



**NOTICE OF A REGULAR MEETING OF THE TOWN COUNCIL
OF THE TOWN OF CLARKDALE
TUESDAY, APRIL 8, 2025 AT 6:00 PM**

In Person: Clark Memorial Clubhouse, 19 N. Ninth St., Clarkdale AZ

OR

Join Zoom Meeting

<https://us02web.zoom.us/j/88206419646>

Meeting ID: 882 0641 9646

Unless otherwise stated, the public will have physical access to the meeting place 15 minutes prior to the meeting start time.

Town of Clarkdale Vision

The Town of Clarkdale capitalizes on our unique history, proximity to the Verde River, and small-town charm. We cultivate an environment where residents and businesses can thrive.

We sustainably enhance our infrastructure, support the arts and education, and develop recreational opportunities to create a bright future for our entire community.

PURSUANT TO A.R.S. §38-431.02, NOTICE IS HEREBY GIVEN to the members of the Common Council of the Town of Clarkdale and to the general public that the Town of Clarkdale Town Council will hold a Regular Meeting open to the public on Tuesday, April 8, 2025, at 6:00 PM in a hybrid meeting via Zoom Video Conference or in person at 19 N. Ninth Street, Clarkdale, Arizona, Clark Memorial Clubhouse, Men's Lounge. Members of the Clarkdale Common Council will attend either in person or by telephone, video or internet conferencing. Pursuant to A.R.S. §38-431.03, the Council may vote to recess the meeting and move into Executive Session on any item, which will be held immediately after the vote and will not be open to the public. Upon completion of Executive Session, the Council may resume the meeting, open to the public, to address the remaining items on the agenda.

Supporting documentation and staff reports furnished to the Council with this agenda are available for review on the Town website at www.clarkdale.az.gov and the Town Clerk's Office.

ALL ITEMS ON THIS AGENDA ARE SCHEDULED FOR DISCUSSION AND POSSIBLE ACTION, UNLESS OTHERWISE NOTED.

1. CALL TO ORDER

2. ROLL CALL

3. PUBLIC COMMENT

The Town Council invites the public to provide comments at this time. Members of the Town Council may not discuss items that are not specifically identified on the agenda. Therefore,

pursuant to A.R.S. §38-431.01, action taken as a result of public comment will be limited to directing staff to study the matter, responding to any criticism, or scheduling the matter for further consideration and decision at a later date. Persons interested in making comments on a specific agenda item are asked to complete a brief form and submit it to the Clerk or liaison during the meeting. Each speaker is asked to limit their comments to five minutes.

4. REPORTS

A. Current Events – (submitted electronically)

A brief summary of current events. The Council will not propose, discuss, deliberate, or take legal action on any matter in the summary. Reports submitted electronically:

- Mayor's Report
- Vice-Mayor's Report
- Councilmembers' Reports

B. Organizational Reports – (submitted electronically)

Reports regarding regional organizations submitted electronically:

- VVTPO – Verde Valley Transportation Planning Organization
- NACOG - Northern Arizona Council of Governments
- NAMWUA - Northern Arizona Municipal Water Users Association
- TPAC – Transportation Policy Advisory Council
- VFLC – Verde Front Leadership Council
- Sustaining Flows Committee
- Yavapai Communities for Young Children
- Cottonwood Airport Noise Working Group
- Vulnerable Road Users SHSP Emphasis Area Team
- NACOG Community Action Board (CAB)

5. CONSENT AGENDA

Items on the consent agenda are of a routine nature or have been previously studied by the Town Council at a work session or during a New Business discussion. They are intended to be acted upon in one motion. Council members may pull items from consent if they would like them considered separately.

A. Approval of Minutes

Consider and act upon the draft minutes from the regular meeting held on March 25, 2025.

B. Resolution #1734 - Adopting a Fair Housing Policy

Consider and act upon Resolution #1734, adopting a Fair Housing Policy, making known our commitment to the Principle of Fair Housing and describing actions we shall undertake to affirmatively further Fair Housing, amending the previous Fair Housing Resolution #1711.

6. NEW BUSINESS

A. Water and Wastewater Master Plan

Discuss, consider and act upon adoption of the Town of Clarkdale Integrated Water

and Wastewater Master Plan prepared by Ardurra.

B. Grant Agreement Between the Town of Clarkdale and the Clarkdale Foundation to Purchase Equipment for Selna-Mongini Park

Discuss, consider, and act upon a request by staff to approve the grant agreement between the Town of Clarkdale (the Town) and the Clarkdale Foundation (CF), for CF to act as a fiscal agent via its 501c3 status, to receive a potential grant award from Arizona Public Service (APS) Foundation, and to purchase equipment for the Town's new Selna-Mongini Park.

C. Ratification of a Grant Application to the Water Infrastructure Finance Authority of Arizona's Water Conservation Grant Fund (WIFA WCGF), for the Design of Purple Pipe to Selna-Mongini Park and Town Park

Discuss, consider, and act upon a request by staff to ratify the submission of a grant application to the Water Infrastructure Finance Authority of Arizona's Water Conservation Grant Fund (WIFA WCGF), for the design of Purple Pipe to Selna-Mongini Park and Clarkdale Town Park, in the amount of \$165,000.

7. FUTURE AGENDA ITEMS

Town Council may propose items to be placed on a future agenda. This item is for discussion only.

8. ADJOURNMENT

Values

Values are the guiding principles that provide an organization with purpose and direction. The Town of Clarkdale's organizational values are:

COPPER

Customer focused

Open, transparent and equitable

Preserving our history, charm, and environment

Planning for a sustainable future

Economic and social resiliency

Resourceful and innovative

Mission

The Town of Clarkdale serves the community by providing amenities, infrastructure, services, and public safety to enhance quality of life. We are stewards of our history while we sustainably and resiliently plan for the future with an emphasis on community engagement and transparency.

Persons with a disability may request reasonable accommodations by contacting the Town Hall at (928) 639-2400 (TTY: 1-800-367-8939) at least 72 hours in advance of the meeting.



From the office of Mayor Prud'homme-Bauer

March 2025 Report

Regularly Held Monthly Meetings:

- Regular weekly one-on-one meetings with the Town Manager on Wednesdays.
- Agenda review meetings on Monday afternoon before the Town Council meeting.
- Host twice monthly Verde Valley Mayors/Managers Zoom meetings.
- Weekly Legislative Call with LACT.

Other Meetings, Events, Emails and Phone Calls:

- Attended the Clarkdale Police Awards Banquet.
- Helped out with CDBA/Clarkdale Car Show.
- Attended the quarterly Verde Valley Mayors/Managers meeting with the County Supervisors.
- Participated in the VVCDO Community Land Trust Planning meeting.
- Attended the Virtual LACT Executive Committee meeting.
- Several meetings with Town Manager Guthrie and Council Member Jones on aircraft noise.
- Spoke at the virtual TEFRA meeting on the bond proposal request for ERAU regarding aircraft noise.
- Attended Community Conversation regarding Health, Gaps and Needs at the APS office.
- Several phone calls with Yavapai-Apache Nation Chairwoman regarding attempted kidnapping at Clarkdale-Jerome School.
- Attended the Clarkdale-Jerome School community meeting on the attempted kidnapping of a student.
- Briefly attended the Housing Working Group meeting.
- Met with County Supervisor Nikki Check.
- Met with Charnelle Thurman, Outreach Director, Governor Hobb's office.
- Met with representatives from the Yavapai-Apache Nation, Town Manager, and Town Attorney regarding mutual aid MOU.
- Met with Julie Schriener, Director of Constituent Services, Rep. Crane's office during their office-hours meeting in Clarkdale.
- Visited the Clarkdale Plant Sale event.
- Met with Dr. Witcher with ERAU, the Town Manager, Council Member Jones, and Town Attorney regarding aircraft noise.



From the office of Vice Mayor Hunseder

March 2025 Report

- 03/01/25 – Attended Clarkdale PD Awards Banquet.
- 03/04/25 – CDBA Meeting.
- 03/08/25 – Volunteered for Clarkdale Car Show.
- 03/10/25 – One-on-one with Town Manager Guthrie.
- 03/11/25 – Town of Clarkdale Council Meeting.
- 03/24/25 – One-on-one with Town Manager Guthrie.
- 03/25/25 – Town of Clarkdale Council meeting.
- 03/27/25 – NACOG Executive Committee.
- 03/28/25 – Volunteered for Clarkdale Plant Sale setup.



From the office of Council Member O'Neill

March Report

- 3-1 I was proud to attend the Police Awards Banquet.
- 3-8 Volunteered at the Clarkdale Car Show.
- 3-9 Ho-hum, daylight savings time.
- 3-11 One-on-one with Town Manager Guthrie; Council meeting.



From the office of Council Member Babbitt-Pierce

March Report

- March 1 - Police Banquet.
- March 4 - YCYC Steering Committee Meeting.
- March 10 - Meeting with Town Manager Guthrie.
- March 11 - Town Council Meeting.
- March 13 - Greater Verde Valley Chamber Mixer; NACOG TPAC.
- March 18 - Meeting with a resident.
- March 21 - Meeting with a resident.
- March 24 - Meeting with Town Manager Guthrie.
- March 25 - APS Community Conversation regarding health gaps and needs; Town Council Meeting.
- March 26 - VVTPO.
- March 29 - Meeting with a resident.



From the office of Council Member Jones

March 2025
Council Member Report

- 3/01 Attended Police Department Annual Awards Banquet.
- 3/3 Participated in the Verde Regional and Verde Valley – Oak Creek MIKE SHE Models-Technical Presentation.
- 3/5 Met with Susan Guthrie, Town Manager to discuss ERAU.
- 3/10 Met with Susan Guthrie, Town Manager.
- 3/11 Attended Town Council Meeting.
- 3/14 Attended Friends of the Verde River fundraiser.
- 3/18 Attended Citizens Advisory Code Review Committee Meeting.
- 3/19 Met with VVAIR.
- 3/24 Met with Susan Guthrie, Town Manager; Attended TEFRA Hearing YCIDA regarding ERAU Bond Issuance.
- 3/25 Attended Community Conversation regarding Health, Gaps and Needs Hosted by Yavapai County Health Department; Town Council Meeting.
- 3/26 Attended NACOG CAB Strategic Planning Session.
- 3/29 Volunteer at CHSM Annual Plant Sale.
- 3/31 Met with ERAU.



Staff Report

Item Number: 5.A.

<u>Agenda Item:</u>	Approval of Minutes Consider and act upon the draft minutes from the regular meeting held on March 25, 2025.
<u>Staff Contact:</u>	Charity Brooks, Town Clerk
<u>Meeting Date:</u>	April 8, 2025
<u>Strategic Goal:</u>	Not applicable.
<u>Background:</u>	Review of the draft minutes from the regular meeting held on March 25, 2025.
<u>Budget Impact:</u>	No budget impact.
<u>Recommendation:</u>	Staff recommends that the Council approve the draft minutes from the regular meeting held on March 25, 2025.



**SUMMARIZED MINUTES OF A REGULAR MEETING OF THE TOWN COUNCIL
OF THE TOWN OF CLARKDALE
TUESDAY, MARCH 25, 2025, AT 3:00 PM**

(To listen to the full audio of the meeting, please visit www.clarkdale.az.gov – agendas & minutes)

Members Present: Mayor Prud'homme-Bauer, Vice Mayor Debbie Hunseder, and Council Members, Marney Babbitt-Pierce, and Laura Jones

Members Absent: Council Member O'Neill

Other Municipal Officials Present: Susan Guthrie, Town Manager; Charity Brooks, Town Clerk; Joni Westcott, Parks and Recreation Director; D.K. Green, Grants Manager; Britania Esparza, Associate Planner; Lou Andersen, Public Works Director; Joshua Tomerlin, Utilities Director; Terry Norman, Public Works Superintendent; Randy Taylor, Police Chief

Zoom: No members of the public were present.

Audience: Approximately 15 members of the public were present.

1. CALL TO ORDER - *Mayor Prud'homme-Bauer called the meeting to order at 3 p.m.*

2. ROLL CALL –

Members Present: *Mayor Prud'homme-Bauer, Vice Mayor Debbie Hunseder, and Council Members, Marney Babbitt-Pierce, and Laura Jones*

Members Absent: *Council Member O'Neill*

3. PUBLIC COMMENT

None.

4. STAFF INTRODUCTIONS

A. Swearing-In of new Police Officer Kyle Nudelman

5. REPORTS

Departmental Reports (submitted with Council packet) –
Summary of written reports from Town Departments and other agencies:

- Building Permit Report

- Grants Report
- Magistrate Court Report
- Parks and Recreation Report
- Police Department Report
- Verde Valley Humane Society
- Water and Wastewater Report
- Finance Report

6. CONSENT AGENDA

Items on the consent agenda are of a routine nature or have been previously studied by the Town Council at a work session or during a New Business discussion. They are intended to be acted upon in one motion. Council members may pull items from consent if they would like them considered separately.

A. Approval of Minutes of the Common Council

Consider and act upon the draft minutes from the regular meeting held on March 11, 2025.

Action: Approve consent agenda item A as presented:

Motion: Council Member Babbitt-Pierce

Second: Vice Mayor Hunseder

Vote: Approved 4-0

Voting Member	Aye/Nay
Mayor Robyn Prud'homme-Bauer	Aye
Vice Mayor Debbie Hunseder	Aye
Council Member Lisa O'Neill	Absent
Council Member Marney Babbitt-Pierce	Aye
Council Member Laura Jones	Aye

7. NEW BUSINESS

A. APS Fire Presentation

The Council received a fire presentation from an APS Representative.

B. Submission of a Grant Application to the AZ SMART Fund for Design of the Luke Lane/Broadway Street Project

Discuss, consider, and act upon a request by staff to approve the submission of a grant application to the Arizona State Match Advantage for Rural Transportation (SMART) Fund, for the design of the Luke Lane/Broadway Project, in the amount of up to \$1 million.

Action: Approve the grant application to the AZ SMART Fund for the design of the Luke Lane/Broadway Street Project to add pavement, sidewalks, bike lanes, curb and gutter, etc. to the Luke Lane Industrial Area, including the completion of multi-modal connectivity to Patio Park in the amount up to \$1 million, and authorize the Town Manager to sign all required documents related to this grant should it be awarded:

Motion: Council Member Babbitt-Pierce

Second: Vice Mayor Hunseder

Vote: Approved 4-0

Voting Member	Aye/Nay
Mayor Robyn Prud'homme-Bauer	Aye
Vice Mayor Debbie Hunseder	Aye
Council Member Lisa O'Neill	Absent
Council Member Marney Babbitt-Pierce	Aye
Council Member Laura Jones	Aye

C. Ratification of a Grant Application to the Rural and Tribal Assistance (RTA) Pilot Program for Design of the Lower Centerville Connector Project

Discuss, consider, and act upon a request by staff to ratify the submission of a grant application to the Rural and Tribal Assistance (RTA) Pilot Program, for the design of the Lower Centerville Connector Project, in the amount of \$350,000.

Action: Approve to ratify the submission of a grant application to the Rural and Tribal Assistance (RTA) Pilot Program, for the design of the Lower Centerville Connector Project, in the amount of \$350,000 and authorize the Town Manager to sign all required documents related to this grant:

Motion: Council Member Jones

Second: Council Member Babbitt-Pierce

Vote: Approved 4-0

Voting Member	Aye/Nay
Mayor Robyn Prud'homme-Bauer	Aye
Vice Mayor Debbie Hunseder	Aye
Council Member Lisa O'Neill	Absent
Council Member Marney Babbitt-Pierce	Aye
Council Member Laura Jones	Aye

D. Public Participation Plan for the Zoning Code Update

Discuss, consider and act upon the approval of the Public Participation Plan for the Zoning Code Update.

Action: Approve the Public Participation Plan for the Zoning Code Update:

Motion: Vice Mayor Hunseder

Second: Council Member Babbitt-Pierce

Vote: Approved 4-0

Voting Member	Aye/Nay
Mayor Robyn Prud'homme-Bauer	Aye
Vice Mayor Debbie Hunseder	Aye
Council Member Lisa O'Neill	Absent
Council Member Marney Babbitt-Pierce	Aye
Council Member Laura Jones	Aye

E. 89A Well Re-Drilling Project

Discuss, consider, and act upon the 89A Well Re-drilling Project ADWR ID# 55-609072 in an amount not to exceed \$531,000.

Action: Approve the 89A Well Re-drilling Project ADWR ID# 55-609072 in an amount not to exceed \$531,000 and authorize the Town Manager to execute all documents related to this project:

Motion: Council Member Jones

Second: Council Member Babbitt-Pierce

Vote: Approved 4-0

Voting Member	Aye/Nay
Mayor Robyn Prud'homme-Bauer	Aye
Vice Mayor Debbie Hunseder	Aye
Council Member Lisa O'Neill	Absent
Council Member Marney Babbitt-Pierce	Aye
Council Member Laura Jones	Aye

F. Clark Memorial Clubhouse Exterior Repair and Paint

Discuss, consider, and act upon a proposal from Diamond Ridge for exterior stucco repair and paint and repair and repainting of the windows and doors at the Clark Memorial Clubhouse at 19 N. Ninth St. for an amount not to exceed \$535,500.

Action: Approve the proposal from Diamond Ridge for exterior stucco repair and paint and repair and repainting of the windows and doors at the Clark Memorial Clubhouse at 19 N. Ninth St. for \$521,080.42 and authorize the Town Manager to execute all documents necessary to complete this project and authorize the Town Manager to approve change orders up to 5%, for an amount not to exceed \$547,143.42:

Motion: Vice Mayor Hunseder

Second: Council Member Jones

Vote: Approved 4-0

Voting Member	Aye/Nay
Mayor Robyn Prud'homme-Bauer	Aye
Vice Mayor Debbie Hunseder	Aye
Council Member Lisa O'Neill	Absent
Council Member Marney Babbitt-Pierce	Aye
Council Member Laura Jones	Aye

G. 2025/2026 Clarkdale Council Strategic Plan

Discuss, consider and act upon approving the 2025/2026 Clarkdale Council Strategic Plan.

Action: Approve the 2025/2026 Clarkdale Council Strategic Plan:

Motion: Council Member Jones

Second: Vice Mayor Hunseder

Vote: Approved 4-0

Voting Member	Aye/Nay
Mayor Robyn Prud'homme-Bauer	Aye
Vice Mayor Debbie Hunseder	Aye
Council Member Lisa O'Neill	Absent
Council Member Marney Babbitt-Pierce	Aye
Council Member Laura Jones	Aye

8. FUTURE AGENDA ITEMS

Town Council did not propose items to be placed on a future agenda.

9. ADJOURNMENT

Action: Motion to Adjourn:

Motion: Council Member Babbitt-Pierce

Second: Vice Mayor Hunseder

Vote: Approved 4-0

Voting Member	Aye/Nay
Mayor Robyn Prud'homme-Bauer	Aye
Vice Mayor Debbie Hunseder	Aye
Council Member Lisa O'Neill	Absent
Council Member Marney Babbitt-Pierce	Aye
Council Member Laura Jones	Aye

Mayor Prud'homme-Bauer adjourned the meeting without objection at 4:51 p.m.

APPROVED:

ATTESTED/SUBMITTED:

Robyn Prud'homme-Bauer, Mayor

Charity Brooks, Town Clerk

CERTIFICATION AND ATTESTATION

I hereby certify that the foregoing minutes are a true and correct copy of the minutes of the regular meeting of the Town Council of the Town of Clarkdale, Arizona held on the 25th day of March 2025. I further certify that the meeting was duly called and held and that a quorum was present.

