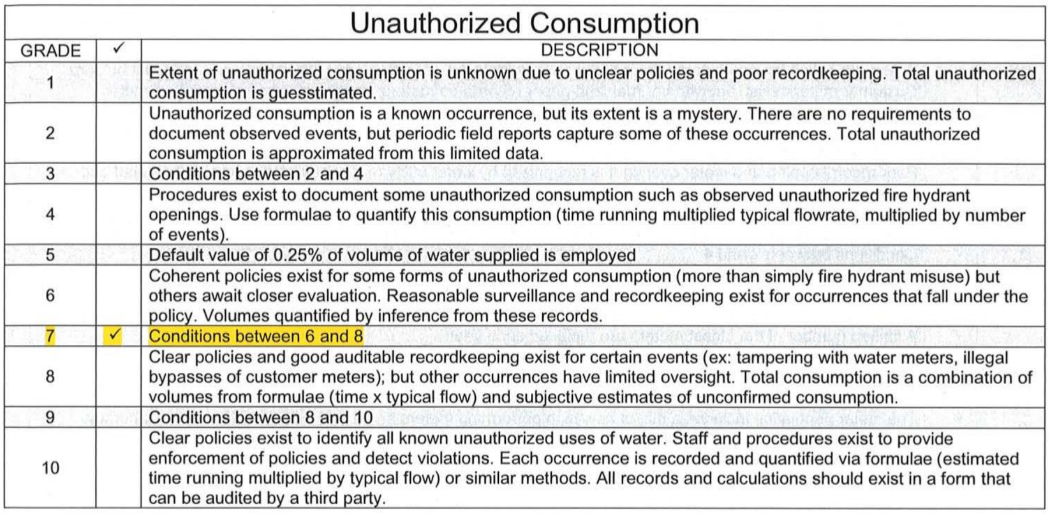
Unbilled metered:

GRADE	✓	DESCRIPTION
n/a		Select n/a if all billing-exempt consumption is unmetered.
1		Billing practices exempt certain accounts, such as municipal buildings, but written policies do not exist; and a reliable count of unbilled metered accounts is unavailable.
		Meter upkeep and meter reading on these accounts is rare and not considered a priority.
		Due to poor recordkeeping and lack of auditing, water consumption for all such accounts is purely guesstimated.
2	✓	Billing practices exempt certain accounts, such as municipal buildings, but only scattered, dated written directives exist to justify this practice.
		A reliable count of unbilled metered accounts is unavailable.
		Sporadic meter replacement and meter reading occurs on an as-needed basis.
		The total annual water consumption for all unbilled, metered accounts is estimated based upon approximating the number of accounts and assigning consumption from actively billed accounts of same meter size.
3		Conditions between 2 and 4
4		Dated written procedures permit billing exemption for specific accounts, such as municipal properties, but are unclear regarding certain other types of accounts.
		Meter reading is given low priority and is sporadic.
		Consumption is quantified from meter readings where available.
		The total number of unbilled, unmetered accounts must be estimated along with consumption volumes.
5		Conditions between 4 and 6
6		Written policies regarding billing exemptions exist but adherence in practice is questionable.
		Metering and meter reading for municipal buildings is reliable but sporadic for other unbilled metered accounts.
		Periodic auditing of such accounts is conducted.
		Water consumption is quantified directly from meter readings where available, but the majority of the consumption is estimated.
7		Conditions between 6 and 8
8		Written policy identifies the types of accounts granted a billing exemption.
		Customer meter management and meter reading are considered secondary priorities, but meter reading is conducted at least annually to obtain consumption volumes for the annual water audit.
		High level auditing of billing records ensures that a reliable census of such accounts exists.
9	✓	Conditions between 8 and 10
10		Clearly written policy identifies the types of accounts given a billing exemption, with emphasis on keeping such accounts to a minimum.
	✓	Customer meter management and meter reading for these accounts is given proper priority and is reliably conducted.
	✓	Regular auditing confirms this.
	✓	Total water consumption for these accounts is taken from reliable readings from accurate meters.



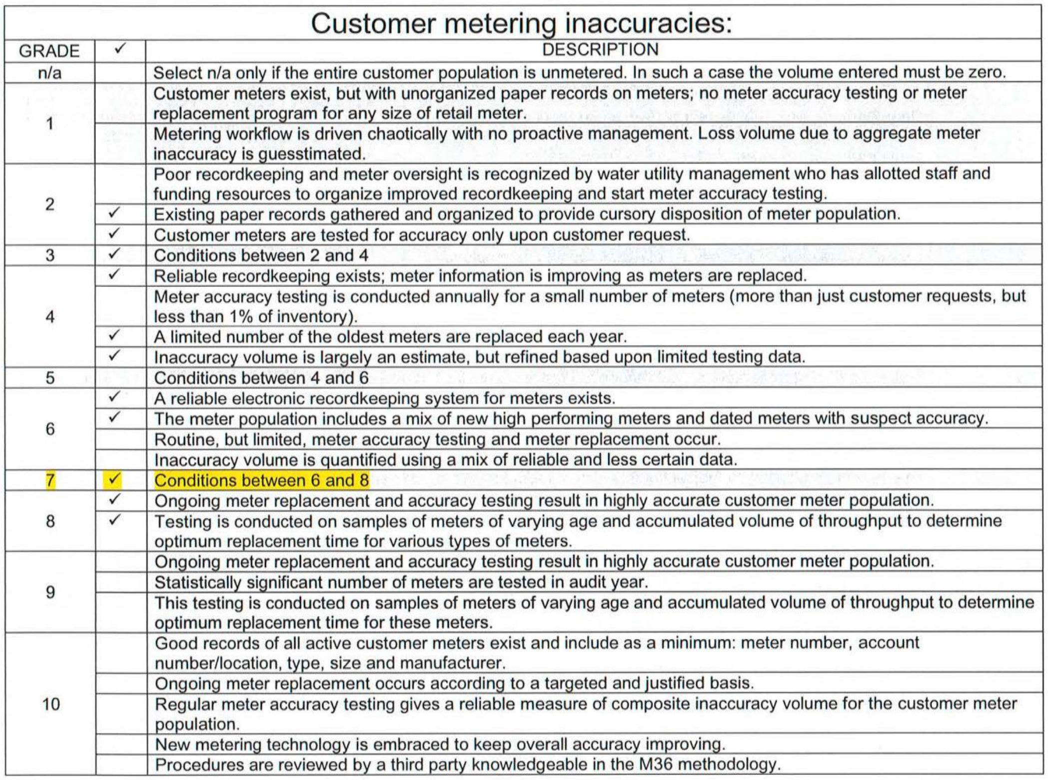
Unbilled Unmetered

GRADE	✓	DESCRIPTION
1		Extent of unbilled, unmetered consumption is unknown due to unclear policies and poor recordkeeping.
		Total consumption is quantified based upon a purely subjective estimate.
2		Clear extent of unbilled, unmetered consumption is unknown, but a number of events are randomly documented each year, confirming existence of such consumption, but without sufficient documentation to quantify an accurate estimate of the annual volume consumed.
3		Conditions between 2 and 4
4		Extent of unbilled, unmetered consumption is partially known, and procedures exist to document certain events such as miscellaneous fire hydrant uses.
		Formulae is used to quantify the consumption from such events (time running multiplied by typical flowrate, multiplied by number of events).
5	✓	Default value of 1.25% of system input volume is employed
6		Coherent policies exist for some forms of unbilled, unmetered consumption but others await closer evaluation.
		Reasonable recordkeeping for the managed uses exists and allows for annual volumes to be quantified by inference, but unsupervised uses are guesstimated.
7		Conditions between 6 and 8
8		Clear policies and good recordkeeping exist for some uses (ex: water used in periodic testing of unmetered fire connections), but other uses (ex: miscellaneous uses of fire hydrants) have limited oversight. Total consumption is a mix of well quantified use such as from formulae (time running multiplied by typical flow, multiplied by number of events) or temporary meters, and relatively subjective estimates of less regulated use.
9		Conditions between 8 and 10
10		Clear policies exist to identify permitted use of water in unbilled, unmetered fashion, with the intention of minimizing this type of consumption.
		Good records document each occurrence and consumption is quantified via formulae (time running multiplied by typical flow, multiplied by number of events) or use of temporary meters.



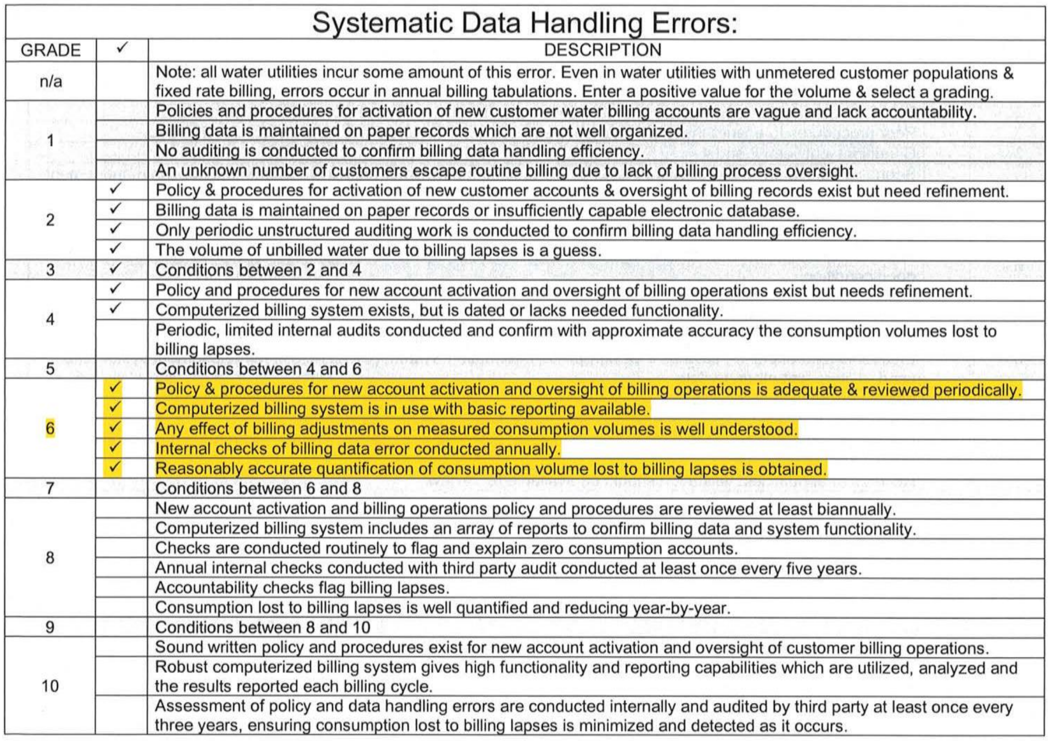
Unauthorized Consumption

GRADE	✓	DESCRIPTION
1		Extent of unauthorized consumption is unknown due to unclear policies and poor recordkeeping. Total unauthorized consumption is guesstimated.
2		Unauthorized consumption is a known occurrence, but its extent is a mystery. There are no requirements to document observed events, but periodic field reports capture some of these occurrences. Total unauthorized consumption is approximated from this limited data.
3		Conditions between 2 and 4
4		Procedures exist to document some unauthorized consumption such as observed unauthorized fire hydrant openings. Use formulae to quantify this consumption (time running multiplied typical flowrate, multiplied by number of events).
5		Default value of 0.25% of volume of water supplied is employed
6		Coherent policies exist for some forms of unauthorized consumption (more than simply fire hydrant misuse) but others await closer evaluation. Reasonable surveillance and recordkeeping exist for occurrences that fall under the policy. Volumes quantified by inference from these records.
7	✓	Conditions between 6 and 8
8		Clear policies and good auditable recordkeeping exist for certain events (ex: tampering with water meters, illegal bypasses of customer meters); but other occurrences have limited oversight. Total consumption is a combination of volumes from formulae (time x typical flow) and subjective estimates of unconfirmed consumption.
9		Conditions between 8 and 10
10		Clear policies exist to identify all known unauthorized uses of water. Staff and procedures exist to provide enforcement of policies and detect violations. Each occurrence is recorded and quantified via formulae (estimated time running multiplied by typical flow) or similar methods. All records and calculations should exist in a form that can be audited by a third party.



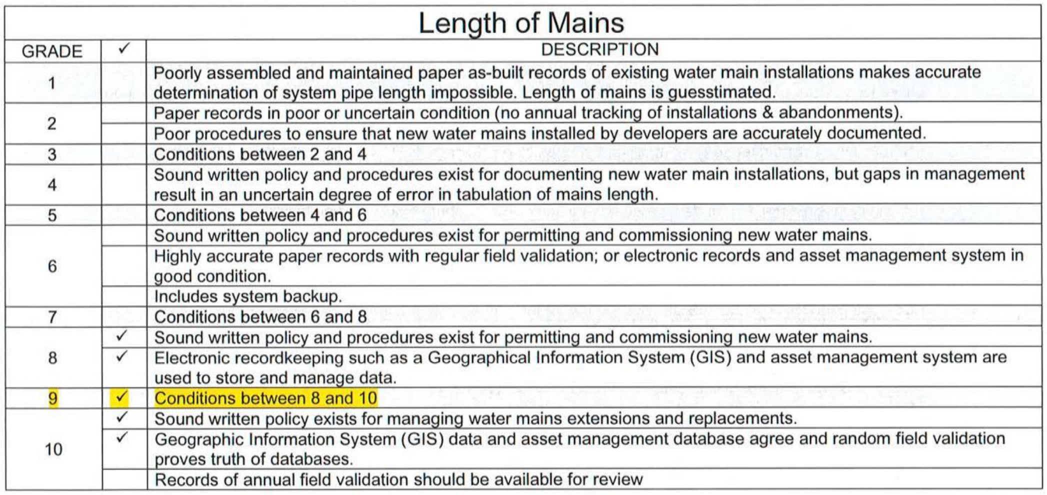
Customer metering inaccuracies:

GRADE	✓	DESCRIPTION
n/a		Select n/a only if the entire customer population is unmetered. In such a case the volume entered must be zero.
1		Customer meters exist, but with unorganized paper records on meters; no meter accuracy testing or meter replacement program for any size of retail meter.
		Metering workflow is driven chaotically with no proactive management. Loss volume due to aggregate meter inaccuracy is guesstimated.
2		Poor recordkeeping and meter oversight is recognized by water utility management who has allotted staff and funding resources to organize improved recordkeeping and start meter accuracy testing.
	✓	Existing paper records gathered and organized to provide cursory disposition of meter population.
	✓	Customer meters are tested for accuracy only upon customer request.
3	✓	Conditions between 2 and 4
4	✓	Reliable recordkeeping exists; meter information is improving as meters are replaced.
		Meter accuracy testing is conducted annually for a small number of meters (more than just customer requests, but less than 1% of inventory).
	✓	A limited number of the oldest meters are replaced each year.
	✓	Inaccuracy volume is largely an estimate, but refined based upon limited testing data.
5		Conditions between 4 and 6
6	✓	A reliable electronic recordkeeping system for meters exists.
	✓	The meter population includes a mix of new high performing meters and dated meters with suspect accuracy.
		Routine, but limited, meter accuracy testing and meter replacement occur.
		Inaccuracy volume is quantified using a mix of reliable and less certain data.
7	✓	Conditions between 6 and 8
8	✓	Ongoing meter replacement and accuracy testing result in highly accurate customer meter population.
	✓	Testing is conducted on samples of meters of varying age and accumulated volume of throughput to determine optimum replacement time for various types of meters.
9		Ongoing meter replacement and accuracy testing result in highly accurate customer meter population.
		Statistically significant number of meters are tested in audit year.
		This testing is conducted on samples of meters of varying age and accumulated volume of throughput to determine optimum replacement time for these meters.
10		Good records of all active customer meters exist and include as a minimum: meter number, account number/location, type, size and manufacturer.
		Ongoing meter replacement occurs according to a targeted and justified basis.
		Regular meter accuracy testing gives a reliable measure of composite inaccuracy volume for the customer meter population.
		New metering technology is embraced to keep overall accuracy improving.
		Procedures are reviewed by a third party knowledgeable in the M36 methodology.



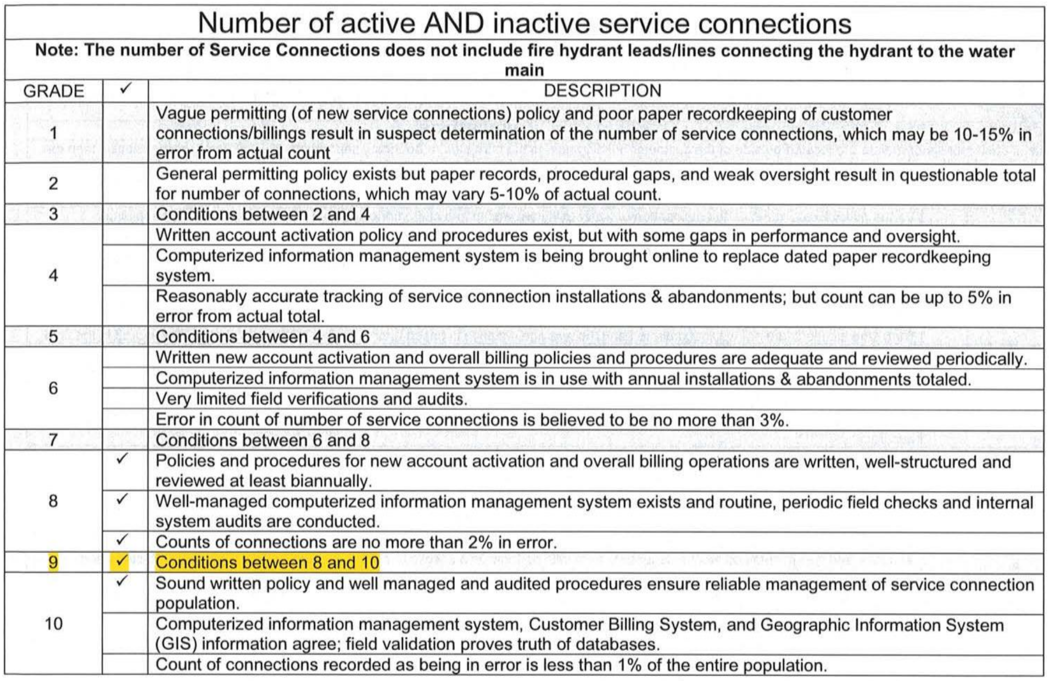
Systematic Data Handling Errors:

GRADE	✓	DESCRIPTION
n/a		Note: all water utilities incur some amount of this error. Even in water utilities with unmetered customer populations & fixed rate billing, errors occur in annual billing tabulations. Enter a positive value for the volume & select a grading.
1		Policies and procedures for activation of new customer water billing accounts are vague and lack accountability.
		Billing data is maintained on paper records which are not well organized.
		No auditing is conducted to confirm billing data handling efficiency.
		An unknown number of customers escape routine billing due to lack of billing process oversight.
2	✓	Policy & procedures for activation of new customer accounts & oversight of billing records exist but need refinement.
	✓	Billing data is maintained on paper records or insufficiently capable electronic database.
	✓	Only periodic unstructured auditing work is conducted to confirm billing data handling efficiency.
	✓	The volume of unbilled water due to billing lapses is a guess.
3	✓	Conditions between 2 and 4
4	✓	Policy and procedures for new account activation and oversight of billing operations exist but needs refinement.
	✓	Computerized billing system exists, but is dated or lacks needed functionality.
		Periodic, limited internal audits conducted and confirm with approximate accuracy the consumption volumes lost to billing lapses.
5		Conditions between 4 and 6
6	✓	Policy & procedures for new account activation and oversight of billing operations is adequate & reviewed periodically.
	✓	Computerized billing system is in use with basic reporting available.
	✓	Any effect of billing adjustments on measured consumption volumes is well understood.
	✓	Internal checks of billing data error conducted annually.
	✓	Reasonably accurate quantification of consumption volume lost to billing lapses is obtained.
7		Conditions between 6 and 8
8		New account activation and billing operations policy and procedures are reviewed at least biannually.
		Computerized billing system includes an array of reports to confirm billing data and system functionality.
		Checks are conducted routinely to flag and explain zero consumption accounts.
		Annual internal checks conducted with third party audit conducted at least once every five years.
		Accountability checks flag billing lapses.
		Consumption lost to billing lapses is well quantified and reducing year-by-year.
9		Conditions between 8 and 10
10		Sound written policy and procedures exist for new account activation and oversight of customer billing operations.
		Robust computerized billing system gives high functionality and reporting capabilities which are utilized, analyzed and the results reported each billing cycle.
		Assessment of policy and data handling errors are conducted internally and audited by third party at least once every three years, ensuring consumption lost to billing lapses is minimized and detected as it occurs.



Length of Mains

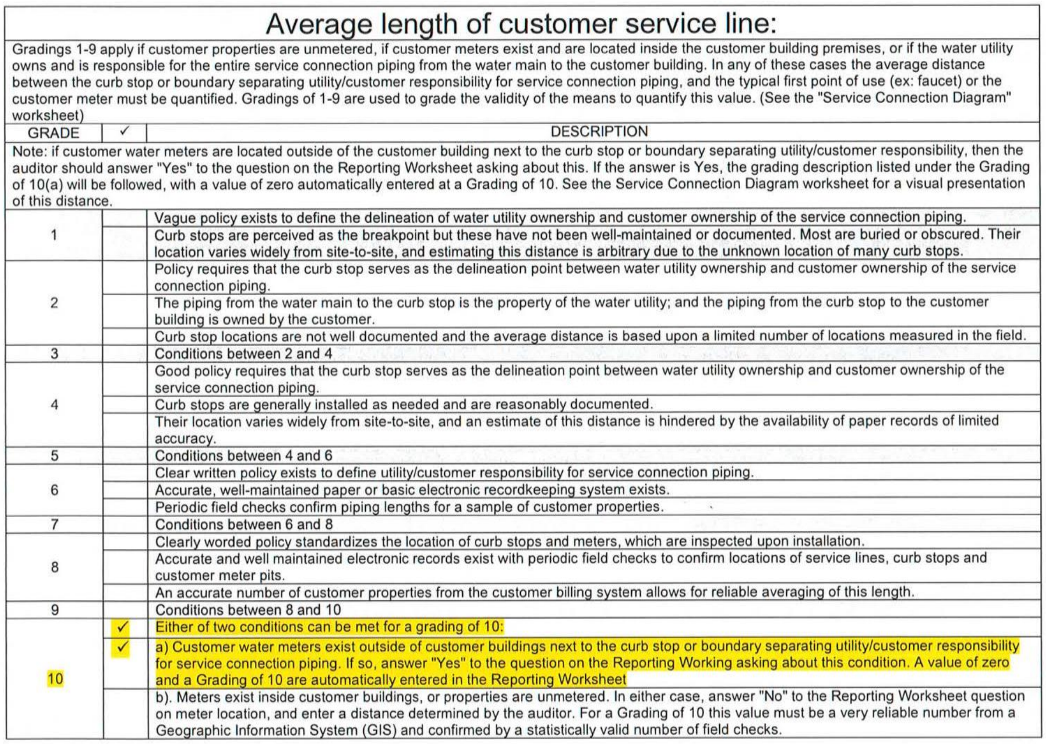
GRADE	✓	DESCRIPTION
1		Poorly assembled and maintained paper as-built records of existing water main installations makes accurate determination of system pipe length impossible. Length of mains is guesstimated.
2		Paper records in poor or uncertain condition (no annual tracking of installations & abandonments).
		Poor procedures to ensure that new water mains installed by developers are accurately documented.
3		Conditions between 2 and 4
4		Sound written policy and procedures exist for documenting new water main installations, but gaps in management result in an uncertain degree of error in tabulation of mains length.
5		Conditions between 4 and 6
6		Sound written policy and procedures exist for permitting and commissioning new water mains.
		Highly accurate paper records with regular field validation; or electronic records and asset management system in good condition.
		Includes system backup.
7		Conditions between 6 and 8
8	✓	Sound written policy and procedures exist for permitting and commissioning new water mains.
	✓	Electronic recordkeeping such as a Geographical Information System (GIS) and asset management system are used to store and manage data.
9	✓	Conditions between 8 and 10
10	✓	Sound written policy exists for managing water mains extensions and replacements.
	✓	Geographic Information System (GIS) data and asset management database agree and random field validation proves truth of databases.
		Records of annual field validation should be available for review



Number of active AND inactive service connections

Note: The number of Service Connections does not include fire hydrant leads/lines connecting the hydrant to the water main

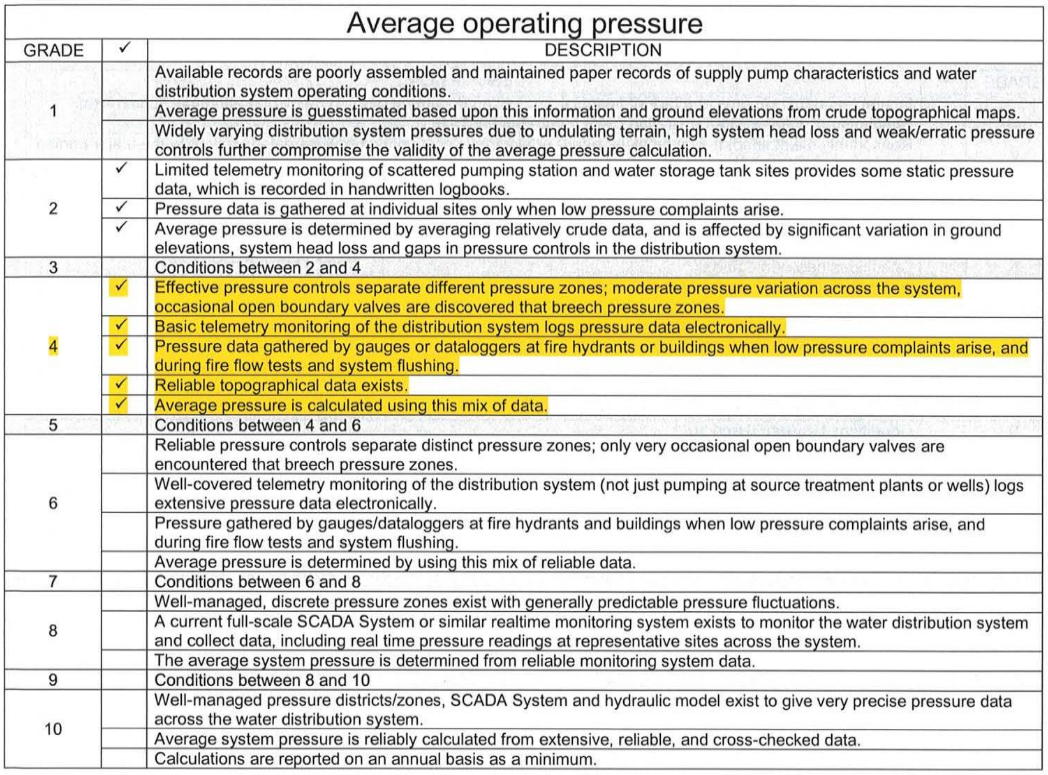
GRADE	✓	DESCRIPTION
1		Vague permitting (of new service connections) policy and poor paper recordkeeping of customer connections/billings result in suspect determination of the number of service connections, which may be 10-15% in error from actual count
2		General permitting policy exists but paper records, procedural gaps, and weak oversight result in questionable total for number of connections, which may vary 5-10% of actual count.
3		Conditions between 2 and 4
4		Written account activation policy and procedures exist, but with some gaps in performance and oversight.
		Computerized information management system is being brought online to replace dated paper recordkeeping system.
		Reasonably accurate tracking of service connection installations & abandonments; but count can be up to 5% in error from actual total.
5		Conditions between 4 and 6
6		Written new account activation and overall billing policies and procedures are adequate and reviewed periodically.
		Computerized information management system is in use with annual installations & abandonments totaled.
		Very limited field verifications and audits.
		Error in count of number of service connections is believed to be no more than 3%.
7		Conditions between 6 and 8
8	✓	Policies and procedures for new account activation and overall billing operations are written, well-structured and reviewed at least biannually.
	✓	Well-managed computerized information management system exists and routine, periodic field checks and internal system audits are conducted.
	✓	Counts of connections are no more than 2% in error.
9	✓	Conditions between 8 and 10
10	✓	Sound written policy and well managed and audited procedures ensure reliable management of service connection population.
		Computerized information management system, Customer Billing System, and Geographic Information System (GIS) information agree; field validation proves truth of databases.
		Count of connections recorded as being in error is less than 1% of the entire population.



Average length of customer service line:

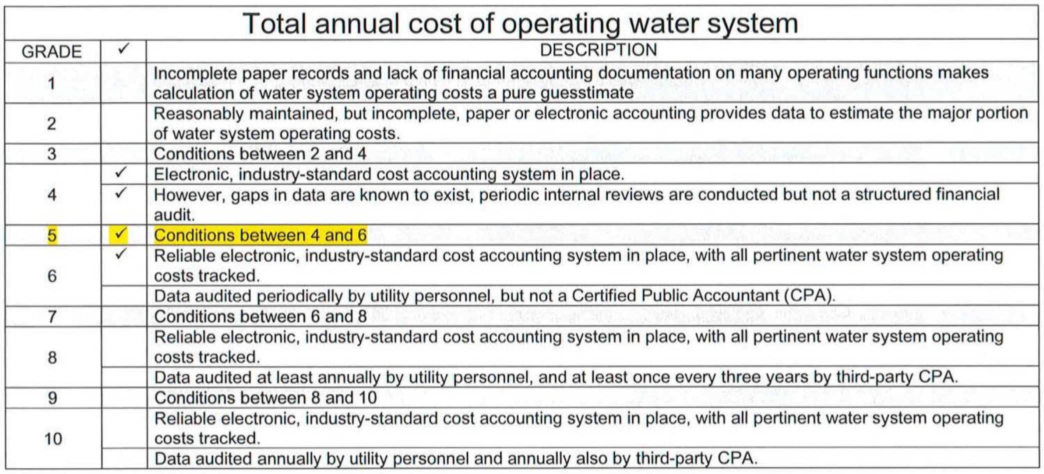
Gradings 1-9 apply if customer properties are unmetered, if customer meters exist and are located inside the customer building premises, or if the water utility owns and is responsible for the entire service connection piping from the water main to the customer building. In any of these cases the average distance between the curb stop or boundary separating utility/customer responsibility for service connection piping, and the typical first point of use (ex: faucet) or the customer meter must be quantified. Gradings of 1-9 are used to grade the validity of the means to quantify this value. (See the "Service Connection Diagram" worksheet)

GRADE	✓	DESCRIPTION
Note: if customer water meters are located outside of the customer building next to the curb stop or boundary separating utility/customer responsibility, then the auditor should answer "Yes" to the question on the Reporting Worksheet asking about this. If the answer is Yes, the grading description listed under the Grading of 10(a) will be followed, with a value of zero automatically entered at a Grading of 10. See the Service Connection Diagram worksheet for a visual presentation of this distance.		
1		Vague policy exists to define the delineation of water utility ownership and customer ownership of the service connection piping.
		Curb stops are perceived as the breakpoint but these have not been well-maintained or documented. Most are buried or obscured. Their location varies widely from site-to-site, and estimating this distance is arbitrary due to the unknown location of many curb stops.
2		Policy requires that the curb stop serves as the delineation point between water utility ownership and customer ownership of the service connection piping.
		The piping from the water main to the curb stop is the property of the water utility; and the piping from the curb stop to the customer building is owned by the customer.
		Curb stop locations are not well documented and the average distance is based upon a limited number of locations measured in the field.
3		Conditions between 2 and 4
4		Good policy requires that the curb stop serves as the delineation point between water utility ownership and customer ownership of the service connection piping.
		Curb stops are generally installed as needed and are reasonably documented.
		Their location varies widely from site-to-site, and an estimate of this distance is hindered by the availability of paper records of limited accuracy.
5		Conditions between 4 and 6
6		Clear written policy exists to define utility/customer responsibility for service connection piping.
		Accurate, well-maintained paper or basic electronic recordkeeping system exists.
		Periodic field checks confirm piping lengths for a sample of customer properties.
7		Conditions between 6 and 8
8		Clearly worded policy standardizes the location of curb stops and meters, which are inspected upon installation.
		Accurate and well maintained electronic records exist with periodic field checks to confirm locations of service lines, curb stops and customer meter pits.
		An accurate number of customer properties from the customer billing system allows for reliable averaging of this length.
9		Conditions between 8 and 10
10	✓	Either of two conditions can be met for a grading of 10:
	✓	a) Customer water meters exist outside of customer buildings next to the curb stop or boundary separating utility/customer responsibility for service connection piping. If so, answer "Yes" to the question on the Reporting Working asking about this condition. A value of zero and a Grading of 10 are automatically entered in the Reporting Worksheet
		b). Meters exist inside customer buildings, or properties are unmetered. In either case, answer "No" to the Reporting Worksheet question on meter location, and enter a distance determined by the auditor. For a Grading of 10 this value must be a very reliable number from a Geographic Information System (GIS) and confirmed by a statistically valid number of field checks.



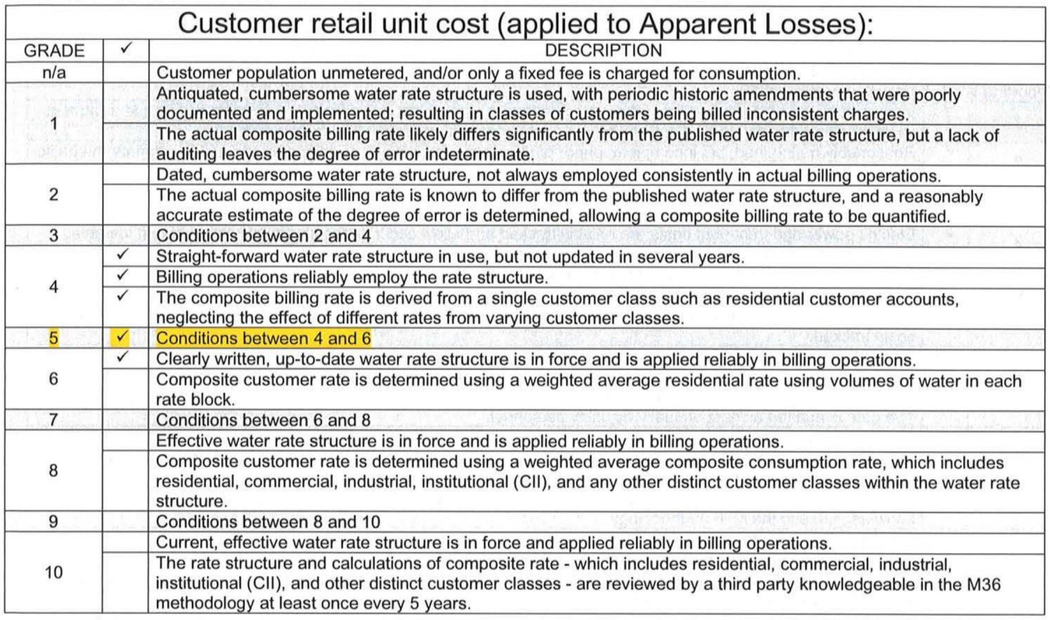
Average operating pressure

GRADE	✓	DESCRIPTION
1		Available records are poorly assembled and maintained paper records of supply pump characteristics and water distribution system operating conditions.
		Average pressure is guesstimated based upon this information and ground elevations from crude topographical maps.
		Widely varying distribution system pressures due to undulating terrain, high system head loss and weak/erratic pressure controls further compromise the validity of the average pressure calculation.
2	✓	Limited telemetry monitoring of scattered pumping station and water storage tank sites provides some static pressure data, which is recorded in handwritten logbooks.
	✓	Pressure data is gathered at individual sites only when low pressure complaints arise.
	✓	Average pressure is determined by averaging relatively crude data, and is affected by significant variation in ground elevations, system head loss and gaps in pressure controls in the distribution system.
3		Conditions between 2 and 4
4	✓	Effective pressure controls separate different pressure zones; moderate pressure variation across the system, occasional open boundary valves are discovered that breech pressure zones.
	✓	Basic telemetry monitoring of the distribution system logs pressure data electronically.
	✓	Pressure data gathered by gauges or dataloggers at fire hydrants or buildings when low pressure complaints arise, and during fire flow tests and system flushing.
	✓	Reliable topographical data exists.
	✓	Average pressure is calculated using this mix of data.
5		Conditions between 4 and 6
6		Reliable pressure controls separate distinct pressure zones; only very occasional open boundary valves are encountered that breech pressure zones.
		Well-covered telemetry monitoring of the distribution system (not just pumping at source treatment plants or wells) logs extensive pressure data electronically.
		Pressure gathered by gauges/dataloggers at fire hydrants and buildings when low pressure complaints arise, and during fire flow tests and system flushing.
		Average pressure is determined by using this mix of reliable data.
7		Conditions between 6 and 8
8		Well-managed, discrete pressure zones exist with generally predictable pressure fluctuations.
		A current full-scale SCADA System or similar realtime monitoring system exists to monitor the water distribution system and collect data, including real time pressure readings at representative sites across the system.
		The average system pressure is determined from reliable monitoring system data.
9		Conditions between 8 and 10
10		Well-managed pressure districts/zones, SCADA System and hydraulic model exist to give very precise pressure data across the water distribution system.
		Average system pressure is reliably calculated from extensive, reliable, and cross-checked data.
		Calculations are reported on an annual basis as a minimum.



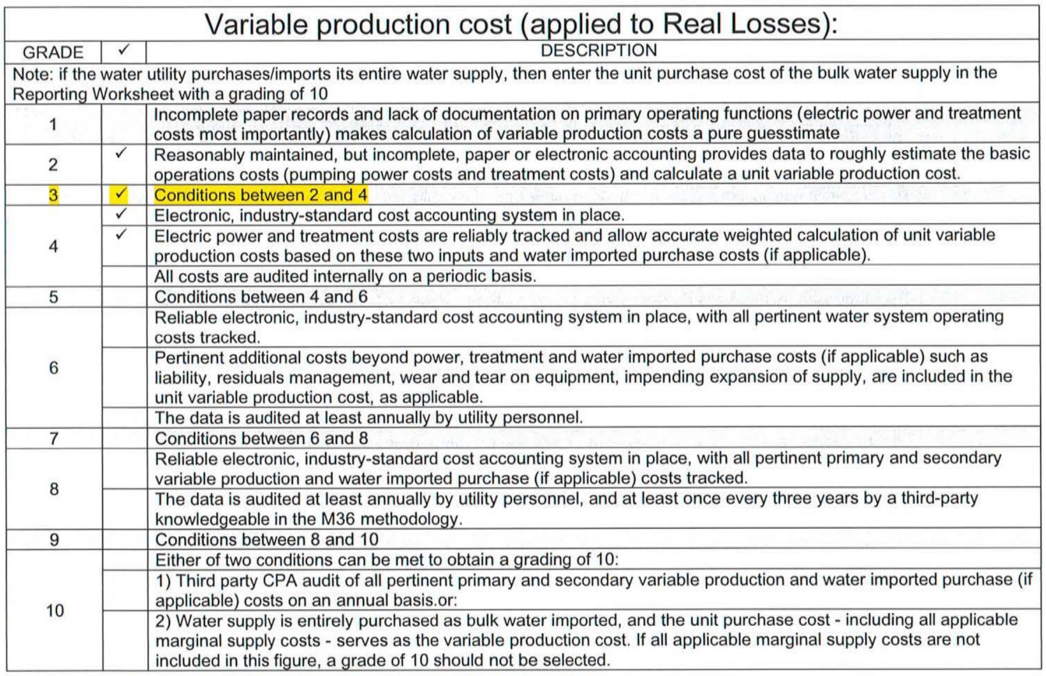
Total annual cost of operating water system

GRADE	✓	DESCRIPTION
1		Incomplete paper records and lack of financial accounting documentation on many operating functions makes calculation of water system operating costs a pure guesstimate
2		Reasonably maintained, but incomplete, paper or electronic accounting provides data to estimate the major portion of water system operating costs.
3		Conditions between 2 and 4
4	✓	Electronic, industry-standard cost accounting system in place.
	✓	However, gaps in data are known to exist, periodic internal reviews are conducted but not a structured financial audit.
5	✓	Conditions between 4 and 6
6	✓	Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked.
		Data audited periodically by utility personnel, but not a Certified Public Accountant (CPA).
7		Conditions between 6 and 8
8		Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked.
		Data audited at least annually by utility personnel, and at least once every three years by third-party CPA.
9		Conditions between 8 and 10
10		Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked.
		Data audited annually by utility personnel and annually also by third-party CPA.



Customer retail unit cost (applied to Apparent Losses):

GRADE	✓	DESCRIPTION
n/a		Customer population unmetered, and/or only a fixed fee is charged for consumption.
1		Antiquated, cumbersome water rate structure is used, with periodic historic amendments that were poorly documented and implemented; resulting in classes of customers being billed inconsistent charges.
		The actual composite billing rate likely differs significantly from the published water rate structure, but a lack of auditing leaves the degree of error indeterminate.
2		Dated, cumbersome water rate structure, not always employed consistently in actual billing operations.
		The actual composite billing rate is known to differ from the published water rate structure, and a reasonably accurate estimate of the degree of error is determined, allowing a composite billing rate to be quantified.
3		Conditions between 2 and 4
4	✓	Straight-forward water rate structure in use, but not updated in several years.
	✓	Billing operations reliably employ the rate structure.
	✓	The composite billing rate is derived from a single customer class such as residential customer accounts, neglecting the effect of different rates from varying customer classes.
5	✓	Conditions between 4 and 6
6	✓	Clearly written, up-to-date water rate structure is in force and is applied reliably in billing operations.
		Composite customer rate is determined using a weighted average residential rate using volumes of water in each rate block.
7		Conditions between 6 and 8
8		Effective water rate structure is in force and is applied reliably in billing operations.
		Composite customer rate is determined using a weighted average composite consumption rate, which includes residential, commercial, industrial, institutional (CII), and any other distinct customer classes within the water rate structure.
9		Conditions between 8 and 10
10		Current, effective water rate structure is in force and applied reliably in billing operations.
		The rate structure and calculations of composite rate - which includes residential, commercial, industrial, institutional (CII), and other distinct customer classes - are reviewed by a third party knowledgeable in the M36 methodology at least once every 5 years.

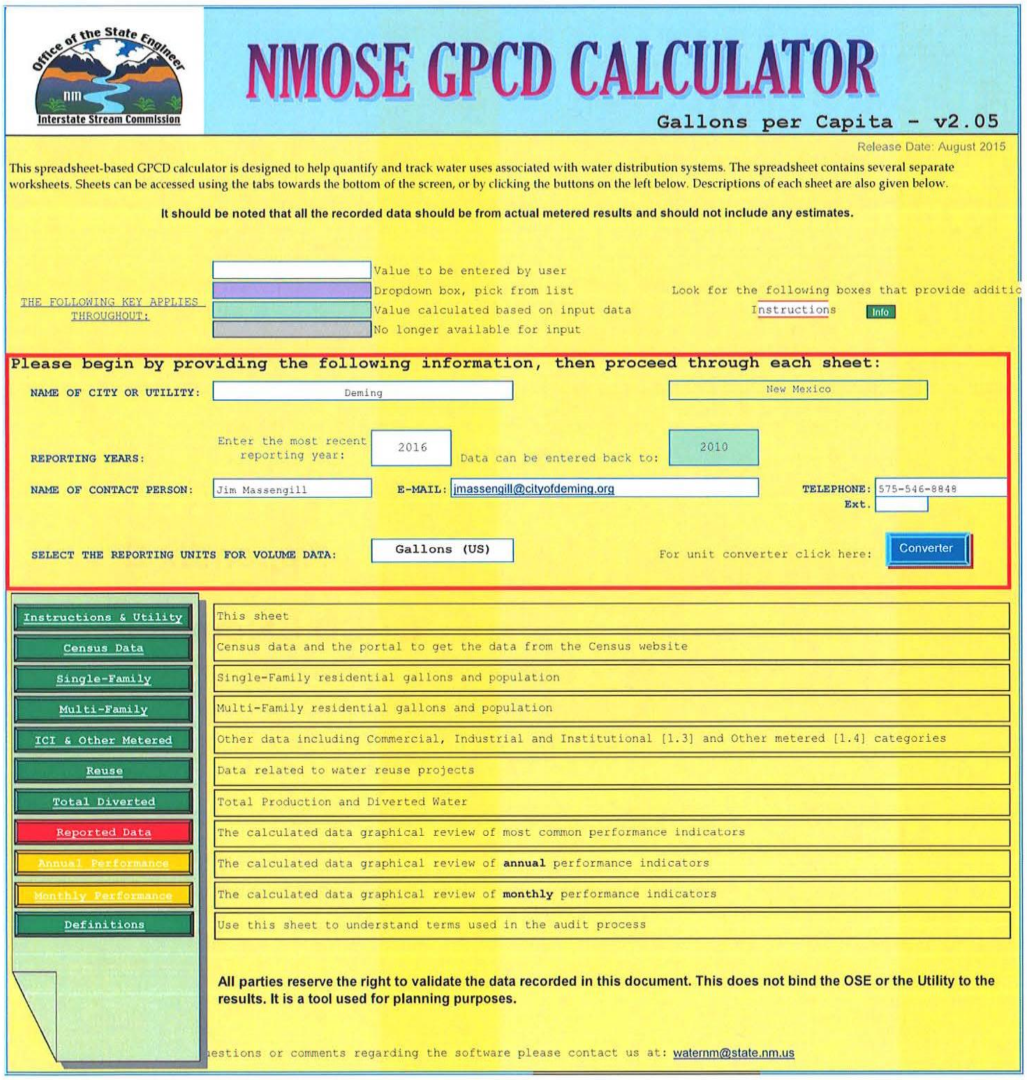


Variable production cost (applied to Real Losses):

GRADE	✓	DESCRIPTION
Note: if the water utility purchases/imports its entire water supply, then enter the unit purchase cost of the bulk water supply in the Reporting Worksheet with a grading of 10		
1		Incomplete paper records and lack of documentation on primary operating functions (electric power and treatment costs most importantly) makes calculation of variable production costs a pure guesstimate
2	✓	Reasonably maintained, but incomplete, paper or electronic accounting provides data to roughly estimate the basic operations costs (pumping power costs and treatment costs) and calculate a unit variable production cost.
3	✓	Conditions between 2 and 4
4	✓	Electronic, industry-standard cost accounting system in place.
	✓	Electric power and treatment costs are reliably tracked and allow accurate weighted calculation of unit variable production costs based on these two inputs and water imported purchase costs (if applicable).
		All costs are audited internally on a periodic basis.
5		Conditions between 4 and 6
6		Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked.
		Pertinent additional costs beyond power, treatment and water imported purchase costs (if applicable) such as liability, residuals management, wear and tear on equipment, impending expansion of supply, are included in the unit variable production cost, as applicable.
		The data is audited at least annually by utility personnel.
7		Conditions between 6 and 8
8		Reliable electronic, industry-standard cost accounting system in place, with all pertinent primary and secondary variable production and water imported purchase (if applicable) costs tracked.
		The data is audited at least annually by utility personnel, and at least once every three years by a third-party knowledgeable in the M36 methodology.
9		Conditions between 8 and 10
10		Either of two conditions can be met to obtain a grading of 10:
		1) Third party CPA audit of all pertinent primary and secondary variable production and water imported purchase (if applicable) costs on an annual basis.or:
		2) Water supply is entirely purchased as bulk water imported, and the unit purchase cost - including all applicable marginal supply costs - serves as the variable production cost. If all applicable marginal supply costs are not included in this figure, a grade of 10 should not be selected.

Appendix B

GPCD Calculator



NMOSE GPCD CALCULATOR

Gallons per Capita - v2.05

Release Date: August 2015

This spreadsheet-based GPCD calculator is designed to help quantify and track water uses associated with water distribution systems. The spreadsheet contains several separate worksheets. Sheets can be accessed using the tabs towards the bottom of the screen, or by clicking the buttons on the left below. Descriptions of each sheet are also given below.

It should be noted that all the recorded data should be from actual metered results and should not include any estimates.

THE FOLLOWING KEY APPLIES THROUGHOUT:

☐ Value to be entered by user
▨ Dropdown box, pick from list
🟩 Value calculated based on input data
▨ No longer available for input

Look for the following boxes that provide additic
Instructions Info

Please begin by providing the following information, then proceed through each sheet:

NAME OF CITY OR UTILITY: Deming New Mexico

REPORTING YEARS: Enter the most recent reporting year: 2016 Data can be entered back to: 2010

NAME OF CONTACT PERSON: Jim Massengill **E-MAIL:** jmassengill@cityofdeming.org **TELEPHONE:** 575-546-8848 **Ext.**

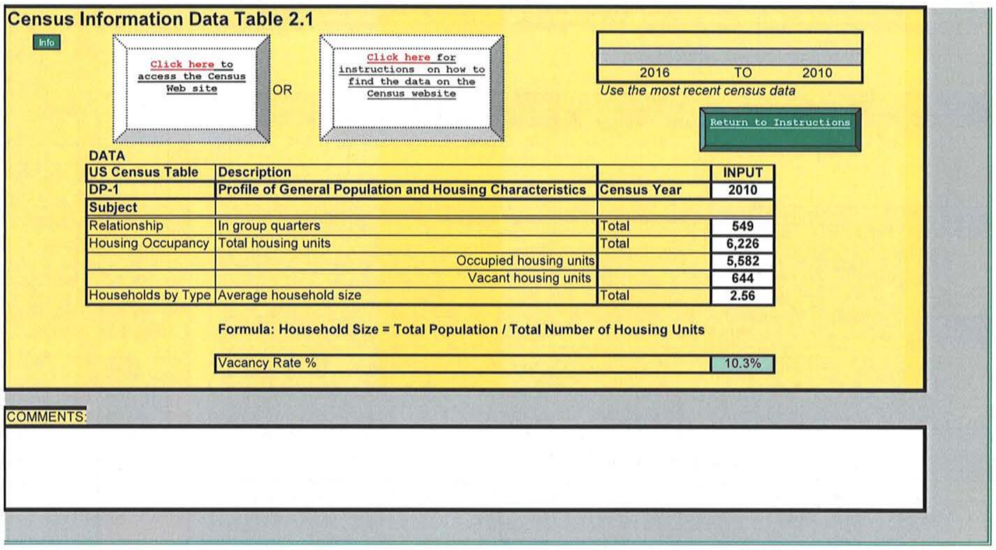
SELECT THE REPORTING UNITS FOR VOLUME DATA: Gallons (US) For unit converter click here: Converter

Instructions & Utility	This sheet
Census Data	Census data and the portal to get the data from the Census website
Single-Family	Single-Family residential gallons and population
Multi-Family	Multi-Family residential gallons and population
ICI & Other Metered	Other data including Commercial, Industrial and Institutional [1.3] and Other metered [1.4] categories
Reuse	Data related to water reuse projects
Total Diverted	Total Production and Diverted Water
Reported Data	The calculated data graphical review of most common performance indicators
Annual Performance	The calculated data graphical review of **annual** performance indicators
Monthly Performance	The calculated data graphical review of **monthly** performance indicators
Definitions	Use this sheet to understand terms used in the audit process

All parties reserve the right to validate the data recorded in this document. This does not bind the OSE or the Utility to the results. It is a tool used for planning purposes.

estions or comments regarding the software please contact us at: watermn@state.nm.us

NMOSE GPCD Calculator v2.02 1



Census Information Data Table 2.1

2016 TO 2010

Use the most recent census data

DATA

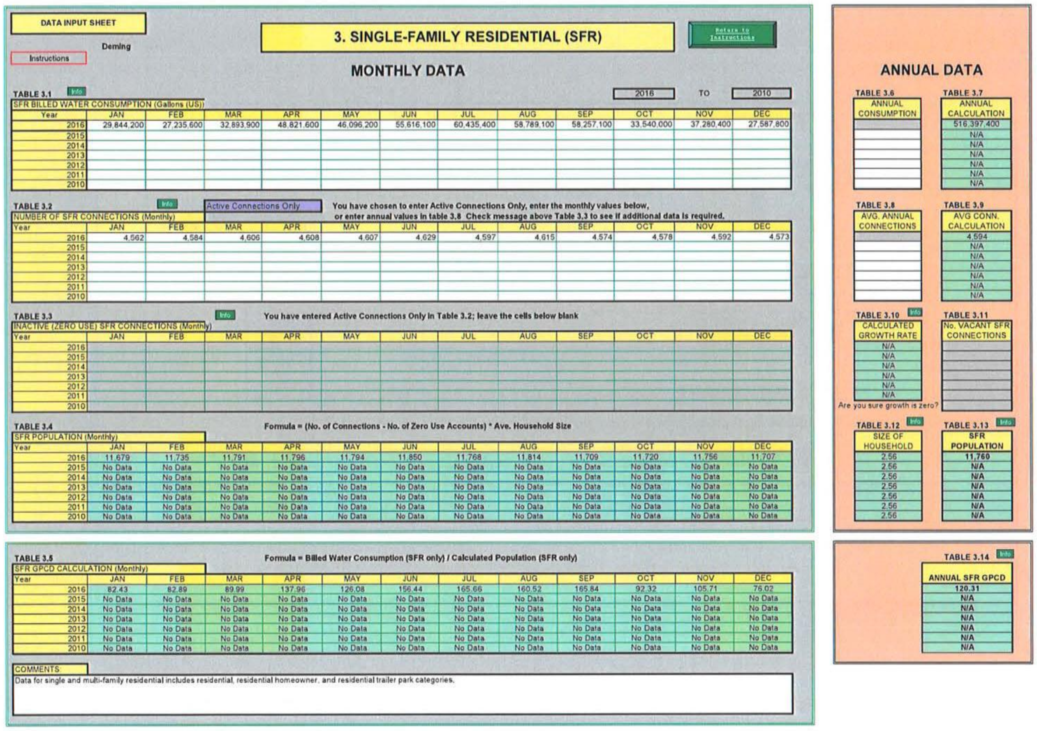
US Census Table	Description		INPUT
DP-1	Profile of General Population and Housing Characteristics	Census Year	2010
Subject			
Relationship	In group quarters	Total	549
Housing Occupancy	Total housing units	Total	6,226
	Occupied housing units		5,582
	Vacant housing units		644
Households by Type	Average household size	Total	2.56

Formula: Household Size = Total Population / Total Number of Housing Units

Vacancy Rate %	10.3%

COMMENTS:

NMOSE GPCD Calculator v2.02



DATA INPUT SHEET

Deming

Instructions

3. SINGLE-FAMILY RESIDENTIAL (SFR)

MONTHLY DATA

TABLE 3.1

2016 TO 2010

SFR BILLED WATER CONSUMPTION (Gallons (US))

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2016	29,844,200	27,235,600	32,893,900	48,821,600	46,096,200	55,616,100	60,435,400	58,789,100	58,257,100	33,540,000	37,280,400	27,587,800
2015												
2014												
2013												
2012												
2011												
2010												

TABLE 3.2

Active Connections Only

You have chosen to enter Active Connections Only, enter the monthly values below, or enter annual values in table 3.8 Check message above Table 3.3 to see if additional data is required.

NUMBER OF SFR CONNECTIONS (Monthly)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2016	4,562	4,584	4,606	4,608	4,607	4,629	4,597	4,615	4,574	4,578	4,592	4,573
2015												
2014												
2013												
2012												
2011												
2010												

TABLE 3.3

You have entered Active Connections Only in Table 3.2; leave the cells below blank

INACTIVE (ZERO USE) SFR CONNECTIONS (Monthly)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2016												
2015												
2014												
2013												
2012												
2011												
2010												

TABLE 3.4

Formula = (No. of Connections - No. of Zero Use Accounts) * Ave. Household Size

SFR POPULATION (Monthly)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2016	11,679	11,735	11,791	11,796	11,794	11,850	11,768	11,814	11,709	11,720	11,756	11,707
2015	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2014	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2013	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2012	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2011	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2010	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data

ANNUAL DATA

TABLE 3.6

ANNUAL CONSUMPTION

TABLE 3.7

ANNUAL CALCULATION
516,397,400
N/A
N/A
N/A
N/A
N/A
N/A

TABLE 3.8

AVG. ANNUAL CONNECTIONS

TABLE 3.9

AVG CONN. CALCULATION
4,594
N/A
N/A
N/A
N/A
N/A
N/A

TABLE 3.10

CALCULATED GROWTH RATE
N/A
N/A
N/A
N/A
N/A
N/A

Are you sure growth is zero?

TABLE 3.11

No. VACANT SFR CONNECTIONS

TABLE 3.12

SIZE OF HOUSEHOLD
2.56
2.56
2.56
2.56
2.56
2.56
2.56

TABLE 3.13

SFR POPULATION
11,760
N/A
N/A
N/A
N/A
N/A
N/A

TABLE 3.5

Formula = Billed Water Consumption (SFR only) / Calculated Population (SFR only)

SFR GPCD CALCULATION (Monthly)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2016	82.43	82.89	89.99	137.96	126.08	156.44	165.66	160.52	165.84	92.32	105.71	76.02
2015	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2014	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2013	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2012	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2011	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2010	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data

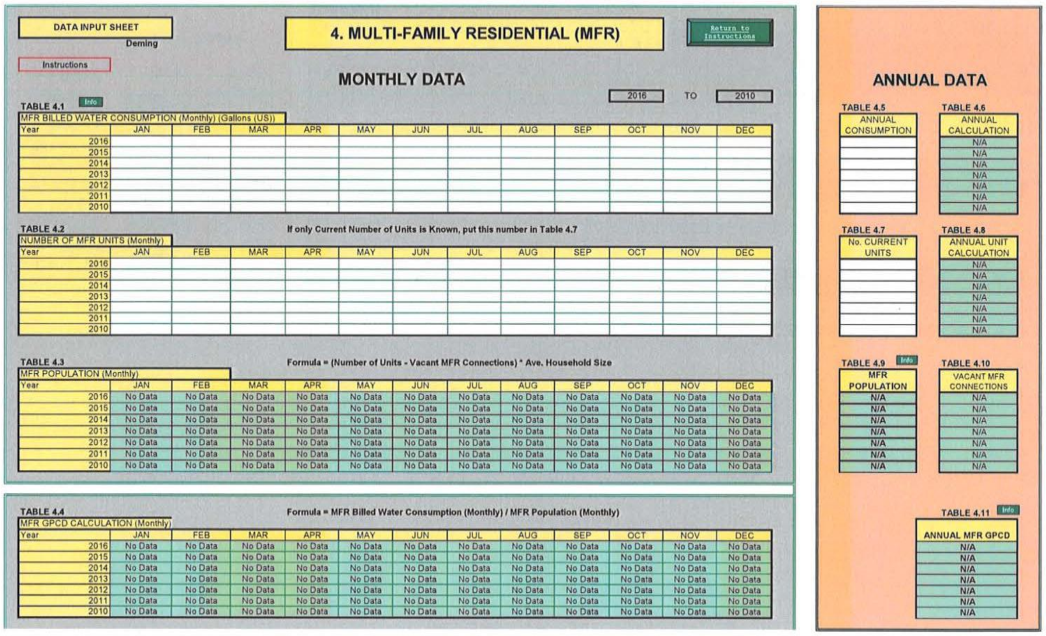
COMMENTS:

Data for single and multi-family residential includes residential, residential homeowner, and residential trailer park categories.

TABLE 3.14

ANNUAL SFR GPCD
120.31
N/A
N/A
N/A
N/A
N/A
N/A

NMOSE GPCD Calculator v2.02



DATA INPUT SHEET

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4. MULTI-FAMILY RESIDENTIAL (MFR)

MONTHLY DATA

2016 TO 2010

TABLE 4.1

MFR BILLED WATER CONSUMPTION (Monthly) (Gallons (US))

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2016												
2015												
2014												
2013												
2012												
2011												
2010												

TABLE 4.2

If only Current Number of Units is Known, put this number in Table 4.7

NUMBER OF MFR UNITS (Monthly)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2016												
2015												
2014												
2013												
2012												
2011												
2010												

TABLE 4.3

Formula = (Number of Units - Vacant MFR Connections) * Ave. Household Size

MFR POPULATION (Monthly)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2016	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2015	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2014	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2013	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2012	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2011	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2010	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data

TABLE 4.4

Formula = MFR Billed Water Consumption (Monthly) / MFR Population (Monthly)

MFR GPCD CALCULATION (Monthly)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2016	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2015	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2014	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2013	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2012	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2011	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2010	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data

ANNUAL DATA

TABLE 4.5 ANNUAL CONSUMPTION	TABLE 4.6 ANNUAL CALCULATION
	N/A
	N/A
	N/A
	N/A
	N/A
	N/A
	N/A

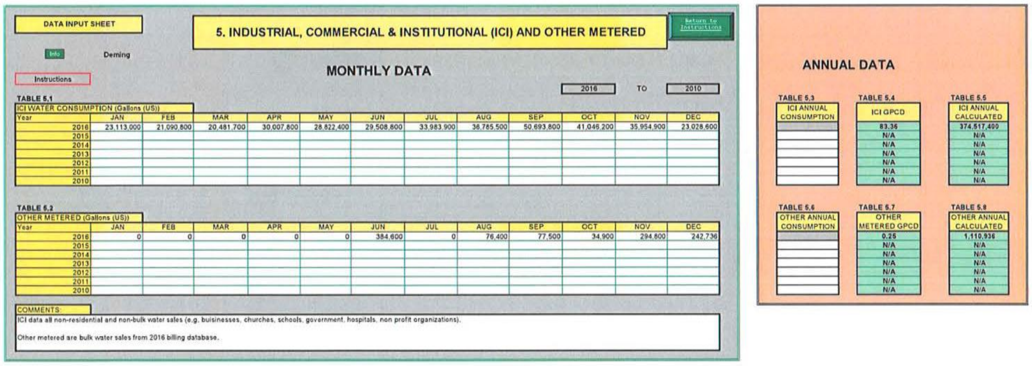
TABLE 4.7 No. CURRENT UNITS	TABLE 4.8 ANNUAL UNIT CALCULATION
	N/A
	N/A
	N/A
	N/A
	N/A
	N/A
	N/A

TABLE 4.9 MFR POPULATION	TABLE 4.10 VACANT MFR CONNECTIONS
N/A	N/A
N/A	N/A
N/A	N/A
N/A	N/A
N/A	N/A
N/A	N/A
N/A	N/A

TABLE 4.11

ANNUAL MFR GPCD
N/A
N/A
N/A
N/A
N/A
N/A
N/A

NMOSE GPCD Calculator v2.02



DATA INPUT SHEET

5. INDUSTRIAL, COMMERCIAL & INSTITUTIONAL (ICI) AND OTHER METERED

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Info Deming

Instructions

MONTHLY DATA

2016 TO 2010

TABLE 5.1

ICI WATER CONSUMPTION (Gallons (US))

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2016	23,113,000	21,090,800	20,481,700	30,007,800	28,822,400	29,508,800	33,983,900	36,785,500	50,693,800	41,046,200	35,954,900	23,028,600
2015												
2014												
2013												
2012												
2011												
2010												

TABLE 5.2

OTHER METERED (Gallons (US))

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2016	0	0	0	0	0	384,600	0	76,400	77,500	34,900	294,800	242,736
2015												
2014												
2013												
2012												
2011												
2010												

COMMENTS:

ICI data all non-residential and non-bulk water sales (e.g. buisinesses, churches, schools, government, hospitals, non profit organizations).