Date approved by Town Council: April 8, 2025

Charity Brooks, Town Clerk



Staff Report

Item Number: 5.B.

Agenda Item:**Resolution #1734 - Adopting a Fair Housing Policy**

Consider and act upon Resolution #1734, adopting a Fair Housing Policy, making known our commitment to the Principle of Fair Housing and describing actions we shall undertake to affirmatively further Fair Housing, amending the previous Fair Housing Resolution #1711.

Staff Contact:

Britania Esparza, Associate Planner

Meeting Date:

April 8, 2025

Strategic Goal:

This agenda item supports the following Clarkdale Strategic Goal Area:

- Goal Area 2 - Enhance the quality of life for residents, businesses and visitors to Clarkdale.
- Goal Area 5 - Plan for the maintenance and growth of quality infrastructure that is sustainable and resilient.

Background:

The Town of Clarkdale acknowledges the importance of promoting equal housing opportunities for all individuals, regardless of race, color, religion, sex, disability, familial status, or national origin. April has been designated as Fair Housing Month to commemorate the passage of the Federal Fair Housing Act in April 1968, which was a critical step toward ending discrimination in housing practices. This landmark legislation, along with the Fair Housing Amendments Act of 1988, prohibits discrimination in the sale, rental, and financing of housing, as well as in real estate services.

The Housing and Community Development Act of 1974, as amended, further requires that recipients of Community Development Block Grant funds affirmatively further fair housing. In line with this, the Town of Clarkdale reaffirms its commitment to fostering inclusive housing practices and ensuring that all individuals have access to safe, affordable, and non-discriminatory housing opportunities.

Through this proclamation, the Town of Clarkdale seeks to raise awareness of fair housing rights and encourage community members to recognize and address discriminatory housing practices. The Town pledges to continue supporting efforts to eliminate discrimination in housing and to assist residents in seeking redress for violations of their housing rights.

This resolution and proclamation are intended to reflect the Town's ongoing dedication to promoting equal housing opportunities for all, in keeping with both federal and state laws, and to honor the legacy of Fair Housing Month in the ongoing fight for housing equality.

Budget Impact: No budget impact.

Recommendation: Staff recommends that the Council approve Resolution #1734, adopting a Fair Housing Policy, making known our commitment to the Principle of Fair Housing and describing actions we shall undertake to affirmatively further Fair Housing, amending the previous Fair Housing Resolution #1711, and authorizing the Mayor and Town Clerk to execute all documents.

RESOLUTION #1734

A RESOLUTION OF THE MAYOR AND COMMON COUNCIL OF THE TOWN OF CLARKDALE, ARIZONA, ADOPTING A FAIR HOUSING POLICY, MAKING KNOWN ITS COMMITMENT TO THE PRINCIPLE OF FAIR HOUSING AND DESCRIBING ACTIONS IT SHALL UNDERTAKE TO AFFIRMATIVELY FURTHER FAIR HOUSING, AMENDING THE PREVIOUS FAIR HOUSING RESOLUTION #1711.

WHEREAS, the Housing and Community Development Act of 1974 as amended requires that all applicants for Community Development Block Grant funds certify that they affirmatively further fair housing; and

WHEREAS, the Civil Rights Act of 1968 (commonly known as the Federal Fair Housing Act) and the Fair Housing Amendments Act of 1988 declare a national policy to prohibit discrimination in the sale, rental, leasing and financing of housing or land to be used for the construction of housing or in the provision of brokerage services, on the basis of race, color, religion, sex, disability, familial status or national origin; and

WHEREAS, discriminatory housing practices undermine the strength and vitality of America and its people;

NOW, THEREFORE, BE IT RESOLVED THAT, the Mayor and Common Council of the Town of Clarkdale, Arizona hereby wish all persons living, working, doing business in or traveling through this Town to know that:

Discrimination in the sale, rental, leasing and financing of housing or land to be used for construction of housing, or in the provision of brokerage services on the basis of race, color, religion, sex, handicap, family status or national origin is prohibited by Title VIII or the Fair Housing Act Amendments of 1988; and that it is the policy of the Town of Clarkdale to implement programs, within the constraints of its resources, to ensure equal opportunity in housing for all persons regardless of race, color, religion, sex, handicap, familial status or national origin; and within available resources, the Town of Clarkdale will assist all persons who feel that they have been discriminated against in housing issues on the basis of race, color, religion, sex, handicap, familial status or national origin to seek equity under existing federal and state laws to file a complaint with the Arizona Attorney General's Office or the U.S. Department of Housing and Urban Development; and

The Town of Clarkdale supports fair housing opportunities for all, regardless of race, color, religion, sex, handicap, family status, or national origin, and endorses the provision of safe and affordable housing for all in all its forms; and

That the Town of Clarkdale shall publicize this Resolution and thereby encourage owners of rental properties, developers, builders and others involved with housing to become aware of their respective responsibilities and rights under the Fair Housing Amendments Act of 1988 and any applicable state or local laws or ordinances; and that the Town of Clarkdale shall undertake the following actions to additionally "affirmatively further fair housing."

- Post a copy of this resolution for 30 days at Town Hall
- Continue to post a fair housing poster at Town Hall

PASSED AND ADOPTED BY THE MAYOR AND COMMON COUNCIL of the Town of Clarkdale on this 8th day of April, 2025.

ATTEST:

Robyn Prud'homme-Bauer, Mayor

Charity Brooks, Town Clerk



Staff Report

Item Number: 6.A.

Agenda Item:**Water and Wastewater Master Plan**

Discuss, consider and act upon adoption of the Town of Clarkdale Integrated Water and Wastewater Master Plan prepared by Ardurra.

Staff Contact:

Lou Andersen, Public Works Director

Meeting Date:

April 8, 2025

Strategic Goal:

This agenda item supports the following Clarkdale Strategic Goal Area:

- Goal Area 1 - Enhance the quality of life for residents, businesses and visitors to Clarkdale.
- Goal Area 4 - Plan for the maintenance and growth of quality infrastructure that is sustainable and resilient.

Background:

Staff recognize the need for professional studies to determine infrastructure expansion requirements to support growth and maintain quality services for our residents.

Staff worked with the Ardurra through the Town Engineering JOC to revise the scope of work to evaluate the current and future water and wastewater infrastructure, including recommendations for CIP projects with budgets.

Council approved the commencement of the study on Oct. 24, 2023.

Data collection for this master plan includes analysis of water production, water demand, wastewater influent, system data, historical data, previous reports and studies, proposed growth data, and data gathered during in-person site assessments. Field survey/observations were completed to document the conditions of existing water and sewer system components. Additionally, old construction documents, as-builts and system maps were used to map the existing water distribution system and sewer collection system. Visual inspections of existing infrastructure as part of the field survey were used to assess the conditions of the existing water and sewer system components. Maintenance recommendations included in the 'Plan CIP' are based on data from field investigations and conversations with Town staff on known issues within the systems.

Budget Impact: No budget impact.

Recommendation: Staff recommends that the Council approve the Town of Clarkdale Integrated Water and Wastewater Master Plan prepared by Ardurra.



TOWN OF CLARKDALE INTEGRATED WATER AND SEWER MASTER PLAN APRIL 1, 2025



Prepared by:



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TABLE OF ABBREVIATIONS

ADEQ – Arizona Department of Environmental Quality
ADF – Average Daily Flow
ADWR – Arizona Department of Water Resources
AF – Acre Feet
AFY – Acre Feet per Year
AMA – Active Management Area
APP – Aquifer Protection Permit
APS – Arizona Public Service
ATP – Arsenic Treatment Plant
ATS – Automatic Transfer Switch
AZPDES – Arizona Pollutant Discharge Elimination System
BFP - Belt Filter Press
BTU- Biological Treatment Unit
BWRF – Broadway Water Reclamation Facility
CBOD5 – Five-day Carbonaceous Biochemical Oxygen Demand
CIP – Capital Improvement Project
d/D – Depth-to-Diameter
DWPF – Dry Weather Peaking Factor
DWSPP – Drought and Water Shortage Preparedness Plan
E and I&C – Electrical and Instrumentation Controls
F/M – Food-to-Microorganism ratio
GPCD – Gallons per Capita per Day
GPD - Gallons per Day
INF – Influent
I&I – Inflow and Infiltration
I/O – Input/Output
LTSC – Long-term Storage Credit
M&A – Montgomery and Associates
MCL – Maximum Contaminate Level
MGD – Million Gallons per Day
MLR – Mixed Liquor Recycle
PLC – Programmable Logic Controller
PRV – Pressure Reducing Valve
PVC – Polyvinyl Chloride
RW – Recovery Well
SCADA – Supervisory Control and Data Acquisition
SS – Stainless Steel
TKN – Total Kjeldahl Nitrogen
TM – Technical Memorandum
TNC – The Town and the Nature Conservancy
TSS – Total Suspended Solids
USF – Underground Storage Facility
VCP – Vitrified Clay Pipe
VFD – Variable Frequency Drive
VRIC – Verde River Iron Company
WIFA – Water Infrastructure Finance Authority of Arizona
WS – Water Storage
WWTP – Wastewater Treatment Plant

INTRODUCTION AND PROJECT SUMMARY

A. BACKGROUND AND HISTORY

The Town of Clarkdale is located in Yavapai County, Arizona, Latitude 34.77N; Longitude 112.06W. Clarkdale was established in 1912 and incorporated in 1957. Clarkdale was built as a “company town” by the United Verde Copper Company as a community for their employees and is renowned as the State of Arizona’s first master planned community. The Town sits at an elevation of around 3545’ along the Verde River. Clarkdale covers just over 10 square miles of land and has a population of 4,424 according to the 2020 census. The Town has experienced steady growth of population through the years and projections show continued population increase and therefore an increase in utility customers along with new developments in the Clarkdale area. Tourism, education, and business make up the economy of Clarkdale today with the Verde Canyon Railroad, Yavapai College and the historic downtown business district playing key roles in the community.

The Clarkdale Public Works Departments are responsible for the operation and maintenance of the Town’s infrastructure. Essential municipal services are provided to customers by the Water and Wastewater Division of the Public Works Department. The Water Division manages the supply, treatment and distribution of potable water to its customers around the Town. The Wastewater Division oversees the operation and maintenance of the Town’s collection system and wastewater treatment.

B. PURPOSE AND SCOPE

This Water and Sewer Master plan has been created to analyze existing system conditions and capabilities, analyze growth projections, address existing and future deficiencies in the system, and recommend Capital Improvement Projects (CIP). This report will give CIP recommendations to the potable water system, arsenic treatment plant, reclaimed water system, sanitary sewer collection system, and Wastewater Treatment Plant (WWTP). The CIP recommendations will include an Engineer’s Estimated cost of construction based on current unit prices for each recommended project.

Data collection for this master plan included analysis of water production, water demand, wastewater influent, system data, historical data, previous reports and studies, proposed growth data, and data gathered during in person site assessments. Field survey/observations were completed to document the conditions of existing water and sewer system components. Additionally, old construction documents, as-builts and system maps were used to map the existing water distribution system and sewer collection system. Visual inspections of existing infrastructure as part of the field survey were used to assess the conditions of the existing water and sewer system components. Maintenance recommendations included in the CIP are based on data from field investigations and conversations with Town staff on known issues within the systems.

A rate study and long-term financial plan was recently completed on Clarkdale’s utility pricing and adopted by the Council in 2024. This study is included in Appendix A11 for reference. A new rate study was not included as a part of this master plan.

C. PLANNING SUMMARY

The Town of Clarkdale has shown a steady growth in population in the last 50 years with 4,424 residents as of the 2020 census. The population is projected to continually increase with plans for future developments. Currently the Town of Clarkdale has proposals for two new subdivision developments, with a total of 100 potential residential lots. Existing subdivisions have the potential for growth with a total of

255 remaining residential lots. Anticipated developments are discussed in the water system and sanitary sewer collection system sections.

Clarkdale has the potential for further future development on vacant properties. These areas have no current plans for development but could be developed in the future and connected to the Town's existing water and sewer systems. Future full buildout scenarios and their impact on the existing systems are discussed later in this report.

D. EXISTING WATER SYSTEM DESCRIPTION AND SUMMARY

Clarkdale's Water System is comprised of two active wells, four tanks, three booster pump stations and approximately 41 miles of potable water lines and eight existing Pressure Reducing Valves (PRV), with four additional PRVs currently under design. The water distribution system can be divided into 9 pressure zones that are separated by booster pumps and PRVs. Some of the groundwater in this region historically contains arsenic, which exceeds the Maximum Contaminant Level (MCL) of 10 µg/l for potable water. Groundwater containing arsenic above the MCL must be treated to lower the arsenic content before it can go into the water distribution system. Further details on the water system's existing components are given in Section II – Water System.

- **Wells**

- Mountain Gate
- Haskell Springs South
- 89A (Inactive)
- Haskell Springs North (Inactive)
- Mescal Well (Inactive)
- River Well (Inactive)
- Cemetery Well

- **Potable Water Storage**

- 89A Tank
- Haskell Springs Tanks
- Mountain Gate Tank

- **Booster Pump Stations**

- 89A Booster Station
- Black Hills Booster Station
- Panorama Booster Station

- **Potable Water Distribution System**

The existing potable water distribution system is comprised of existing water mains of various sizes from 2" to 12". A map of the existing water system is included in Appendix A1. Water distribution is divided into two distribution areas and nine pressure zones. See map of existing pressure zones in Appendix A2.

- **Pressure Reducing Valves (PRV)**

Pressure relief valves around Clarkdale allow for the regulation of downstream pressure within the distribution system. Existing PRVs are adjusted to control pressure and allow for customers pressure to fall within a favorable range (40 to 70 psi).

E. ARSENIC TREATMENT PLANT DESCRIPTION AND SUMMARY

Water from the Mountain Gate well is treated to reduce arsenic content at the Arsenic Treatment Plant (ATP) located on 89A. The original ATP was installed in 2007 by Empire Development for the Mountain Gate Subdivision. The ATP was designed for the removal of arsenic using pH adjustment with carbon dioxide (carbonic acid formation), prechlorination, ferric chloride as a coagulant, and filtration using ceramic media (originally Macrolite FM 360). The plant is currently using ceramic granular media with Ceraflo – 50.

F. EXISTING EFFLUENT DISPOSAL DESCRIPTION AND SUMMARY

Broadway Water Reclamation Facility (BWRf) produces A+ effluent that is distributed at the Verde River Iron Company (VRIC) Irrigation Site. The reclaim water system's major components are summarized below.

- **Effluent Storage**
The treated effluent is stored in two separate reservoirs at the Broadway Water Reclamation Facility. The reservoirs have a capacity of approximately 2.3 million gallons (MG). Effluent from the BWRf is also stored in an 88,000-gallon steel tank at the VRIC Irrigation Site.
- **Effluent Pump Stations**
 - BWRf Effluent Pump Station
 - VRIC Irrigation Site
- **Effluent Force Main**
The existing effluent force main pumps effluent from the BWRf to the VRIC Irrigation Site. The force main is an 8", 9,200 lineal foot pipe.

G. EXISTING SEWER COLLECTION SYSTEM DESCRIPTION AND SUMMARY

The collection system is comprised of 22 miles of sewer mains, 358 known manholes, and four lift stations. Further details on the sewer system's existing components are provided in Section IV – Sanitary Sewer Collection System.

- **Gravity Sewer Mains and Force Mains**
The existing collection system includes approximately 22 miles of gravity sewer mains. The existing gravity sewer mains are made up of varying sizes from 4" to 15". The collection system also includes approximately 7800 LF of force mains. Detailed records of all the existing mains do not exist, and the pipes are comprised of various materials of various ages. A map of the existing sanitary sewer collection system is included in Appendix C1.
- **Manholes**
There are 358 known existing manholes in Clarkdale's sanitary sewer collection system.
- **Lift Stations**
 - 89A Lift Station (Arsenic Backwash)
 - Alamos Lift Station
 - Fiesta Lift Station
 - Mescal Lift Station

H. EXISTING WASTEWATER TREATMENT PLANT DESCRIPTION AND SUMMARY

The Town of Clarkdale's Broadway Water Reclamation Facility (BWRF), located on Town-owned property off of South Broadway and adjacent to the Verde River, is permitted through the Arizona Department of Environmental Quality (ADEQ) to treat and distribute up to 0.35 million gallons per day (MGD) or 400 AF / yr of Class A+ reclaimed water at full capacity. The plant is a Smith and Loveless Activated Sludge Treatment Plant with anoxic selectors for nitrogen removal. The plant received major upgrades in 2013.

I. WATER SYSTEM

A. CURRENT AND FUTURE DEMANDS

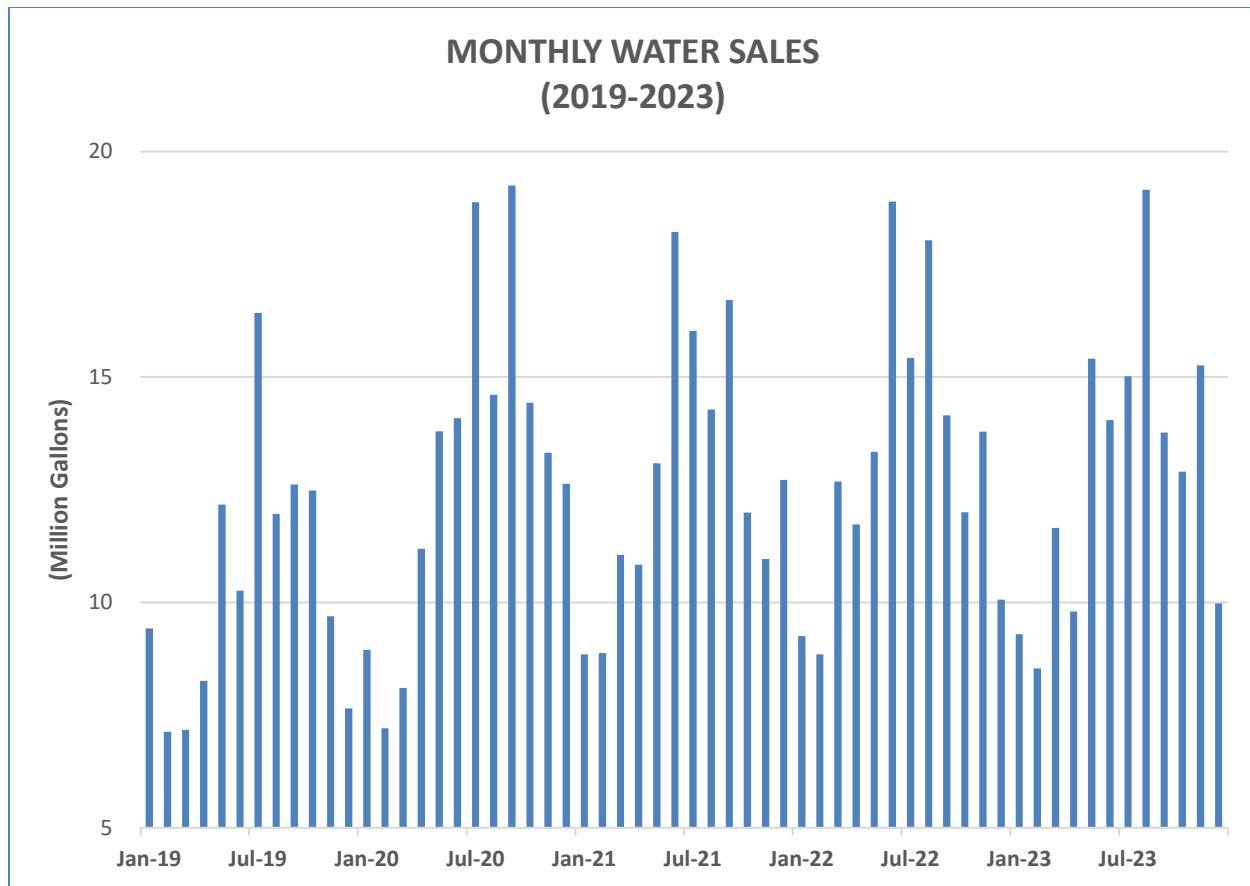
Clarkdale provided data for the number of customers by type, water production, water sales, and anticipated future water demands. This data was used to estimate future water demand and identify existing vulnerabilities within the existing system.