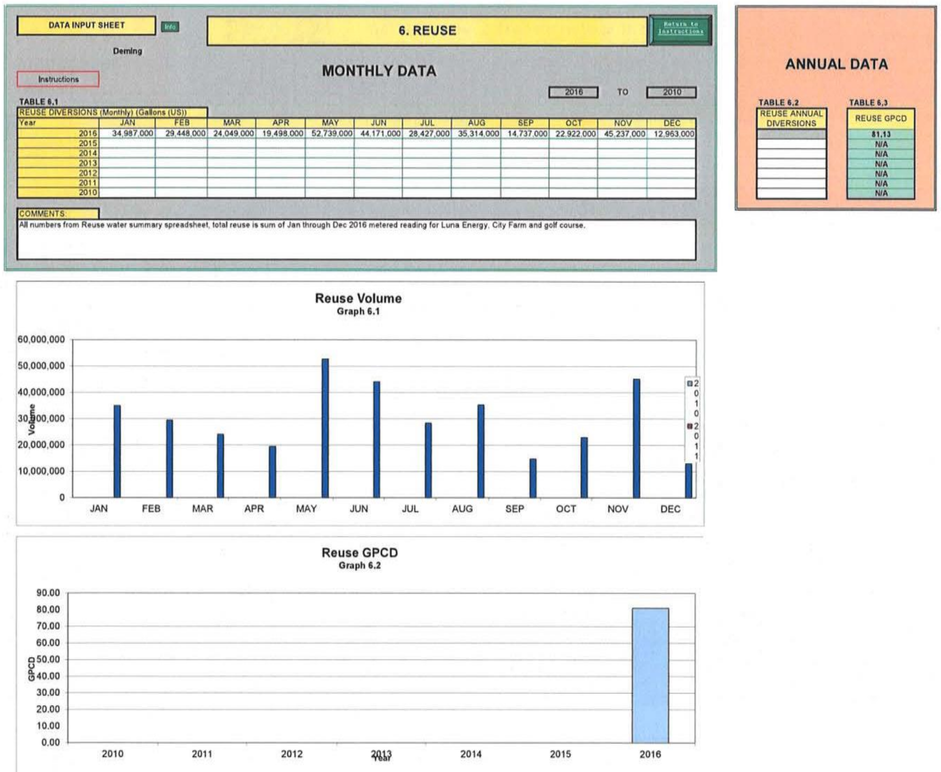
Other metered are bulk water sales from 2016 billing database.

ANNUAL DATA

TABLE 5.3 ICI ANNUAL CONSUMPTION	TABLE 5.4 ICI GPCD	TABLE 5.5 ICI ANNUAL CALCULATED
	83.36	374,517,400
	N/A	N/A
	N/A	N/A
	N/A	N/A
	N/A	N/A
	N/A	N/A
	N/A	N/A

TABLE 5.6 OTHER ANNUAL CONSUMPTION	TABLE 5.7 OTHER METERED GPCD	TABLE 5.8 OTHER ANNUAL CALCULATED
	0.25	1,110,936
	N/A	N/A
	N/A	N/A
	N/A	N/A
	N/A	N/A
	N/A	N/A
	N/A	N/A

NMOSE GPCD Calculator v2.02



DATA INPUT SHEET

Info

6. REUSE

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MONTHLY DATA

2016 TO 2010

TABLE 6.1

REUSE DIVERSIONS (Monthly) (Gallons (US))

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2016	34,987,000	29,448,000	24,049,000	19,498,000	52,739,000	44,171,000	28,427,000	35,314,000	14,737,000	22,922,000	45,237,000	12,963,000
2015												
2014												
2013												
2012												
2011												
2010												

COMMENTS:

All numbers from Reuse water summary spreadsheet, total reuse is sum of Jan through Dec 2016 metered reading for Luna Energy, City Farm and golf course.

ANNUAL DATA

TABLE 6.2

REUSE ANNUAL DIVERSIONS

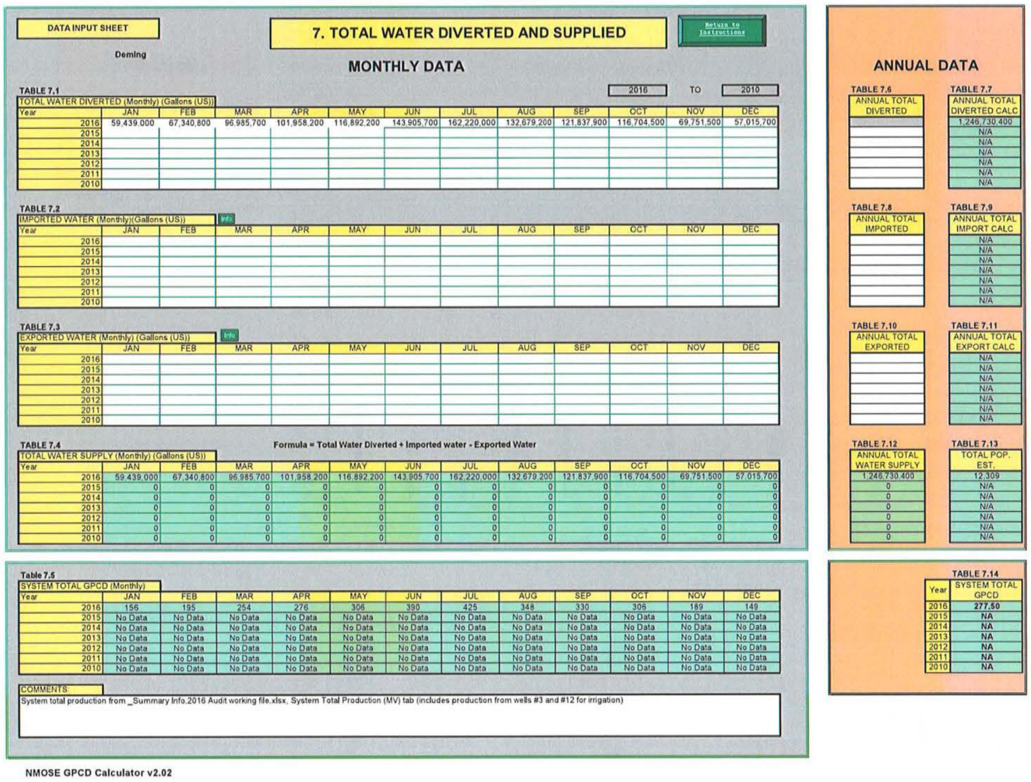
TABLE 6.3

REUSE GPCD
81.13
N/A
N/A
N/A
N/A
N/A
N/A

Reuse Volume
Graph 6.1

Reuse GPCD
Graph 6.2

NMOSE GPCD Calculator v2.02



DATA INPUT SHEET

Deming

7. TOTAL WATER DIVERTED AND SUPPLIED

MONTHLY DATA

2016 TO 2010

TABLE 7.1

TOTAL WATER DIVERTED (Monthly) (Gallons (US))

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2016	59,439,000	67,340,800	96,985,700	101,958,200	116,892,200	143,905,700	162,220,000	132,679,200	121,837,900	116,704,500	69,751,500	57,015,700
2015												
2014												
2013												
2012												
2011												
2010												

TABLE 7.2

IMPORTED WATER (Monthly)(Gallons (US))

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2016												
2015												
2014												
2013												
2012												
2011												
2010												

TABLE 7.3

EXPORTED WATER (Monthly) (Gallons (US))

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2016												
2015												
2014												
2013												
2012												
2011												
2010												

TABLE 7.4

Formula = Total Water Diverted + Imported water - Exported Water

TOTAL WATER SUPPLY (Monthly) (Gallons (US))

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2016	59,439,000	67,340,800	96,985,700	101,958,200	116,892,200	143,905,700	162,220,000	132,679,200	121,837,900	116,704,500	69,751,500	57,015,700
2015	0	0	0	0	0	0	0	0	0	0	0	0
2014	0	0	0	0	0	0	0	0	0	0	0	0
2013	0	0	0	0	0	0	0	0	0	0	0	0
2012	0	0	0	0	0	0	0	0	0	0	0	0
2011	0	0	0	0	0	0	0	0	0	0	0	0
2010	0	0	0	0	0	0	0	0	0	0	0	0

ANNUAL DATA

TABLE 7.6

ANNUAL TOTAL DIVERTED

TABLE 7.7

ANNUAL TOTAL DIVERTED CALC
1,246,730,400
N/A
N/A
N/A
N/A
N/A
N/A

TABLE 7.8

ANNUAL TOTAL IMPORTED

TABLE 7.9

ANNUAL TOTAL IMPORT CALC
N/A
N/A
N/A
N/A
N/A
N/A
N/A

TABLE 7.10

ANNUAL TOTAL EXPORTED

TABLE 7.11

ANNUAL TOTAL EXPORT CALC
N/A
N/A
N/A
N/A
N/A
N/A
N/A

TABLE 7.12

ANNUAL TOTAL WATER SUPPLY
1,246,730,400
0
0
0
0
0
0

TABLE 7.13

TOTAL POP. EST.
12,309
N/A
N/A
N/A
N/A
N/A
N/A

Table 7.5

SYSTEM TOTAL GPCD (Monthly)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2016	156	195	254	276	306	390	425	348	330	306	189	149
2015	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2014	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2013	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2012	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2011	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2010	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data

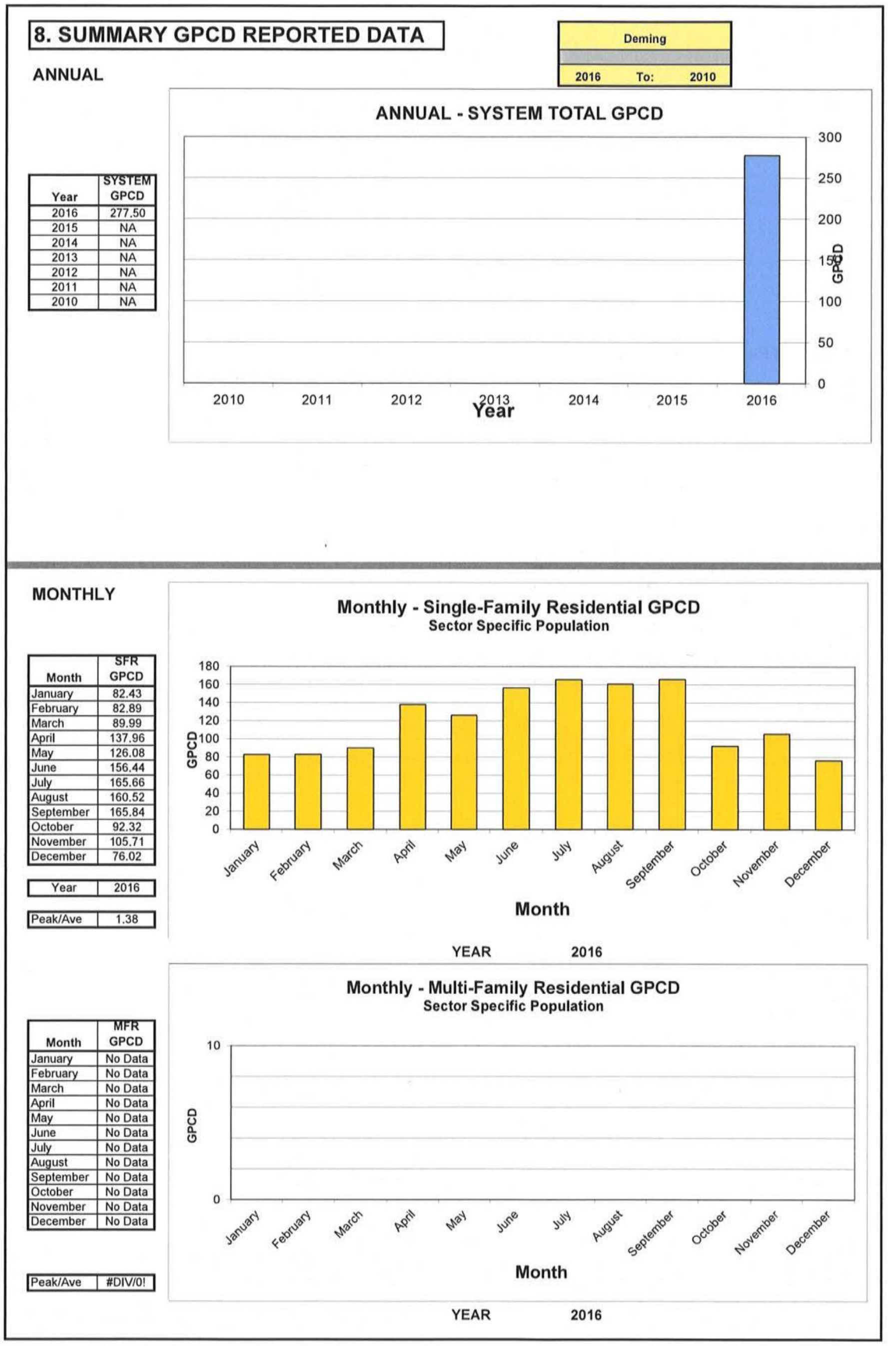
TABLE 7.14

Year	SYSTEM TOTAL GPCD
2016	**277.50**
2015	NA
2014	NA
2013	NA
2012	NA
2011	NA
2010	NA

COMMENTS:

System total production from _Summary Info.2016 Audit working file.xlsx, System Total Production (MV) tab (includes production from wells #3 and #12 for irrigation)

NMOSE GPCD Calculator v2.02



8. SUMMARY GPCD REPORTED DATA

Deming

2016 To: 2010

ANNUAL

Year	SYSTEM GPCD
2016	277.50
2015	NA
2014	NA
2013	NA
2012	NA
2011	NA
2010	NA

MONTHLY

Month	SFR GPCD
January	82.43
February	82.89
March	89.99
April	137.96
May	126.08
June	156.44
July	165.66
August	160.52
September	165.84
October	92.32
November	105.71
December	76.02

Year	2016
Peak/Ave	1.38

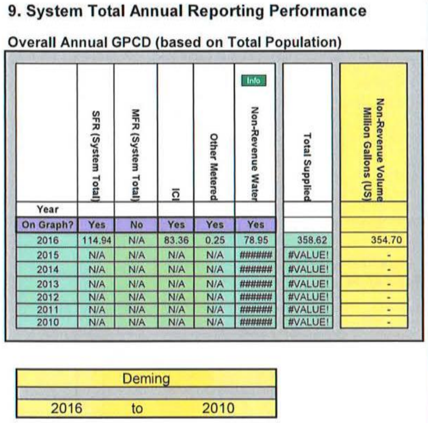
YEAR 2016

Month	MFR GPCD
January	No Data
February	No Data
March	No Data
April	No Data
May	No Data
June	No Data
July	No Data
August	No Data
September	No Data
October	No Data
November	No Data
December	No Data

Peak/Ave	#DIV/0!

YEAR 2016

NMOSE GPCD Calculator v2.02



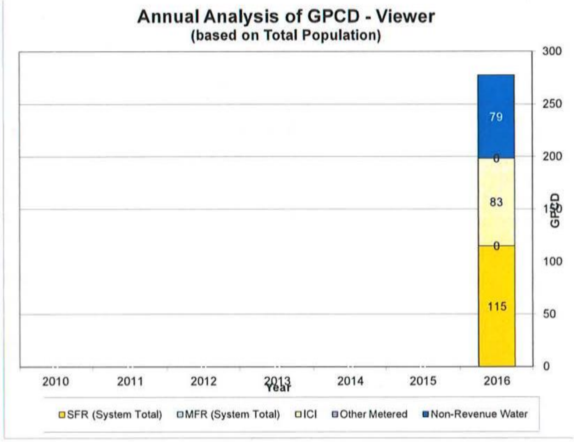
9. System Total Annual Reporting Performance

Overall Annual GPCD (based on Total Population)

Year	SFR (System Total)	MFR (System Total)	ICI	Other Metered	Non-Revenue Water	Total Supplied	Non-Revenue Volume Million Gallons (US)
On Graph?	Yes	No	Yes	Yes	Yes		
2016	114.94	N/A	83.36	0.25	78.95	358.62	354.70
2015	N/A	N/A	N/A	N/A	######	#VALUE!	-
2014	N/A	N/A	N/A	N/A	######	#VALUE!	-
2013	N/A	N/A	N/A	N/A	######	#VALUE!	-
2012	N/A	N/A	N/A	N/A	######	#VALUE!	-
2011	N/A	N/A	N/A	N/A	######	#VALUE!	-
2010	N/A	N/A	N/A	N/A	######	#VALUE!	-

Deming

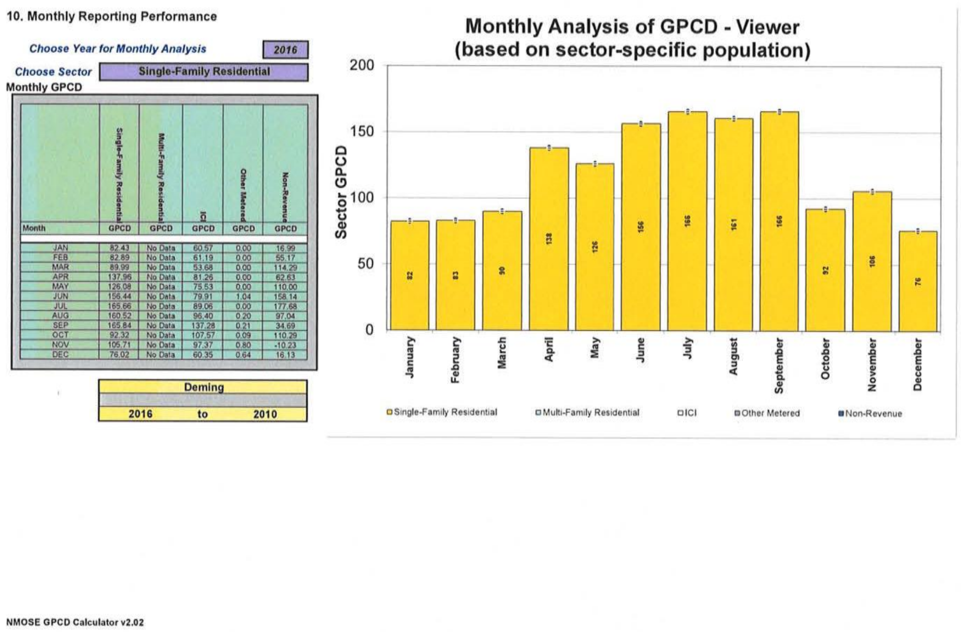
2016 to 2010



Annual Analysis of GPCD - Viewer

(based on Total Population)

NMOSE GPCD Calculator v2.02



10. Monthly Reporting Performance

Choose Year for Monthly Analysis 2016

Choose Sector Single-Family Residential

Monthly GPCD

Month	Single-Family Residential GPCD	Multi-Family Residential GPCD	ICI GPCD	Other Metered GPCD	Non-Revenue GPCD
JAN	82.43	No Data	60.57	0.00	16.99
FEB	82.89	No Data	61.19	0.00	55.17
MAR	89.99	No Data	53.68	0.00	114.29
APR	137.96	No Data	81.26	0.00	62.63
MAY	126.08	No Data	75.53	0.00	110.00
JUN	156.44	No Data	79.91	1.04	158.14
JUL	165.66	No Data	89.06	0.00	177.68
AUG	160.52	No Data	96.40	0.20	97.04
SEP	165.84	No Data	137.28	0.21	34.69
OCT	92.32	No Data	107.57	0.09	110.29
NOV	105.71	No Data	97.37	0.80	-10.23
DEC	76.02	No Data	60.35	0.64	16.13

Deming

2016 to 2010

Monthly Analysis of GPCD - Viewer
(based on sector-specific population)

NMOSE GPCD Calculator v2.02

Appendix D Groundwater Model of the Mimbres Basin

GROUNDWATER MODEL OF THE MIMBRES BASIN, LUNA, GRANT, SIERRA AND DOÑA ANA COUNTIES, NEW MEXICO

1912

By

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nm
Interstate Stream Commission

New Mexico Office of the State Engineer
Hydrology Bureau Technical Report 11-1

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1. INTRODUCTION

A three-dimensional groundwater flow model of the Mimbres Basin has been developed to be used as a tool in water-use management and administration. This model is to be used to evaluate the availability of water and the effects of proposed water rights appropriations on existing groundwater rights.

The New Mexico Office of the State Engineer (OSE) has been using a numerical model developed by the OSE in the late 1970s for water rights administration in the Mimbres Basin. A subsequent model of the basin was developed by the U. S. Geological Survey (USGS) in 1994 but was never adopted by the OSE for use in water rights administration, primarily because of uncertainties in the historical pumping inputs to that model.

The model described in this report was developed to improve on several aspects of the existing model. These include:

- Basin geometry. Better basin geometry is available as a result of geophysical surveys conducted in the basin. The geophysical surveys provide a much more detailed configuration of the basin than was previously available.

- Basin geology. Recent work on alluvial basins in New Mexico has produced improved geological maps and cross sections of the basin-fill material which could be incorporated in a new model.

- Pumping history. Pumping rates from 1975 to 2005 were developed using Landsat imagery to estimate irrigated acreage from which pumping rates were calculated. This methodology provided pumping rates which are believed to be more accurate and span a longer period than the estimates provided by other records and thus enable a better calibration of the new model.

- Model accuracy. Faster computers and better software have enabled the construction of a new model with a finer grid, better calibration, and incorporation of available electronic data such as topography, rivers, geology, well locations and water levels.

2. HYDROGEOLOGY

The hydrogeology of the Mimbres Basin has been described by Hansen (1994) and the New Mexico Water Resources Research Institute (WRRI) et al. (2000). Trauger (1972) provided a detailed description of the geology and water resources of Grant County, New Mexico.

The basin, shown on Figure 1, is defined primarily as a surface water basin and covers parts of Luna, Grant, Sierra and Doña Ana counties in southwestern New Mexico and extends south into Mexico. The groundwater model extent corresponds to the watershed boundary. The OSE has defined an administrative basin, also shown on Figure 1, which corresponds closely with the watershed boundary except for an area on the east side of the basin towards Las Cruces. This area is not explicitly covered by the model presented in this report because it is outside the area of saturated basin-fill alluvium. The OSE administrative basin does not extend into Mexico, whereas the surface water and model boundaries do.

Reeds Peak is the northern-most and highest point in the basin. Southeast of Reeds Peak, the basin boundary passes through the Black Range and Mimbres Mountains to the Goodsight Mountains. The boundary extends northeast to the Sierra de las Uvas, then south to the West Potrillo Mountains. The basin extends into Mexico and includes the Los Muertos Basin. On the southwest, the basin is bounded by Sierra Alta, the Carrizalillo Hills and the Cedar Mountains. The boundary follows the Continental Divide northward across the Antelope Plains, the Big Burro Mountains and northeast through the Pinos Altos Range back to Reeds Peak. In all, the basin encompasses approximately 5,140 square miles, 4,410 of which are in New Mexico.

2.1. Geology

Figure 2 shows the area of basin-fill alluvium within the Mimbres Basin. The northern part of the basin contains a series of north northwesterly-trending mountains, including the Big Burro Mountains, the Pinos Altos Range, the Black Range, the Mimbres Mountains and the Cooke Range. These mountains consist of Precambrian intrusive and metamorphic rocks, Paleozoic sediments, and Cretaceous-Tertiary intrusive, volcanic and sedimentary rocks.

The southern part of the basin contains isolated exposures of the basin bedrock in the Cedar, Victorio, Black, Florida and Tres Hermanas Mountains. These mountains consist of Precambrian intrusive and metamorphic rocks, Paleozoic sediments, and Cretaceous-Tertiary intrusive, volcanic and sedimentary rocks. Some areas in the southern part of the basin, particularly in the West Potrillo Mountains and the area south of the Tres Hermanas Mountains are dominated at the surface by late Tertiary or Quaternary basalt flows which are interbedded with basin-fill alluvium.

The basin itself consists of a number of sub-basins filled with deposits of various geologic units, which in this report are collectively referred to as basin-fill alluvium. Figure 2 shows thickness contours of the basin-fill alluvium. The basin configuration shown on Figure 2 was largely derived by interpretations performed by Heywood (2002) using gravity surveys. The basin configuration was modified based on surface geologic mapping, cross-sections presented in WRRI et al. (2000) and lithologic logs from deep drill holes available from the New Mexico Oil Conservation Division. The basin fill has a maximum thickness of slightly over 4,000 feet near Deming. Other areas with significant thickness greater than 2,000 feet are southeast and southwest of the Florida Mountains and beneath the San Vicente Arroyo between Silver City and Deming.

For the purposes of this groundwater model, the basin-fill alluvium was divided into two units, an upper unit and a lower unit. The source of the upper and lower demarcation is from a technical completion report from the New Mexico Water Resources Research Institute (2000). The upper unit corresponds to sediments classified as Upper Gila Group, which is also referred to as the Upper Santa Fe Group, and various surface alluvial and fluvial deposits. The lower unit corresponds to sediments classified as Lower to Middle Gila Group also called the Lower to Middle Santa Fe Group. The primary difference between the upper and lower units is that the lower unit is more indurated than the upper unit.

2.2. Hydrology

Precipitation. Precipitation ranges from about 9 inches annually at the lower elevations (Deming and Columbus) to about 25 inches in the higher elevations of the Black Range. Table 1 presents average monthly temperatures and precipitation amounts for Columbus, Deming and Fort Bayard, near Silver City. Data in Table 1 were obtained from the Western Regional Climate Center website.

Surface Water. The only major perennial stream in the basin is the upper reach of the Mimbres River. The river starts in the Black and Pinos Altos ranges and flows south to Faywood at which point it emerges from the bedrock of the mountains and flows out onto the basin-fill alluvium. The river channel passes Black Mountain and ends about 10 miles east of Deming. The river is a losing stream after it passes Faywood and only rarely flows past Deming. After Faywood, losses from the stream to the aquifer occur by infiltration through unsaturated sediments. There is not a direct connection of the stream to the aquifer. The USGS maintained three stream gaging stations on the Mimbres River between October 1, 1963 and September 30, 1968. The locations of the gaging stations are shown on Figure 1. Flows during this period are summarized in Table 2.

Infiltration and recharge to groundwater in the basin fill takes place in the Mimbres River channel downstream from Faywood. The decrease in flows between Faywood and Spalding is a measure of the amount of recharge from the river to the groundwater in the basin-fill alluvium. The recharge between Faywood and Spalding is approximately 3,932 acre-feet/year or 394 acre-feet/year/mile given the distance between the two points of 9.98 miles. Between 1963 and 1968, flows were observed at Faywood on approximately 99.4% of the days and at Spalding on approximately 19.1% of the days.

The decrease in flows between Spalding and the Wamel Canal is also a result of infiltration of the river flows. However, the flows measured at Wamel Canal also include an additional contribution from flows in the San Vicente Arroyo which enter the Mimbres River during times of high surface water flows. More recharge is taking place between Spalding and the Wamel Canal than that indicated by the difference between the flows at Spalding and the Wamel Canal. The minimum amount of recharge between Spalding and the Wamel Canal is the difference between the two adjusted flows or 3,501 acre-feet/year. An estimated maximum recharge can be obtained by assuming that recharge takes place at the same rate downstream from Spalding as it does upstream from

Spalding (394 acre-feet/year/mile as calculated above). The distance from Spalding to the Wamel Canal is approximately 14.6 miles and a maximum recharge amount is approximately 5,752 acre-feet/year.

The flows measured at the Wamel Canal are a measure of the amount of recharge taking place in the Mimbres River channel downstream from the Wamel Canal because there are no major tributaries entering the river below the Wamel Canal. Flows measured at the Wamel Canal infiltrate over the reach of the river channel extending approximately 10 miles east of Deming. The recharge below Wamel Canal is approximately 2,794 acre-feet/year, or about 279 acre-feet/year/mile. Flows were measured at the Wamel Canal on approximately 8% of the days between 1963 and 1968.

The Mimbres River upstream from Faywood flows through a relatively narrow valley bounded by bedrock. Flow in the river is sustained by snowmelt and rainfall runoff and by inflows of groundwater. The river is believed to be in good hydraulic communication with the alluvium in the valley. No attempt was made to model groundwater in the alluvium upstream from Faywood due to the relatively small scale of the river valley and because this portion of the river, being bounded by bedrock, does not interact with the main portion of the Mimbres Basin. The net effects of the contributions by the Mimbres River on recharge to the main portion of the Mimbres Basin are combined in the streamflow measurements at the Faywood gage.

San Vicente Arroyo is the major drainage in the northwestern portion of the basin. The arroyo is an ephemeral stream for most of its length. The USGS maintains a stream flow gage on the arroyo near Silver City but has never had a gage near the confluence of San Vicente Arroyo and the Mimbres River. There are numerous tributaries to San Vicente Arroyo between the USGS gage and the confluence with the Mimbres River. As a result, no good measurements are available to estimate the amount of recharge to the groundwater system made by San Vicente Arroyo and its tributaries.

Evaporation. Net lake evaporation in the Mimbres Basin ranges from a maximum rate of 60 to 70 inches per year at the lower elevations to a minimum of 10 to 20 inches per year at the higher elevations (NM Interstate Stream Commission and OSE, 2002). Net lake evaporation is defined as gross lake evaporation minus annual precipitation.

2.3. Groundwater

In general, prior to development of the basin, groundwater in the Mimbres Basin was recharged by mountain-front recharge and recharge from the Mimbres River primarily in the northern portion of the basin. Groundwater flowed to the south. The basin was considered to be closed and groundwater losses from the basin occurred by evapotranspiration.

Figure 3 shows a predevelopment water level map of the basin indicating the generally southerly flow of groundwater. Water levels on Figure 3 were obtained from data presented in Darton (1916) and from the U.S. Geological Survey's Ground Water Site

Inventory database. The predevelopment water level map is based on water level measurements in wells completed in the upper 200 feet of the saturated zone. Water levels presented on Figure 3 were those measured prior to 1916, from Darton (1916), or were judged to represent water levels in an area prior to significant development.

Deflections in the predevelopment water level contours indicate that significant areas of mountain-front recharge are present on both sides of the San Vicente Arroyo, around the Cooke Range, around the Florida Mountains, and along the West Potrillo Mountains. Additional recharge takes place in the upper portion of White Rock Canyon on the western side of the basin.

Natural evapotranspiration takes place where groundwater levels are close to land surface, generally less than 40 to 50 feet. Prior to development of the basin, large areas of shallow groundwater were present south of Deming. The maximum rate of evapotranspiration in the basin equals the maximum net lake evaporation of 60 to 70 inches per year.

2.3.1. Aquifer Properties

A summary of aquifer tests of wells in basin-fill alluvium is presented in Table 3. These tests were performed as constant discharge tests of varying duration, primarily on production wells. Horizontal hydraulic conductivities were calculated from the transmissivities generally using the entire saturated thickness of alluvium observed at the well. The hydraulic conductivities were distributed approximately log-normally and the geometric mean of the conductivities was approximately 11 feet/day. The mean conductivity is probably significantly biased towards a high value relative to the true conductivity of the alluvium because:

- nearly all of the tests were performed on production wells which were installed preferentially in areas of high hydraulic conductivity,

- wells are screened only in zones of high productivity (although this factor was offset by using the entire saturated thickness to calculate conductivity from transmissivity), and

- wells were generally drilled only as deep as needed to obtain sufficient productivity.

As a result, the average of 11 feet/day probably represents an upper value of the conductivity of the basin fill. Kernodle (1992) suggests that typical basin-fill conductivities are in the range of 2 to 10 feet/day in closed-drainage basins, such as the Mimbres Basin.

No data were available regarding vertical hydraulic conductivities in the basin. Kernodle (1992) suggests that horizontal to vertical conductivity ratios vary from 200:1 to 1000:1.

An estimate of specific yield of 0.14 was provided by Hanson (1994) who estimated the consumptive use of water pumped between 1910 and 1970 and divided by the total volume of aquifer dewatered in that period.

2.3.2. Water Levels

Water levels measured in the Mimbres Basin were obtained from the U.S. Geological Survey's Ground Water Site Inventory. Water levels were used from wells which had sufficient construction information to assign them to a model layer. A database of water level measurements containing nearly 16,000 measurements from over 1400 wells was assembled. Measurements were collected between 1910 and 2006.

2.4. Groundwater Use

Groundwater pumped in the Mimbres Basin is used for agricultural irrigation, municipal and industrial uses and domestic water supplies. No attempt was made to quantify domestic pumping within the basin. Pumping in Mexico was quantified only for agricultural irrigation based on satellite imagery; no records were available for municipal, industrial or domestic uses.

2.4.1. Agricultural Irrigation

Irrigation began in the Mimbres Basin in the early 1900s. Significant expansion of the irrigated acreage occurred in the mid-1930s. Except for some occasional flood waters in the Mimbres River, all of the irrigation water in the main portion of the basin comes from groundwater pumping. Irrigation along the upper Mimbres River, upstream of Faywood, is primarily from surface water in the Mimbres River; however, the net effect of this water use is measured by the surface water gage at Faywood.

Table 4 presents estimated water consumption for irrigation between 1933 and 2005. The acreages in Table 4 for 1933, 1936 and 1940 came from maps published by White (1934), Theis (1939) and Conover and Akin (1942), respectively. Hydrographic survey maps from 1975 to 1982 provided the irrigated acreage for those years. The irrigated acreages were also estimated from satellite imagery analysis from 1975 to 2005. Irrigation pumping was determined from the irrigated areas identified by the Normalized Difference Vegetation Index (Bohannan Huston, 2006) and assumes that irrigation water was not pumped significant distances to the fields being irrigated. Satellite imagery was interpreted in conjunction with hydrographic survey maps that served to limit the potential areas evaluated for irrigation.

The consumptive irrigation requirements (CIRs) were calculated using software developed by the Office of the State Engineer (OSE) and documented by Wilson (1992). The program is based on the Soil Conservation Service modifications to the Blaney-Criddle method. Climate data used in the CIR calculations were based on the average of the Columbus and Deming data presented in Table 1. Additional climate data included the spring and fall days in which minimum temperatures were reached. These were based on data presented in Wilson (1992) for Deming.

The growing season information was input from file GS29 provided with the CIR program, corresponding to the Mimbres Basin in Luna County.

The percent daylight hours used in the CIR program is based on the latitude of the location for which CIRs are being calculated. A latitude of 32° 16' corresponding to Deming was input to the program.

Individual crop acreages were obtained from the series of reports published by the Agricultural Experiment Station at New Mexico State University concerning irrigation water sources and cropland acreages (New Mexico State University, 1981). These acreages and the CIRs for years between 1939 and 2001 are presented in Table 5. The CIR used for administration is 1.6 acre-feet/acre, falling within the range of values given in Table 5. Two Farm Delivery Requirements (FDR) are used within the basin. From Township 18 South and north, the FDR is 2.7 acre-feet/acre; from Township 19 South and south, the FDR is 3.0 acre-feet/acre.

2.4.2. Municipal/Industrial Pumping

Municipal and industrial pumping was compiled from records maintained by the OSE-Deming office and, for the mines near Silver City, from a modeling report prepared by Hargis and Montgomery (1983). Municipal pumping records were obtained for Bayard, Columbus, Deming, Santa Clara, Silver City and Tyrone. The periods for which pumping records were available are summarized in Table 6. Generally, in earlier years, only total pumping from wellfields was available. In later years, meter readings for individual wells were available. Total pumping for municipal wellfield is summarized at five-year intervals in Table 7.

Industrial pumping is related to mining near Silver City. Pumping at individual wellfields is summarized at five-year intervals in Table 7.

2.4.3. Trends in Groundwater Use

As seen in Table 4, agricultural water use reached a maximum in the late 1970s and is currently only about 40 percent of its 1979 peak. Municipal and industrial use, shown in Table 7, increased until about 1990 and has remained relatively constant since then. Agricultural use has always exceeded municipal and industrial use. However, the gap has closed significantly due, primarily, to the decrease in agricultural use.

3. GROUNDWATER MODEL

The Mimbres Basin groundwater model was designed and run using Groundwater Vistas Version 5 developed by Environmental Simulations, Inc. Groundwater Vistas runs the U.S. Geological Survey MODFLOW 2000 code (Harbaugh et al., 2000).

3.1. Model Description

3.1.1. Model Dimensions

The extent of the model grid is shown on Figure 4. The north-south oriented grid contains 242 rows, 214 columns and three layers. The model cells are each 2,000 feet by 2,000 feet. The southwest corner of the grid is positioned at x=177,495.64 meters and y=3,483,603.78 meters in the NAD1983 UTM Zone 13N coordinate system and the Transverse Mercator projection.

The simulation runs through 16 stress periods. The first stress period, represents a predevelopment steady state. The subsequent 15 stress periods are each 5 years in length and represent a calibration period from January 1, 1931 through December 31, 2005.

The three layers of the model each vary in thickness. Layers have thicknesses greater than 0 only in areas where basin-fill alluvium is present. Bedrock is assigned as no-flow cells and is not simulated in the model. The total thickness of the model is based on the configuration previously shown on Figure 2.

The top of Layer 1was defined as the land surface elevation. The bottom of Layer 1 was defined as 200 feet below the predevelopment water table. In areas where the saturated alluvium was less than 200 feet thick, Layer 1 included the full thickness of the saturated alluvium. The total thickness of the combined saturated and unsaturated portions of Layer 1 ranged from 5 feet to 954 feet. Because Layer 1 was defined based on the location of the predevelopment water table, it crosses geologic contacts and included both the upper and lower units of the basin-fill alluvium. As described earlier, the upper unit of the basin-fill alluvium corresponds to sediments classified as Upper Gila Group, Upper Santa Fe Group, and various surface alluvial and fluvial deposits. The lower unit corresponds to sediments classified as Lower to Middle Gila Group or Lower to Middle Santa Fe Group.

The bottom of Layer 2 was defined as the deeper of:

- The bottom of the upper alluvium, or
- 200 feet below Layer 1 but not extending into the underlying bedrock.

Layer 2 ranged in thickness from 5 feet to 550 feet.

Layer 3, the bottom layer, included all the basin-fill alluvium below Layer 2. Because the bottom of Layer 2 was defined as including all the upper alluvium, if present, Layer 3 consisted entirely of lower alluvium. The thickness of Layer 3 ranged from 5 feet to 3,330 feet.

Figure 5 shows an east-west cross section along model row 97 through the City of Deming showing geologic units and model layers.

3.1.2. Boundary Conditions

Boundary conditions in the model included no-flow boundaries, mountain-front recharge, stream recharge, evapotranspiration and pumping wells.

No-Flow Boundaries. Model cells consisting of bedrock were assigned as no-flow cells. The basin is closed and is completely surrounded by no-flow cells. Additional no-flow cells were placed internally in the basin to simulate bedrock highs and mountains within the basin boundaries.

Mountain-Front Recharge

Locations of mountain-front recharge cells are shown, for Layer 1, in Figure 6. Mountain front recharge was simulated as constant flux cells using the recharge package. Recharge cells were located near the edges of the mountains in model Layer 1. In general, recharge cells were not placed immediately next to the mountain-front (no-flow cells) because the saturated thickness in these areas was small and the cells had a tendency to dry up during the model runs. This would lead to the recharge cells becoming inactive and prevent simulated recharge from taking place at that location.

Most mountain-front recharge takes place in the northern part of the basin. Flow rates for mountain-front recharge were initially obtained by calibrating a steady-state model to predevelopment water levels. These flow rates were revised after performing the transient calibration. Annual mountain-front recharge volumes are shown in Figure 6. The annual total simulated mountain-front recharge volume is 21,146 acre-feet.

Mimbres River Recharge

Locations of Mimbres River recharge cells are shown in Figure 6. Mimbres River recharge was simulated as recharge cells and only acted on Layer 1. Recharge rates were estimated based on the USGS stream gaging data described earlier in Section 2.2. The river was divided into four reaches:

1) from Faywood to Spalding,
2) from Spalding to Black Mountain
3) from Black Mountain to the Wamel Canal, and
4) from the Wamel Canal to about 10 miles east of Deming.

The annual simulated recharge volume from the Mimbres River to the basin-fill alluvium (downstream from Faywood) is 9,967 acre-feet.

The total model recharge of 31,113 acre-feet/year is about 1% of the average basin-wide precipitation. Recharge remains constant in the steady state and transient simulations.

Evapotranspiration

The potential for evapotranspiration was assigned to all active cells in Layer 1. Model cells with a simulated depth to water less than the assigned extinction depth of 40 feet could produce up to the maximum assigned evapotranspiration rate of 5 feet/year. This maximum evapotranspiration rate was based on the net lake evaporation rate determined by the New Mexico Interstate Stream Commission and the OSE (2002).

Pumping Wells

Agricultural irrigation, municipal and industrial pumping determined in section 2.4 of this report was assigned to model cells. Figure 7 shows groundwater pumping centers and simulated rates over the calibrated period of the model. Peak model pumping of 74,859 acre-feet/year occurs in 1976.

Irrigation pumping was assigned to model cells underlying the irrigated areas. The amount of pumping assigned to a cell was the product of the irrigated acreage within the cell and the CIR applicable to a particular stress period.

Municipal pumping was assigned to the model cells in which the production wells lay.

3.1.3. Calibrated Aquifer Properties

Figures 8 through 10 show the values of hydraulic conductivity assigned to the three layers of the calibrated model. The lower alluvium is assigned a single horizontal hydraulic conductivity of 1 feet/day. In most areas, the upper alluvium is assigned a horizontal hydraulic conductivity of 5 feet/day. A zone of hydraulic conductivity of 2 feet/day is assigned to the upper alluvium in an area northeast of the village of Columbus.

Hydraulic conductivities in the x-direction equaled those in the y-direction. The ratio of horizontal to vertical hydraulic conductivity was assigned a value of 200:1 based on the recommendation given in Kernodle (1992).

The calibrated zonation of the specific yield is shown in Figure 11. A specific yield of 0.10 is assigned for all of the lower alluvium. A large area of the upper alluvium is assigned a specific yield of 0.14. During model calibration, specific yield zones of 0.05 and 0.01 west and south of Deming were specified. A semi-confined storage of 0.001 is assigned east of the Village of Columbus. This area has been delineated as lacustrine in

Hanson and others (1994). A single specific storage of 1×10^{-6} ft^{-1} was assigned to the upper and lower alluvium.

3.1.4 Calibration Results

Figure 12 summarizes the steady state calibrated fit of simulated to observed water elevations. Calibration targets were largely taken from Darton (1916) and supplemented by water levels from the U.S. Geological Survey's Ground Water Site Inventory measured primarily in the 1950s. Some measurements in locations away from pumping areas were measured as recently as 1970. The model is generally well calibrated to steady state water elevations. Water elevations are better estimated away from the no-flow boundaries of the model.

Figure 13 shows the model cells with active evapotranspiration in the steady state simulation. In predevelopment, 31,113 acre-feet/year leaves the model area as evapotranspiration. Over the historical simulation, the areal extent and the rate of the evapotranspiration decrease. In 2005 the rate of evapotranspiration from the model is 12,911 acre-feet/year. Tables 8A and 8B summarize the model budget components for the steady state and the year 2005 simulation periods. Figure 14 shows the steady state and transient model flow components over the entire calibrated period.

Figure 15 shows the simulated depression of water levels from predevelopment in the year 1931 through the historical pumping period in 2005. In 2005 the depression has a depth of 120 feet in an area located 10 miles south of Deming.

Figure 16 shows the goodness of fit between observed and simulated water elevation hydrographs for selected wells. Calibration data for the transient simulation is from the U.S. Geological Survey's Ground Water Site Inventory. The priority of the transient calibration was simulating to the observed drawdown trends. This was coupled with a statistical evaluation of water elevations. For the 9949 observed transient water elevations, 50 % of the simulated values are within 20 feet of the observations and 89% are within 50 feet of the observations.

The model reasonably simulates the observed rate of drawdown in most areas of the model. There is some local variability. In a long-term well hydrograph 5 miles southwest of Deming, 24S.10W.12.341HRNA, drawdown is over-predicted in the simulation. Drawdown in other nearby wells is accurately simulated. Similarly, in the semi-confined area just west of Columbus, wells showing moderate rates of drawdown are interspersed with wells showing rapid rates of drawdown. The model is calibrated to the larger observed rates of drawdown.

The sensitivity of the calibration when model parameters are varied was examined. The most sensitive parameters are storage of the upper alluvial zone and recharge. Variations in these parameters by 20% change the average residual mean of the transient water elevations by 2 to 3 feet.

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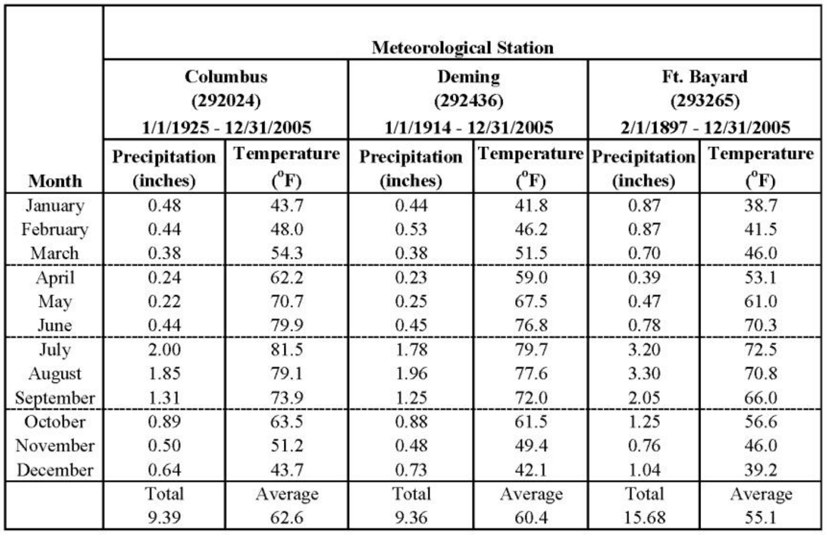
TABLES

Table 1. Average Monthly Precipitation and Temperatures in the Mimbres Basin



	Meteorological Station					
	Columbus (292024) 1/1/1925 - 12/31/2005		Deming (292436) 1/1/1914 - 12/31/2005		Ft. Bayard (293265) 2/1/1897 - 12/31/2005	
Month	**Precipitation (inches)**	**Temperature (°F)**	**Precipitation (inches)**	**Temperature (°F)**	**Precipitation (inches)**	**Temperature (°F)**
January	0.48	43.7	0.44	41.8	0.87	38.7
February	0.44	48.0	0.53	46.2	0.87	41.5
March	0.38	54.3	0.38	51.5	0.70	46.0
April	0.24	62.2	0.23	59.0	0.39	53.1
May	0.22	70.7	0.25	67.5	0.47	61.0
June	0.44	79.9	0.45	76.8	0.78	70.3
July	2.00	81.5	1.78	79.7	3.20	72.5
August	1.85	79.1	1.96	77.6	3.30	70.8
September	1.31	73.9	1.25	72.0	2.05	66.0
October	0.89	63.5	0.88	61.5	1.25	56.6
November	0.50	51.2	0.48	49.4	0.76	46.0
December	0.64	43.7	0.73	42.1	1.04	39.2
	Total 9.39	Average 62.6	Total 9.36	Average 60.4	Total 15.68	Average 55.1

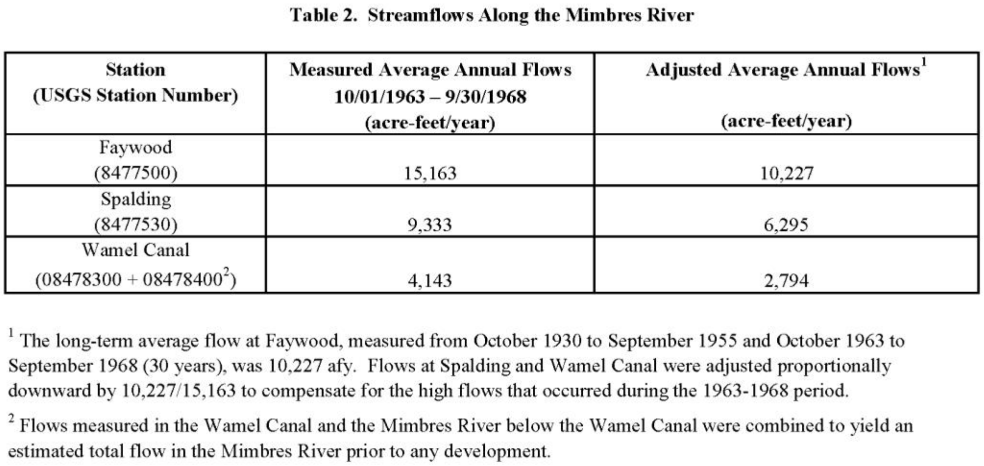


Table 2. Streamflows Along the Mimbres River

Station (USGS Station Number)	Measured Average Annual Flows 10/01/1963 – 9/30/1968 (acre-feet/year)	Adjusted Average Annual Flows[1] (acre-feet/year)
Faywood (8477500)	15,163	10,227
Spalding (8477530)	9,333	6,295
Wamel Canal (08478300 + 08478400[2])	4,143	2,794

[1] The long-term average flow at Faywood, measured from October 1930 to September 1955 and October 1963 to September 1968 (30 years), was 10,227 afy. Flows at Spalding and Wamel Canal were adjusted proportionally downward by 10,227/15,163 to compensate for the high flows that occurred during the 1963-1968 period.

[2] Flows measured in the Wamel Canal and the Mimbres River below the Wamel Canal were combined to yield an estimated total flow in the Mimbres River prior to any development.

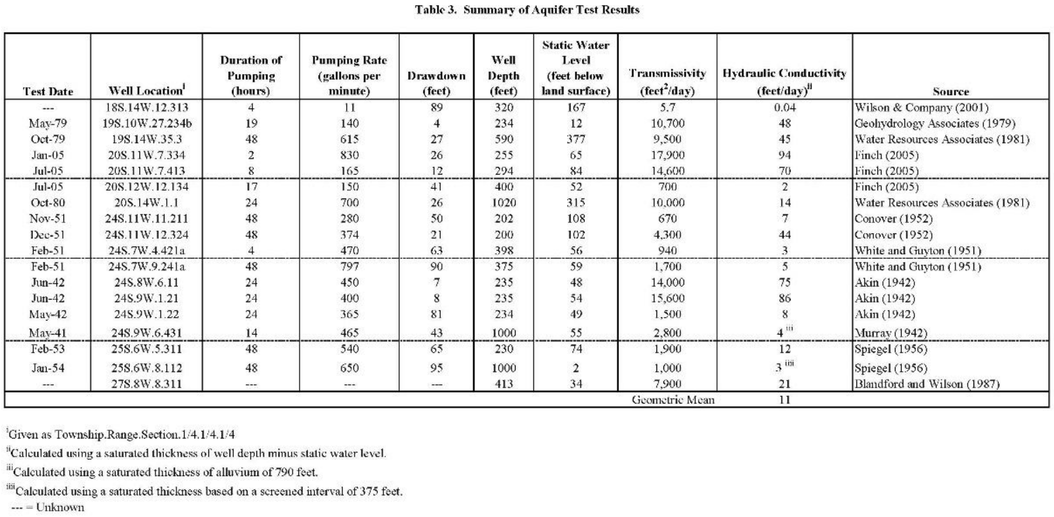


Table 3. Summary of Aquifer Test Results

Test Date	Well Location[i]	Duration of Pumping (hours)	Pumping Rate (gallons per minute)	Drawdown (feet)	Well Depth (feet)	Static Water Level (feet below land surface)	Transmissivity (feet²/day)	Hydraulic Conductivity (feet/day)[ii]	Source
---	18S.14W.12.313	4	11	89	320	167	5.7	0.04	Wilson & Company (2001)
May-79	19S.10W.27.234b	19	140	4	234	12	10,700	48	Geohydrology Associates (1979)
Oct-79	19S.14W.35.3	48	615	27	590	377	9,500	45	Water Resources Associates (1981)
Jan-05	20S.11W.7.334	2	830	26	255	65	17,900	94	Finch (2005)
Jul-05	20S.11W.7.413	8	165	12	294	84	14,600	70	Finch (2005)
Jul-05	20S.12W.12.134	17	150	41	400	52	700	2	Finch (2005)
Oct-80	20S.14W.1.1	24	700	26	1020	315	10,000	14	Water Resources Associates (1981)
Nov-51	24S.11W.11.211	48	280	50	202	108	670	7	Conover (1952)
Dec-51	24S.11W.12.324	48	374	21	200	102	4,300	44	Conover (1952)
Feb-51	24S.7W.4.421a	4	470	63	398	56	940	3	White and Guyton (1951)
Feb-51	24S.7W.9.241a	48	797	90	375	59	1,700	5	White and Guyton (1951)
Jun-42	24S.8W.6.11	24	450	7	235	48	14,000	75	Akin (1942)
Jun-42	24S.9W.1.21	24	400	8	235	54	15,600	86	Akin (1942)
May-42	24S.9W.1.22	24	365	81	234	49	1,500	8	Akin (1942)
May-41	24S.9W.6.431	14	465	43	1000	55	2,800	4 [iii]	Murray (1942)
Feb-53	25S.6W.5.311	48	540	65	230	74	1,900	12	Spiegel (1956)
Jan-54	25S.6W.8.112	48	650	95	1000	2	1,000	3 [iiii]	Spiegel (1956)
---	27S.8W.8.311	---	---	---	413	34	7,900	21	Blandford and Wilson (1987)
							Geometric Mean	11	

[i] Given as Township.Range.Section.1/4.1/4.1/4

[ii] Calculated using a saturated thickness of well depth minus static water level.

[iii] Calculated using a saturated thickness of alluvium of 790 feet.

[iiii] Calculated using a saturated thickness based on a screened interval of 375 feet.

--- = Unknown

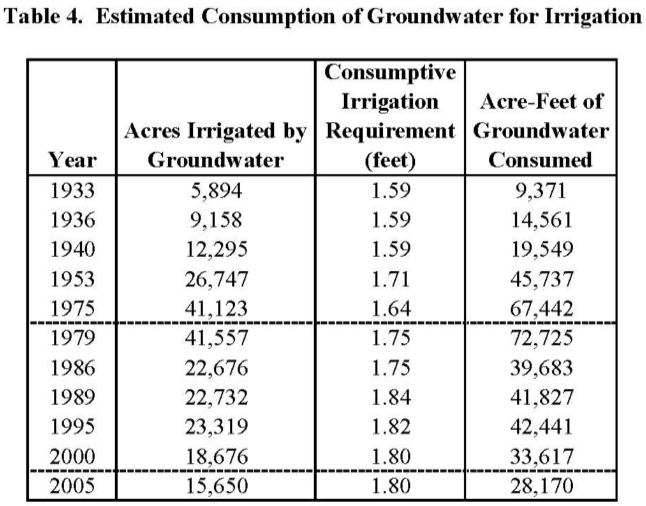
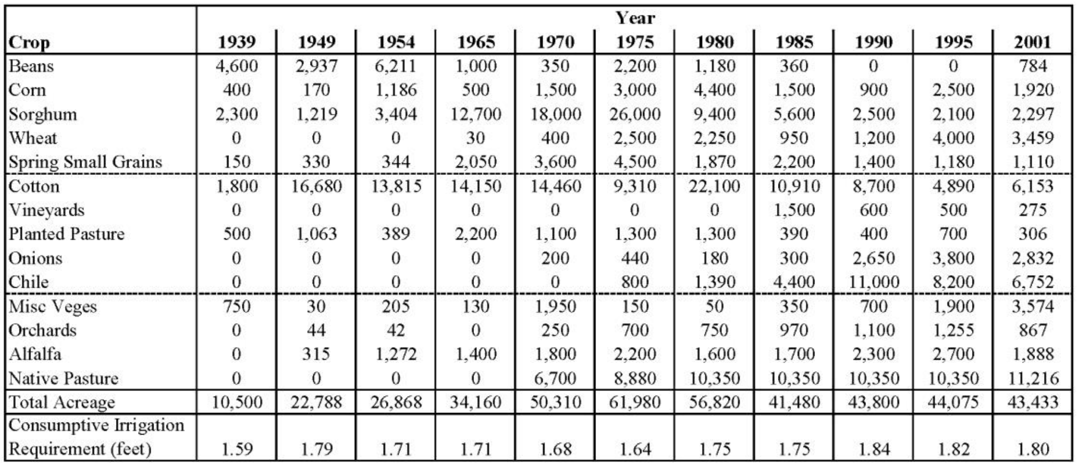


Table 4. Estimated Consumption of Groundwater for Irrigation

Year	Acres Irrigated by Groundwater	Consumptive Irrigation Requirement (feet)	Acre-Feet of Groundwater Consumed
1933	5,894	1.59	9,371
1936	9,158	1.59	14,561
1940	12,295	1.59	19,549
1953	26,747	1.71	45,737
1975	41,123	1.64	67,442
1979	41,557	1.75	72,725
1986	22,676	1.75	39,683
1989	22,732	1.84	41,827
1995	23,319	1.82	42,441
2000	18,676	1.80	33,617
2005	15,650	1.80	28,170

Table 5. Irrigated Acreages by Crop and Consumptive Irrigation Requirement



	Year										
Crop	**1939**	**1949**	**1954**	**1965**	**1970**	**1975**	**1980**	**1985**	**1990**	**1995**	**2001**
Beans	4,600	2,937	6,211	1,000	350	2,200	1,180	360	0	0	784
Corn	400	170	1,186	500	1,500	3,000	4,400	1,500	900	2,500	1,920
Sorghum	2,300	1,219	3,404	12,700	18,000	26,000	9,400	5,600	2,500	2,100	2,297
Wheat	0	0	0	30	400	2,500	2,250	950	1,200	4,000	3,459
Spring Small Grains	150	330	344	2,050	3,600	4,500	1,870	2,200	1,400	1,180	1,110
Cotton	1,800	16,680	13,815	14,150	14,460	9,310	22,100	10,910	8,700	4,890	6,153
Vineyards	0	0	0	0	0	0	0	1,500	600	500	275
Planted Pasture	500	1,063	389	2,200	1,100	1,300	1,300	390	400	700	306
Onions	0	0	0	0	200	440	180	300	2,650	3,800	2,832
Chile	0	0	0	0	0	800	1,390	4,400	11,000	8,200	6,752
Misc Veges	750	30	205	130	1,950	150	50	350	700	1,900	3,574
Orchards	0	44	42	0	250	700	750	970	1,100	1,255	867
Alfalfa	0	315	1,272	1,400	1,800	2,200	1,600	1,700	2,300	2,700	1,888
Native Pasture	0	0	0	0	6,700	8,880	10,350	10,350	10,350	10,350	11,216
Total Acreage	10,500	22,788	26,868	34,160	50,310	61,980	56,820	41,480	43,800	44,075	43,433
Consumptive Irrigation Requirement (feet)	1.59	1.79	1.71	1.71	1.68	1.64	1.75	1.75	1.84	1.82	1.80

Table 6. Summary of Periods of Available Pumping Records

Municipal Pumping

Town	Period of Record
Bayard	1983 - 2004 [1]
Columbus	1982 - 2004 [1]
Deming	1985 - 2005 [1]
Santa Clara	1978 - 2004 [2]
Silver City	1958 - 2004 [1]
Tyrone	1989 - 2004 [1]

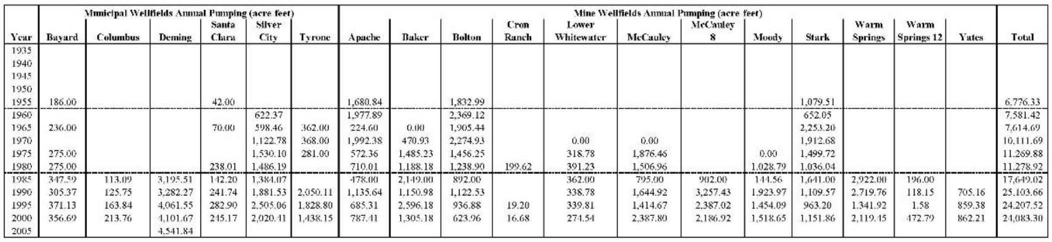
Mine Pumping

Wellfield	Period of Record
Apache	1952 - 1986[2], 1989 - 2004[1]
Baker	1952 - 1986[2], 1989 - 2004[1]
Bolton	1952 - 1986[2], 1989 - 2004[1]
Cron Ranch	1976 - 1983[2], 1993 - 2003[2]
Lower Whitewater	1952 - 1986[2], 1989 - 2004[1]
McCauley	1952 - 1986[2], 1989 - 2004[1]
McCauley 8	1983 - 1986[2], 1988 - 2004[1]
Moody	1979 - 1987[2], 1988 - 2004[1]
Stark	1952 - 1986[2], 1989 - 2004[1]
Warm Springs	1983 - 1986[2], 1989 - 2004[1]
Warm Springs 12	1983 - 1986[2], 1989 - 2004[1]
Yates	1988 - 2004[1]

[1] Meter records available for individual wells

[2] Records available for total wellfield only

Table 7. Municipal and Industrial Pumping



Year	Municipal Wellfields Annual Pumping (acre feet)						Mine Wellfields Annual Pumping (acre feet)												Total
Year	Bayard	Columbus	Deming	Santa Clara	Silver City	Tyrone	Apache	Baker	Bolton	Cron Ranch	Lower Whitewater	McCauley	McCauley 8	Moody	Stark	Warm Springs	Warm Springs 12	Yates	Total
1935																			
1940																			
1945																			
1950																			
1955	186.00			42.00			1,680.84		1,832.99						1,079.51				6,776.33
1960					622.37		1,977.89		2,369.12						652.05				7,581.42
1965	236.00			70.00	598.46	362.00	224.60	0.00	1,905.44						2,253.20				7,614.69
1970					1,122.78	368.00	1,992.38	470.93	2,274.93		0.00	0.00			1,912.68				10,111.69
1975	275.00				1,530.10	281.00	572.36	1,485.23	1,456.25		318.78	1,876.46		0.00	1,499.72				11,269.88
1980	275.00			238.01	1,486.19		710.01	1,188.18	1,238.90	199.62	391.23	1,506.96		1,028.79	1,036.04				11,278.92
1985	347.59	113.09	3,195.51	142.20	1,384.07		478.00	2,149.00	892.00		362.00	795.00	902.00	144.56	1,641.00	2,922.00	196.00		17,649.02
1990	305.37	125.75	3,282.27	241.74	1,881.53	2,050.11	1,135.64	1,150.98	1,122.53		338.78	1,644.92	3,257.43	1,923.97	1,109.57	2,719.76	118.15	705.16	25,103.66
1995	371.13	163.84	4,061.55	282.90	2,505.06	1,828.80	685.31	2,596.18	936.88	19.20	339.81	1,414.67	2,387.02	1,454.09	963.20	1,341.92	1.58	859.38	24,207.52
2000	356.69	213.76	4,101.67	245.17	2,020.41	1,438.15	787.41	1,305.18	623.96	16.68	274.54	2,387.80	2,186.92	1,518.65	1,151.86	2,119.45	472.79	862.21	24,083.30
2005			4,541.84																

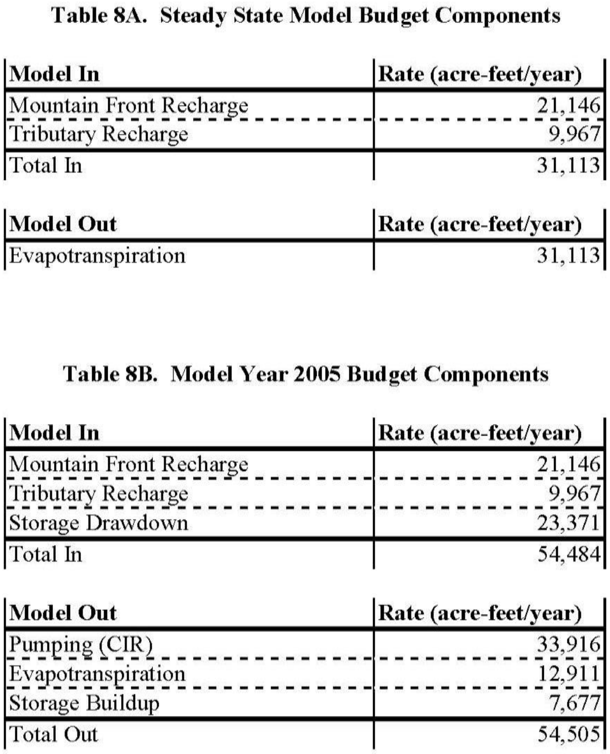


Table 8A. Steady State Model Budget Components

Model In	Rate (acre-feet/year)
Mountain Front Recharge	21,146
Tributary Recharge	9,967
Total In	31,113

Model Out	Rate (acre-feet/year)
Evapotranspiration	31,113

Table 8B. Model Year 2005 Budget Components

Model In	Rate (acre-feet/year)
Mountain Front Recharge	21,146
Tributary Recharge	9,967
Storage Drawdown	23,371
Total In	54,484

Model Out	Rate (acre-feet/year)
Pumping (CIR)	33,916
Evapotranspiration	12,911
Storage Buildup	7,677
Total Out	54,505