1. CUSTOMER BILLING/WATER DEMANDS

Clarkdale currently serves 2,283 water customers; 1,877 residential, 406 commercial, industrial, and government accounts. Customer usage varies seasonally with the lowest usages occurring in the winter months. Table 1 - Water Sales (gallons) summarizes monthly and yearly water sales data for the previous 5 years (2019-2023). This table does not account for water used in backwashing and flushing at the Arsenic Treatment Plant, and fire hydrants around Clarkdale. Over the same 5-year period an average of 233,000 gallons were used monthly for backwashing and flushing. Table 2 - Demand by Distribution Area shows average daily demand separated into distribution areas. Pressure Zones are discussed in the next section and a map of the pressure zones and distribution areas are included in Appendix A2 Existing Pressure Zone Map.

	2023	2022	2021	2020	2019
January	9,296,055	9,249,538	8,847,352	8,943,387	9,422,256
February	8,532,471	8,843,972	8,878,458	7,206,076	7,131,571
March	11,652,126	12,680,485	11,055,260	8,101,992	7,169,234
April	9,796,642	11,727,901	10,836,737	11,191,252	8,258,909
May	15,406,299	13,339,408	13,085,067	13,796,498	12,168,971
June	14,038,832	18,886,328	18,212,956	14,087,304	10,257,194
July	15,010,888	15,417,499	16,023,506	18,875,312	16,417,992
August	19,151,272	18,028,174	14,275,825	14,603,319	11,963,792
September	13,767,101	14,148,647	16,701,666	19,247,028	12,617,028
October	12,902,601	11,999,492	11,992,859	14,426,688	12,482,619
November	15,253,206	13,789,511	10,962,794	13,321,462	9,693,997
December	9,973,162	10,058,769	12,711,800	12,632,103	7,650,504
Total	154,780,655	158,169,724	153,584,280	156,432,421	125,234,067

Table 1 - Water Sales (gallons)



	Haskell Springs Distribution Area Average Daily Demand (gal)	Mountain Gate/89A Distribution Area Average Daily Demand (gal)	Total Average Daily Demand (gal)
2023	196,518	227,539	424,057
2022	212,842	232,250	445,091
2021	214,457	206,322	420,779
2020	216,086	212,496	428,582
2019	183,188	159,919	343,107
5 Year Average Daily Demand	204,618	207,705	412,323

Table 2 - Demand by Distribution Area

2. WATER PRODUCTION

Clarkdale keeps records of water production, billing, storage and estimates water losses due to known leaks. This data is used to calculate total water loss compared to production. Water is currently drawn from the two active wells in Clarkdale at Haskell Springs and Mountain Gate. See Table 3 - Water Production (gallons) and Table 4 - Water Production: High, Low and Averages (gallons) for water production amounts from the previous 5 years (2019-2023).

	2023	2022	2021	2020	2019
January	10,354,484	10,570,830	10,117,982	12,734,226	11,633,416
February	10,023,300	10,985,720	10,081,668	10,325,354	9,245,027
March	12,687,958	13,813,921	12,606,190	11,134,761	9,273,857
April	10,718,663	12,775,944	12,318,380	15,940,627	10,635,557
May	17,562,129	14,895,889	14,115,142	16,945,053	15,274,491
June	14,823,552	21,307,550	19,894,035	13,633,579	13,115,781
July	16,381,205	17,704,050	18,056,371	21,131,001	19,229,568
August	21,438,902	21,014,556	16,024,219	16,639,980	14,711,224
September	16,057,632	16,128,121	20,047,616	31,147,694	14,863,301
October	15,164,167	13,238,731	14,838,155	15,620,262	15,593,554
November	18,178,770	15,065,137	13,264,689	13,524,363	11,787,905
December	12,815,343	11,178,236	14,084,863	14,257,639	10,588,456
TOTAL	176,206,105	178,678,685	175,449,310	193,034,539	155,952,137

Table 3 - Water Production (gallons)

	Average Daily (2019-2023)	Monthly Low	Monthly High	Average Monthly (2019-2023)
January	357,490	10,117,982	15,379,980	11,082,188
February	361,865	9,245,027	11,587,808	10,132,214
March	383,979	9,273,857	13,813,921	11,903,337
April	415,928	10,635,557	15,940,627	12,477,834
May	508,340	14,115,142	17,562,129	15,758,541
June	551,830	13,115,781	21,307,550	16,554,899
July	596,788	16,381,205	21,131,001	18,500,439
August	579,541	14,711,224	21,438,902	17,965,776
September	654,962	14,863,301	31,147,694	19,648,873
October	480,354	13,238,731	15,620,262	14,890,974
November	478,806	11,787,905	18,178,770	14,364,173
December	405,965	10,588,456	14,257,639	12,584,907

Table 4 - Water Production: High, Low and Averages (gallons)

City of Cottonwood Connection

Through a connection with the City of Cottonwood, Clarkdale's water system can supply to or receive potable water from Cottonwood during times of water shortage. Water can be sent to Cottonwood's Distribution system or received via existing booster pumps at multiple existing connections. This connection accounts for a small amount of water in and out of the system but allows for additional redundancy in the Town's water supply. Table 5 - Cottonwood Connection Summary (gallons) lists the amount of water sent and received each of the previous 5 years (2019-2023).

	From Cottonwood	To Cottonwood
2023	119,204	240,300
2022	876,572	0
2021	517,951	170,600
2020	0	4,000
2019	0	10,000

Table 5 - Cottonwood Connection Summary (gallons)

3. WATER LOSS

Clarkdale keeps records of estimated water losses in the system each month. Water loss is calculated by taking water production and subtracting total usage plus the change in the amount of stored water. Total usage is calculated by adding customer sales to other non-revenue sources of usage, including City of Cottonwood, Fire Department, backwash, flushing, and known leaks. Stored water is the difference in the water level from the beginning to the end of each billing cycle. Non-revenue sources of usage and leaks are estimated and therefore water loss is not exact. Potential metering inaccuracies exist for both production and billing. Clarkdale's water loss percentage falls in the 8-12% range. Water loss is only an estimation and cannot account for all leaks, breaks and unmetered uses in the system, but this can be used as a reference to identify irregularities in water usage and determine when excessive losses should be further investigated. It is important to limit water loss in the system especially during times of water shortage as this can place additional strain on the water supply. Table 6 - Water Loss Percentage below shows the previous 3 years of water loss expressed as a percentage of total production.

	2023	2022	2021
January	9.88%	10.60%	9.94%
February	13.51%	18.53%	5.78%
March	5.24%	6.18%	10.85%
April	10.11%	6.94%	9.82%
May	10.17%	9.74%	6.25%
June	4.30%	9.86%	7.00%
July	6.13%	11.98%	9.14%
August	8.76%	12.94%	7.07%
September	12.47%	11.41%	15.29%
October	12.50%	8.52%	14.97%
November	14.64%	6.83%	16.16%
December	19.77%	8.50%	7.34%
	3 Year Average %		10.25%

Table 6 - Water Loss Percentage

At the time of writing this master plan, the Town is experiencing an increased water loss. Water production and billing data in 2024 show an excess water loss of approximately 1,000,000 gallons per month compared to the normal water loss range. Clarkdale has contracted with different consultants to test the existing meters and locate potential sources of water loss. It was suspected that there was an issue with the meter on the Mountain Gate Well. This meter has been replaced, and data is being collected to determine if this was the anomaly. Initial data shows that this meter was the issue.

4. CALCULATED PER CAPITA WATER DEMAND

Per capita water demand was calculated using water sales data from the previous 5 years (2019-2023) from the Town of Clarkdale. Per capita water demand is expressed as gallons per day (gpd). This amount varies seasonally with the lowest values occurring during the winter months and highs typically during the

summer months. This calculation represents the water usage for all connections, residential and non-residential, within the system. See Table 7 – Water Demand Per Capita (gpd) for monthly per capita water demand and an overall average per capita demand.

	Average Daily (2019-2023)	Per Capita GPD
January	295,217	67
February	289,947	66
March	326,833	74
April	345,410	78
May	437,395	99
June	503,217	114
July	527,388	119
August	503,370	114
September	509,876	115
October	411,640	93
November	420,140	95
December	342,105	77
Average Per Capita Demand (gpd):		93

Table 7 – Water Demand Per Capita (gpd)

2022 & 2023		
Average Sales	156,475,190	gallons/year
Average Connections	2,275	
Average Demand Per Connection	68,780	gallons/year
	188	gpd
Peak Month (August) Average Sales	18,589,723	gallons/month
Peak Month Average Demand Per Connection	8,171	gallons/month
	264	gpd

Table 8 - Water Demand Per Connection

2022 & 2023		
Average Sales	109,258,870	gallons
Average Connections	1,853	
Sales Per Connection	58,963	gallons/year
	162	gpd
Peak Average Sales August	12,563,074	gallons/month
Peak Sales Per Connection	6,780	gallons/month
	219	gpd

Table 9 - Residential Demand Per Connection

2022 & 2023		
Average Production	177,442,395	gallons
Average Connections	2,275	
Total Usage Per Connection	77,997	gallons/year
	214	gpd
Peak Average Total Usage (Aug.)	21,226,729	gallons/month
Peak Total Usage Per Connection	9,330	gallons/month
	301	gpd

Table 10 -Total System Usage Per Connection

For planning purposes, the average daily demand per connection and the average total system usage per connection were calculated in Table 8 - Water Demand Per Connection and Table 10 -Total System Usage Per Connection respectively.

5. PEAKING FACTORS

Since hourly flow data is not available to calculate an hourly peaking factor, a standard peaking factor of 3.0 will be used to calculate flows during peak hours in the system model. For calculating future demands on the system, the Peak Monthly Demand for 2022 and 2023 were averaged to come up with a monthly peaking factor of 1.4.

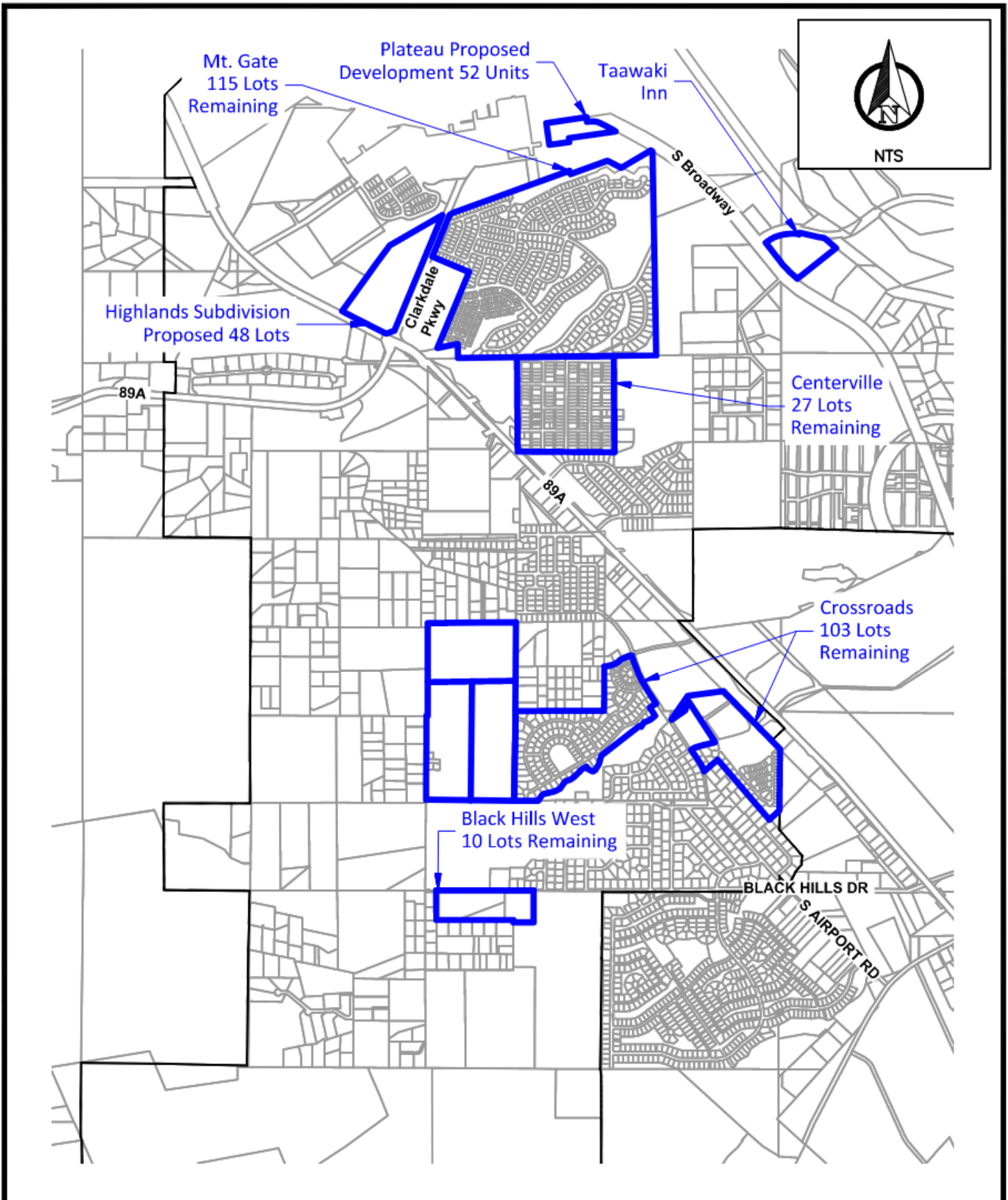
6. ANTICIPATED DEMAND AREAS

Clarkdale has shown steady growth in population with both residential and commercial developments. Projections show continued growth and therefore an increased water demand. Two new subdivisions have been proposed, the Plateau at Clarkdale and the Highlands at Clarkdale, with potential for 100 lots in total. Centerville, Mountain Gate, Crossroads and Black Hills West subdivisions have lots remaining with the potential for construction. These lots and the Taawaki Inn, opened in the Summer of 2024, are included in the anticipated demand calculations. Using water sales data from the previous 2 years (2022 and 2023) the average daily usage and peak monthly usage was determined. Peak usage was calculated using the highest average month, August, for the previous 2 years. Water usage for the Taawaki Inn was calculated using City of Flagstaff Engineering Water Demand Criteria, see Table 13-09-003-02 Water Demand Criteria. These numbers were used to calculate the anticipated additional water demand associated with future developments. See Table 11 – Anticipated Additional Water Demand.

Development Area	# of Lots	Average Additional Daily Demand (gpd)	Average Monthly Additional Demand (gallons)	Peak Month Additional Average Daily Demand (gpd)	Peak Monthly Additional Demand (gallons)
Centerville Lots	27	5,076	154,395	7,128	216,810
Mountain Gate Lots	115	21,620	657,609	30,360	923,451
Crossroads Lots	103	19,364	588,989	27,192	827,091
Black Hills West	10	1,880	57,183	2,640	80,300
Plateau Subdivision	52	9,776	297,354	13,728	417,560
The Highlands at Clarkdale	48	9,024	274,480	12,672	385,440
Totals	355	66,740	2,030,011	93,720	2,850,653
	# of Rooms	Average Unit Design Flow	Peak Unit Design Flow	Additional Average Daily Demand (gpd)	Additional Peak Daily Demand (gpd)
Taawaki Inn	44	75 gpcd	120 gpcd	3,300	5,280

Table 11 – Anticipated Additional Water Demand

See the following map for areas associated with anticipated additional water demand.



SHEET 1 OF 1	DRAWN BY: CTO	WATER DEMAND ANALYSIS ANTICIPATED DEMAND	 ARDURRA www.ardurra.com
	DATE: MARCH 2025		
	SCALE: AS SHOWN		
	JOB NO: 223351		
		YAVAPAI COUNTY	TOWN OF CLARKDALE

7. FUTURE FULL BUILDOUT

Full buildout demand and total system usage have been estimated for planning purposes. This calculation is based on vacant land, current zoning data, expected buildout density and existing usage rates. Demand unit rates were determined from existing customer billing based on type of connection. This additional water demand does not include areas outlined in the Anticipated Demand Areas section above. Actual water demands cannot be accurately estimated and plans for development in these areas should include further evaluation on a case-by-case basis to determine more accurately the water demand that will be added to the system. Undeveloped acreage totals are approximate and included for planning purposes only.

Zoning	Undeveloped Acreage	Average Additional Daily Water Demand (gallons)	Peak Additional Daily Water Demand (gallons)	Average Annual Use (gal)	Average Annual Use (AF)
Residential	1,733	942,763	1,319,868	344,108,332	1,056
Commercial	94	33,724	47,214	12,309,250	38
Industrial	256	20,391	28,548	7,442,802	23
Total	2083	996,878	1,395,629	363,860,384	1,117

Table 12 - Full Buildout Additional Water Demand

(Based on Sales Data)

Table 12 - Full Buildout Additional Water Demand represents the increase in water demand associated with areas of potential growth around Clarkdale. These values were calculated using the water demand per connection for residential areas and the average usage rates for both commercial and industrial areas. Since this calculation is based on sales and meter data it does not account for expected leaks, losses and other unmetered uses. For future planning purposes Table 13 - Full Buildout Full System Usage includes the full buildout scenario based on the total usage per connection identified in Table 10.

Zoning	Undeveloped Acreage	Average Additional Daily Water Demand (gallons)	Peak Additional Daily Water Demand (gallons)	Average Annual Use (gal)	Average Annual Use (AF)
Residential	1,733	1,073,145	1,502,402	391,697,782	1,202
Commercial	94	38,388	53,743	14,011,593	43
Industrial	256	23,211	32,496	8,472,126	26
Total	2083	1,134,744	1,588,641	414,181,501	1,271

Table 13 - Full Buildout Full System Usage

(Based on Production Data)

Water Rights Settlement Agreement

The Town of Clarkdale and the Yavapai-Apache Nation have reached an agreement on water rights for the Town. The Yavapai-Apache Nation Water Rights Settlement Agreement dated June 26, 2024 states the Town's water budget as a maximum average annual diversion amount of 1,889 Acre Feet from underground water for M&I uses inside or outside Town limits. M&I uses are defined as the use of water for domestic, municipal, industrial, and commercial purposes. The agreement also gives a separate water budget for PSA Land, a maximum average annual diversion amount of 633 AFY. PSA Land is defined in the settlement agreement, these properties are located northwest of Clarkdale off Cement Plant Road.

The annual water budget represents the total production of groundwater required from the wells in Clarkdale to meet demands plus other non-revenue sources of water such as unmetered uses and other leaks/losses. Potable water production, anticipated average demand, and future full buildout are calculated in sections above but shown in the breakdown below.