FIGURES

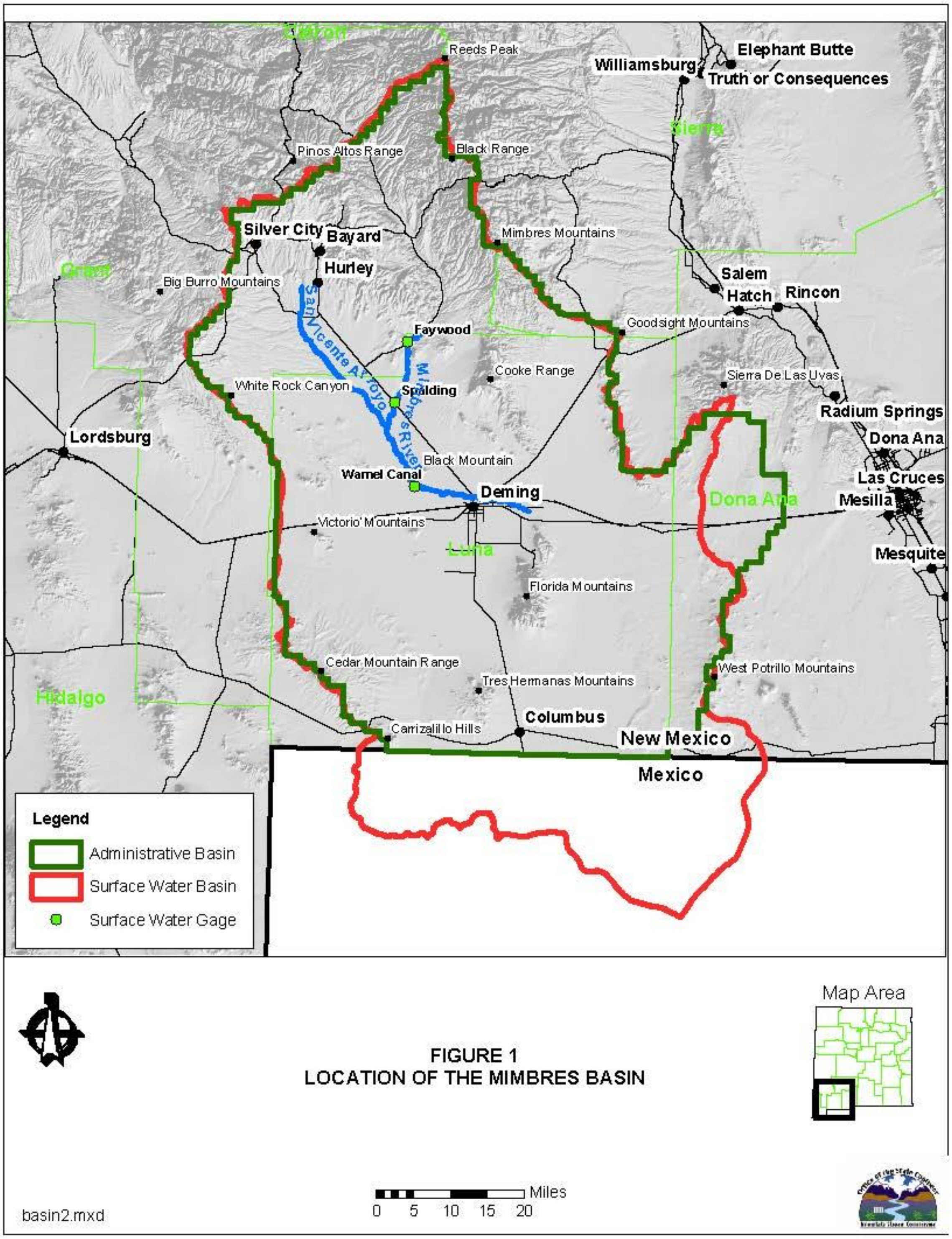
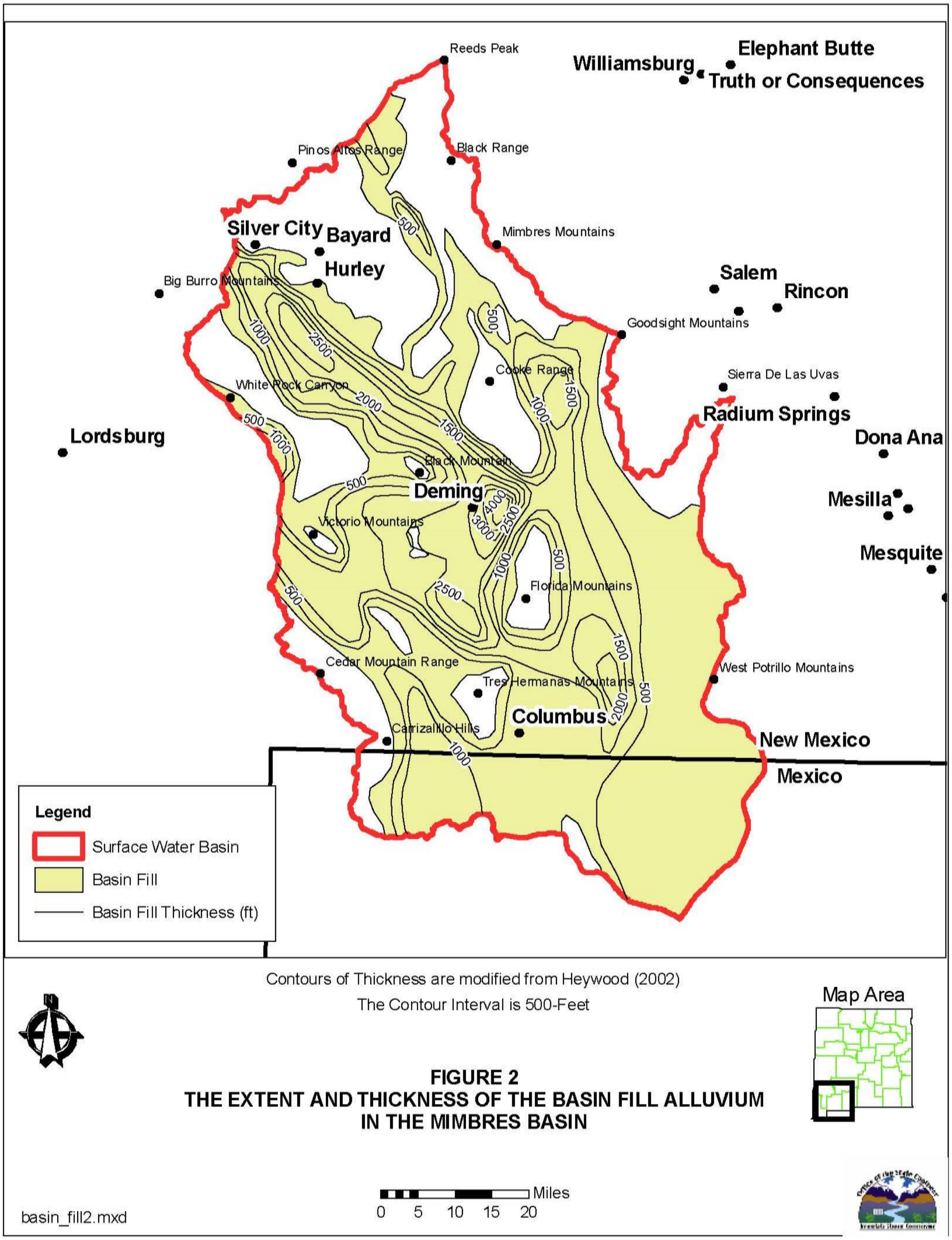


FIGURE 1
LOCATION OF THE MIMBRES BASIN



Contours of Thickness are modified from Heywood (2002)

The Contour Interval is 500-Feet

FIGURE 2
THE EXTENT AND THICKNESS OF THE BASIN FILL ALLUVIUM
IN THE MIMBRES BASIN

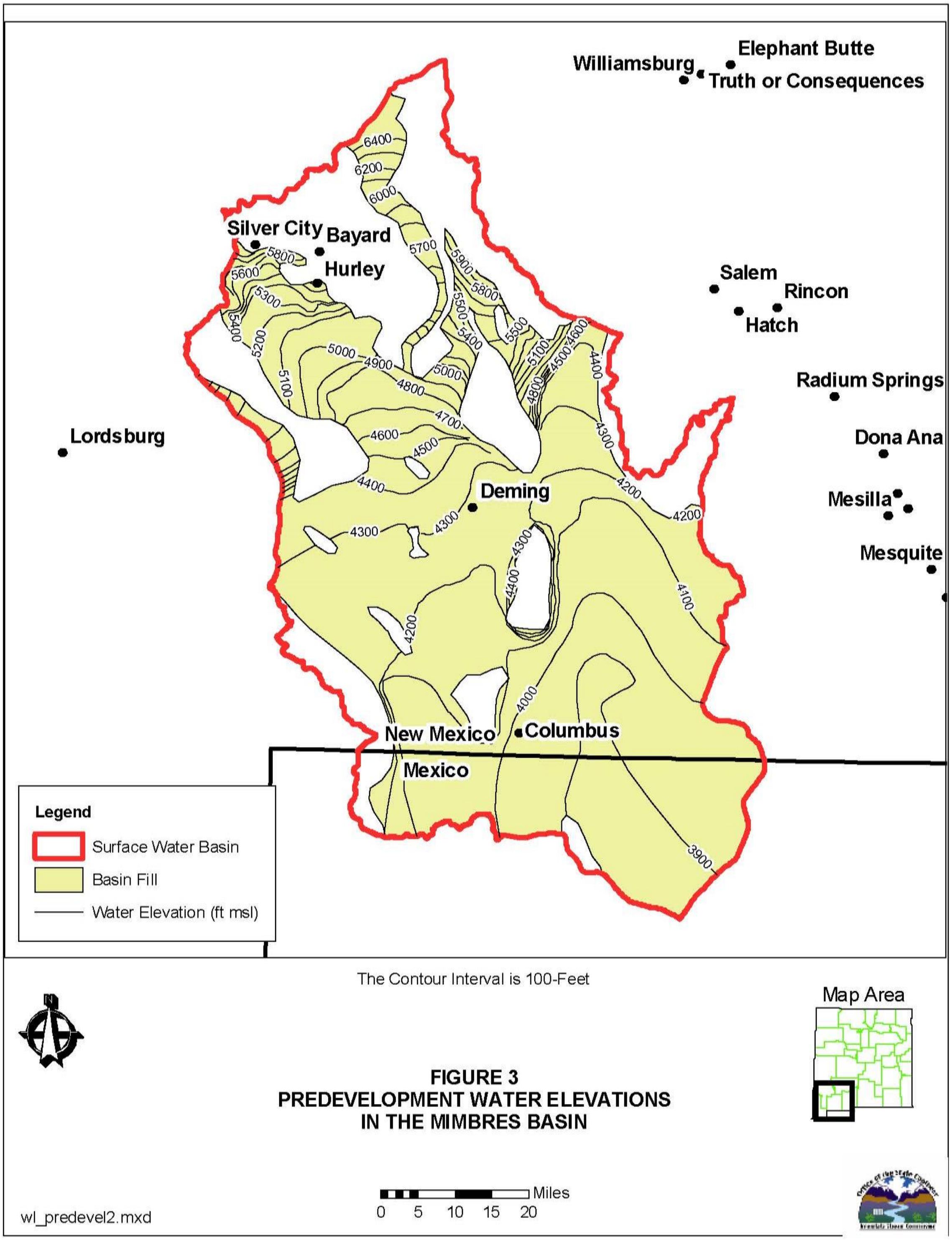
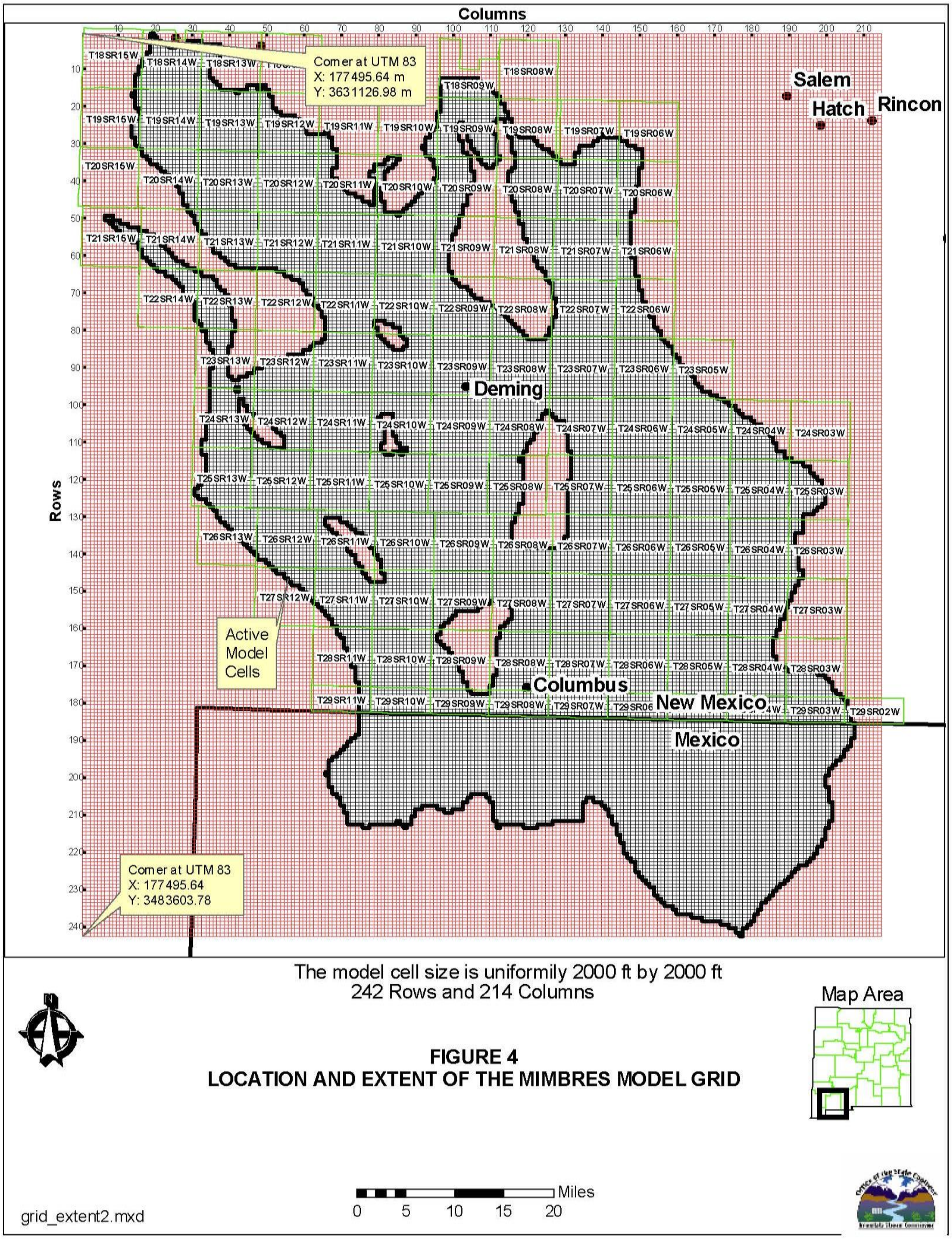


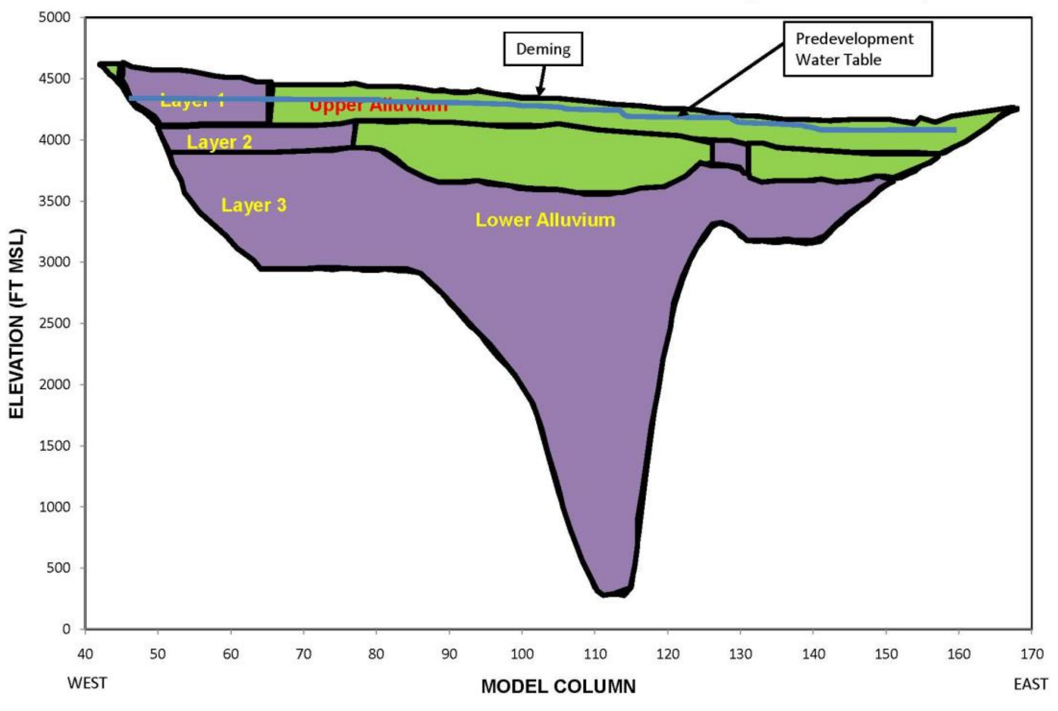
FIGURE 3
PREDEVELOPMENT WATER ELEVATIONS
IN THE MIMBRES BASIN



The model cell size is uniformly 2000 ft by 2000 ft
242 Rows and 214 Columns

FIGURE 4
LOCATION AND EXTENT OF THE MIMBRES MODEL GRID

FIGURE 5
MODEL CROSS-SECTION THROUGH THE CITY OF DEMING (MODEL ROW 97)



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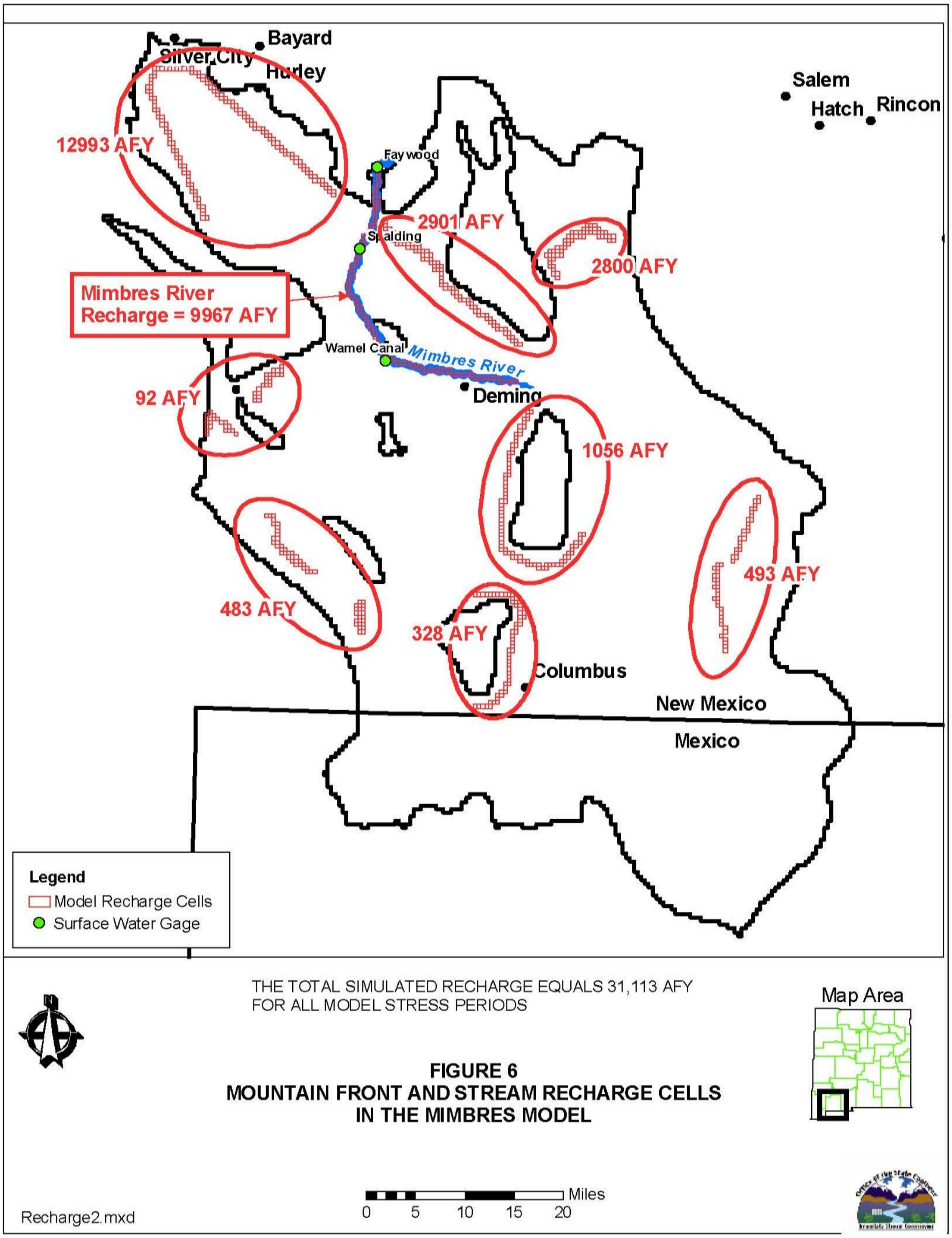
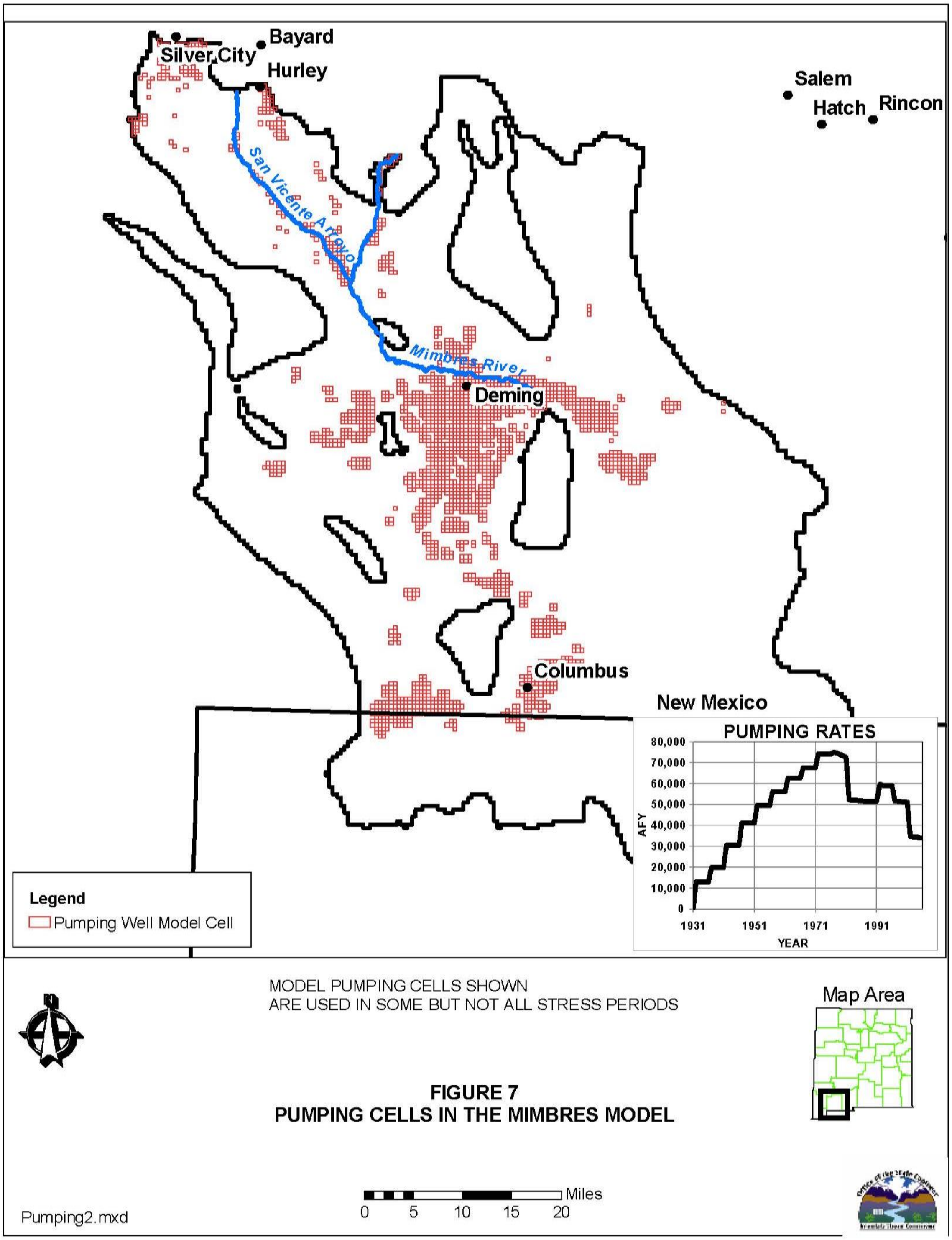