5-Year Average Production (2019-2023) – **175,864,155 gal (540 AF)**

Anticipated Additional Daily Average Demands – **25,564,600 gal (78 AF)**

Future Full Buildout Full System Usage – **414,181,501 gal (1,271 AF)**

Annual Water Budget (M&I Uses) **1,889 AFY**

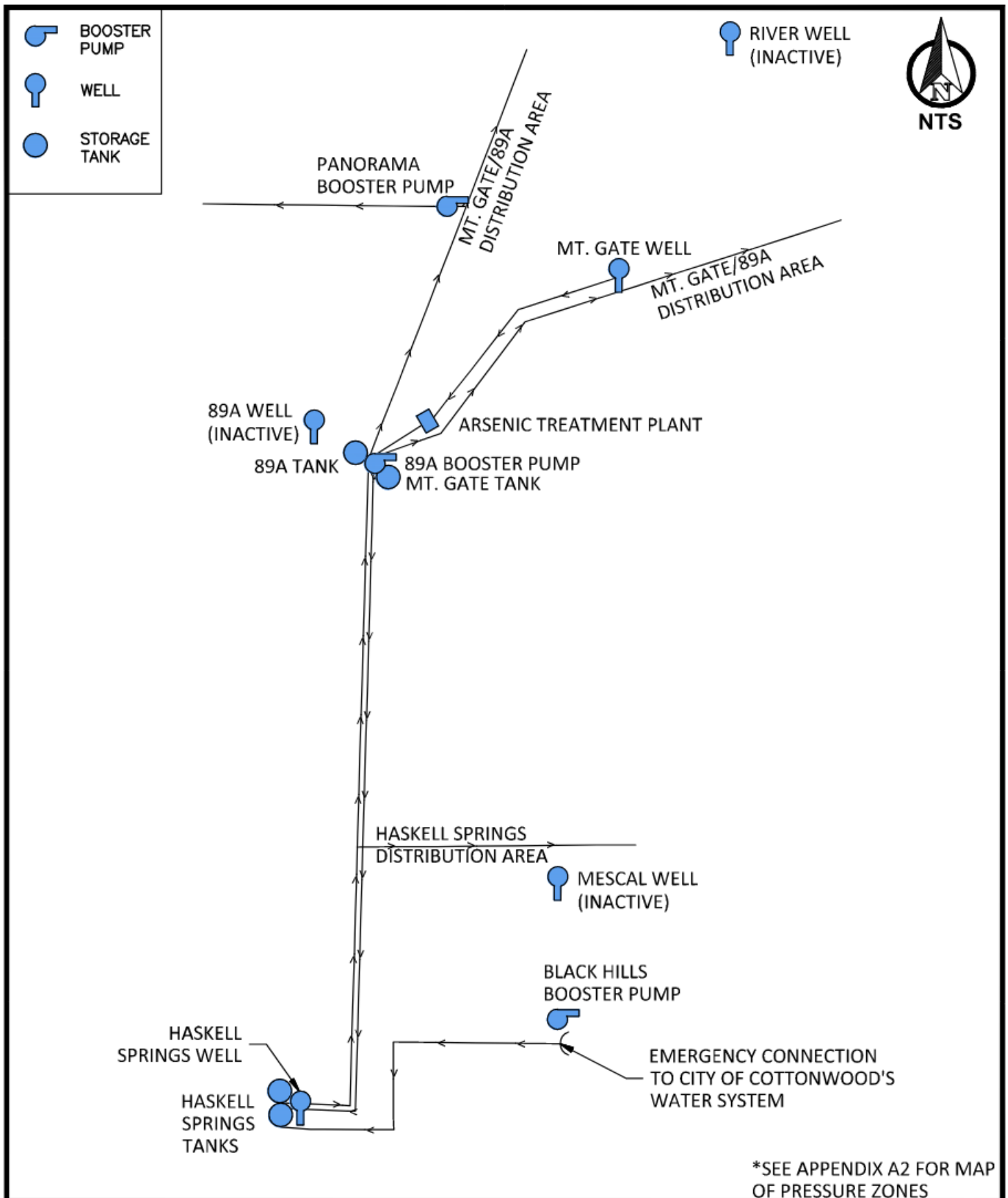
As the Town receives proposals for developments in both non-PSA Land and PSA Land it should evaluate the impact on the water budget on a case-by-case basis.

8. WATER DISTRIBUTION SYSTEM EXPANSION

A previous study was prepared in June 2019 for the Town of Clarkdale by Southwestern Environmental Consultants, INC. titled *"Feasibility Study – Expansion of Water Distribution System and Sewer Collection System."* The study is included in Appendix A12 for reference. The study identified proposed water mains to connect properties that do not currently have access to the Town's potable water system. The proposed water expansion included properties that were both developed and vacant, as well as properties that utilize existing private wells. At this time there are no plans to expand the distribution to these properties. The impact on the system's demand was not investigated as a part of the feasibility study. Construction costs and the water demands associated with different areas of expansion will vary widely. Proposals for expansion should be evaluated individually based on the impact to the existing system.

B. EXISTING INFRASTRUCTURE

Clarkdale is supplied by groundwater from two active wells, Mountain Gate and Haskell Springs. Groundwater from these wells is treated with chlorine at the well sites. Mountain Gate pumps to the Arsenic Treatment Plant where arsenic content is removed below the Maximum Contaminate Level (MCL.) Potable water is stored in two tanks at the Haskell Springs well site and two tanks at the 89A well site. Water gravity feeds from the tanks into the distribution system. Clarkdale's distribution system is comprised of approximately 41 miles of water lines of various sizes and ages. See the map on the following page for a schematic of Clarkdale's water system. See Appendix A1 Existing Water System Map for locations of existing infrastructure.



SHEET 1 OF 1	DRAWN BY: CTO DATE: NOVEMBER 2024 SCALE: N.T.S. JOB NO: 223351	WATER MASTER PLAN WATER SCHEMATIC YAVAPAI COUNTY TOWN OF CLARKDALE	
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1. WELLS

Clarkdale's groundwater system consists of two active wells that feed the distribution system, Mountain Gate and Haskell Springs. Information on four Town owned inactive wells around Clarkdale are included for planning purposes. The Cemetery Well is utilized for onsite irrigation purposes only. The Town's wells are as follows:

1. Mountain Gate
2. Haskell Springs South
3. 89A (Inactive)
4. Haskell Springs North (Inactive)
5. Mescal Well (Inactive)
6. River Well (Inactive)
7. Cemetery Well

Table 14 - Well Information includes detailed information on each well; the map on the previous page shows general well locations.

Well Name	ADWR ID#	Depth Drilled (Feet)	Static Level (Feet)	Date Drilled	Maximum Daily Production (gal)
Mountain Gate	55-202370	1690	480	May 2004	856,800
Haskell Springs South	55-503444	325(ADWR) 237**	168	November 1982 Redrilled 2001	554,400
Haskell Springs North (Inactive)	55-609073	600	168	January 1961	N/A
89A (Inactive)	55-609072	925	425	January 1957	N/A
Mescal Well (Inactive)	55-202140	1500	455.5	July 2004	N/A
River Well (Inactive)	55-609071	260	10	1935	N/A
Cemetery Well	55-559554	500	290	September 1996	36,000*
Total					1,411,200

Table 14 - Well Information

*Used solely for irrigation not connected to the Town's potable water system.

**Depth taken from recent camera investigation; depth differs from ADWR records.

Mountain Gate

The Mountain Gate well was drilled in 2004. The pump and motor were replaced in January of 2022. The well is run on a VFD, and its pumping rate is variable. The well has a pumping capacity of approximately 595 gpm at 60 hz currently which is sent to the ATP for treatment. Testing shows that water from this well contains around 31 µg/l of arsenic: Over the previous 5 years (2019-2023) the Mt Gate well has produced an average of 213,515 gpd. Previous studies indicated a potential discharge of 1400+ gpm, but this well is currently limited by the current ATP capacity of 600 gpm. This well is discussed later in the CIP section. See Appendix A7 for pump curve.

Mountain Gate Well	
Depth Drilled	1690'
Static Water Level	480'
Dynamic Water Level	Variable - 100' max. draw down
Pump Setting Depth	633'
Well Head Elevation	3645'
Casing Diameter	12"
Column Pipe Diameter	6"
Pump Make	Franklin Electric
Pump Model	550STS8
Pump HP	175
Discharge Diameter	6"
Pumping Rate	Variable – Average 540 gpm
Head on Pump	Variable – 920' at 595 gpm
Discharge Pressure (At Well Head)	47 psi
Pumps To	Arsenic Treatment Plant
Year Constructed	2004
Treatment Type	Chlorine, Arsenic Treatment Plant
Recent Maintenance	Pump and Motor replaced Jan. 2022. Transducer added and Wiring replaced Spring 2024, VFD replaced and New MAG Meter installed Dec. 2024
Recommended Maintenance	Up size pump after arsenic plant expansion, lightning /surge protection need to be replaced



Well Head and Discharge Piping



Mountain Gate Well – Treatment

Table 15 – Mountain Gate Well Data

Haskell Springs South Well

The Haskell Springs Well was originally drilled in 1982 with the pump and motor replaced in July of 2023. The well is run on a VFD, and its pumping rate is variable. The well is currently pumping at 315 gpm at 57 Hz but can produce 365 gpm at 60 Hz. The well produces water with levels of arsenic below the MCL and is pumped directly to the two storage tanks at the Haskell Springs site. Heavy use of the Haskell Springs Well causes a decline in the water levels, but this water level recovers during periods of lower use. Over the previous 5 years (2019-2023), the Haskell Springs Well has produced an average of 267,475 gpd. See Appendix A7 for pump curve.

Haskell Springs South Well	
Depth Drilled	237'*
Static Water Level	168'
Dynamic Water Level	110' draw down
Pump Setting Depth	217'
Well Head Elevation	3900'
Casing Diameter	14"
Column Pipe Diameter	6"
Pump Make	Franklin Electric
Pump Model	375STS6
Pump HP	40
Pump Size	6"
Discharge Diameter	8"
Pumping Rate	Variable, currently 315 gpm, Pumping Capacity 365 gpm
Head on Pump	205'
Discharge Pressure (At Well Head)	Unknown
Pumps To	Haskell Springs Tanks
Year Constructed	1982, redrilled 2001
Treatment Type	Chlorine added
Recent Maintenance	VFD replaced Jan. 2019, Pump and motor replaced July 2023
Recommended Maintenance	Replace pressure gauge at well head., Replace VFD in next 3 years; replace well pump in next 7 years



Well Head and Discharge Piping



Haskell Springs South Well – Well Site

Table 16 – Haskell Springs South Well Data

*Depth taken from recent camera investigation; depth differs from ADWR records.

Haskell Springs North Well (Inactive)

Haskell Springs North Well is located just north of the Haskell Springs South Well. It is unknown when this well was abandoned. The well has been used recently to read the static water level of the active well at Haskell Springs.

Haskell Springs North Well	
Depth Drilled	200'*
Static Water Level	178'
Dynamic Water Level	N/A
Pump Setting Depth	N/A
Well Head Elevation	3900'
Casing Diameter	8"
Column Pipe Diameter	Unknown
Pump Make	N/A
Pump Model	N/A
Pump HP	N/A
Pump Size	N/A
Discharge Diameter	N/A
Pumping Rate	470 gpm
Head on Pump	N/A
Discharge Pressure	N/A
Pumps To	N/A
Year Constructed	1961
Treatment Type	None
Last Date of Maintenance	Unknown
Recommended Maintenance	None

Table 17 - Haskell Springs North Well Data

*Assumed depth, differs from ADWR records.



Haskell Springs Well Site



*Haskell Springs North (left)
Haskell Springs South (right)*

89A Well (Inactive)

The well on 89A was drilled in 1957 but is no longer in use due to a collapsed casing. Water produced from this well has shown levels of arsenic below the maximum contaminant level (MCL). The Matrix New World Engineering Memorandum dated Sept 2, 2024, found in Appendix A9, identified this location as the most favorable location for a new well based on existing infrastructure at the site, historic yield and quality. The Town has a proposal to redrill a well at this site with a goal of producing 300+ gpm. Historically, this location produced water that did not require arsenic removal and redrilling this well could potentially improve Clarkdale's water supply without the additional cost of arsenic removal. Further analysis will be required once yield and quality are tested for the new well.

89A Well	
Depth Drilled	925'
Static Water Level	425'
Dynamic Water Level	N/a
Pump Setting Depth	N/a
Well Head Elevation	3765'
Column Pipe Diameter	Unknown
Casing Diameter	8"
Pump Make	N/a
Pump Model	N/a
Pump HP	N/a
Pump Size	N/a
Discharge Diameter	N/a
Pumping Rate	135-200 gpm
Head on Pump	N/a
Discharge Pressure (At Well Head)	N/a
Pumps To	N/a-
Year Constructed	1957
Treatment Type	None
Last Date of Maintenance	N/A
Recommended Maintenance	Cap existing well, Drill New Well



89A Well – Well Head (Inactive)

Table 18 – 89A Well Data

Mescal Well (Inactive)

The Mescal Well was drilled in 2004 but was never put into service. Yield testing estimated a potential pumping capacity of 300-400 gpm, but analysis of previous water samples from the well have shown an arsenic level between 23 µg/l and 15 µg/l. Usage of the Mescal Well would require infrastructure upgrades to the distribution system as well as increased capacity for arsenic treatment, with a previous study estimating the costs of these upgrades at \$10-16 million. This well site was evaluated in the Matrix New World Engineering Memorandum dated Sept 2, 2024, but was considered less favorable due to the lack of existing infrastructure, potential yield, and groundwater quality.

Mescal Well	
Depth Drilled	1500’
Static Water Level	455.5’
Dynamic Water Level	N/a
Well Head Elevation	3639’
Column Diameter	unknown
Casing Diameter	12”
Pumping Rate	Estimated 300-400 gpm
Pumps To	N/a
Year Constructed	2004
Treatment Type	None
Last Date of Maintenance	None
Recommended Maintenance	None



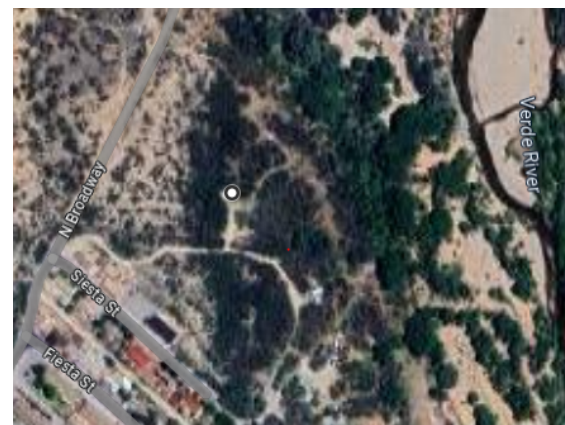
Mescal Well – Well Site (Inactive)

Table 19 - Mescal Well Data

River Well (Inactive)

The River Well is located northeast of downtown Clarkdale, just west of the Verde River. The well changed ownership from Cottonwood Water Works Inc. to the Town of Clarkdale in 2006. Historically, the rights of the well had a maximum flow rate of 5 cubic feet per second (approximately 2244 gpm) and records show a 45-gpm pump was installed in 1977. At this time Potential yield and water quality for the river well is unknown. Use of the River Well would require further study and infrastructure upgrades to connect it to the existing water system.

River Well	
Depth Drilled	265'
Static Water Level	10'
Dynamic Water Level	N/a
Pump Setting Depth	unknown
Well Head Elevation	3370'
Column Diameter	unknown
Casing Diameter	12"
Pump Make	N/a
Pump Model	N/a
Pump HP	N/a
Pump Size	N/a
Discharge Diameter	N/a
Pumping Rate	Previously 45 gpm
Head on Pump	N/a
Discharge Pressure (At Well Head)	Unknown
Pumps To	Unknown
Year Constructed	1935
Treatment Type	None
Last Date of Maintenance	Unknown
Recommended Maintenance	None



River Well Location

Table 20 – River Well Data

Cemetery Well

The Cemetery Well is located at the Valley View Cemetery. The well is not connected to the Town's potable water distribution system and is only used for onsite irrigation. This well was originally drilled in 1996 with records showing a tested capacity of 35 gpm. The pump failed in 2021, and a 25 gpm pump was installed along with a 1,550 gal storage tank, a 30 gpm booster pump and other upgrades to the irrigation system. The current pump can produce a maximum of 36,000 gallons a day.

The Town is exploring the feasibility of developing this well as a potable water well. Further study and testing would be required to determine the water quality and increased production of this well.

Cemetery Well	
Depth Drilled	500'
Static Water Level	290'
Dynamic Water Level	100' Drawdown
Pump Setting Depth	unknown
Well Head Elevation	3400'
Column Diameter	Unknown
Casing Diameter	6"
Pump Make	Unknown
Pump Model	Unknown
Pump HP	5
Pump Size	4"
Discharge Diameter	Unknown
Pumping Rate	25 gpm
Head on Pump	Unknown
Discharge Pressure (At Well Head)	Unknown
Pumps To	Onsite storage tank
Year Constructed	1996
Treatment Type	None
Last Date of Maintenance	2021
Recommended Maintenance	None

Table 20 – Cemetery Well Data



Cemetery Well Irrigation Tank

2. POTABLE WATER STORAGE

Clarkdale's potable water is stored at two existing tanks located on Haskell Springs Road and two existing tanks at the 89A well site. In total the four tanks have a capacity of nearly 2.4 million gallons (MG) divided into the distribution areas as shown in Table 22 – Potable Water Storage below. The map on the following page shows general locations and capacities of the existing tanks. Recent tank inspection reports are included in Appendix A10.

Name	Location	Capacity (Gallons)
Haskell Springs Tanks	2550 Haskell Springs Rd	1,275,793
89A Tank	1725 W 89A	422,799
Mountain Gate Tank	1725 W 89A	689,910
Total Current Storage		2,388,502

Table 22 – Potable Water Storage

Legend

 TANK



NTS

89A RESERVOIR
422,799 GAL

MT. GATE TANK
689,910 GAL

HASKELL SPRINGS TANKS
1,275,793 GAL

This map is for planning and informational purposes only. The information in this map is based on best available data and is not accurate to engineering or surveying standards.

SHEET

DRAWN BY: CTO

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DATE: MAY 2024

OF 1

SCALE: AS SHOWN

JOB NO: 223351

WATER MASTER PLAN EX. STORAGE CAPACITY

YAVAPAI COUNTY

TOWN OF CLARKDALE



Haskell Springs Tanks

The Haskell Springs Tanks receive water from the well at Haskell Springs. These tanks distribute water to Haskell Springs Distribution Area by gravity feed. Water can be sent or received from Mountain Gate/89A Distribution Area via the existing 12" water main that runs primarily North/South between the tank sites. The two Haskell Springs tanks are interconnected and float equally. Historically, the configuration of the tanks required that both tanks had to be in service at the same time or both tanks must be taken out of service simultaneously, that made repairs and maintenance difficult because of a lack of adequate storage within the system with both tanks out of service. A project was recently completed that installed a bypass line to allow one tank to remain in service, while taking the other out of service for maintenance or repairs.

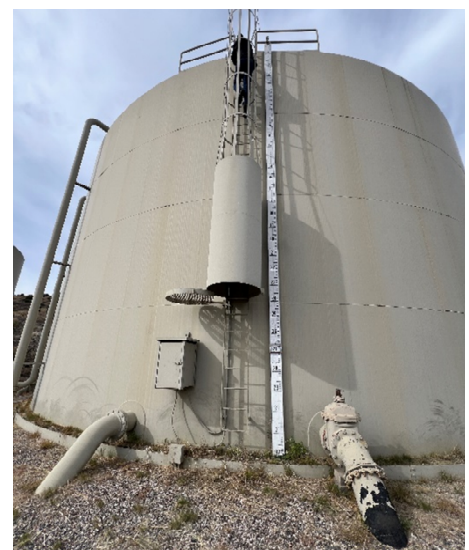
These tanks were last cleaned in 2022. The most recent inspection of the tanks revealed roof beams at the bottom of the north tank that had rusted out and fell into the bottom of the tank. It is recommended that both tanks be recoated, and the roof beams in the bottom of the north tank be removed and repaired.

Haskell Springs North Tank	
Height	30'
Diameter	65'
Capacity	750,000 gal
Material	Steel
Floor Elevation	Approximately 3900'
Inlet Pipe Diameter	8"
Outlet Pipe Diameter	12"
Outside Coating Condition	Good
Inside Coating Condition	Fair
Year Constructed	1995
Last Date of Maintenance	Cleaned 2022
Recommended Maintenance	Drain, clean, repair interior coating, and rusted roof beams., Add Tank Mixers

Table 23 – Haskell Springs North Tank Data



Haskell Springs Tanks – Facing West



Haskell Springs North Tank

Haskell Springs South Tank	
Height	30'
Diameter	56'
Capacity	Approx. 500,000 gal
Material	Steel
Floor Elevation	Approximately 3900'
Inlet Pipe Diameter	8"
Outlet Pipe Diameter	12"
Outside Coating Condition	Good
Inside Coating Condition	Fair
Year Constructed	1970s*
Last Date of Maintenance	Cleaned 2022
Recommended Maintenance	Drain, clean, repair interior coating, Add Tank Mixers



Haskell Springs (South Tank) – Inside Coating

Table 24 - Haskell Springs South Tank Data

*Approximate date based on conversation with Town staff.

89A Tank

The 89A tank receives water from the Haskell Springs site and the Arsenic Treatment Plant. This tank is connected and floats equally with the Mountain Gate Tank located just to the southeast. The tank was last cleaned in 2017 and inspected in 2023. The existing tank is located close to highway 89A and does not meet the sanitary requirements for ADEQ; Therefore, the Town has contracted the design of a new steel tank to replace the 89A tank. The date of construction is unknown, but the tank has exceeded its usable life, and its condition is deteriorating. The tank was constructed with wooden beams, a deteriorating wood shake roof, and wooden columns. The new tank is expected to be constructed near the site of the existing Mountain Gate Tank with upgrades to the yard piping around the tanks.

89A Tank	
Height	Unknown
Diameter	Approx. 100'
Capacity	Approx. 0.42 MG
Material	Wood, concrete and cement block
Ground Elevation	Approximately 3770'
Inlet Pipe Diameter	8"
Outlet Pipe Diameter	12"
Outside Coating Condition	N/a
Inside Coating Condition	Poor
Year Constructed	Unknown
Last Date of Maintenance	Cleaned in 2017, Inspected in 2023
Recommended Maintenance	Will be taken out of service and replaced with a steel tank

Table 25 – 89A Tank Data**89A Tank NW Tank – Facing South East****89A Tank NW Tank - Inside**

Mountain Gate Tank

Mountain Gate tank receives treated water from the arsenic treatment plant and is interconnected with the 89A tank. The interior coating is showing signs of deterioration and is in need of replacement.

Mountain Gate Tank	
Height	16'
Diameter	90'-6"
Capacity	Approx. 0.7 MG
Material	Steel
Floor Elevation	Approximately 3753'
Inlet Pipe Diameter	8"
Outlet Pipe Diameter	12"
Outside Coating Condition	Good
Inside Coating Condition	Fair/Poor
Year Constructed	2006
Last Date of Maintenance	Spring 2023
Recommended Maintenance	Drain, clean, and repair interior coating, add mixer

Table 26 – Mountain Gate Tank Data



MT Gate Tank – Facing South



MT Gate Tank – Interior Coating

3. BOOSTER PUMP STATIONS

Clarkdale has three existing booster pump stations. The 89A booster station pumps water from the Mountain Gate tank to the Haskell Springs tanks. The Black Hills booster pump station connects Clarkdale's Water System to the City of Cottonwood's Water System and operates to receive water from Cottonwood. In case of emergency the Panorama Booster Pump Station pumps water uphill to a small tank that provides water to the houses along Panorama Way, and to the Yavapai Apache Neighborhood along Cement Plant Road.

The booster pump stations are as follows:

1. 89A Booster Station
2. Black Hills Booster Station
3. Panorama Booster Station

See Appendix A1 for a system map and general locations of each booster pump station.

89A Booster Pump Station

Located on the Northwest side of the Mountain Gate Tank, the 89A booster pump station contains two 6" pumps. The 89A Booster Station pump can send water from the Mountain Gate Tank to the Haskell Springs Tanks. This connection allows for water to be transferred from Mountain Gate/89A Distribution Area to Haskell Springs Distribution Area as needed. This pump station can be set to run on a timer or based on water levels in Haskell Springs. Town staff has stated that the booster station is currently only operated manually because the existing water check valves leak, and an existing butterfly valve will not open.

89A Booster Pump Station			
Pump Station Elevation	3753'	Pump Make	Grundfos
Pumping Rate	632 gpm	Pump Model	10N6-30707-14000X-1881P
Pumping Pressure	65 psi	Pump Motor Make	Baldor-Reliance
Inlet Diameter	6"	Pump Motor Model	EJMM2534T
Outlet Diameter	6"	Pump Motor Year	May 2016
Number of Pumps	2	Pump Motor HP/Power	30 HP/460 V
Pump Year Installed	May 2016	Pump Discharge Size	3"
Pump Type	Centrifugal	Recommended Maintenance	Replace check valves and butterfly valve

Table 27 – 89A Booster Pump Station Data



Booster Pumps and Discharge Header



Booster Pump and Shade Structure

Black Hills Booster Pump Station

The Black Hills Booster Pump Station connects Clarkdale's water system to the City of Cottonwood and allows for water to be received from Cottonwood's water system during periods of water shortage. This booster pump station was previously operated by the City of Cottonwood. Records show that the VFD was replaced in 2015.

Black Hills Booster Pump Station			
Pump Station Elevation	3676'	Pump Discharge Size	6"
Pumping Rate	656 gpm	Pump Suction Size	6"
Max. Pumping Pressure	653 psi	Pump Pumping Rate	669 gpm
Inlet Diameter	6"	Pump Pumping Pressure	266 psi
Outlet Diameter	6"	Pump Motor Make	Baldor Reliance
Number of Pumps	1	Pump Motor Model	EJMM2516T
Pump Year Installed	2003	Pump Motor Year	2003
Pump Type	Submersible Booster	Pump Motor HP/Power	25 HP / 460 V
Pump Make	Grundfos	Last Date of Maintenance	VFD replaced in 2015
Pump Model	BMB 125-3-A-96442267-403	Recommended Maintenance	Replace Flowmeter

Table 28 – Black Hills Booster Pump Station Data



Booster Pump Station Building



Booster Pump and Piping Assembly

Panorama Booster Pump Station

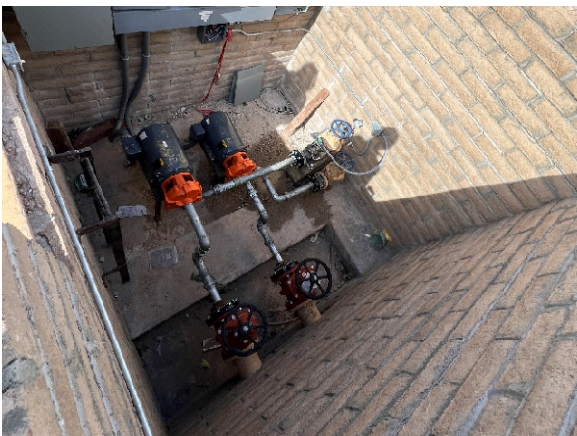
The Panorama Booster provides water to the houses along Panorama Way and the Yavapai – Apache Nation Neighborhood to the northwest along Cement Plant Road. The houses along Panorama Way are supplied by a 10,000-gallon hydropneumatic tank that provides pressure to those properties. There have been recent upgrades and reconfiguration of the existing pump station due to failure of pumps, motors and electrical system after the station was flooded. The pumps are still located in a recessed building, which is vulnerable to flooding. This booster pump station is currently slated for replacement. Replacement of this booster pump station will include the removal of the existing hydropneumatic tank along Panorama Way.

Panorama Booster Pump Station			
Pump Station Elevation	3725'	Pump Discharge Size	1-1/2"
Pumping Rate	140	Pump Suction Size	2"
Max. Pumping Pressure	220 psi	Pump Pumping Rate	140 gpm
Inlet Diameter	6"	Pump Pumping Pressure	266 psi
Outlet Diameter	6"	Pump Motor Make	Baldor Reliance
Number of Pumps	2	Pump Motor Model	EJMM2516T
Pump Year Installed	2024	Pump Motor Year	2024
Pump Type	Centrifugal	Pump Motor HP/Power	25 HP / 460 V
Pump Make	Berkeley Pentair	Recommended Maintenance	Pump Station scheduled for replacement
Pump Model	B1-1/2ZPHS		

Table 29 - Panorama Booster Pump Station Data



Booster Pump Station Building



Booster Pump and Piping Assembly

4. DISTRIBUTION

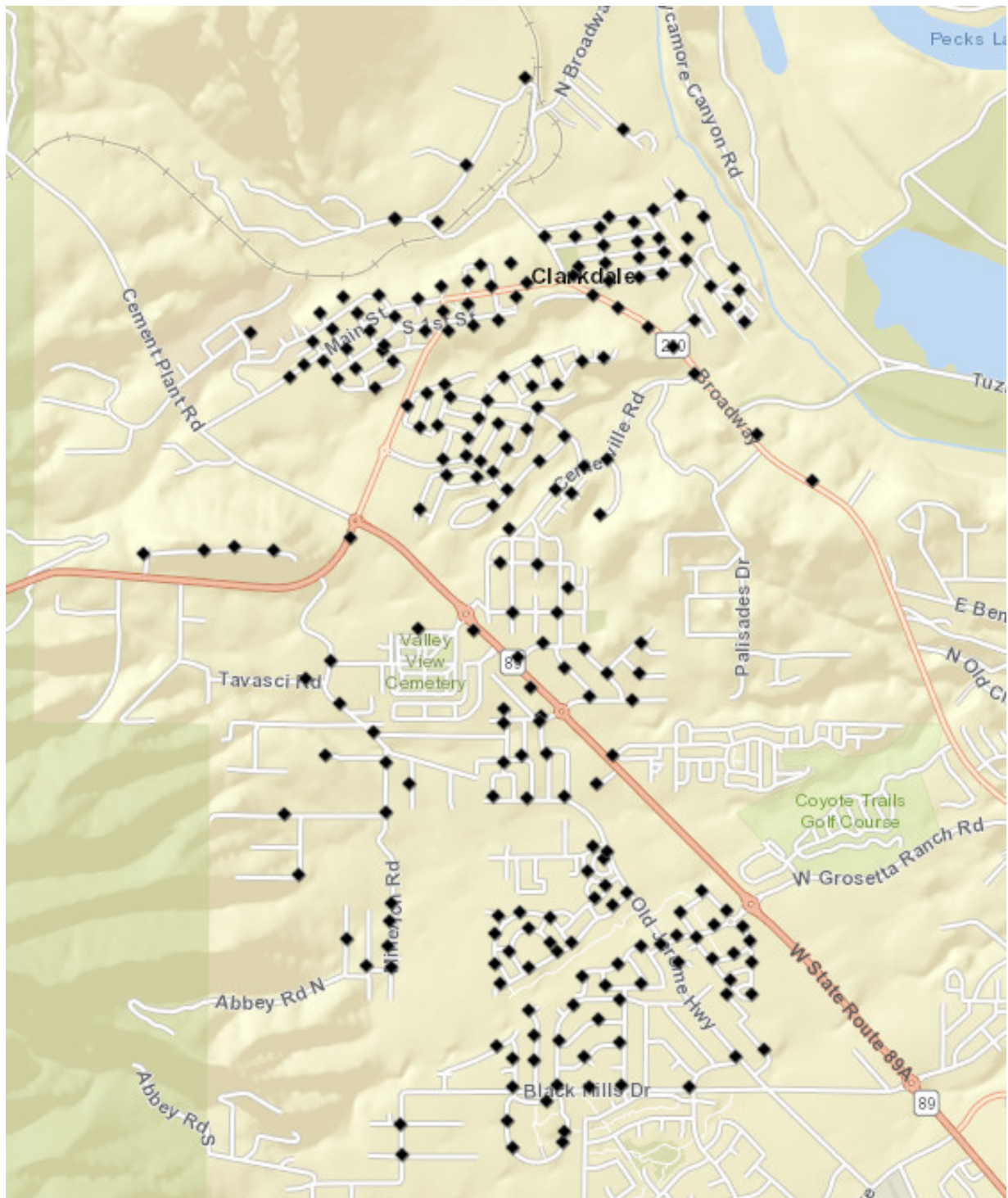
The Town of Clarkdale's distribution system is comprised of two distribution areas: Haskell Springs and Mountain Gate. Haskell Springs Area is defined as the area serviced by the Haskell Springs Tanks to the south. Mountain Gate/89A Distribution Area is defined as the area serviced by the 89A and Mountain Gate tanks. These distribution areas are based on the areas that are supplied by each tank site during normal conditions. Distribution areas are divided into pressure zones, with eight existing pressure zones. A project is currently under design to divide the pressure zones in the Black Hills neighborhood into pressure zone #5 and #6, as shown in Appendix A2. Pressure zones are regulated by PRVs and closing valves to create pressure boundaries in the system. The existing system is comprised of approximately 41 miles of existing water mains with sizes varying from 1.5" – 12". (See Table 30 - Existing Water Mains Summary.) Existing water mains were constructed with varying materials, with recent replacements primarily using PVC. In accordance with ADEQ water design standards, typical minimum pipe installations should be 8" minimum. It is estimated that the system includes an additional 26.5 miles of service lines. See Appendix A1 – System Map for locations of existing water lines.

Water can be transferred between distribution areas as production and demand requires. The Haskell Springs Tanks gravity feed to the 89A via the existing 12" water main that runs north-south, primarily along Minerich Road. The 89A Booster Pump Station transfers water from the Mountain Gate Tank to the Haskell Springs Tanks through the same 12" water main. This connection allows for water to be shared between areas during maintenance or unplanned repairs.

Besides serving the water utility customers in Clarkdale, the distribution system also provides fire protection. There are approximately 233 standard fire hydrants in Clarkdale and 4-2.5" hydrants. A map of existing fire hydrants is included on the following page.

	Approximate LF
12-inch	29,802
10-inch	3,400
8-inch	126,668
6-inch	55,414
4-inch	1,860
2.5-inch and smaller	Unknown Quantity
Total	217,144 LF (41.1 miles)

Table 30 - Existing Water Mains Summary



***Town of Clarkdale Fire Hydrant
Location Map***

5. PRESSURE REDUCING VALVES

PRVs lower the downstream pressure in the water main and allow for the system pressure to be regulated as required to maintain water pressure within a desired range. As part of data collection, visual inspections were done on existing PRVs around Clarkdale. The location of these existing PRVs is shown on the system map in Appendix A1. The Town's PRVs are manufactured by Cla-Val with general locations, model and features given in Table 31 – Existing PRV Data below. Locating new PRVs will be discussed later in the report as potential CIPs.

General Location	Size & Model #	Bypass Size & Model #
South Broadway/Hollow Reed Ln	8" 90-01BDV	n/a
Main/N 7 th St	8" 90-01BCSY	4" 90-01BCSY
Cleopatra Hill Rd/ Mountain Gate Dr	8" 90-01BY	2" 90-01AS
Alfonse Rd/ Mountain Gate Dr	8" 90-01BY	2" 90-01AS
Old Centerville Rd/South Broadway	8" 90-01BDV	n/a
Lanny Ln	6" 690-01BCSY	2" 90-01AS
West Black Hills Dr	6" 90-01BCPSVY	2" 90-01ABS
Park Rd	8" 90-01BCPSVY	2" 90-01BCPSVY

Table 31 – Existing PRV Data



PRV – Hollow Reed Ln



PRV – Cleopatra Hill Rd/Mountain Gate Dr

Mid Zone PRV Project

There are four PRVs proposed as part of the Mid Zone PRV project in the Black Hills Neighborhood. The design for this project is currently being finalized. The project will divide Pressure Zone #5 and Pressure Zone #6 as shown in Appendix A2. The purpose of this project is to regulate these pressure zones and allow for a looped feed into the Black Hills Neighborhood. Currently, a valve is closed along Old Jerome Highway to create a pressure boundary, and the neighborhood is fed by the 8" water main in West Black Hills Drive. See Table 32 - Mid Zone PRV Project Proposed PRVs for PRV model and general locations.

General Location	Size & Model #	Bypass Size & Model #
Sky Dr/Windy St	6" 90G-01BCPSVY	2" 90G-01BCVSY
Antelope Dr/Casner Dr	6" 90G-01BCPSVY	2" 90G-01BCVSY
Black Hills Dr/ Canyon Dr	8" 90G-01BCPSVY	2" 90G-01BCVSY
Old Jerome Hwy/ Skyline Blvd	8" 90G-01BCPSVY	2" 90G-01BCVSY

Table 32 - Mid Zone PRV Project Proposed PRVs

6. EXISTING VULNERABILITIES/DEFICIENCIES

The water system has vulnerabilities that need to be addressed as funding allows. The system has a lack of redundancy in supply and storage. Correcting storage and supply vulnerabilities would make the system more dependable and increase the capacity available for future development. Anticipated deficiencies associated with future demands and improvements to the system are discussed later in the report. At this time, preliminary designs are being prepared to upgrade Clarkdale's supply and storage as part of the Clarkdale Water Campus project. Recommended system improvements and corresponding CIP projects are given in later sections.

Supply

The main vulnerability of the water supply is due to current water production coming from the Mountain Gate and Haskell Springs wells. The supply from either well can meet average daily demand, but should the supply from Mountain Gate be cut off, Haskell Springs Well would not be able to keep up with peak demand. Currently, the supply from Mountain Gate would be adequate to supply the Town, even during times of peak demand, but this does not account for additional demand that would come with future development in Clarkdale. The vulnerability of supply not only falls on the Mountain Gate Well, but the Arsenic Treatment Plant as well. Should the Mountain Gate Well or ATP go offline, Haskell Springs would not be able to keep up with peak demand. As previously mentioned, Clarkdale has the option to receive water from Cottonwood during times of water shortage or during maintenance periods; however, this connection should only be used in times of an emergency.

It is recommended that the Town add additional water supply sources to add redundancy to the system. An additional supply source in the system would allow for demand to be met by any combination of two wells during periods of maintenance or repairs. Depending on the testing results of a new well, arsenic treatment may be required before water can be added to the distribution system. Potential future improvements are evaluated later in this section and included as CIP projects in Section VII Capital Improvement Projects. See Table 33 – Existing Production Evaluation for the vulnerability analysis that is addressed in later sections with potential projects to increase production capabilities.