THE TOTAL SIMULATED RECHARGE EQUALS 31,113 AFY
FOR ALL MODEL STRESS PERIODS

FIGURE 6
MOUNTAIN FRONT AND STREAM RECHARGE CELLS
IN THE MIMBRES MODEL



MODEL PUMPING CELLS SHOWN
ARE USED IN SOME BUT NOT ALL STRESS PERIODS

FIGURE 7
PUMPING CELLS IN THE MIMBRES MODEL

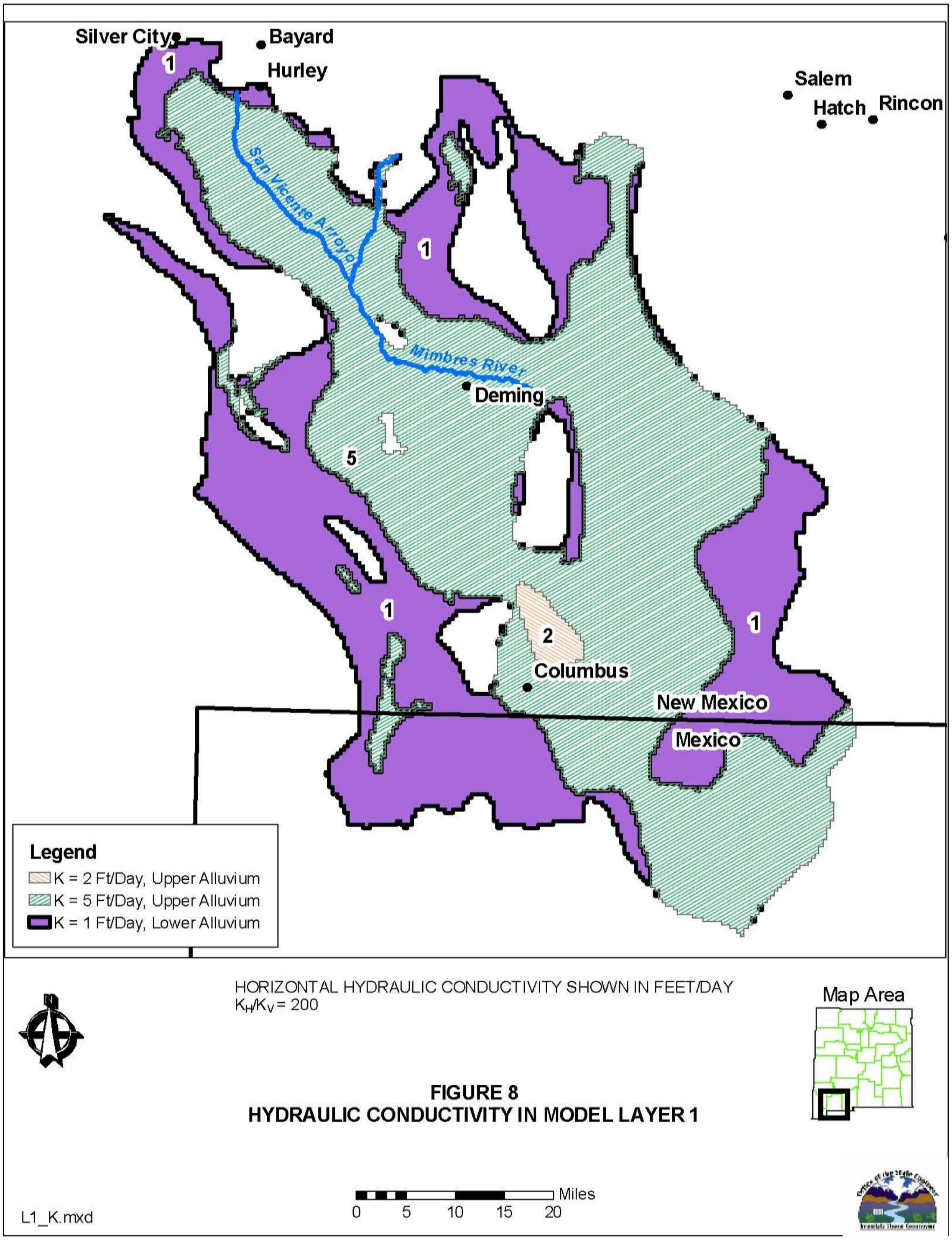


FIGURE 8
HYDRAULIC CONDUCTIVITY IN MODEL LAYER 1

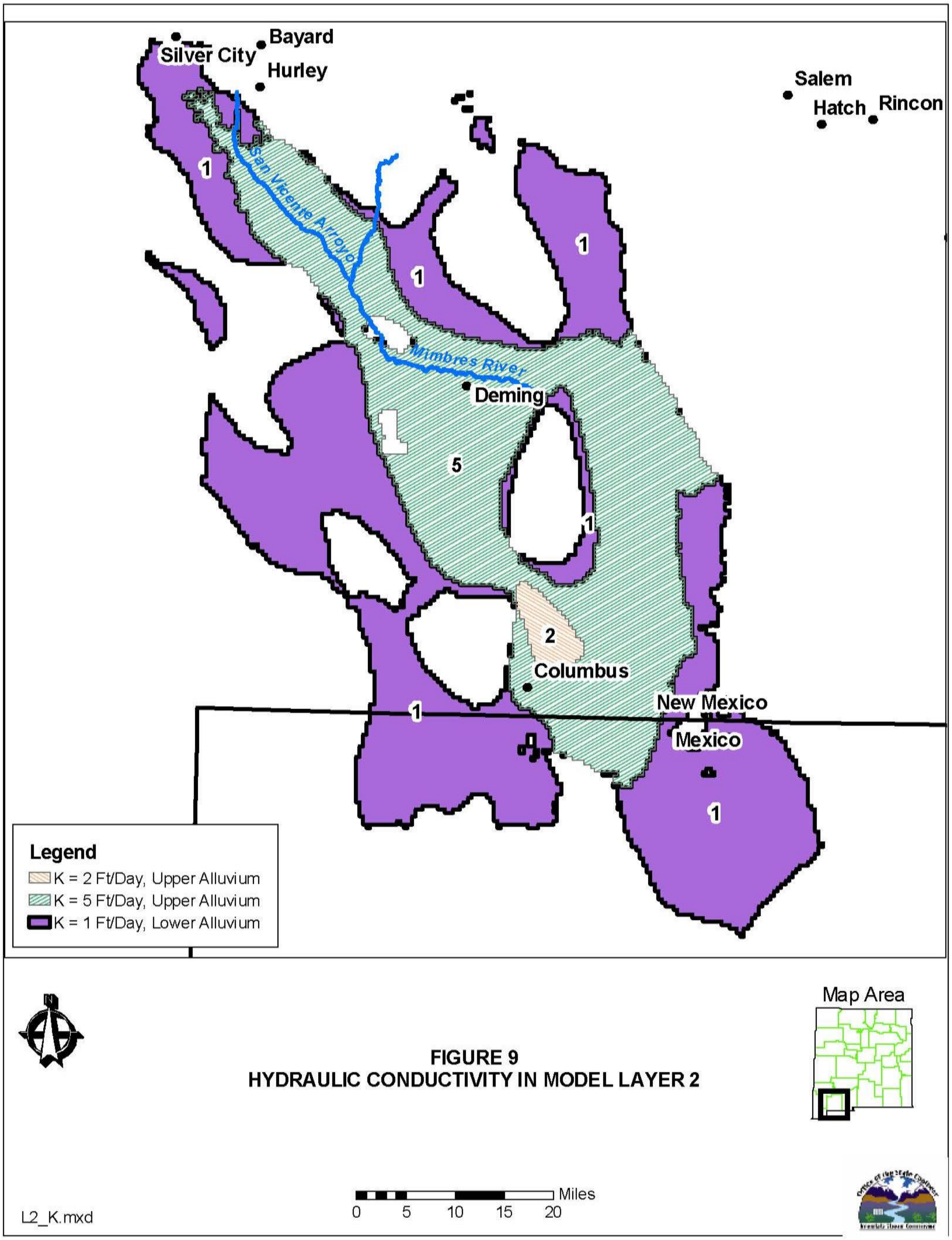


FIGURE 9
HYDRAULIC CONDUCTIVITY IN MODEL LAYER 2

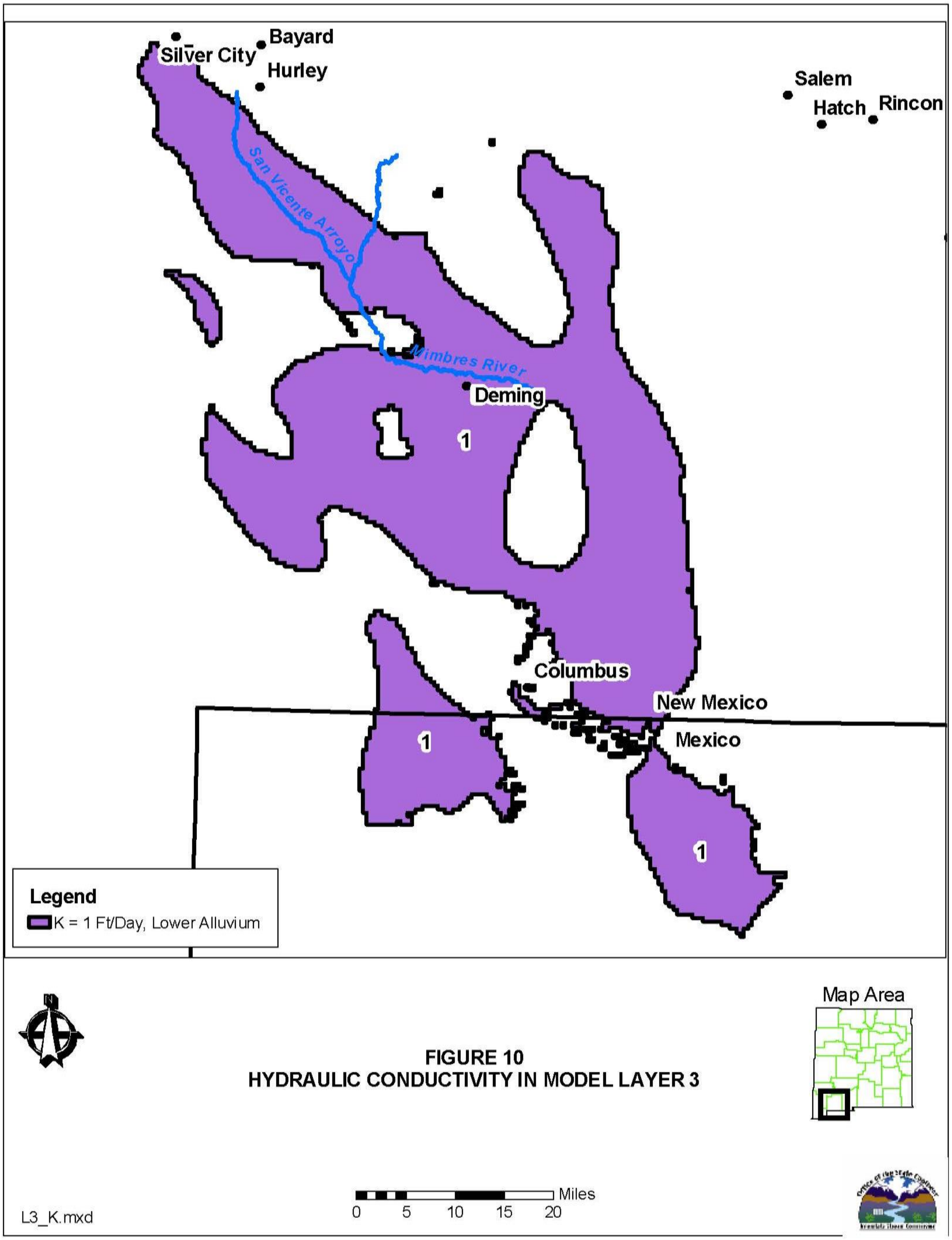


FIGURE 10
HYDRAULIC CONDUCTIVITY IN MODEL LAYER 3

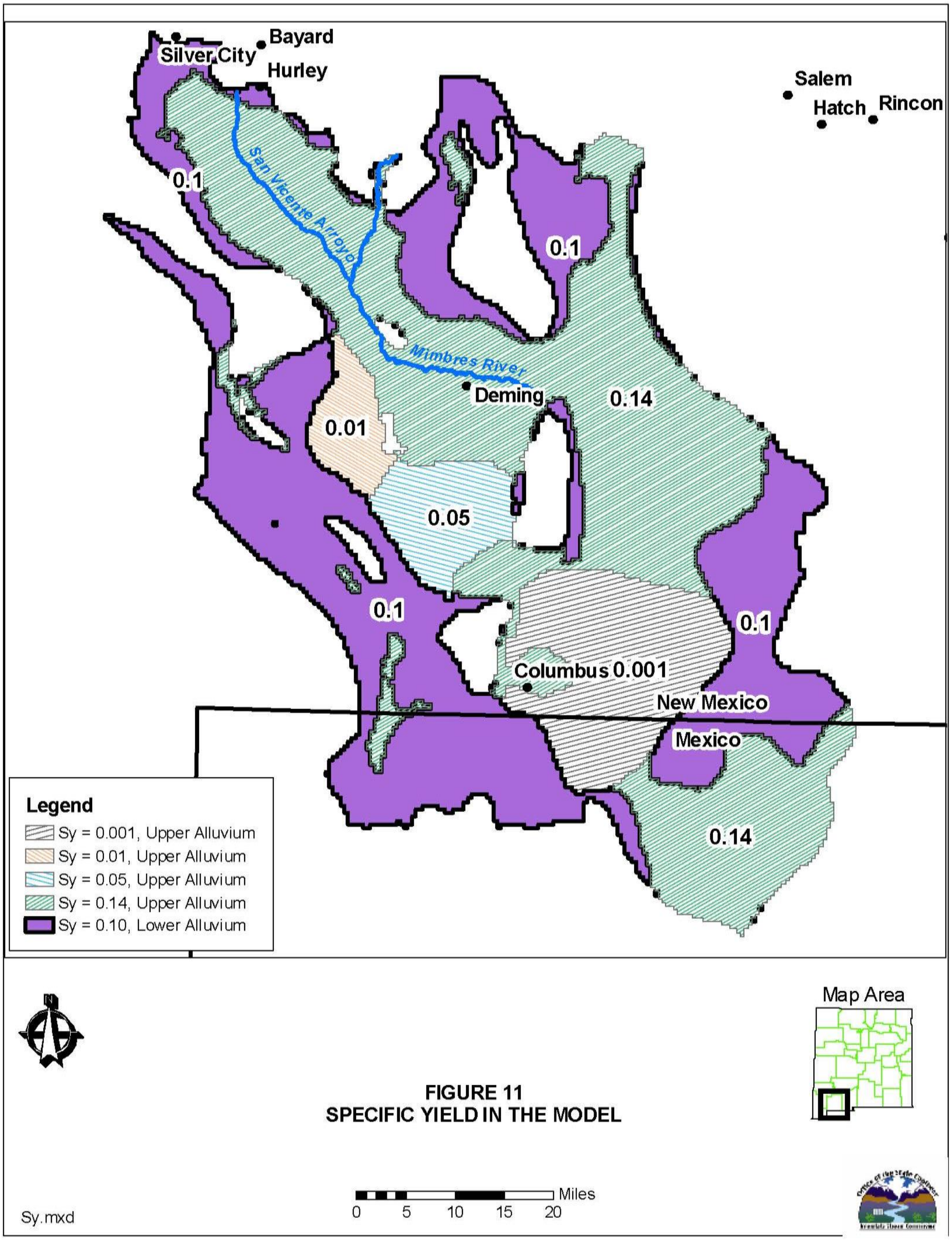
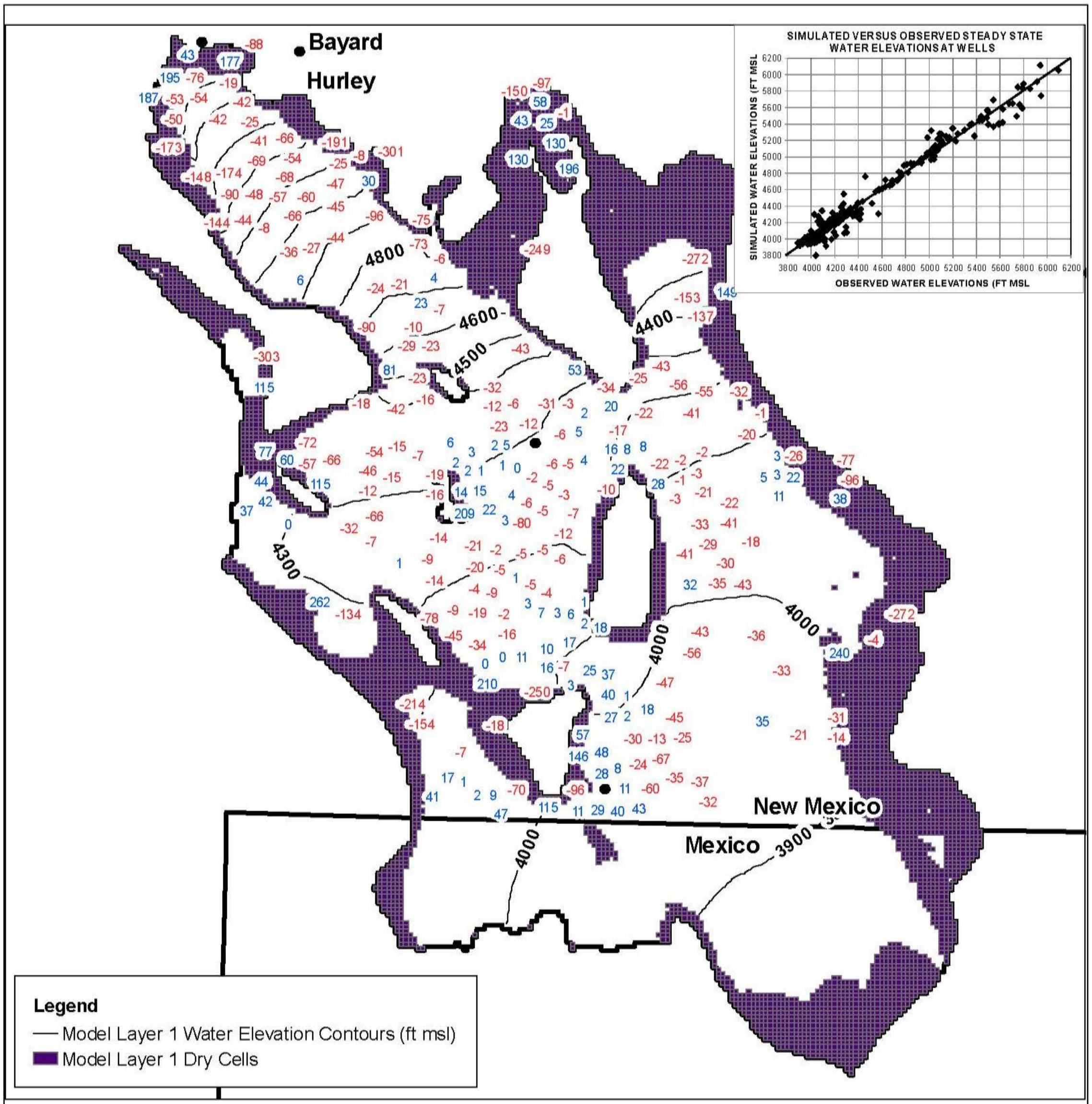


FIGURE 11
SPECIFIC YIELD IN THE MODEL



The contour interval is 100-feet
The residuals are posted as observed - simulated water elevation in feet
Negative red values represent the amount that the model
overpredicted steady state water elevations

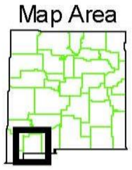


FIGURE 12
STEADY STATE WATER ELEVATION AND RESIDUALS
IN THE MIMBRES MODEL

ss_resid2.mxd

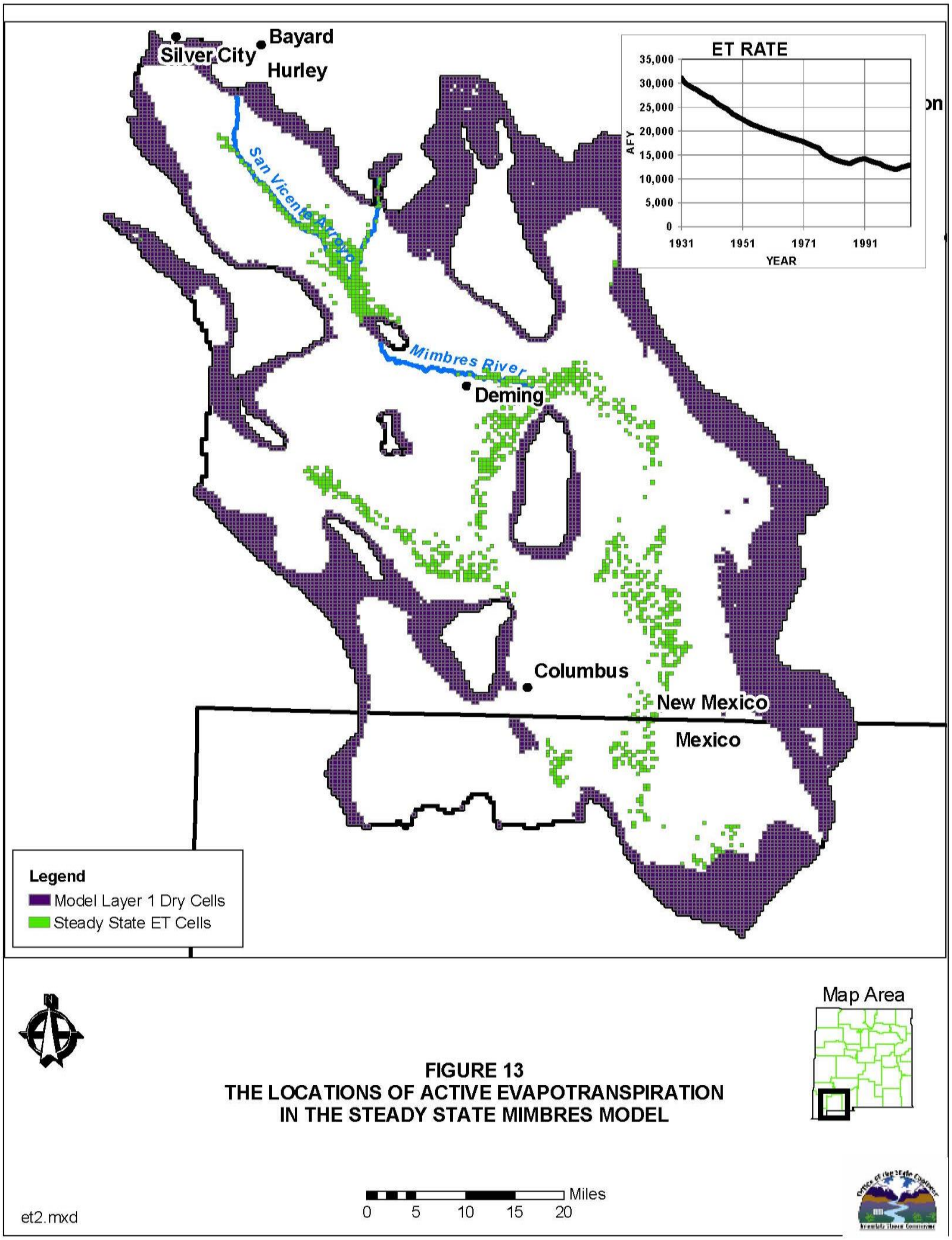
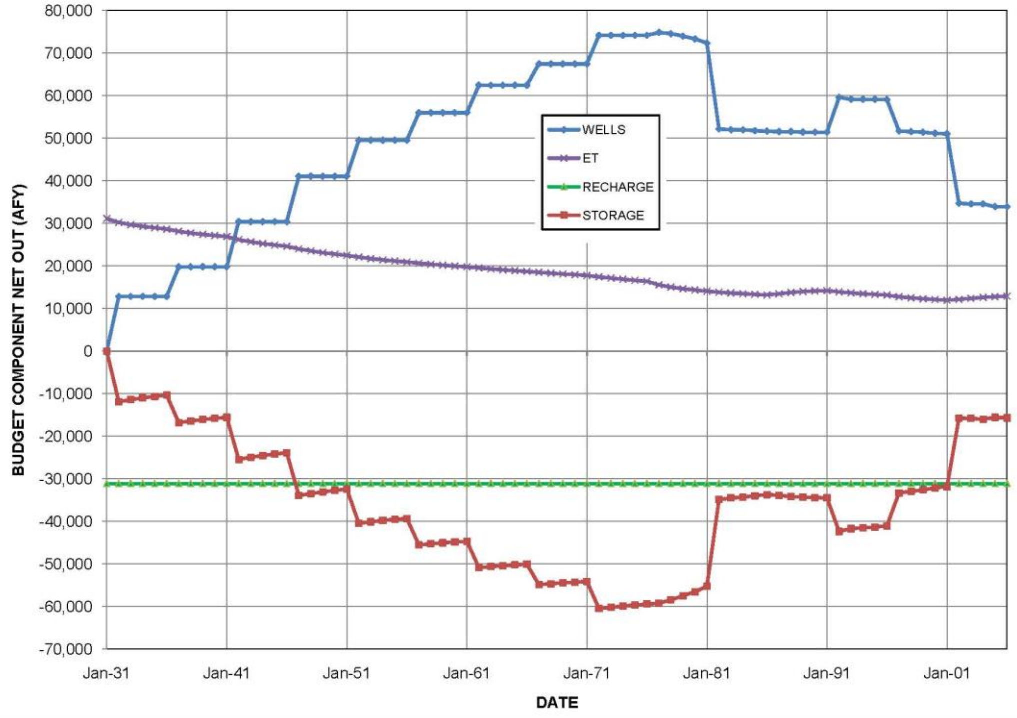


FIGURE 13
THE LOCATIONS OF ACTIVE EVAPOTRANSPIRATION
IN THE STEADY STATE MIMBRES MODEL

FIGURE 14
STEADY STATE AND TRANSIENT FLOW BUDGET COMPONENTS IN THE MIMBRES MODEL



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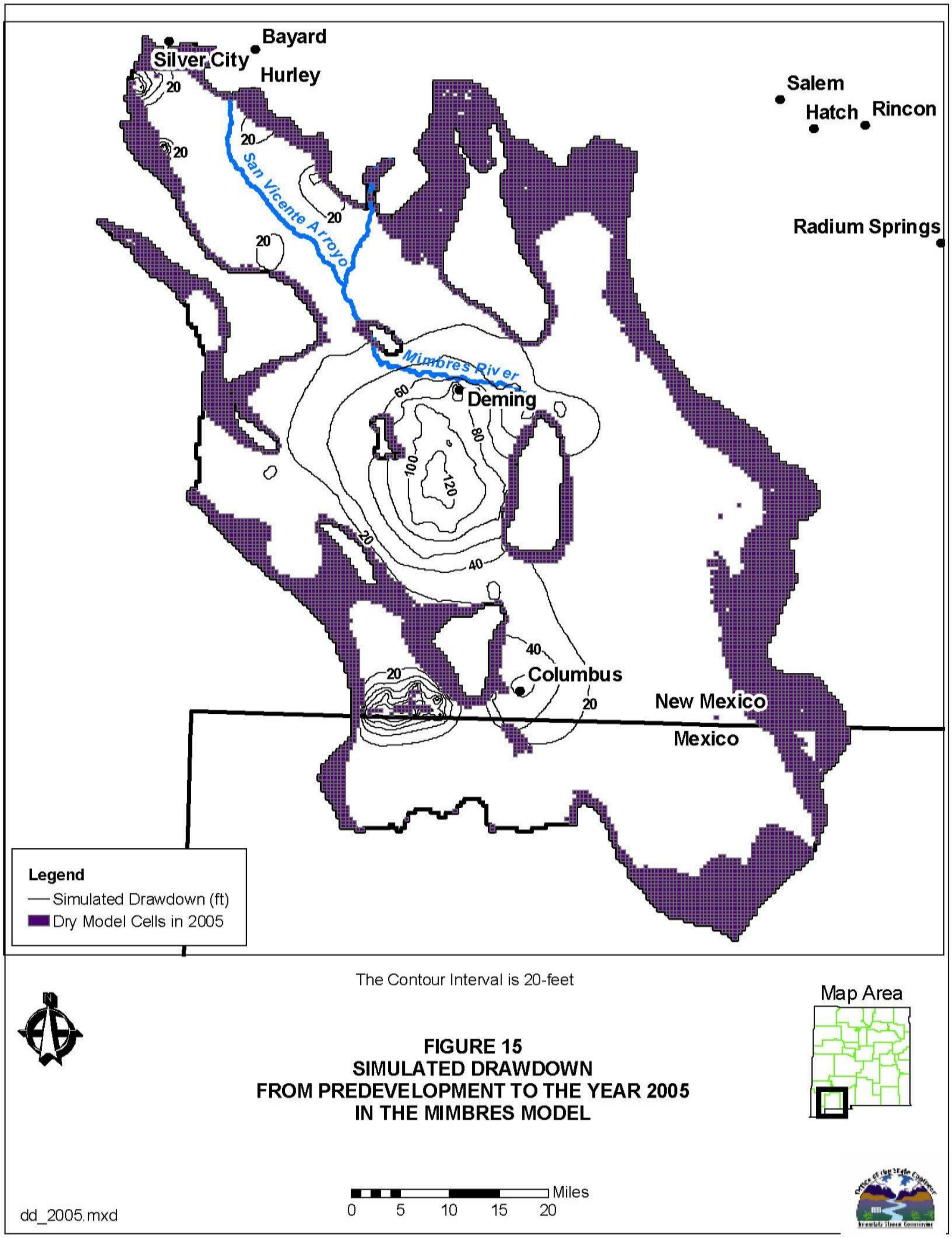


FIGURE 15
SIMULATED DRAWDOWN
FROM PREDEVELOPMENT TO THE YEAR 2005
IN THE MIMBRES MODEL

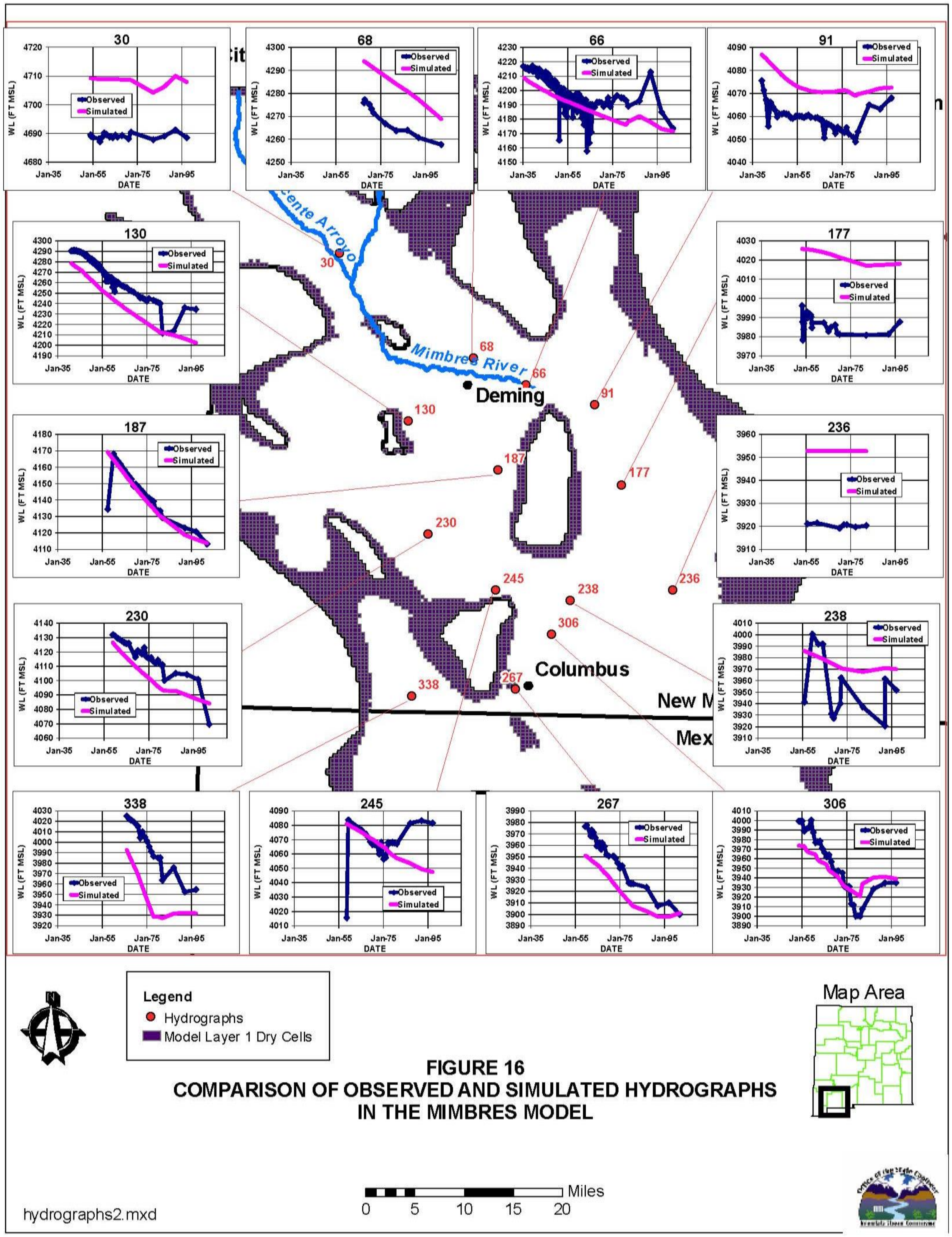
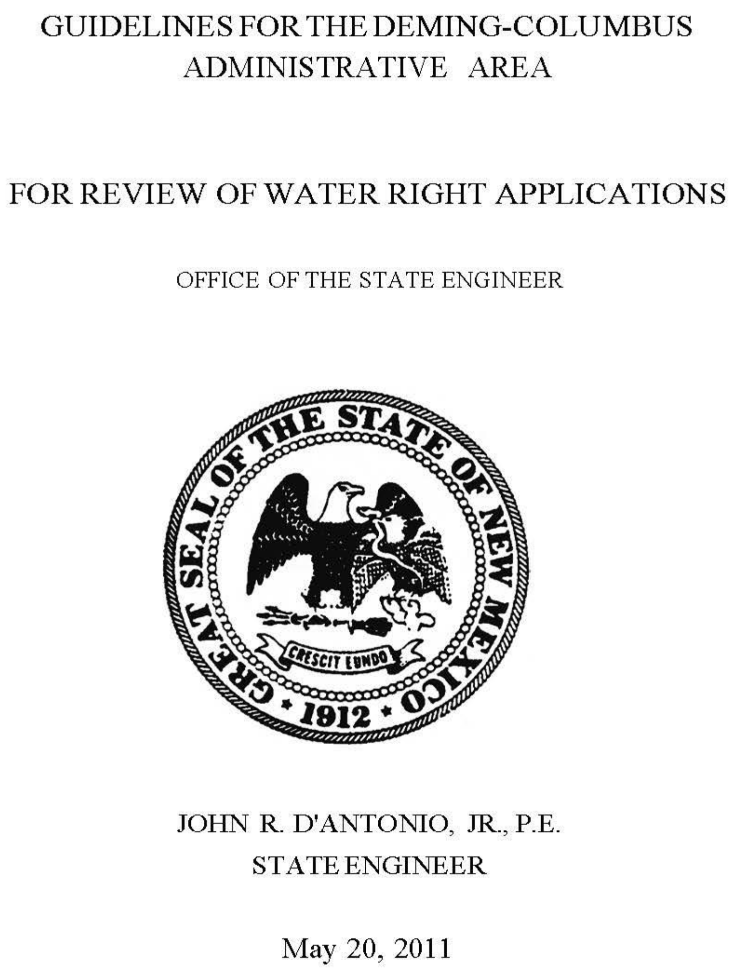


FIGURE 16
COMPARISON OF OBSERVED AND SIMULATED HYDROGRAPHS
IN THE MIMBRES MODEL

Appendix E Guidelines for the Deming-Columbus Administrative Area



GUIDELINES FOR THE DEMING-COLUMBUS ADMINISTRATIVE AREA

FOR REVIEW OF WATER RIGHT APPLICATIONS

OFFICE OF THE STATE ENGINEER

GREAT SEAL OF THE STATE OF NEW MEXICO

1912

JOHN R. D'ANTONIO, JR., P.E.
STATE ENGINEER

May 20, 2011

DEMING-COLUMBUS ADMINISTRATIVE AREA GUIDELINES FOR REVIEW OF WATER RIGHT APPLICATIONS

INTRODUCTION

The purpose of this document is to provide guidelines to Office of the State Engineer (OSE) personnel on the procedures for processing water rights applications filed within the Deming-Columbus Administrative Area (DCAA) within the Mimbres Underground Water Basin. The DCAA is located in Luna County in southwestern New Mexico (Figure 1). The Mimbres Basin was declared on July 29, 1931 by State Engineer Order 1. Since that date there have been 7 orders extending the boundaries of the basin. These guidelines replace the Mimbres Basin Administrative Criteria adopted in 1982 (NMOSE, 1982).

The OSE has developed administrative guidelines in order to promote the orderly development of water resources in the DCAA while meeting statutory obligations regarding impairment, conservation of water within the state, and public welfare of the state. Applications filed on or after the adoption date of the guidelines shall be evaluated using these guidelines. All pending applications submitted prior to this date shall be reviewed on a case-by-case basis. These guidelines do not apply to the permitting of applications filed under NMSA Section 72-12-1.1, 72-12-1.2 and 72-12-1.3. The guidelines apply to applications within the DCAA proposing production from the basin-fill alluvium, which is composed of gravel, sand, clay, silt and interbedded basalt flows. Applications proposing diversion from other geologic units, or outside of the boundaries of the DCAA, will be processed on a case-by-case basis.

Block administration and local assessment methods are applied to limit drawdowns caused by pending and future applications. The regional groundwater flow model developed by Cuddy and Keyes (2011) is available for block administration and may also be applied to assess local drawdown if the Theis equation is unsuitable. The model grid is shown in Figure 2. Each groundwater model cell is 2,000 feet by 2,000 feet in size and represents an administrative block. A 40-year planning period ending in year 2050 has been selected for block administration.

A block administrative drawdown limit of 2.50 feet per year was adopted for the 1982 basin criteria to protect irrigation and other non-domestic wells from excessive drawdown. This limit was evaluated and deemed appropriate for the administration of the DCAA. Domestic wells were also assessed to determine whether the 2.50 limit was appropriate to prevent excessive drawdown. The average domestic water column in the DCAA is about 140 feet based on WATERS using wells which were completed after January 1, 2000. If the allowable drawdown within DCAA is assumed to be about 70 percent of the average water column, a drawdown limit of about 100 feet is obtained which is equivalent to a rate of decline of 2.50 feet per year over the 40-year planning period.

Modeling studies predict portions of the aquifer in the DCAA will experience an average annual water level decline of more than 2.50 feet per year over the planning period due to the full exercise of existing permits and declarations. To protect water availability for existing rights over the planning period these areas require a greater level of restriction compared to other areas and are designated Critical Management Areas (CMAs). In addition to these areas, areas previously closed to new appropriations by order of the State Engineer shall remain closed. The boundaries of the CMAs and closed areas are shown in Figure 3 and 4, respectively.