	Pump Rating (gpm)	Pump Rating (gpd)
Total Production Capabilities of Existing Wells	980	1,411,200
Production with Haskell Springs Offline	595	856,800
Production with Mountain Gate Offline	385	554,400
Existing Peak Daily System Demand	455	654,960

Table 33 – Existing Production Evaluation

Storage

ADEQ requires community water systems to provide potable water storage for one average daily demand during the peak month, plus one fire flow event. However, due to long lead times, supply chain interruptions, and extended times for repairs, we recommended the Town have a potable water storage capacity for three days of average daily demand during the peak month as well as a fire flow event to decrease the possibility of water emergency and crisis events. Minimum fire flow requirements are 1000 gpm for one hour in residential areas or 1500 gpm for two hours in commercial and industrial areas. For storage calculations, a commercial/industrial fire flow requires 180,000 gallons of additional storage. Should the Haskell Springs Tanks or Mountain Gate Tank go offline, or require maintenance, the minimum recommended storage capacity would not be met. As mentioned previously, the current configuration of the Haskell Springs Tanks would require both be taken out of service for maintenance. See Table 34 - Existing Storage for the system's current capacities.

Due to its existing condition, the 89A tank will be taken out of service. Future improvements are discussed later in this section, but it is recommended that the tank be replaced with a storage tank of larger capacity. Potential water storage CIPs are included in Section VII Capital Improvement Projects. This analysis of the system is based on current demand; the effect of future development is discussed later in this report. See Table 35 – Minimum Recommended Storage for existing demand at average and peak daily flows compared to available storage without the use of the 89A Tank.

	Storage (gallons)
89A Tank	422,799
Haskell Springs Tanks	1,275,793
Mountain Gate Tank	689,910
Total Existing Storage Capacity	2,388,502

Table 34 - Existing Storage

	Minimum Storage (One Day) Peak Month Average Daily Usage	Minimum Storage (Three Days) Peak Month Average Daily Usage
Existing Demand +Fire Flow Event	834,960	2,144,880

Table 35 – Minimum Recommended Storage

Distribution

Certain areas within Clarkdale's distribution have existing vulnerabilities that should be addressed as funding allows. Due to the age and condition of the existing distribution system, several areas have a history of water line breaks. In addition, some parts of the system are supplied by a single feed waterline. Could an issue occur with single feed waterlines, areas of Town would be without water until the issue is fixed and back online. These issues are outlined below with potential Capital Improvement Projects discussed in Section VII Capital Improvement Projects.

Black Hills Subdivision

The Black Hills neighborhood in south Clarkdale has a history of waterline breaks and bad valves making isolating water mains difficult. Water mains in this area are asbestos concrete pipe (ACP) and the valves in this area are often unable to isolate individual streets due to the condition of the valves or poor configuration. This neighborhood also contains four old 2.5" fire hydrants connected to 4" ACP mains. It is unclear whether fire flow is available to these hydrants, because the fire department

and Town staff do not operate these hydrants due to the fear of not being able to close them once they are opened. These vulnerabilities are discussed later as potential CIPs.

The 8" water main along Old Jerome Hwy is closed to create a pressure boundary in this area. Therefore, this neighborhood is currently fed by a single 8" main in West Black Hills Drive. The mid zone PRV project currently under design will provide a looped feed into this neighborhood and divides pressure zones #5 and #6 as shown in Appendix A2.

Centerville and Mingus Shadows Subdivisions

The Centerville and Mingus Shadows neighborhoods, located off 89A, have a history of breaks. The existing water mains are undersized and include some 1.5" and 2.5" mains. Town staff have also noted that many water mains in this neighborhood are shallow. A closed valve on an 8" main near Centerville Avenue creates a pressure boundary to the Centerville Neighborhood, but also means the Centerville neighborhood is fed by one single 6" ACP pipe to the south. A break or repair in this area would shut off water to the entire neighborhood. The Centerville neighborhood watermains are primarily asbestos concrete pipe, with galvanized services. The Mingus Shadows neighborhood watermains are primarily asbestos concrete pipe with copper water services. Some of the homes in these neighborhoods share a single service connection to the main with no individual shutoff. Improvements to these neighborhoods are discussed later in the CIP section.

Upper Crossroads Subdivision Water Services

The Upper Crossroads have experienced over 20 water service breaks in the last 2 years. It has been reported that during construction, the Polypipe used for the water services was left open to the elements for many years prior to final installation underground and being put in service. Ultraviolet radiation breaks down Polypipe and the services have proven to be compromised. It is recommended that water services to the remaining properties be replaced.

12" Main on Clarkdale Pkwy

The existing 12" main from the 89A and Mountain Gate tanks is a critical piece of infrastructure and provides water to a large population of customers in the northern areas of Clarkdale. This main water line is original to the system and over 100 years old with suspected leaks in the water line. It is recommended that this water main be replaced. Details on a potential replacement project are given in the CIP section of this report.

Main/N 7th St PRV Gate Valves

The PRV station located on the northwest corner of N. 7th St. and Main St. needs maintenance. This work cannot be completed due to the existing gate valves located in the station not being able to be closed. The replacement gate valves have been purchased by the Town and should be installed. To shut off water to the station a large part of the water system will need to be shut off due to interconnected waterlines and insufficient gate valves.

7. WATER CONSERVATION

Clarkdale adopted its Drought and Water Shortage Preparedness Plan (DWSPP) in 2006. The DWSPP is included in Appendix A8. The plan's purpose is to provide guidance during times of water shortage. The objective of the plan is to reduce the use and demand of water during periods of drought and insufficient water production. The DWSPP also outlines the connection of Clarkdale's water system to the City of Cottonwood. During periods of water supply shortage, water can be sent to or received from the City of Cottonwood's water system. The plan gives three levels of water resource status summarized below.

Resource Status Level I

Resource Status Level I automatically goes in effect from May to September when water production and demand is typically at its highest. Outside of these peak months, Level I goes into effect when water demand exceeds safe production (75% of available daily supply capacity) for five consecutive days.

Resource Status Level II

Level II is in effect when water demand exceeds safe production by more than 20 percent.

Resource Status Level III

Resource Status Level III is in effect when water demand exceeds maximum production capacity, when there is a failure of any major supply or distribution infrastructure component in the system, or when the amount of water in storage may impair fire protection to zones around the Town.

Also outlined in the DWSPP are three levels of demand reduction strategies. The purpose of the demand reduction strategies is to reduce the use of potable water beyond common water conservation practices. Compliance among customers is mandatory, with violations resulting in potential additional charges being added to customers' utility bills as outlined in the DWSPP. The three demand reduction strategies are summarized below.

Demand Reduction Strategy I "Water Alert"

This strategy corresponds to Resource Status Level I with the goal of reducing water demand below the safe production capacity. Strategy I limits outdoor uses of potable water and requires contractors to use reclaimed water for dust control and construction purposes. Details of mandatory measures corresponding to this strategy are given in the DWSPP.

Demand Reduction Strategy II "Water Emergency"

The goal of strategy II is to reduce water demand to a level where safe production capacity exceeds water demand for ten consecutive days. This strategy includes all the mandatory measures in strategy I plus additional measures to limit outdoor washing and landscaping.

Demand Reduction Strategy III "Water Crisis"

Strategy III's goal is to reduce water demand to a level deemed necessary to recover from the loss of supply due to temporary or permanent failure, or to increase water storage to a level where fire protection capabilities are not impaired. Demand reduction strategy III includes all requirements in Strategies I and II, plus additional measures such as no potable water for outside uses, water permits shall not be issued and permitted new connections shall not be activated until strategy II is no longer in effect.

Clarkdale currently recycles water at the Broadway Water Reclamation Facility (BWRF) on Miller Road. The BWRF has produced an average of 0.12 MGD over the previous 5 years (2019-2023). A small amount of reclaimed water is sold to contractors for non-potable use at the VRIC Irrigation Site, but the remaining effluent is discharged to the irrigation area with no beneficial use. Reclaimed water use is being analyzed in a separate section of this report, but expanding the usage of reclaimed water could have a direct impact on potable water supply. Reclaimed water could replace usage of potable water in applications that do not require the use of potable water, such as watering parks and fields around Clarkdale. Use of reclaimed water would involve construction of new infrastructure to transport water from the Broadway Reclamation Facility to the site where it would be used. Reclaimed water is discussed further in Section IV - Reclaimed Water System later in this report.

C. WATER SYSTEM MODEL

1. SYSTEM PERFORMANCE STANDARDS AND DESIGN CRITERIA

The existing system should meet the minimum requirements as outlined by ADEQ in the Arizona Administrative Code (A.A.C.) R18-5-501 through R18-5-509. Minimum design standards are outlined in the following ADEQ Bulletins Arizona Department of Environmental Quality, Engineering Bulletin No. 10 *Guidelines for the Construction of Water Systems* (1978) and Arizona Department of Environmental Quality, Engineering Bulletin No. 8 *Disinfection of Water Systems* (1978).

Included in the standards are the minimum criteria for the design and construction of water treatment facilities, distribution mains, storage tanks, booster pump stations, and hydropneumatic tanks.

The relevant modeling criteria from ADEQ Bulletin 10 and additional local ordinances for water distribution mains, storage tanks, and booster pump stations are included below.

Distribution Mains

- Minimum pressure of 20 psi at ground level at all points in the system under all conditions of flow. The worst-case scenario is peak domestic demand plus a fire flow event.
- Normal working pressure is between 40 psi and 75 psi.
- Maximum pressure of 100 psi is allowable in small areas not subject to high flow rates. Pressure reducing valves shall be located to create multiple pressure zones that provide working pressures between 40 psi and 75 psi.
- During a fire flow event the system should maintain a minimum pressure of 20 psi, hydrants should provide a minimum of 1,000 gpm for 2 hours in residential areas and 1,500 gpm for 2 hours in commercial and industrial areas.

Storage Tanks

- Minimum storage capacity shall be equal to the average daily demand during the peak month of the year plus fire flow.
- Three days of storage including a fire flow event is generally recommended to lessen the impact of emergencies that may temporarily disrupt water production/service.

Booster Stations

- Booster pumps shall be designed to limit the intake pressure to no less than 20 psi.

2. WATER MODEL

As a part of this master plan the existing water system model was updated to model the systems existing conditions. System modeling was done using Bentley WaterGEMS (Connect Edition 10.04). Model inputs include junction nodes, storage tanks/reservoirs, pipe diameter, elevations, and flow demands. Different scenarios were analyzed using the model including average daily demand, peak daily demand and fire flows.

This model was used to identify existing system deficiencies and future anticipated system deficiencies. Deficiencies are summarized in the section below with potential improvements to the system given later in the report.

3. EXISTING SYSTEM DEFICIENCIES

Supply

The Town's Water supply is not currently deficient in its existing state. Production can meet the current demands of the system with the two active wells in the system. However, as discussed previously, critical pieces of infrastructure and the use of only two supply sources leave the system vulnerable to failures.

Storage

The existing water storage in the system meets the recommended minimum storage for average and peak day demands plus a fire flow event. However, the condition of the 89A tank and the configuration of the Haskell Springs Tanks leave the system vulnerable as previously discussed.

Distribution

Fire flow and pressure deficiencies were identified by the WaterGems model in the systems existing state as follows:

Fire Flow

Results of the model in the system's existing conditions reveal fire flow deficiencies around Clarkdale. As shown in Appendix A4, Existing System Fire Flow Analysis, roughly half of the nodes in Clarkdale do not meet the fire flow requirements as outlined above. Fire flow deficiencies are primarily due to undersized mains and isolated areas that are supplied by a single feed within the system. The areas listed below were identified in the model to be fire flow deficient. See Section VII Capital Improvement Projects and the sections below for potential projects to provide fire flow to identified fire flow deficient areas, including cost estimates associated with each project.

Panorama Way & Yavapai - Apache Neighborhood: The houses along Panorama Way and the Yavapai – Apache Neighborhood off Cement Plant Road are supplied by the existing Panorama Booster pump station. As mentioned previously, this booster pump station is being replaced and the hydropneumatics tank on Panorama Way will be removed. To provide fire flow to these areas this booster pump station should be sized with pumps in parallel to have fire flow capacity. Additionally, the existing water main from the booster pump station to Panorama Way is undersized for fire flow. More details on potential improvements are given in the CIP section.

Centerville and Mingus Shadows Neighborhoods: Most of this area has adequate pressure but fire flow is not available due to undersized water mains and a single feed into the neighborhood to the south near Lincoln Drive. The water main near Valley View Road. could feed this neighborhood but is currently closed in order to create a pressure boundary and protect this area from high pressures. Fire flow in these areas would require additional feeds and the upsizing of existing water mains. As

previously mentioned, these neighborhoods are vulnerable to breaks; the configuration of valves and services make maintenance and repairs difficult. Potential improvements to provide additional feeds into these neighborhoods could coincide with a larger water main replacement project.

Patio Park: This area is supplied by one water main from Vista Ln and 3rd North Street. This main is undersized to meet fire flow requirements. A potential improvement to provide fire flow could coincide with the replacement of additional existing water mains in this neighborhood.

Mescal Spur/Skyline Boulevard/Lisa Street Neighborhoods: These neighborhoods along 89A do not meet fire flow requirements due to being fed by a single flow and sections of existing undersized water mains. Fire flow could be achieved by an additional PRV connection to the neighborhoods which would provide a looped-feed, as well as the upsizing of several undersized water mains in this area.

Black Hills Neighborhood: Much of the Black Hills Neighborhood does not have available fire flow due to a single feed from the water main in West Black Hills Drive as well as undersized hydrants and water mains. The existing water main to the north in Old Jerome Highway is currently closed to provide a pressure boundary, but will be opened with the construction of the Mid-Zone PRV Project. Further improvements to this area could provide fire flow to the entire neighborhood. It is recommended that this improvement coincide with a larger waterline and fire hydrant replacement in Black Hills. The existing 2.5" hydrants on undersized water mains should be replaced.

South 9th Street: This run of water main would need to be at least 8" diameter to supply fire flow. It is believed that all or a portion of this run is an existing 6"; However, the extent of the undersized water main is uncertain. A potential project to upsize this water main is included in the CIP Section, however, should this project be chosen for implementation, further investigation should be done to scope out the extent of the undersized lines.

System Pressure

Static pressures during peak day demands are shown in Appendix A3. Several isolated areas around Clarkdale experience static pressures below 40 psi. These areas include nodes in the Centerville Neighborhood, a portion of the neighborhood off Skyline Boulevard, and Kerrie Lee Drive as shown in the WaterGems peak day static pressure map.

4. FUTURE SYSTEM DEFICIENCIES

While the items outlined in the previous section depict deficiencies within the existing system under current demand, anticipated future development and future full buildout will place additional demands on the system. Anticipated buildout demands were added to the model in Water Gems based on location and assumed water demand as outlined previously. Future full buildout conditions were not modeled in the existing distribution system because this growth cannot be accurately predicted due to the uncertainty of timing and demand associated with future development. It is recommended that the existing model be updated and used to analyze the effects of future development as they are proposed. Future system deficiencies with respect to anticipated buildout are as follows.

Supply

In its existing state, anticipated peak demand can be met by running the Mountain Gate Well and the Arsenic Treatment Plant, but cannot be met by the production of the Haskell Springs Well. (Refer to Table 33 – for the maximum daily production of the active wells.) Production from the two active wells would not meet peak demand in the full buildout scenario. (See Table 36 - Future Supply

Demands.) Improvements to the system are recommended in the in the next section and potential CIP are given in Section VII.

	Average Daily Usage (Total System)	Peak Month Average Daily Usage (Total System)
Existing Demand	481,320	654,960
Anticipated Demand	551,360	753,960
Full Buildout Demand	1,686,104	2,342,601

Table 36 - Future Supply Demands

Storage

Minimum recommended storage for the anticipated peak daily demand scenario exceeds the existing storage capacity, refer to Table 34 - Existing Storage. Therefore, it is recommended that upgrades to the storage capacity are made before adding any demands associated with future developments to the system. Table 37 below gives the minimum and recommended storage based on existing, anticipated and full buildout water usage, including a fire flow event. 89A tank replacement is currently under design and its effect on the system is evaluated in Section D, Future Water System Improvements.

	Minimum Storage (One Day) Peak Month Average Daily Usage	Minimum Storage (Three Days) Peak Month Average Daily Usage
Existing Demand +Fire Flow Event	834,960	2,144,880
Anticipated Demand +Fire Flow Event	933,960	2,441,880
Full Buildout +Fire Flow Event	2,522,601	7,207,804

Table 37 - Minimum Recommended Storage

Distribution

The areas that are deficient during existing demands will have marginally less fire flow and lower pressures with the addition of anticipated demand. However, no new deficiencies were identified with the anticipated development demands added to the distribution system. Future development proposals should be evaluated using the model on a case-by-case basis to determine the effect that the added demand will have on the distribution system.

D. FUTURE WATER SYSTEM IMPROVEMENTS

Improvements can be made to the areas of storage, supply and distribution with general recommendations to increase the system's capabilities described below. These recommendations address existing and future deficiencies associated with the potential projects, including cost estimates, are given in Section VII: Capital Improvement Projects.

1. STORAGE

It is recommended that additional storage be added to the system to accommodate increased demand associated with future developments around Clarkdale. Due to its condition, the Town is planning on replacing the 89A tank as a part of the proposed Clarkdale Water Campus Project. It is recommended that the tank be replaced with an increased capacity tank. The proposed 89A tank will be a 1-1.5 MG steel tank, see Table 38 - Proposed Storage Capacity.

	Proposed 1 MG Tank (gallons)	Proposed 1.5 MG Tank (gallons)
Proposed 89A Tank	1,000,000	1,500,000
Haskell Springs Tanks	1,275,793	1,275,793
Mountain Gate Tank	689,910	689,910
Total Proposed Storage Capacity	2,965,703	3,465,703

Table 38 - Proposed Storage Capacity

Due to the uncertainty of future developments, storage should be re-evaluated with the proposals of any large developments in Clarkdale. Further increases in storage may be required in the future depending on future growth and increases in demands.

2. SUPPLY

The Town is currently reliant on two sources of groundwater. It recommended that a new well be drilled to increase capacity and reliability to the water supply system. Alternatively, another potential improvement to the system is to increase production of the Mountain Gate well, based on previous studies indicating the well could be pumped at a higher rate.

Hydrogeological Evaluation and Well Siting Analysis Memorandum

A technical memo was prepared by Matrix New World Engineering in Sept 2024 as a part of this master plan. This memo analyzes potential locations for a new well in Clarkdale. This memo is included for reference in Appendix A9. Results of the memo found that the most favorable location for a new well is near the existing 89A well site. The well at this site previously produced water with a low arsenic content that did not require arsenic treatment. This new well is proposed near the existing site because of its proximity to the existing infrastructure as well as the proposed 89A replacement water tank. The desired pumping capacity of this new well is 300+ gpm. Arsenic treatment may be required depending on water quality. Final configuration will be based on yield and quality once testing data is completed for the new well. A cost estimate for the new well is included in Section VII: Capital Improvement Projects.

Proposed Redrilled Well at 89A Site: See Table 39 - Supply Capacity w/ Proposed 89A Well for supply capacity with the proposed 89A well at an assumed pumping rate of 300 gpm. This would allow for average and peak demand at current and anticipated demand be met by any two wells, during maintenance or repairs of any individual well.