Figure 3 and 4 provide a general representation of the boundaries at a basin scale. However, because the model grid and boundaries do not align everywhere with PLSS sections, it may not be possible to accurately determine whether a given application is located within an area using Figure 3 and 4 alone. The boundaries are defined by the geographic information systems (GIS) layer (based on the model grid) that was used to produce Figure 3 and 4. The OSE Hydrology Bureau will maintain and provide both the model and the GIS layer of the boundaries for use by OSE and the public.

No unappropriated water exists within the CMAs and areas closed by OSE order. For this reason, and to protect against impairment of existing rights located in the CMAs and closed areas, all new applications filed under NMSA Section 72-12-3 to appropriate water from the CMA and closed areas shall be denied. In addition, changes in point of diversion from the areas outside of a CMA into the CMA will be denied and changes in point of diversion from the areas outside of a closed area into a closed area shall be denied.

Preventing any level of new impact within a CMA is impractical, as this would result in the denial of applications causing relatively small impacts. Drawdown allowances have been selected to define the relatively small impacts that may be allowed to occur on CMA cells by year 2050. Applications may be allowed to induce drawdowns on CMAs up to 0.10 feet per year times the number of years in the simulation period. The drawdown allowance selected is comparable to the values used for other basins and was applied in the 1982 basin criteria. The simulation period starts January 1 of the calendar year in which the calculations are performed and ends January 1, 2050.

In summary, a groundwater model was used to estimate the drawdowns in year 2050 due to the exercise of existing permits and declarations. If the average rate of decline exceeds 2.50 feet per year in any model block, that block will be classified as a CMA and the allowable impacts thereafter on that block from any application should not exceed 0.10 feet per year. For blocks which have not been designated as a CMA at the time of application review, an application, in conjunction with existing rights, may cause declines to reach a rate up to 2.50 feet per year, and the application may be allowed to induce an additional 0.10 feet per year (total decline of 2.6 ft/yr). If a block is classified as a CMA at the time the application is being acted upon, all future applications for new appropriations under NMSA Section 72-12-3 will be denied if they are located within that block. In general, water rights may be moved within a CMA, or supplemental wells may be proposed, if the net effect on any CMA block does not exceed 0.10 feet per year and other statutory requirements have been met. However, water rights may not be transferred from outside of a CMA to within a CMA.

In addition to the block administration guidelines described above, applications are also evaluated to assess local impacts to nearby wells. Well completions and other site-specific information are considered to assess local impacts.

The more restrictive provisions of the guidelines may provide the basis for decision making; however nothing in these guidelines shall limit the State Engineer's authority to take alternative or additional actions relating to the management of the water resources of the DCAA as provided by New Mexico statutes, orders of the court, or Rules and Regulations of the Office of the State Engineer. Basin guidelines are to be applied on a case-by-case basis and alternative guidelines may be used, as recommended by the District Chief and approved by the Director of Water Rights. A glossary is also provided at the end of this document.

BASIN GUIDELINES

I. GENERAL GUIDELINES

A. New Appropriations: Applications filed under NMSA Section 72-12-3 to appropriate water from the CMA shall be denied if they were filed on or after the adoption date of these guidelines. Pending applications submitted before this date shall be assessed on a case-by-case basis.

B. Closed Areas: Areas closed to new appropriations under NMSA Section 72-12-3 by State Engineer order shall remain closed. Changes in point of diversion from the areas outside of a closed area into a closed area will be denied. Closed areas are shown in Figure 4.

C. Critical Management Area (CMA): Model cells have been designated a CMA if predicted drawdowns exceed an average annual decline of 2.50 feet per year over the planning period. The designation of CMA cells is based on the assumption that existing declarations and permits are exercised to their full extent. Designated CMA cells at the date of guideline approval are shown in Figure 3. The OSE has the sole responsibility to determine the boundaries of the CMAs and may modify these as applications are processed or as new data become available. Additional CMAs may be designated if predicted drawdowns exceed an average annual decline of 2.50 feet per year over the simulation period, which extends from the year calculations are performed to 2050.

D. Declaration and Permit Limits: For declarations of water rights other than those that meet the provisions of NMSA Section 72-1-9 (Water Development Plans), the OSE determination of the amount of ground water placed to consumptive beneficial use shall be the limit of any subsequent permit. For permitted water rights, that quantity of water applied to consumptive beneficial use is available for transfer provided the permit is in good standing. The inability to apply water to beneficial use for reasons beyond the owner's control may be taken into consideration.

E. Water Right Transfers: Applications may be accompanied with proof of the amount of water consumptively used. A farm delivery requirement (FDR) and consumptive irrigation requirement (CIR) of 3.00 and 1.6 acre-feet per acre per annum will be applied, respectively. The following limits shall apply unless the other values are recommended by the District Chief and approved by the Director of Water Rights:

1. For applications proposing to change the purpose of use of irrigation rights, diversions will be

limited to the CIR times the irrigated acreage of the existing right placed to beneficial use.

2. For applications to change purpose of use of spread or stacked irrigation rights, diversions will be limited to the CIR times the irrigated acreage of the original water right placed to beneficial use.
3. For applications proposing to change the place of use ofirrigation rights, other than spread or stacked water rights, diversions will be limited to the FDR times the irrigated acreage of the existing right.
4. For applications proposing to change the place of use ofirrigation rights, where water will be spread, diversions will be limited to the CIR acre-feet per acre per year times the irrigated acreage of the existing right placed to beneficial use.
5. For applications proposing to change place of use of irrigation rights, where water will be stacked, diversions will be limited to the combined diversion amount.
6. For applications proposing to change the purpose of use from non-irrigation to irrigation, diversions will be limited to the amount placed to consumptive beneficial use, unless Section I.E.7 applies.
7. Non-irrigation water rights placed to consumptive beneficial use which originated as irrigation water rights may be transferred back to irrigation use at the same diversion rate associated with the original water right.
8. For applications proposing the transfer of rights placed in conservation reserve program, in accordance with NMSA Section 72-12-8, diversions will be limited to the amount placed to beneficial use prior to the date the water right was placed in the program.
9. Applications to change place or purpose of use (without changing the point of diversion) will be considered throughout the basin regardless of CMA designation.

F. **Water Quality:** Groundwater quality assessments may be performed when necessary and shall consider groundwater capture and migration patterns. The evaluation technique to assess potential water quality degradation shall be selected on a case-by-case basis.

G. **Metering Requirements:** Meters may be required for wells permitted under NMSA Section 72-12-1.1, 72-12-1.2, and 72-12-1.3, in accordance with OSE rules and regulations. All other wells permitted after the adoption of these guidelines shall be metered. Permits issued for supplemental wells, or other points of diversion shall be conditioned to require metering of each point of diversion (existing and new) covered under the permit.

H. Conservation of Water: Applications shall be reviewed to ensure that the highest and best technology practically available and economically feasible for the intended purpose is used. The applicant may be required to provide information to support this review.

I. Supplemental Wells: When applying for a well (an additional point of diversion) that will be used in conjunction with other wells associated with the permit, the applicant should submit a pumping schedule with the application for the proposed and existing wells. If the applicant does not submit a schedule, the OSE may return the application for additional information or assume a worst case pumping distribution. The maximum combined diversion from all authorized points of diversion shall be the permitted diversion limit for a permit in good standing or the amount placed to beneficial use for a declared water right.

J. Return Flow Plan: A permit is required in order to increase a diversion based on return flow credit. If an application for return flow credit is filed, it shall include a return flow plan containing meter readings demonstrating flows directly to the source aquifer. Return flow credit will not be considered or granted for leakage or seepage occurring from irrigation or dairy operations, ponds, or any flows from onsite wastewater dispersal (septic) systems, or other constructed works not specifically designed to return water directly to the underground source.

K. Eastern Extension Area Restrictions: In accordance with State Engineer Order 46, wells shall not exceed 230 feet in depth except in instances where the formation at the 230 foot depth is sand and gravel not sufficiently stable to afford a satisfactory casing seat. In those instances the driller may, with the consent and under the supervision of the District Chief, proceed with the drilling to the top of the first clay strata next encountered below the 230 foot depth. The boundaries of the Eastern Extension Area are shown in Figure 4.

L. Calculation Methods: General methods include:

1. Drawdowns due to a change in point of diversion shall be estimated by finding the water level decline difference (net drawdown) between pumping the move-from and move-to wells. Drawdowns due to supplemental wells shall be computed by finding the net drawdown between the existing and proposed pumping configurations.

2. Calculations shall be made by assuming full production of the requested diversion amount unless the applicant has filed a pumping schedule acceptable to the OSE. If a reasonable pumping schedule has been proposed for the application and existing associated permits under the control of the applicant, analyses shall be performed in accordance with the schedule. If approved, the pennit shall be conditioned to limit pumping in accordance with the schedule or as the OSE otherwise determines necessary.
3. For drawdown calculation purposes only, the diversion amount will be considered to be fully consumed unless the State Engineer has approved a return flow plan.
4. Drawdowns due to the full exercise of existing water rights shall be estimated using the model developed by Cuddy and Keyes (2011) or other models accepted by the OSE.
5. References to CMAs and non-CMAs in this document pertain to model cells within the Cuddy and Keyes (2011) numerical model. The non-CMA or CMA designation assigned to any model cell extends vertically through all layers of the model. CMA designations pertain to the estimated conditions at year 2050 prior to the review of an application.
6. Local assessments shall be performed using the Theis equation or a numerical model.
7. Applications involving dry model cells shall be assessed on a case-by-case basis.

II. REGIONAL ASSESSMENTS

A. Restrictions for Wells to be Located Outside of a CMA: If a proposed well is outside of a CMA, the more restrictive of the following shall apply.

1. An application, in conjunction with the full exercise of existing wells, may be pennitted to induce drawdowns up to the rate of 2.50 feet per year on any cell outside of the CMA.
2. If drawdowns reach 2.50 feet per year, an application may be permitted to induce a drawdown allowance of 0.10 feet times the number of years in the simulation period. The simulation period starts January 1 of the calendar year in which the calculations are performed and ends January 1, 2050.
3. For CMA cells existing prior to application evaluation, an application may be permitted provided the rate of drawdown on these cells does not exceed 0.10 feet per year times the number of years in the simulation period, unless the cumulative effects become excessive.

4. Applications to change point of diversion from a CMA to an area outside of the CMA will be considered.

B. Restrictions for Wells to be Located Within a CMA: For applications where the proposed well is within the CMA, the more restrictive of the following will apply:

1. Applications filed under NMSA Section 72-12-3, on or after the adoption date of these guidelines shall be denied. All pending applications filed before the adoption date shall be reviewed on a case-by-case basis.
2. Applications to move a point of diversion into the CMA from outside of the CMA will generally be denied but the District Chief may recommend to the Director of Water Rights that special circumstances be considered.
3. Applications to change point of diversion within a CMA are generally limited to transfers within contiguous CMA cells but the District Chief may recommend to the Director of Water Rights that special circumstances be considered. An application may be allowed to induce a net drawdown in a CMA up to 0.10 feet per year; times the number of years in the simulation period, unless the cumulative effects become excessive. Section II.A.1 and II.A.2 shall also apply.
4. If a permittee owns a primary or supplemental well within the area outside of the CMA, which abuts a CMA, an application for a supplemental well within that CMA may be considered.

C. Administrative Model: Applications may be evaluated using the Cuddy – Keyes Model (2011), or other subsequent model version selected by the OSE. The input files will be immediately updated following application approval for applications other than those filed under NMSA Section 72-12-1.1, 72-12-1.2, and 72-12-1.3. Model input files will be made available to the public upon request. Applications located in areas where the model is deemed inappropriate by the OSE shall be evaluated on a case-by-case basis by applying the Theis equation or other method. Observed field conditions may be incorporated.

D. Calculations: The following methods shall apply:

1. The diversion from any individual well shall be simulated from a single model cell and shall not be divided among more than one cell unless the vertical distribution into more than one layer is appropriate. If the applied-for location creates uncertainty as to which model cell the

well could be located in, the most realistic scenario resulting in the greater impact will be used.

2. For a multi-layer stack of cells, the maximum drawdown in any layer shall be the value used to apply the guidelines. Ifany layer cell becomes a CMA, the other layers within the stack will also be considered a CMA.
3. Calculations shall be performed by assuming diversions begin in January of the calendar year the calculations are performed to January 2050, unless an alternative schedule has been proposed by the applicant and accepted by the OSE.
4. The rate of drawdown shall be computed by dividing the net drawdown by the number of years between the year the calculations are performed and year 2050.
5. Effects due to existing permits and declarations shall be made by assuming full production of the permitted and declared rights up to year 2050. Ifthe OSE modifies the amount permitted or found valid, these modifications may be incorporated to update baseline estimates. An updated inventory of water rights will be maintained by the OSE following the approval of any application other than those filed under NMSA Section 72-12-1.1, 72-12-1.2, and 72-12-1.3.

III. LOCAL AREA ASSESSMENTS

A. Water Level Decline Restrictions: Local area assessments shall evaluate 40-year impacts on nearby wells of other ownership using the following guidelines:

1. Applications to appropriate water, in conjunction with the full exercise of existing rights, may be permitted to reduce water levels at existing well sites as follows:
   a. Up to 70 percent of the current water column.
   b. For domestic well sites, the water column may be reduced to 20.0 feet, unless the 70 percent guideline is more restrictive.
   c. For non-domestic well sites, the allowable drawdown will be assessed on a case-by-case basis using the procedures presented in Morrison (2006), or other appropriate method.
   d. Other limits as deemed appropriate.
2. Ifthe limits in 111.A.1 are reached due to the use of existing rights alone, or in conjunction

with the application, the application may be permitted to induce a drawdown up to 0.10 feet per year times 40 years.

3. Applications to replace an existing well within 100 feet of the existing well location may be allowed to impact junior users by any amount. The State Engineer assumption, which may be confirmed by calculation, is that pumping from a new well within 100-feet of the old well will cause no impairment to existing water rights.
4. Decisions pertaining to local impairment shall be made on a case-by-case basis. Failure to meet any limit may be sufficient for rendering a negative decision. Upon recommendation by the District Chief, the Director of Water Rights may also consider:
    a. Validity of the water right of the affected well(s).
    b. Age of the affected well(s).
    c. Well yield.
    d. Water level decline and saturated thickness data.
    e. Whether the affected well(s) may be deepened and were constructed to secure a 40-year minimum supply.
    f. Conditional approval for an amount lower than requested to meet drawdown limits.
    g. Conditional approval based on the submittal of an acceptable monitoring and mitigation plan.
    h. Other appropriate considerations.

B. **Calculations:** The following methods shall apply:

1. Applications shall be evaluated on a case-by-case basis to assess impacts to nearby water supply wells of other ownership, including those permitted under NMSA 72-12-1.1, 72-12-1.2, and 72-12-1.3.
2. Local assessments may be performed using the Theis equation or appropriate numerical model. A numerical model may be used to estimate the 40-year impacts due to the full use of existing water rights.
3. Aquifer parameters used to calculate drawdowns on nearby wells may be obtained from accepted groundwater flow models or from reasonable site-specific information.
4. Calculations shall be computed for a 40-year period beginning at the start of the calendar year the calculations are being performed.

Adopted this twentieth day of May' 2011.

John R. D'Antonio, Jr., P.E.
State Engineer

JOHN R. D'ANTONIO, JR. PE
14846

REFERENCES

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Morrison, Tom, 2006, Guidelines for the Assessment of Drawdown Estimates: New Mexico Office of the State Engineer, Hydrology Bureau Report 06-01.

New Mexico Office of the State Engineer (NMOSE), 1982, Mimbres Basin Administrative Criteria. Prepared by New Mexico State Engineer Office, August 1982.

GLOSSARY

Acre-foot: Quantity of water that will cover one acre of land to a depth of one foot; 43,560 cubic feet or 325,851 gallons of water.

Aquifer: A saturated underground geologic formation of permeable materials capable of storing water and transmitting usable amounts of water to wells.

Basin-fill alluvium: The primary water supply source in the Mimbres Basin consisting of sand, gravel, clay and silt.

Beneficial use: All uses not defined by court decisions, statute, or the OSE as being wasteful. All beneficial uses are equal under New Mexico law.

Block administration: A procedure used in many areas of the state to administer water rights on a regional scale. An underground basin is divided into blocks or cells of land and guidelines are applied as a way of determining which applications should be approved or denied. For the DCAA, an administrative block is 2,000 by 2,000 feet in size and is represented by a groundwater model cell.

Cell: A unit used in a numerical groundwater flow model that simulates part of an aquifer system. Aquifer properties, water levels and flows may vary from cell to cell, but are assumed to be uniform within a cell. Groundwater diversions and aquifer properties are assigned to each cell. Drawdowns are computed for each saturated cell and this information is compared to the guideline restrictions. Cells are used to represent administrative blocks.

Closed area: An area in which new appropriations under NMSA Section 72-12-3 are prohibited.

Consumptive beneficial use: The consumptive beneficial use for irrigation rights does not include incidental depletions. Consumptive beneficial use for non-irrigation rights is the diversion amount less any return flow accepted by the OSE.

Critical management area (CMA): Model cells within the regional model boundaries requiring a greater degree of water level decline restriction compared to other areas. CMA limits are the threshold drawdowns that result in a non-CMA becoming a CMA.

Declared underground water basin: An area designated by the state engineer as requiring management to prevent impairment to existing water rights and to ensure the orderly development of water rights. Following the declaration of a basin by the OSE, applications must be filed to appropriate groundwater or to make changes to an existing water right.

Declared water right: A right established prior to the State Engineer's declaration of an underground water basin.

Diversion: The amount of ground water withdrawn by wells.

Domestic wells: Wells permitted under NMSA Section 72-12-1.1.

Drawdown: The decline in the water level over a given time caused by well diversions.

Ground water: Water located below the surface of the earth that is stored in pores of geologic sediments (sands and gravels), cracks and crevices of rocks (fractures) and solution cavities in limestone.

Groundwater-flow model: A series of mathematical equations representing the aquifers in the area that are solved using a computer. Models are used to estimate the water level declines due to the use of wells.

Guidelines: A statement of general procedure to be applied in a specific area by OSE personnel to any application to ensure a consistent set of guiding principles is used to evaluate all applications. Due to the wide variety of physical conditions that may be encountered, guidelines should be applied on a case-by-case basis.

Hydrogeologic: Characteristics that enable geologic units to store and transmit water.

Impairment (underground water): A finding by the state engineer of negative impact based on water level decline, remaining saturated thickness, available water columns and other relevant factors or facts.

Licensed water right: A water right in which a license has been issued by the State Engineer that defines the extent of the water right.

Local assessment: The determination and assessment of water level decline on water supply wells in the vicinity of a proposed well.

Move-from well: The well from which the water rights will be transferred.

Move-to well: The well to which water rights are being transferred.

New appropriation: A groundwater diversion permitted under NMSA Section 72-12-3.

NMSA: New Mexico Statutes Annotated.

Non-CMA: Areas within the regional model boundaries that are not designated a Critical Management Area. Restrictions are placed on non-CMAs that are less severe relative to those placed on CMAs.

Pending application: Any application that was filed with the OSE but has not been acted upon.

Permit: Is an application that has been approved by the state engineer for a specific purpose, such as changing point of diversion, drilling a supplemental or replacement well, changing place or purpose of use, etc.

Permitted right: The right to use water as provided for by permit. A water right is established by exercising a permit and by putting water to continuous beneficial use.

Primary well: The well that was originally permitted or declared.

Pumping schedule: May include a changing diversion rate with time for a given well, or the diversion rate for multiple wells.

Regional groundwater flow model: Is typically a basin-wide numerical model that allows the estimation of impacts due to existing wells and proposed appropriations.

Return flow credit: Is that amount of water directly returned to the same immediate underground source from which it was appropriated, after the water has been applied to beneficial use. Return flow credit will not be considered or granted for incidental leakage or seepage occurring from irrigation use, constructed works, or ponds, or for any flows from onsite dispersal (septic) systems.

Return flow plan: Is a report based on factual and acceptable scientific measurements demonstrating return flow credit.

Saturated thickness: The underground zone in which the void spaces in the rocks and soils are filled with water. As water levels decline, the saturated thickness also declines.

Section 72-1-9: The statute which allows municipalities, counties, state universities and public utilities supplying water to municipalities or counties to acquire water rights pursuant to a water development plan for reasonably projected water needs that will occur within 40 years.

Section 72-12-1.1: The statute that regulates wells required for relatively small amounts of water for single or multiple households, including drinking and sanitary uses in conjunction with a commercial operation.

Section 72-12-1.2: The statute that regulates livestock wells.

Section 72-12-1.3: The statute that regulates wells used for a period not to exceed one-year for specifically listed purposes of use.

Section 72-12-3: The statute that regulates wells for new appropriation other than those applications filed under Section 72-12-1. Section 72-12-3 applications generally seek to obtain quantities of water greater than allowed by the OSE for Section 72-12-1 wells.

Spread irrigation water rights: Irrigation water rights on an acre of land that are less than the amount of water per irrigated acre associated with the average basin-wide cropping pattern.

Stacked water rights: Irrigation rights on an acre of land that exceed the amount of water per irrigated acre associated with the average basin basin-wide cropping pattern.

Statutory: Regulated by law.

Supplemental well: An alternate point of diversion to supplement the supply of an existing water right.

Theis equation: An analytical method that calculates water level declines using one set of aquifer parameters .

Transfer: Is a general term that is not defined in the statutes but is used to indicate a change in point of diversion or change of place or purpose of use of a water right.

Water column: Is the length of the column of water in a well that is potentially available for production. It is generally calculated by subtracting the non pumping water level from the well depth for wells that have screens extending to the bottom of the well. As water levels decline due to pumping, water columns and well yields also decline.

Water right: The amount of water that can be legally placed to beneficial use by the water right owner.

Well completion: The specific well construction information provided in a well record, such as the depth of a well, perforated interval, casing materials, surface seals, or other relevant data.

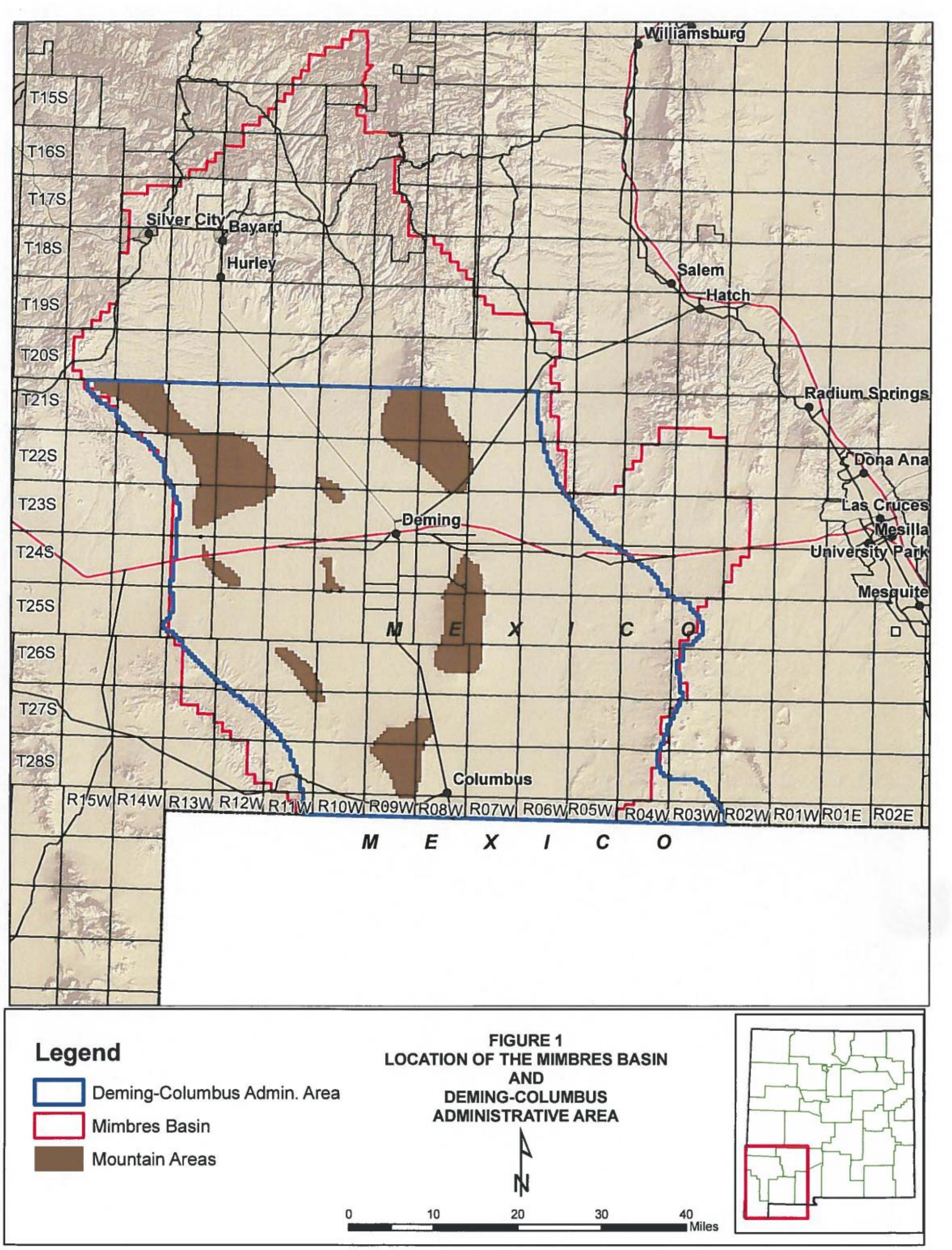


FIGURE 1
LOCATION OF THE MIMBRES BASIN
AND
DEMING-COLUMBUS
ADMINISTRATIVE AREA

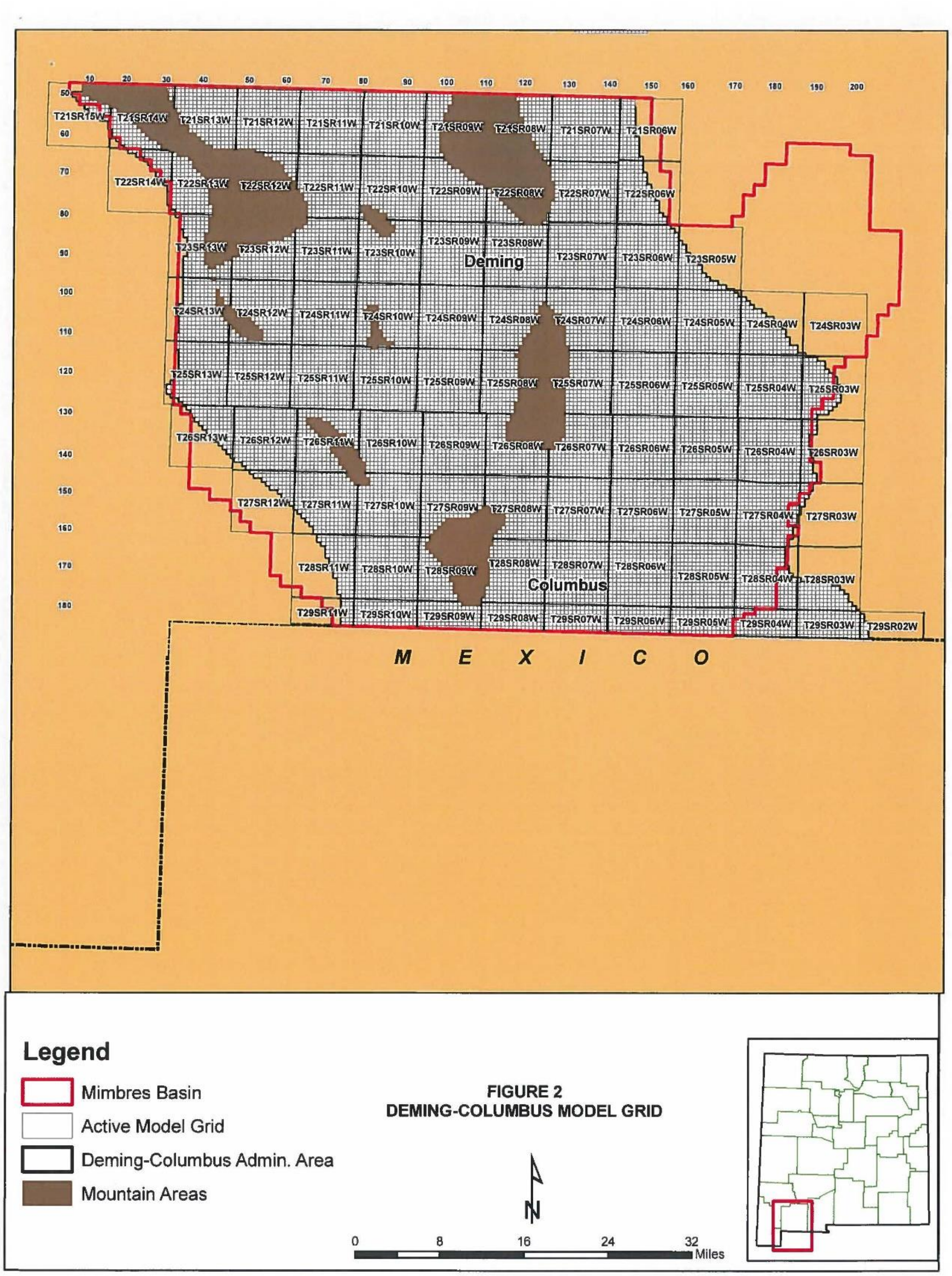


FIGURE 2
DEMING-COLUMBUS MODEL GRID

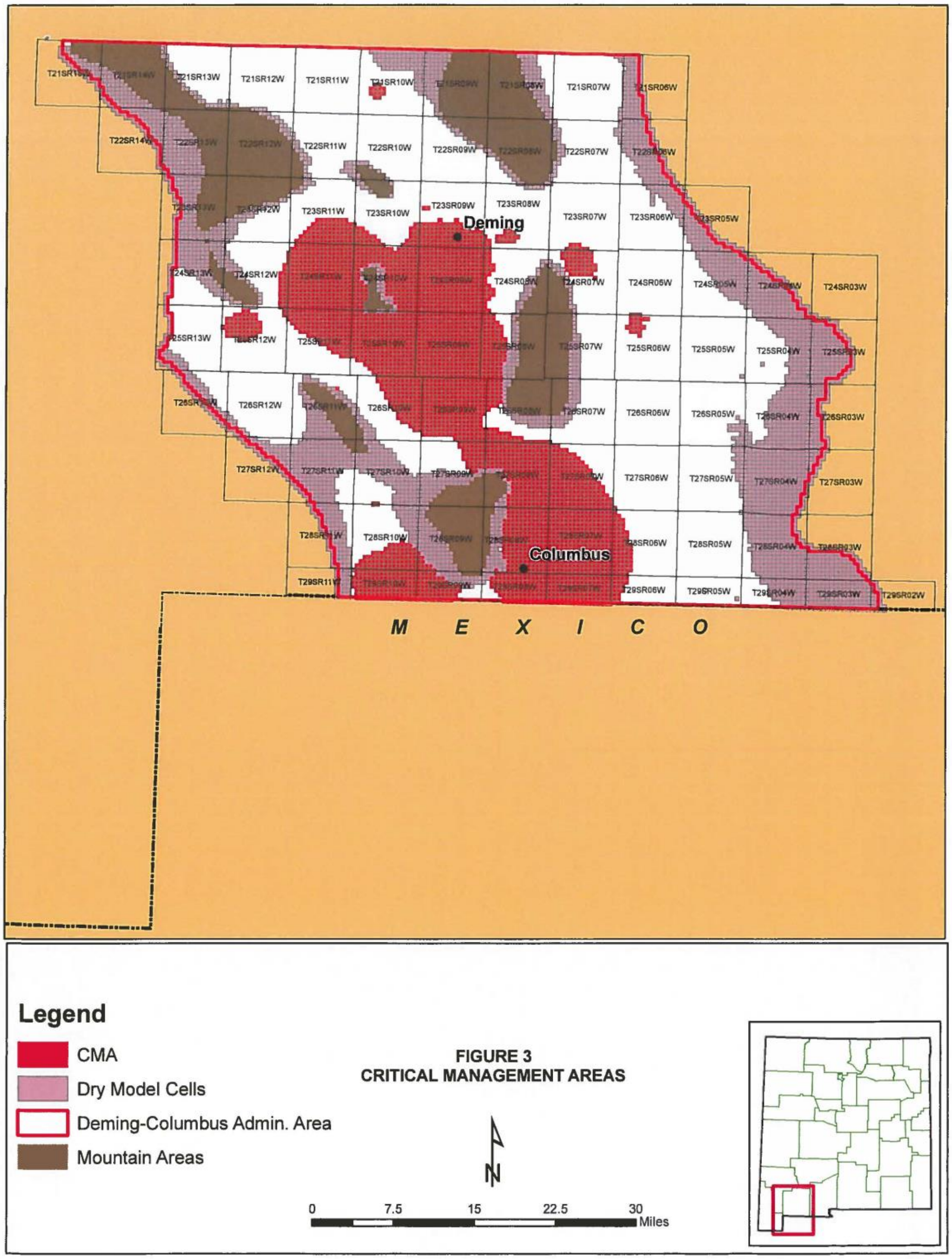


FIGURE 3
CRITICAL MANAGEMENT AREAS

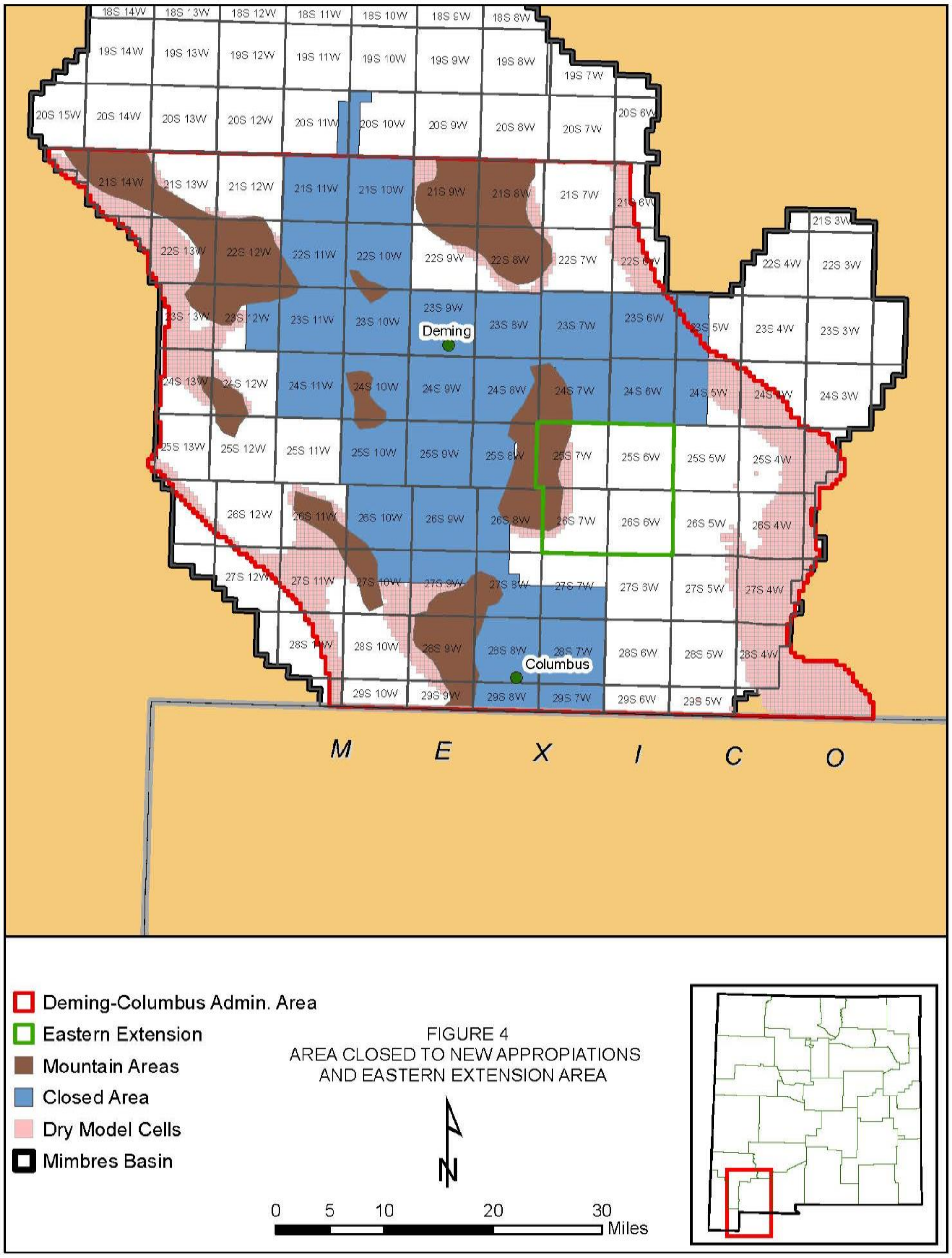
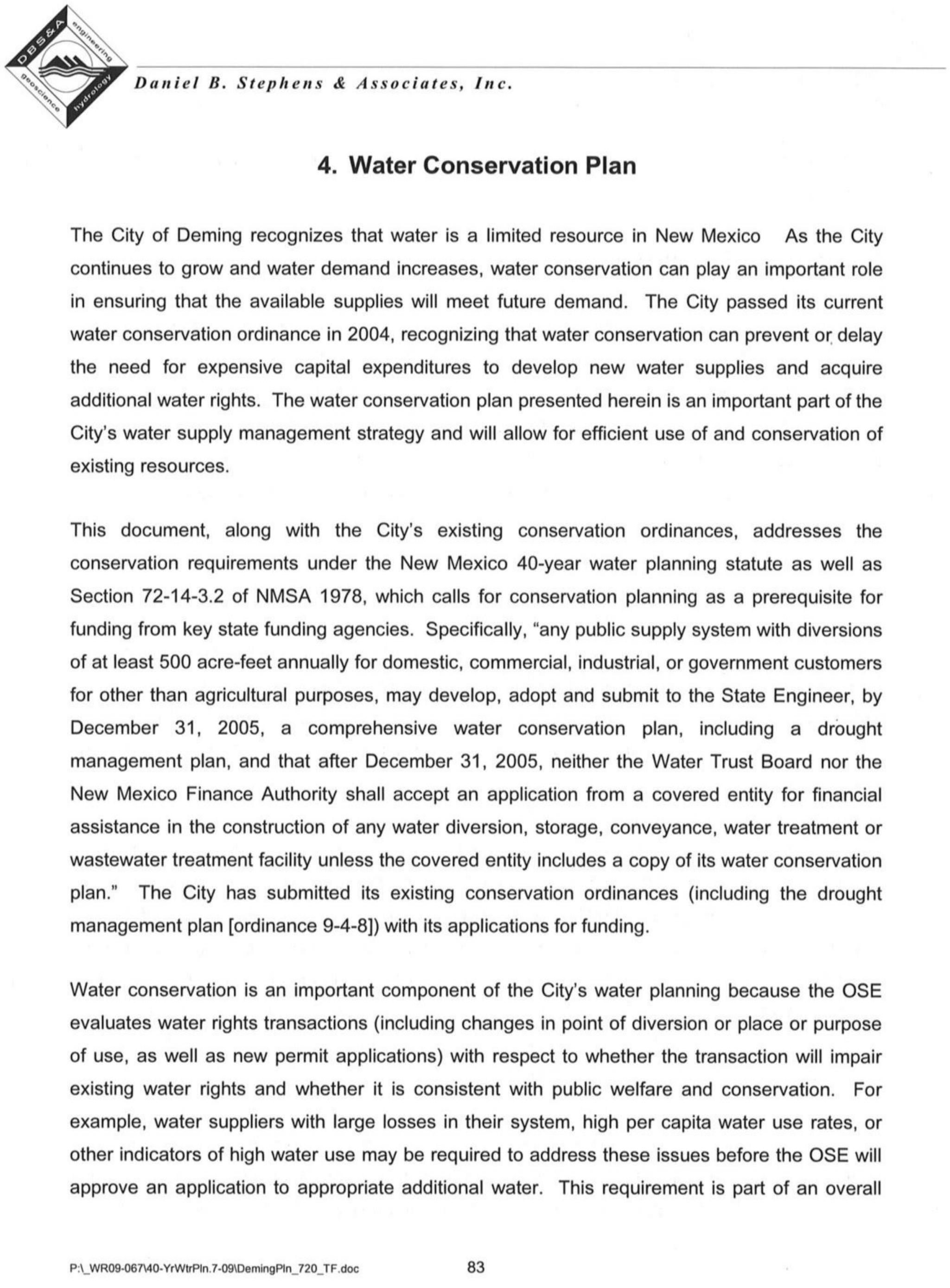


FIGURE 4
AREA CLOSED TO NEW APPROPIATIONS
AND EASTERN EXTENSION AREA

Appendix F 2009 Water Conservation Plan (From 2009 40-Year Water Plan)



4. Water Conservation Plan

The City of Deming recognizes that water is a limited resource in New Mexico   As the City continues to grow and water demand increases, water conservation can play an important role in ensuring that the available supplies will meet future demand. The City passed its current water conservation ordinance in 2004, recognizing that water conservation can prevent or delay the need for expensive capital expenditures to develop new water supplies and acquire additional water rights. The water conservation plan presented herein is an important part of the City's water supply management strategy and will allow for efficient use of and conservation of existing resources.

This document, along with the City's existing conservation ordinances, addresses the conservation requirements under the New Mexico 40-year water planning statute as well as Section 72-14-3.2 of NMSA 1978, which calls for conservation planning as a prerequisite for funding from key state funding agencies. Specifically, "any public supply system with diversions of at least 500 acre-feet annually for domestic, commercial, industrial, or government customers for other than agricultural purposes, may develop, adopt and submit to the State Engineer, by December 31, 2005, a comprehensive water conservation plan, including a drought management plan, and that after December 31, 2005, neither the Water Trust Board nor the New Mexico Finance Authority shall accept an application from a covered entity for financial assistance in the construction of any water diversion, storage, conveyance, water treatment or wastewater treatment facility unless the covered entity includes a copy of its water conservation plan." The City has submitted its existing conservation ordinances (including the drought management plan [ordinance 9-4-8]) with its applications for funding.

Water conservation is an important component of the City's water planning because the OSE evaluates water rights transactions (including changes in point of diversion or place or purpose of use, as well as new permit applications) with respect to whether the transaction will impair existing water rights and whether it is consistent with public welfare and conservation. For example, water suppliers with large losses in their system, high per capita water use rates, or other indicators of high water use may be required to address these issues before the OSE will approve an application to appropriate additional water. This requirement is part of an overall strategy by the State to ensure that water is being used wisely before additional water rights are permitted.

4.1 Existing Conservation Practices

The City of Deming implemented comprehensive water conservation and drought management ordinances in 2004 (Appendix A). Likewise, the City has already implemented a number of water conservation-related activities, including an increasing block water rate structure, automated billing system, customer water meter replacement, production management using a system control and data acquisition (SCADA) system, leak surveys and standards for water line construction and wastewater reuse. Sections 4.1.1 through 4.1.7 summarize the City's existing programs.

4.1.1 Water Rates

City water rates were last updated by an Ordinance No. 1185, passed April 16, 2009 (City of Deming, 2009). The updated water rates have an increasing block rate structure; that is, as water consumption increases, so does the cost to the customer, thus creating an incentive to reduce consumption. In addition, water rates are higher from May 15 to October 15 of each year.

Deming water rates were compared to the water rates in other New Mexico communities of similar size. An analysis of 2006 water rates by the NMED Construction Programs Bureau indicates that the charge for 6,000 gallons of water in the residential sector ranged from a minimum of $6.75 (Artesia) to a maximum of $50.00 (San Ysidro). Average and median residential water rates for New Mexico communities of similar size to Deming (Table 29) were $13.51 and 14.08, respectively, per 6,000 gallons in 2006; Deming's summer rate was $11.16 per 6,000 gallons. Under the new residential rates, the cost for 6,000 gallons is $12.26 for 2009, $13.42 for 2010, and $14.84 for 2011.

The charge for 6,000 gallons of water in the commercial sector ranged from a minimum of $8.50 (Tatum) to a maximum of $140.79 (Albuquerque Bernalillo County Water Utility Authority) for the 101 New Mexico municipalities that were included in the survey. New Mexico communities of similar size to Deming had average and median commercial water rates of $17.45 and 14.61, respectively, per 6,000 gallons in 2006. Under the new commercial rates for Deming, the cost for 6,000 gallons is $18.32 for 2009, $21.56 for 2010, and $25.76 for 2011.

Table 29. Municipal Water Rates in Comparable New Mexico Municipalities

	Residential		Commercial	
Municipality	Number of Connections	Monthly Charge for 6,000 Gallons ($)	Number of Connections	Monthly Charge for 6,000 Gallons ($)
Artesia	3,979	6.75	551	13.50
Carlsbad	9,195	10.53	1,480	12.46
Deming	5,730	12.26 [a]	596	18.32 [a]
Gallup	5,977	20.92	1,257	33.72
Hobbs	9,320	11.03	1,463	11.03
Portales	3,995	14.41	731	14.41
Raton	3,591	15.55	570	20.56
Silver City	5,603	14.80	575	14.80
Socorro	3,345	14.23	361	14.23
Sunland Park	4,002	13.92	345	20.32
Average		13.44		17.34
Median		14.08		14.61

Source: NMED, 2007a, unless otherwise noted

[a] Current summer rate

4.1.2 *Automated Billing System*

The City of Deming uses the Itron system for billing its customers, and billing is done twice a month (Jenkins, 2008). The Itron billing system is an electronic read system in which data are collected by meter readers using handheld units. Data are automatically entered and downloaded from the handheld units into the billing system (Jenkins, 2008). The system flags accounts when the current reading is out of range for historical readings, and the meter reader gets an error signal and is immediately asked to re-read the meter if use is extremely high or low. If the repeat reading is correct, it is followed up with a field check (Jenkins, 2009).

4.1.3 *Customer Water Meter Replacement Program*

The City of Deming has a 10-year customer water meter replacement program (Jenkins, 2009).

4.1.4 *Production Management*

In July 2007, the City installed a SCADA system, which is being used to control the four largest production wells. Additional wells will be added over time. This system controls when each well is being pumped, helping the City to keep the optimal amount of water in storage and preventing overflows (Jenkins, 2008). The system limits are set to trigger increased production whenever the storage tanks are less than half full and to shut off all pumps when the storage tanks are three-quarters full. Having the SCADA system in place allows the system to respond more efficiently to fluctuations in demand (Jenkins, 2009).

In 2009 the City brought online a 3,000,000-gallon ground-level water storage tank. Five 600-gpm booster pumps are SCADA-controlled to supply water from this new tank to the distribution system. The pumps are controlled by the level of water in the two overhead water storage tanks (Section 3.1) to maintain a much more constant level in the overhead tanks.

4.1.5 *Leak Surveys and Standards for Water Line Construction*

The City of Deming follows American Water Works Association (AWWA) water line construction standards and performs leak surveys every five years as required. Leak detection companies are hired to perform these surveys, and the City decides when a survey is necessary based on the volume of non-revenue water for the year. In 2008, non-revenue water accounted for 4 percent of total production (Jenkins, 2009).

Meter readers are trained to look for leaks, and when leaks are apparent, meter reading staff attempt to inform the customer and may turn off the water if no one is home (Jenkins, 2008). The City also often receives phone calls reporting wet spots or water leaks that result in field surveys and leak repair (Jenkins, 2008). The Public Works and Utilities Department analyzes the previous year of water use data by account each January and, based on this review, investigates individual accounts with higher than normal use (Jenkins, 2008).

4.1.6 Wastewater Reuse

The wastewater treatment plant treats an average of approximately 1 to 1.3 million gallons of wastewater per day (Jenkins, 2008). During December, January, and February, treated wastewater is stored in lined lagoons at the treatment plant, where the City has 130,000,000 gallons storage capacity. This stored effluent is currently used for irrigation from March through the fall (Jenkins, 2008); however, since early 2008, approximately 300,000 gallons of treated effluent has been contracted for use by Luna Energy. This reuse of city effluent reduces diversions from the Mimbres groundwater basin by an equivalent amount. The remaining 1 million gallons of treated effluent are commingled with water from the City system to supplement irrigation of the municipal cemetery and golf course, reducing system diversions by 336 ac-ft/yr (Jenkins, 2008). The balance of municipal wastewater not used to directly offset these system diversions is applied as irrigation to City-owned farms, increasing return flow to the aquifer by up to 1,120 ac-ft/yr.

4.1.7 Outdoor Water Conservation Ordinance

The City of Deming passed its water conservation ordinance effective June 2004 (Deming Municipal Code 9-4-8). The ordinance mandates turf and landscape irrigation conservation measures, including irrigation day restrictions (even-numbered addresses may irrigate on Mondays, Wednesdays, Fridays, and Sundays; odd-numbered addresses may irrigate on Tuesdays, Thursdays, Saturdays, and Sundays) and time of day irrigation restrictions (all outdoor irrigation is prohibited between the hours of 10:00 a.m. and 6:00 p.m. from April 1 through September 30) (D.M.C. 9-4-8 C). The outdoor water conservation provisions restrict nonessential water use and require that all home and/or automobile washing be done using a handheld bucket or handheld hose with a shutoff nozzle (D.M.C. 9-4-8(D)).

The ordinance prohibits water waste, defined as follows:

- Causing water to discharge onto any street, alley, gutter, ditch, drain, or public right of way
- Failing to repair a leak in a system within 10 days of discovery

- Washing any outdoor impervious surface, except in emergencies or where mandated by federal, state, or local law
- Serving drinking water in local restaurants except on request

The code also mandates that any swimming pools constructed after the effective date of the outdoor conservation code be equipped with filtration, pumping, and recirculation systems (D.M.C. 9-4-8(E)).

Requests for variances from the requirements set out by conservation ordinance are reviewed by the planning and zoning commission on the basis of hardship or special cases, and the commission makes recommendations to the city council if it feels a variance should be approved. Inconvenience and/or the potential for damages to landscaping do not justify a request for a variance (D.M.C. 9-4-8 (F)). Exceptions to enforcement include water used for firefighting purposes, inspection and pressure testing of fire hydrants, street sweeping, sewer maintenance, or other established utility and public works practices, and water used to establish newly seeded or sodded turf grass and landscaping (D.M.C. 9-4-8 (G)).

To implement additional water use restrictions, the Deming City Council has the authority to declare a water emergency, on the advice of the city administrator and/or director of public works. The city council may, by resolution, restrict or prohibit use of water for irrigation, residential home and/or car washing, swimming pool filling and refilling, operation of ornamental fountains, or any other use deemed unappropriate given the circumstances (D.M.C. 9-4-8 (H)). Variances may not be issued during this time. The maximum penalty for violation of any of the outdoor water conservation code provisions is a fine of $500, imprisonment for up to 90 days, or both (D.M.C. 9-4-8 (I)).

4.1.8 Landscape Requirements for New Development

In addition to its water conservation ordinance, the City of Deming has passed landscape standards to encourage water conservation by preserving native vegetation and encouraging the use of low-water-use and drought-tolerant plants (D.M.C 12-18-2). General design standards mandate the use of low-water-use plants and limit the amount of surface area that may be planted in turf for single family and multifamily dwellings and for commercial sites (D.M.C. 12-18-2 (D), (E), and (F)). Modifications may be allowed if a compelling case can be made before the City Council. Financial hardship is not a basis for granting a modification request (D.M.C. 12-18-2).

4.2 Conservation Goals and Measures

Improving customer and public awareness of the need to conserve water is one of the main goals of this water conservation planning document (Jenkins, 2008). Continued implementation and future expansion of a public education program that focuses both on water waste and indoor and outdoor water use in all sectors is a priority, in addition to continued implementation of the City's existing programs. Continued promotion of xeriscaping, landscape requirements for new development, and an indoor water conservation ordinance are measures under consideration.

4.2.1 Conservation Goals

Conservation activities are generally implemented either by the water supplier or the water customer, and improvement in customer and public awareness is likely to lead to the implementation of conservation measures by customers. Important components of the City of Deming water conservation public education program include:

- Providing the rationale for conservation and demonstrating that the City is already addressing water conservation in its system management before asking customers to change how they use water. Customers will be more willing to voluntarily change their behaviors/habits that lead to excess water use if they understand why it's important and if they know that all water users are also doing the same.

- Addressing the obvious forms of water waste first, targeting the most wasteful practices before asking individual users to change the ways that they use water.

- Educating customers about what they can do to reduce their use.

The most common types of water waste are over watering (applying more water than is needed to keep landscapes green), which results in higher outdoor water use due to increased evaporation and evapotranspiration, and fugitive water, which can be seen in the form of runoff. Fugitive water is not a large problem in Deming. As described in Section 4.1.7, the City can assess fines for water waste, although the issuance of warnings along with public education has resolved all water waste issues to date (Jenkins, 2008). Water waste fines go through the municipal courts, as do fines for any code violation (Jenkins, 2008).

4.2.2 Conservation Measures

The Department of Public Works and Utilities has an existing public education program, which involves speaking to several different groups each year (Jenkins, 2008). The City of Deming has an outdoor water conservation code that went into effect in June 2004, setting watering days and times and prohibiting water waste (Section 4.1.7). The City does not currently offer rebates for the removal or replacement of high-water-use plants, nor does it have a rebate program for the replacement of high-water-use appliances (Jenkins, 2008).

The measures that the City of Deming plans to implement to continue to meet its conservation goals are outlined in Sections 4.2.2.1 through 4.2.2.3.

4.2.2.1 Public Education Program for Residential and Commercial Users

A number of tools can be used to share water conservation tips with customers and the general public, including bill inserts, feature articles and announcements in the news media, workshops, booklets, posters, and bumper stickers. Public school education is also an important means for instilling water conservation awareness.

The City of Deming's public education efforts already include speaking to different groups each year, and the number of presentations made will be increased to reach more members of the general public (Jenkins, 2009). In addition, the City will include water conservation materials in customer mailings and make water conservation literature available online and at public locations. The City will also contact Deming Public Schools to begin bringing water conservation lessons to the classroom. Children who learn about conservation in the classroom will take that information home and educate their own families.

4.2.2.2 Evaluation of Rebate Programs for Replacement of High-Water-Use Appliances

The City will evaluate implementing a rebate program for replacing high-water-use appliances with approved lower-water-use models, similar to existing programs in many other New Mexico communities. Such a program can reduce indoor and per capita demand.

4.2.3 Evaluation of Existing Use and Implementation of Conservation Measures

Potential savings from implementation of conservation measures are discussed in Sections 4.2.3.1 and 4.2.3.2. Figure 29 shows the net and residential per capita water demands for Deming from 2000 to 2008. While the net rate has varied, the residential per capita demand has steadily declined, from 137 gpcd in 2000 to 97 gpcd in 2008, a 29.5 percent reduction. Some of the decline is likely a result of the conservation efforts initiated by the City of Deming.

4.2.3.1 Residential Sector

Residential sector demand reductions can be achieved through improving efficiency of indoor plumbing and reducing use for outdoor irrigation. In 2008, residents of the City of Deming (including the transient population) used 97 gpcd for residential use (use by all sectors brought the total per capita demand to 194 gpcd). The amount of indoor residential use was estimated by multiplying the average monthly winter use, when outdoor watering is at a minimum, times 12 months to obtain an annual indoor use. This amount does not include the water used by evaporative coolers over the warmer months. Of the 97 gpcd, approximately 61 percent (59 gpcd) was used indoors in 2008, while the remaining 38 percent (37 gpcd) is estimated to have been used for outdoor irrigation and/or evaporative coolers. Average evaporative cooler demand is estimated to be 14.4 gpcd (39 gallons per day per house or 66 gallons per day over the 214-day cooling season) (Vickers, 2001). With 2.68 people per household in Deming in 2000 (U.S. Census, 2000), the overall annual indoor use can be estimated at 73.4 gpcd.

An indoor water use of 73.4 gpcd is less than the 1999 national average of 94.3 gpcd (Vickers, 2001) for non-conserving homes with evaporative coolers (Table 30). Vickers (2001) estimates that homes with low-water-use fixtures and with non-circulating evaporative coolers can reduce indoor demand to 70.5 gpcd. A reduction of this magnitude would be a 4 percent reduction in indoor demand. A 5 percent reduction in the residential sector's 2008 water demand, from 97 to 92 gpcd, would result in an overall 3 percent reduction in the total Deming water sales.

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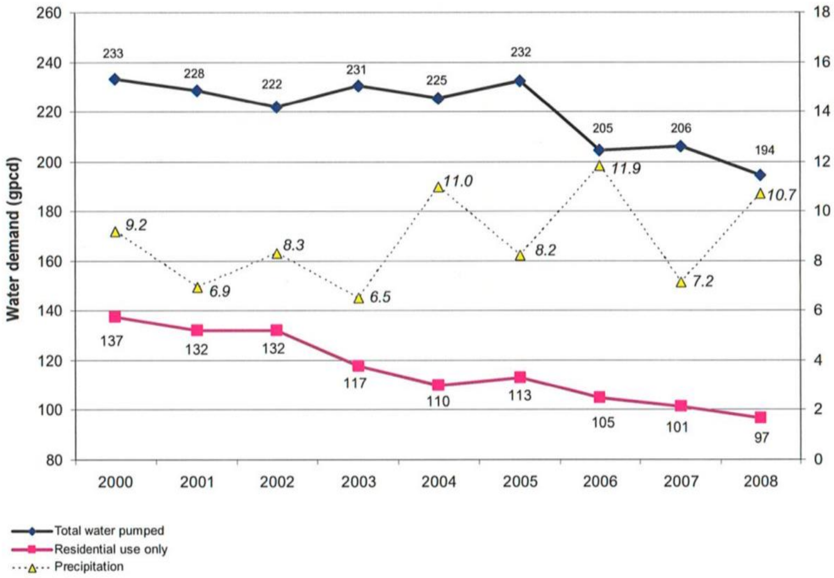

DEMING 40-YEAR WATER PLAN

City of Deming
Per Capita Water Demands and Precipitation

Figure 29

Daniel B. Stephens & Associates, Inc.
5/21/09

Table 30. Indoor Water Demand Estimates

Scenario	Per Capita Indoor Demand (gpcd)
City of Deming indoor use, including 14.4 gpcd for evaporative coolers	73.4
National average for non-conserving household with evaporative cooler in 1999 [a]	94.3
Water-conserving households with evaporative coolers [a]	70.5

[a] Vickers, 2001

gpcd = Gallons per capita per day

Average outdoor residential water demand was estimated to be 23 gpcd in Deming in 2008 and averaged 30 gpcd from 2000 to 2008. Table 31 shows the estimated outdoor water demand in Deming for different landscaping types and irrigation methods, assuming an average landscaped area (Wilson, 1996). If each household were to irrigate an 800-square-foot (ft^2) lawn of Kentucky bluegrass, 1,000 ft^2 of trees and 200 ft^2 of garden by conventional methods, annual water demand would be 78,040 gallons per household.

Table 31. Potential Demand for Outdoor Use

Outdoor Use	Irrigation Requirement (gal/ft^2/yr) [a]	Area (ft^2)	Demand (gal/yr)
Kentucky bluegrass [b]	53.42	800	42,736
Bermuda grass [b]	40.59	800	32,472
Buffalo grass [b]	28.60	800	22,880
Trees [b]	30.06	1,000	30,060
Horticultural plants (herbs and gardens) [b]	26.22	200	5,244
Trees [c]	17.68	1,000	17,680
Horticultural plants (herbs and gardens) [c]	15.42	200	3,084

Source: Wilson, 1996

gal/ft^2/yr = Gallons per square foot per year

gal/yr = Gallons per year

[a] Luna County irrigation requirement

[b] Sprinkler or flood irrigation

[c] Drip irrigation

Average City of Deming house size was 2.68 people in 2000 (U.S. Census, 2000), so a household use of 78,040 gallons per year would yield an outdoor per capita demand of 80 gallons. If buffalo grass were used for lawn, and trees and gardens were irrigated using drip irrigation, outdoor demand would be 43,644 gallons, or 44.6 gpcd. Both of these examples are more than the average City of Deming resident uses for outdoor watering, suggesting that outdoor water use is already at reasonable levels.

Top users in the residential sector included golf course and the Country Club Garden Mobile Home Park accounts (Table 14), which accounted for almost 3 percent of total Deming water sales in 2006. Other top users included individual, apartment, church, and public school accounts.

4.2.3.2 Commercial and Industrial Sectors

Use in the commercial and industrial sectors accounted for about 28 percent of the total water sales by the City of Deming in 2008.

- The top commercial users in 2006 included highway, hotel and motel, manufacturing, and restaurant and bar accounts. Use by these top commercial users collectively accounted for about 12 percent of total water sales in 2006.

- Top users in the industrial sector include food and drink manufacturers (Border Foods, Deming Coca Cola, Mimbres Valley Produce, and Joseph's Lite Cookies), energy/oil, construction, and wastewater and septic tank manufacturing accounts. Border Foods is the single top industrial user and accounted for almost 12 percent of total water sales in 2006. Use by the top industrial users collectively accounted for approximately 13 percent of total sales in 2006.

Vickers (2001) cites typical conservation savings in the commercial sector as ranging from 15 to 35 percent. A 15 percent reduction in the commercial sector's 2008 water demand would result in an overall 2.4 percent reduction in total Deming water sales, reducing the per capita use of 194 gallons for all sectors to 190 gpcd. A 15 percent reduction in the industrial sector's 2008 water demand would result in an overall 1.7 percent reduction in total Deming water sales, from 194 gpcd for all sectors to 191 gpcd. Reducing the commercial and industrial demands by 15 percent each in 2008 would result in an overall 4.2 percent reduction in total Deming water sales, from 194 gpcd to 186 gpcd.

4.2.4 Summary of Conservation Potential

The City of Deming has already significantly reduced per capita demand in the residential sector; however, if all residents implement indoor conservation efforts, the residential indoor demand can be further reduced. Conservation efforts by commercial and industrial users must be investigated on an individual basis, but a goal of 15 percent reduction is reasonable for these sectors. If the efforts outlined in Sections 4.2.1 through 4.2.3 are realized, an overall demand reduction of 7 percent could be achieved. Figure 30 shows the reduction in predicted future water demand if the overall demand can be reduced by 10 percent.

4.2.5 Funding and Implementation of Deming's Water Conservation Plan

The City of Deming can increase its water conservation efforts using existing staff and funding. However, to implement all phases of the conservation effort and to continually monitor demand data and improve conservation efforts, the City will need to obtain and dedicate additional sources of funding. In addition to potential grant funding (e.g., federal drought programs, community development block grants), technical assistance may be available from state or federal agencies.

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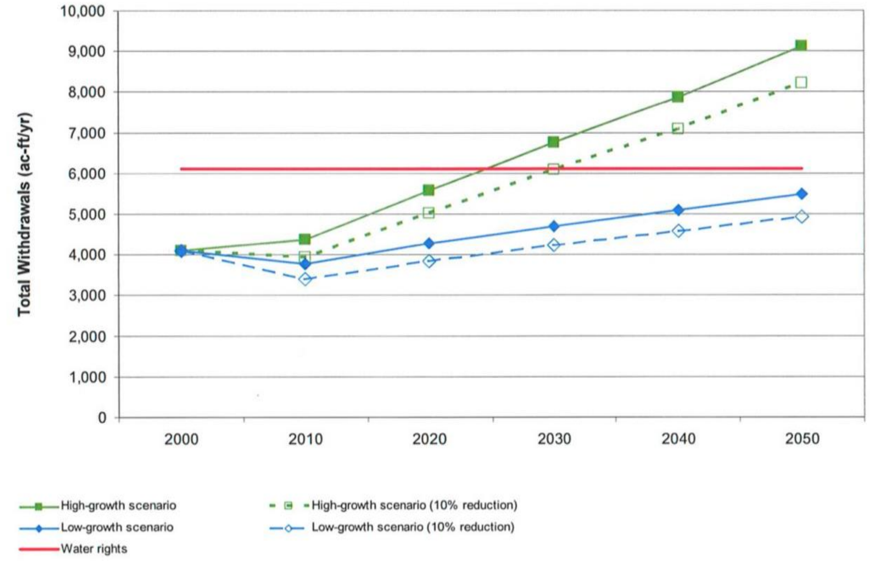

DEMING 40-YEAR WATER PLAN

Potential Effects of Conservation on City of Deming Projected Water Demand

Figure 30

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5/21/09