Well	Max Pumping Capacity (gpm)	Max Pumping Capacity (gpd)
Mountain Gate Well	595	856,800
Haskell Springs Well	385	554,400
Proposed 89A Well	300	432,000
Total Supply Capacity	1260	1,814,400

Table 39 - Supply Capacity w/ Proposed 89A Well

Mountain Gate Well Upgrades: Previous studies indicated Mountain Gate would be capable of a higher pumping capacity but is currently limited by the ATP capacity. Potential improvements to the ATP are discussed later in this section. Replacing the column pipe and pump at the well would allow for increased production. This improvement would need to be completed after proposed expansions to the ATP. Table 40 – Supply Capacity w/ Proposed Mountain Gate Upgrades below shows the supply capacity with the Mountain Gate upgrades and the proposed 89A well. Peak demand would be met for the anticipated buildout, current and anticipated demand.

Well	Max Pumping Capacity (gpm)	Max Pumping Capacity (gpd)
Mountain Gate Well – Upgraded Pump	800	1,152,000
Haskell Springs Well	385	554,400
Proposed 89A Well	300	432,000
Total Supply Capacity	1465	2,109,600

Table 40 – Supply Capacity w/ Proposed Mountain Gate Upgrades

Mescal Improvements and Transmission Line: The Mescal well was considered less favorable in the Matrix New World report due to the water quality and lack of existing infrastructure. This would lead to higher costs associated with adding this well to the Town’s water supply. Use of this well could be re-evaluated in the future depending on the growth of Clarkdale and increased demand.

3. DISTRIBUTION – FIRE FLOW

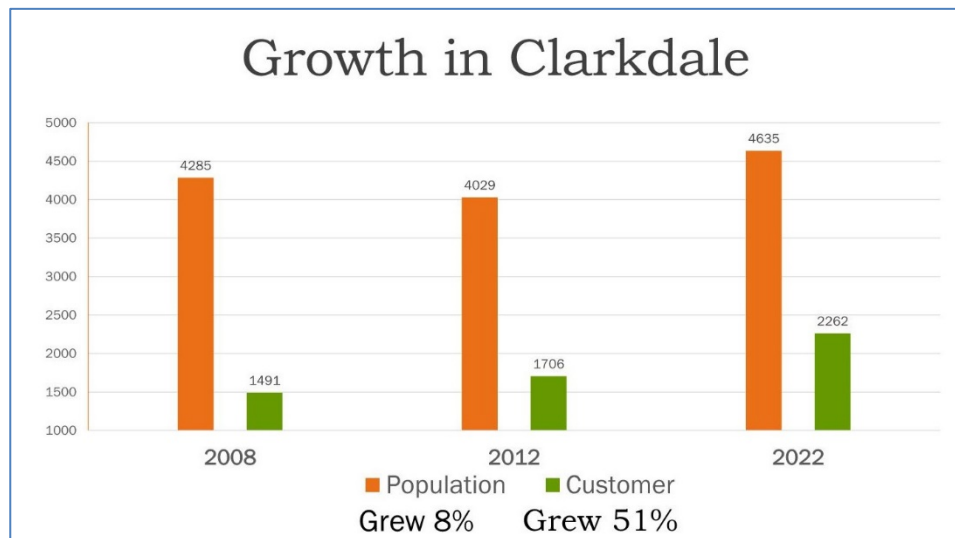
The existing distribution system does not meet fire flow requirements in roughly half of the system. It is recommended that as funding allows, improvements to the system can be made to provide fire protection in the areas identified by the model as fire flow deficient. Fire flow deficient areas and potential improvements are shown on the map in Appendix A5: Fire Flow Improvements, with an estimated cost given for each potential project in Section VII: Capital Improvement Projects.

II. ARSENIC TREATMENT PLANT

A. BACKGROUND

The initial developer installed the Mountain Gate Well and Arsenic Water Treatment Plant in 2007 to serve the Mountain Gate Subdivision and other parts of the Clarkdale service area. The Mountain Gate Well pump is currently rated for 595 gpm flow and is operated on a VFD to reduce flow, but the well is able to provide more than 800 gpm with a larger pump. The Water Treatment Plant removes arsenic from the well and is typically referred to as the Arsenic Treatment Plant (ATP). The Haskell Springs Well also supplies water to the Clarkdale service area and is currently rated for 385 gpm; because levels are so low, this water is not treated for arsenic.

Clarkdale is experiencing growth as shown in the table below and requires additional groundwater supply and additional arsenic treatment capacity. The existing ATP has significant problems with equipment and reliability/redundancy and needs improvements. The purpose of this section is to provide an evaluation of the ATP and develop recommendations for improvements and expansion.



B. EXISTING FACILITIES

The existing treatment facilities are located at 1725 AZ 89-A in Clarkdale near the intersection of Old Jerome Highway. The original Arsenic Treatment Plant (ATP) was installed in 2007 by Empire Development for the Mountain Gate Subdivision. Shepherd-Wesnitzer Inc. was the design engineer. The Design Memorandum for the original project is provided in Appendix B1 and the Construction As-built Plans for the original project is provided in Appendix B2.

The ATP was designed for the removal of arsenic using pH adjustment with carbon dioxide (carbonic acid formation), prechlorination, ferric chloride as a coagulant, and filtration using ceramic media; it currently uses Ceraflow 50 (originally was Macrolite FM 360). The ATP receives water from the Mountain Gate Well, treats the water, and stores finished water in the Mountain Gate Tank at more than 600,000 gallons. The design value for raw water arsenic is not more than 60 ppb and the effluent is designed to be less than 10 ppb. The original 89A Tank onsite has a capacity of just over 400,000 gallons but has a wooden roof and other structural concerns. The ATP currently uses three (3) filtration vessels each rated for 200 gpm, for a total capacity of 600 gpm with all skids in service.

The ATP filter media has been replaced and currently uses Ceraflow for arsenic removal. The filter media layering includes the following, in reverse order from bottom to top:

4" of 1/8 -inch to 1/16-inch gravel

3.5" of #16 garnet

3.5" of #36 garnet

24" of Ceraflow 50

The ATP filter backwash water drains to an onsite pump station that pumps the backwash to the sewer system and wastewater treatment plant. The ATP finished water typically has a chlorine residual of 1-1.5 mg/L and pH of 7.4-7.8. A polyphosphate (Carus 8500) is also added for corrosion control.

The original Operating & Maintenance Manual provided by Kinetico is included in Appendix B3. Some operating processes and procedures have changed since the original installation and operators monitor and adjust chemicals as needed daily.



Arsenic Treatment Building



Filter Vessels

C. EVALUATION AND CAPACITY ASSESSMENT

The following criteria are needed for the ATP for current and future conditions:

- Design capacity = 1,200 gpm with one filter vessel out of service
- Raw water arsenic = 60 ppb (max); effluent arsenic = less than 10 ppb
- Filter backwash flow = 200 gpm; two backwashes per day at 2,000 gals per backwash

Ardurra completed a site visit and evaluation of the ATP facilities. Site pictures are included in Appendix B4. Although the ATP performance is currently acceptable, the plant has experienced significant equipment failures and lacks filtration redundancy. The current arrangement of three filter vessels each at 200 gpm only provides a total capacity of 600 gpm with all filters in operation; however, with a single filter out of service (say for backwash or maintenance) the capacity is only 400 gpm. For a firm capacity of 1,200 gpm, seven total filter vessels are needed at 200 gpm each so that total capacity is 1,400 gpm and with one unit out of service the firm capacity is 1,200 gpm. The media in the existing filter vessels was recently replaced with new media. In addition, the piping valves and actuators, air release valves, and pressure relief valves have been replaced.

The current backwash water piping that drains to the onsite pump station is 4" PVC and causes a restriction on flow that often results in backup or overflow during backwash. The onsite drain piping should be upsized to accommodate the backwash flow. The existing backwash pump station that pumps flow to the sewer system appears to have satisfactory wet well volume and pump sizing. This item will be evaluated as part of the ATP Expansion CIP project

Clarkdale uses Mission Communications for SCADA telemetry, which appears to be satisfactory. However, much of the instrumentation and controls at the ATP is faulty or unreliable and should be upgraded to provide operators real-time data. The chemical feed systems are performing but should be improved for reliability and dosage accuracy. This item will be evaluated as part of the ATP Expansion CIP project

D. FUTURE ARSENIC TREATMENT IMPROVEMENTS

The existing arsenic treatment is not deficient in its current operation, but its treatment capacity limits the amount of water that the Mountain Gate Well can produce. Expansion of the Arsenic Treatment Plant would allow for increased production from the Mountain Gate Well and the additional flows from the proposed 89A Well, contingent upon arsenic levels in water produced by the 89A Well.

Arsenic Treatment Plant Expansion

Improvements to the Arsenic Treatment plant are recommended to coincide with the proposed new well and Mountain Gate Well improvements. Improvements include a new building near the existing ATP to house four additional filter vessels that would mirror the three existing vessels. The treatment capacity of each vessel is assumed 200 gpm for a maximum of 1400 gpm and a firm capacity of 1200 gpm with any one vessel offline for maintenance or repair. Final configuration will be based on yield and water quality testing results of the new 89A Well, and the Mountain Gate Well upgrades. This project is currently planned to be a part of the Clarkdale Water Campus Project.

III. RECLAIMED WATER SYSTEM

A. INTRODUCTION

The Town of Clarkdale's Broadway Water Reclamation Facility (BWRF), located on Town-owned land and adjacent to the Verde River, is permitted through the Arizona Department of Environmental Quality (ADEQ) to treat and distribute up to 0.35 million gallons per day (MGD) or 400 AF / yr of Class A+ reclaimed water when operating at full capacity.

The Town is working to identify and assess opportunities to maximize the benefits of its reclaimed water supply and support the community. Evaluation of supplies and alternative uses of reclaimed water and identified options for reuse are described in this Chapter.

B. BACKGROUND

The Town's water supplies include groundwater, wastewater effluent and stormwater runoff. Currently, the Town sells a small amount of reclaimed water to contractors for dust control, while the remaining effluent is pumped and discharged to the 53.9-acre Verde River Iron Company (VRIC) Irrigation Site, located approximately 1.5 miles northwest of the BWRF and that is historically known as the Verde River Iron Company (VRIC) irrigation site. As there is limited capacity for reuse, the Town is interested in evaluating other options for use of its effluent.

The Town of Clarkdale General Plan 2021 (General Plan) includes the Town's goals, objectives and policies that are intended to provide direction and guidance to address concerns regarding existing and future water resources. The General Plan includes recommendations for developing a Water Resource Plan and updating its Wastewater Master Plan. Also included are recommendations to develop a new water resource, including potable reuse and effluent recharge programs.

1. ADEQ PERMITS FOR CLARKDALE

The Arizona Department of Environmental Quality (ADEQ) issued the Town two (2) permits to operate the BWRF. The permits include the following:

Type III Recycled General Permit for a Reclaimed Water Agent LTF ID #94873 - This ADEQ issued permit allows for the Town to act as the agent for the reuse of reclaimed / recycled water per AAC R18 – 9 -7. This allows the Town to determine who can reuse reclaimed water. It is the responsibility of the Town to maintain contracts with the designated end users to guarantee the reclaimed water is being used appropriately and that the end users are in compliance with the requirements and regulations of AAC R18-9-708. The permit is valid for five years per AAC R18 -9-709. The current expiration is set for 8/26/2027.

Aquifer Protection Permit (APP) No. 105414, LTF No. 55479 – This ADEQ permit authorizes the Town to operate the BWRF. This permit became effective Nov 4, 2013, and is valid for the life of the treatment facility. Tertiary treatment of effluent is obtained through use of tertiary filters and chlorine disinfection. This permit also authorizes the Town to produce a maximum average monthly flow of 0.35 MGD of Class A+ effluent which may be reused for many different applications as outlined by ADEQ.

2. WATER RESOURCES

The primary source of water is groundwater that is obtained from two (2) active wells including Mountain Gate and Haskell Springs, which provide the main source of the Town's water. Currently, there are three (3) inactive wells including 89A, Mescal Well, and the River Well. There is also an irrigation well at the cemetery. Additionally, there are private wells throughout the Town that serve residential, commercial and other water uses. Reported to the Arizona Department of Water Resources (ADWR) and documented in the report prepared by Montgomery & Associates (M&A), the potable water wells delivered 545 acre-feet / year in 2022 and are projected to deliver over 700 AF / yr in 2032.

Another resource available to the Town is approximately 0.13 million gallons per day (mgd) of Class A+ effluent supply produced at the BWRP. This high-quality effluent is safe for human contact, permitted to be used for direct reuse for irrigation and industrial uses, readily available to support the Town's objectives for developing and implementing a sustainable water resource program for its projected growth and to safeguard existing potable water resources.

3. PREVIOUS STUDIES

Multiple studies have been prepared to assess alternatives for effluent use, including a technical memorandum (TM), titled "Evaluation of Effluent, Stormwater, and Recharge Opportunities," prepared by Montgomery & Associates (M&A) dated June 6, 2024. The Town and The Nature Conservancy (TNC) recently began collaborating to implement water management projects that support the community and the Verde River. M&A was retained by TNC to assess opportunities for reclaimed water.

A study prepared in December 2015 by Lacher Hydrological Consulting titled "*Groundwater Modeling to assess Water Resources Management Alternatives for the Town of Clarkdale, Arizona*," documents the evaluation of the Town's hydrology and municipal water resources, the projected future demands and effluent production, and the viability and effectiveness of various water management strategies through groundwater modeling. The groundwater modeling serves to evaluate various pumping and effluent recharge scenarios and the potential impact to groundwater levels and flows in the Verde River. Recommendations included that in the near term, the irrigation of the Bitter Creek site be managed to accomplish more recharge and reduce the loss to evapotranspiration. Additionally, should the Town identify sites feasible for recharge and perform investigations to evaluate the potential for one or more rapid infiltration basins.

The Town retained the services of Mr. Fred E. Goldman, PhD, PE, a consulting hydrologist, to prepare a water budget for maximizing effluent reuse on Town owned land that may be available for effluent management. The study, currently titled "*Clarkdale Effluent Management Plan Reuse Site Survey and Land Ownership Information and Request for Information for the Water Balance Analysis*" is still in progress, and therefore findings of the study were not available at the time this report was prepared.

Other studies include the "Reclaimed Water Feasibility Study for the Town of Clarkdale," prepared by Sunrise Engineering, dated September 2023. The purpose of the study was to identify the most beneficial and effective utilization of the Class A+ reclaimed water for Direct Reuse for Industrial / Manufacturing-Type Application and Direct Reuse for Irrigation. A 2014 study prepared by the University of Arizona Water Resources Research Center (WRRC) included a recommendation for development of more sustainable water management strategies.

The M&A study noted above also notes that a "Water Primer" summarized the Town's water management strategies including the hydrology and water resources. Also noted is that the Water Resources Management Program report included a recommendation of a holistic approach to the Town's water

management to include community engagement, efficient use of existing resources and developing a strategic plan for the reuse of effluent and reclaimed water recharge.

4. RECYCLED WATER REUSE

Arizona's Administrative Code Section R18-11-303, includes the definition of Class A+ reclaimed water as wastewater that has been treated to a high standard of cleanliness through secondary treatment processes, filtration, nitrogen removal treatment and disinfection and as a result is safe / clean for human contact and allowed for direct reuse including the following:

- Gardens
- Toilet and urinal flushing
- Outdoor hosing and washdown
- School ground landscape irrigation
- Landscape / open space irrigation
- Spray irrigation of an orchard or vineyard
- Commercial closed loop air conditioning systems
- Vehicle and equipment washing
- Recreational use areas
- Fire protection systems
- Irrigation of human food crops
- Washing animals (except pigs)
- Stock watering
- Industrial purposes
- Water features and fountains

C. EXISTING INFRASTRUCTURE

Existing infrastructure used to convey recycled water consists of an 8-inch reclaimed pipeline, two effluent storage ponds, a storage tank, an effluent booster pump station and an irrigation booster pump station. Water is pumped from the BWRP by an effluent pump station through the reclaimed water main to the VRIC Irrigation site where it is primarily sprayed throughout the irrigation site. The following is a summary of the Town's existing infrastructure components:

1. RECLAIMED WATER MAIN

The 8-inch reclaimed water pipeline originates at the BWRP and extends in a north westerly direction. The pipeline is located in an easement that parallels Verde Place and Main Street to 3rd North Street. The pipeline continues and crosses Bitter Creek as it parallels the train tracks to North Broadway. At North Broadway the pipeline crosses the railroad tracks and continues to parallel the tracks along the north side to approximately Miller Road and then veers towards the VRIC Irrigation Tank and booster pump station. The recycled water pipeline is approximately 9,200 linear feet in length.

2. VRIC IRRIGATION SITE TANK

Effluent from the BWRP is pumped to the VRIC Irrigation Site Tank from the BWRP effluent pump station. The BWRP effluent lift station is operated by floats in the tank.

VRIC Irrigation Site Tank	
Height	16'
Diameter	34'
Capacity	88,000 gallons
Material	Steel
Ground Elevation	3519.75'
Inlet Pipe Diameter	8"
Outlet Pipe Diameter	6"
Outside Coating Condition	Good
Inside Coating Condition	Fair/Good
Year Constructed	2006
Last Date of Maintenance	Inspected December 2023
Recommended Maintenance	Drain, Clean, Repair Interior Coating Replace or Rebuild Altitude Valve

Table 41 – VRIC Irrigation Site Tank



VRIC Irrigation Site Tank

3. VRIC IRRIGATION BOOSTER PUMP STATION

The VRIC irrigation booster pump station delivers water to the irrigation system near the booster pump station and tank. The pumps are controlled by a timer that sprays different areas of the irrigation site on a schedule. The irrigation booster pump station includes a 1,000-gallon hydropneumatic surge tank.

VRIC Irrigation Booster Pump Station			
Pump Station Elevation	3519.75	Pump Make	Grundfos
Pumping Rate	500 gpm	Pump Type	CRE 95-2-2 A-G-A-E-KQQE
Pumping Pressure	153.2' head	Pump Motor Make	Grundfos
Inlet Diameter	4"	Pump Motor Model	MLE160AC
Outlet Diameter	4"	Pump Motor Year	2024
Number of Pumps	2	Pump Motor HP/Power	25 HP, 3530 rpm
Pump Year Installed	2024	Pump Discharge Size	6"
Pump Type	Centrifugal	Recommended Maintenance	Replace pumps

Table 42 – VRIC Irrigation Booster Pump Station



Booster Pump Station Elevated View



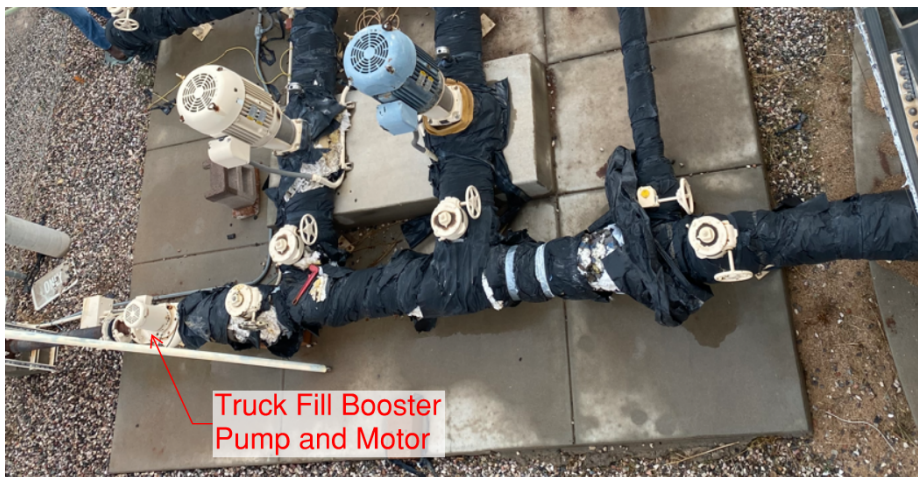
Booster Pump Station Looking East

4. VRIC TRUCK FILL BOOSTER PUMP

A small amount of reclaim water at the VRIC Irrigation Site is sold to contractors, primarily for dust control. The reclaimed water truck fill is located at the site of the VRIC Irrigation Tank. Water is pumped through a 3" steel pipe approximately 16 feet high and discharges outside of the chain link fence through a 3" rubber hose. The truck fill pump is operated manually.

VRIC Truck Fill Booster Pump			
Pump Station Elevation	3519.75	Pump Make	PACO
Pumping Rate	250 gpm	Pump Type	16-40707-130101-2562
Pumping Pressure	16' head	Pump Motor Make	Baldor Reliance
Inlet Diameter	4"	Pump Motor Model	VJMM3558T
Outlet Diameter	4"	Pump Motor Year	Unknown
Number of Pumps	1	Pump Motor HP/Power	2 HP, 1725 rpm
Pump Year Installed	Unknown	Discharge Size	3"
Pump Type	Centrifugal	Recommended Maintenance	Needs to be Rebuilt, Pump needs replacement, Add Check Valve

Table 43 - VRIC Truck Fill Booster Pump



Truck Fill Booster Elevated View



Discharge Piping and Hose

D. EXISTING EFFLUENT USE

As previously noted, the Town currently sells a small amount of reclaimed water to contractors for dust control and the remaining effluent produced at the BWRf is discharged to the 53.9-acre VRIC Irrigation Site, located 1.5 miles northwest of the BWRf in an upland area.

The Town has limited opportunities to reuse effluent for irrigation and is currently working with TNC and a consulting hydrologist to explore alternatives for expanding the use of the BWRf effluent. Similar to the findings of other studies, the consulting hydrologist noted that there is need to plan for future growth of the Town and exploring recharge may offer the community multiple long-term benefits.

E. EFFLUENT USE ALTERNATIVES

The reuse of non-potable water lessens the demand on sources of potable water and can be used for multiple purposes and for replenishing local groundwater resources. Included in the studies previously completed were the findings of evaluations of several options to optimize the beneficial reuse of the effluent supply and recommendations for alternative uses. The following includes a summary of the findings included in these studies.

The 2023 Sunrise Study includes a summary of the findings associated with two options including what is referred to as Option 1, which included the Direct Reuse for Industrial Purposes, and Option 2, which included Direct Reuse for Agricultural Purposes. The following is a summary of the two (2) options evaluated and the infrastructure identified as required.

Option 1: Included assessing the viability of establishing the infrastructure required to supply reclaimed water to high water users. These users included Clarkdale Metals, Bent River Machine, Verde Valley Railroad, and Salt River Material Group (SRMG). Only Clarkdale Metals and SRMG showed potential interest and ultimately SRMG was not pursued further. Thus, the infrastructure to serve Clark Metals was identified to require a booster station and a hydropneumatics tank to pump reclaimed water from the existing main. Additionally, a 1-inch service line extending from the existing main would be needed.

Option 2: Included the evaluation of potential reuse of reclaimed water for irrigation purposes. Two (2) potential locations identified included Selna-Mongini Park while continuing to irrigate the existing 53.9-acre site should it be developed for vineyards or other agricultural purposes.

Selna-Mongini Park: While use of recycled water at the Selna-Mongini Park will reduce the potential increase in potable water demand, to irrigate the Town owned park, the infrastructure identified included a booster pump station, a 500- gallon hydropneumatics tank with associated appurtenances, and a 6-inch pipeline connecting to the existing 8-inch main to extend along Main Street. The reclaimed water usage was estimated to be 3 AF / year or 2% of the existing annual effluent. Thus, there would be a significant volume of effluent available for other customers and / or uses.

Vineyard or Agricultural: For irrigation of a vineyard or other agriculture, it was assumed the existing infrastructure would be sufficient as the existing 53.9-acre site would be the location used for either of these purposes. Though there is an established irrigation system, further water quality analysis would be required to evaluate and ensure the appropriate levels of constituents (e.g. phosphorus and nitrogen) and /or determine if pretreatment strategies are required. This option was the favorable option due to lower infrastructure and operation and maintenance costs and it would replace use of potable water for irrigation.

The study prepared by M&A also includes a summary of findings associated with the evaluation of alternative uses of the effluent. For purposes of that study, the Town and TNC participated in identifying

effluent alternatives that are summarized in Table 39 - Effluent Utilization Alternatives, included in the technical memo. Presented below is Table 1 from the M&A technical memo.

Status Quo. Spray Irrigation at VRIC Irrigation Site	
1. Direct Discharge	
A.	Verde River
B.	VRIC Irrigation Site
2. Advanced Water Purification (Direct Potable Reuse)	
3. Reclaimed Water, Non-potable Reuse	
A.	Irrigation (new sites)
B.	Other Direct Use (Industrial, Ag, Tourism)
4. Recharge	
A.	Near-Stream Recharge near BWRP
B.	Deep Injection in Unused Production Well 89A
C.	Upland Basins at VRIC Irrigation Site

Table 44 - Effluent Utilization Alternatives

*Table 1, Evaluation of Effluent, Stormwater, and Recharge Opportunities, June 6, 2024
by Montgomery & Associates, Water Resources Consultants*

The Town and TNC also participated in developing the criteria for evaluating the alternatives. Generally, the criteria included:

- Environmental Benefit (streamflow, riparian habitat)
- Minimize Evaporative Losses
- Water Supply Resiliency
- Technical Feasibility
- Cost Favorability
- Water Quality Permitting

The scoring ranged from 1 to 3 with the environmental benefit and water quality permitting weighted higher than the other factors. A breakdown of the scoring for each criterion is provided in the M&A technical memo. The following is a summary of the findings, that generally revealed that irrigation to replace potable water use and direct discharge into Bitter Creek were preferred:

1. DIRECT DISCHARGE

Verde River: Not considered a viable option as the Town would require an AZPDES permit that would allow direct discharge into the Verde River. However, the nutrient criteria is not achievable by the existing wastewater treatment technology and requires improvements to the treatment plant for advanced treatment such as reverse osmosis.

VRIC Irrigation Site: Continuing to spray effluent to irrigate the Bitter Creek area was not ranked highly in categories of resiliency, evaporative losses and environmental benefits.

Bitter Creek: This would require an AZPDES permit and was identified as benefitting riparian habitat, stream flow, and potentially providing a recreational amenity. The Town is currently exploring the requirements and feasibility of direct discharge to Bitter Creek.

2. ADVANCED WATER PURIFICATION (DIRECT POTABLE REUSE)

Direct Potable Reuse (DPR) includes recycled water that is treated and distributed as a drinking water supply without an environmental buffer. That is, purified water may be introduced directly into an existing drinking water treatment plant or distribution system. This alternative is not currently considered a viable option as regulations were not finalized at the time this document was prepared. Additionally, this option would require expansion of the treatment plant to accommodate the additional treatment of the effluent.

3. RECLAIMED WATER, NON-POTABLE REUSE

Generally, this option was favorable, and the Town intends to implement opportunities as options are identified and funding becomes available. Opportunities are discussed further in Section G below.

4. RECHARGE

The three (3) options identified as viable for recharge included direct discharge into Bitter Creek, near-stream recharge near BWRF / Fisher house parcel and the recharge in the upland basins at VRIC Irrigation Site. The following three (3) areas were identified as potential effluent recharge locations. All locations are within the Town's jurisdiction.

- VRIC Irrigation Site Upland – infiltration basins at or near current spray irrigation site
- Bitter Creek Channel – in-channel infiltration near the spray irrigation site
- BWRF – infiltration basins on adjacent Fisher House parcel

The findings for each alternative were summarized in tabular format. Also summarized were the potential subsequent actions for each alternative including whether the alternative was considered a viable option or whether further investigations are needed. Table 45 - Summary of Key Considerations and Potential Actions for Pursuing Effluent Alternatives, included in the M&A study is presented below.

Based on recent research completed to support the recent studies completed, Alternatives 1A, 2, and 4A were assessed and deemed not viable options for the Town to pursue. Presented below is information pertaining to the more favorable alternatives including Reclaimed Water, Non-potable Reuse for Irrigation Purposes, and Recharge.

Alternative	Location or End Use	Key Considerations	Potential Actions
1. Direct Discharge	A. Verde River	- Technically feasible - Currently no clear permitting pathway for direct discharge to Verde River because nutrient standards are not achievable by the BWRf's existing water treatment technology; a variance from ADEQ could be considered	None; not considered viable at this time
	B. Bitter Creek	- Technically feasible at several locations in Bitter Creek - Surface water quality standards for effluent-dependent waters (EDWs) must be met - Permits required from ADEQ: new AZPDES and APP amendment; ADWR: possibly USF and WSP for recharge projects - Bitter Creek must not be deemed perennial, and discharge must not conflow with the Verde River (i.e., it must infiltrate) due to numeric nutrient criteria; possibly "404" permit	- Conduct hydrologic investigations in stream channel and estimate infiltration rates and length of surface flow; demonstrate water infiltrates before confluence with Verde River - Collect monitoring data and petition ADEQ to redesignate lower Bitter Creek as not perennial
2. Advanced Water Purification (Direct Potable Reuse)		- Extremely expensive to construct and operate - ADEQ rulemaking in progress; expected by end of 2024	None; not considered viable at this time
3. Reclaimed Water, Non-potable Reuse	A. Irrigation (new sites)	Relatively low cost; 1:1 replacement of potable water use; small demand will not use all effluent; seasonal demands and water quality considerations such as chlorine, pH, and salinity for specific crops	Town is pursuing funding for Selma Mogini Park irrigation and interested in additional customers
	B. Other Direct Use (Industrial, Ag, Tourism)	Currently no other users identified	None; consider extending to new users in the future if there is interest and financially feasible
4. Recharge	A. Near-Stream Recharge at BWRf	- Technically feasible; benefits to alluvial aquifer and Verde River for near-stream recharge; infrastructure in place - Permits required: ADWR USF permit required for recharge; ADEQ AZPDES has <i>County of Maui</i> case permitting uncertainties	- Investigation of unsaturated stream alluvium and impeding clay unit - Develop strategy for data collection and outreach to ADEQ
	B. Deep Injection in Unused Production Well	- Constructing reclaimed line from WRF to well is not economically feasible; technical and permitting uncertainties - Town may rehabilitate and restore production at well	None; not considered viable at this time
	C. Upland Basins at VRIC Irrigation Site	- High cost for excavation; low infiltration rate; recharge area lacks direct benefit to production wells - Permits: ADWR USF; likely no AZPDES issues	Investigation of upland sediment for infiltration capacity; Underground Storage Facility (USF) permitting considerations

Table 45 - Summary of Key Considerations and Potential Actions for Pursuing Effluent Alternatives

Table 3, Evaluation of Effluent, Stormwater, and Recharge Opportunities, June 6, 2024 by Montgomery & Associates, Water Resources Consultants

The more favorable recommendations have included recharge, reclaimed water and non-potable reuse. The following sections include a summary of the findings for these alternatives.

F. RECHARGE ALTERNATIVES

The M&A study identified three (3) viable locations for effluent infiltration for subsurface recharge. These locations include VRIC Irrigation Site Upland, the Bitter Creek Channel, and the BWRP-Fisher House Parcel. These locations were identified due to their proximity to existing infrastructure and the hydrogeologic characteristics of the subsurface. Table 4 included in the M&A study, and presented below as Table 46 - Estimates of Area Required for Infiltration, includes a summary of the three (3) sites and the specific estimates of the area required for infiltration. A delivery rate of 400 AF/yr with an assumed peaking factor of 2.0 was used to calculate infiltration / delivery rates of 800 AF/yr or 2.2 AF/day.

	Recharge Method	Estimated Infiltration Rate (ft/day)	Estimated Infiltration Area
1. VRIC Irrigation Site Upland	Infiltration Basins	1.0	5.5 acres of basins
2. Bitter Creek Channel	In-Channel Discharge	4.0	2,000 ft x 12 ft
3. BWRP – Fisher House	Infiltration Basins	2.5	2.2 acres of basins

Table 46 - Estimates of Area Required for Infiltration

Table 4, Evaluation of Effluent, Stormwater, and Recharge Opportunities, June 6, 2024 by Montgomery & Associates, Water Resources Consultants

Findings of the analysis included the following:

VRIC Irrigation Site Upland – This area is located at or near the current spray irrigation site and was determined to have a moderate infiltration capacity. No other recommendations were provided.

Bitter Creek Channel – Direct discharge to the Bitter Creek Channel requires a discharge permit from ADEQ under the Arizona Pollutant Discharge Elimination System (AZPDES), an amendment to the Town's Aquifer Protection Permit (APP) and further consultation with ADWR regarding an Underground Storage Facility (USF) and Water Storage (WS) permit. While the USF permit would allow the Town to use an aquifer for storage using some type of constructed device, the WSP would enable the Town to accrue long-term storage credits. These credits could be accrued and used should the Town become part of an Active Management Area (AMA) and comply with the associated rules. The Town is not currently associated with an AMA to benefit from this program.

Recommendations for potentially discharging into Bitter Creek included:

- Monitor and record flow in Bitter Creek and conduct inspections for approximately one (1) year. The data collected would serve to support the Town's request to ADEQ to reclassify the affected segment of Bitter Creek to non-perennial.
- Conduct subsurface investigations of soil properties and infiltration testing of the hydrogeological conditions to determine the length of stream required to allow infiltration of effluent within the channel and avoid surface flow from reaching the Verde River.
- Document the characteristics of the effluent produced at BWRP prior to meeting with ADEQ as the information will be required for determining any water quality limitations for an AZPDES permit. The characteristics of the effluent will also be used for other determinations in the permitting process.

- Perform an engineering evaluation of the stream channel and flow characteristics to assess the potential for channel erosion. The outfall of the channel should be designed to maximize the lateral spreading of the flow originating at the source and throughout the channel.

While direct discharge into tributary streams is common in the region, when permitting for such purposes, ADEQ requires site specific information when determining the viability of this option for reclaimed water reuse.

Infiltration Basins at BWRP-Fisher House – This location was identified as having the highest infiltration capacity based on the soils data reviewed. However, it was also noted that the projected infiltration rates may not be sustainable on a long-term basis due to the high groundwater level and the depth of clayey, poorly permeable sediments. Additionally, the M&A study cited the opinions of the court in the *County of Maui* case that would make the BWRP parcel not a viable option due to its proximity to the Verde River and the uncertainty of the permitting that may be required. Therefore, this site was not determined to be a viable option.

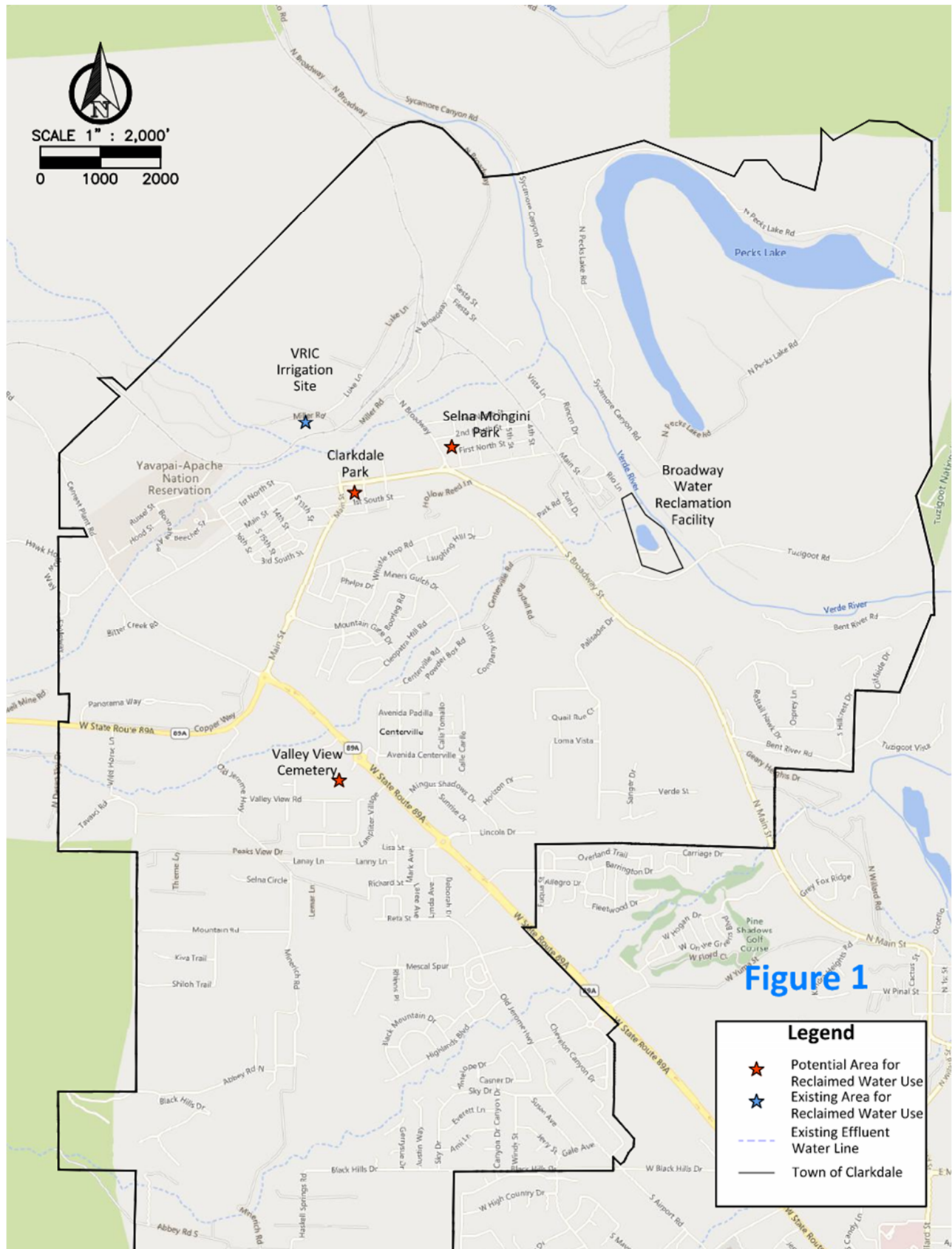
While treated Class A+ effluent has the greatest variety of reuse applications and there are other neighboring agencies utilizing this method for the reuse of reclaimed water, additional site-specific research needs to be completed to validate the use of Class A+ treated effluent for groundwater recharge.

G. RECLAIMED WATER, NON- POTABLE REUSE ALTERNATIVES

The other preferred method for managing and maximizing the use of recycled water supply is for irrigation at locations where potable water can be replaced with Class A+ effluent. In addition to the existing VRIC area, locations identified in previous studies, other locations were identified as possible options. Table 47 - Non-Potable Reuse Areas includes a summary of the three (3) locations identified and the estimated acreage available for irrigation and the map on the following page illustrates these potential locations of effluent reuse including the VRIC location which is currently irrigated with the effluent.

Location / Feature	Area (Ac)
VRIC	53.9
Selna-Mongini Park	4.5
Clarkdale Park	3.8
Valley View Cemetery	29.0
Total	94.2

Table 47 - Non-Potable Reuse Areas



It was noted in the Sunrise study that the allocation of BWRf effluent to the Selna Mongini Park may be up to approximately 2,930 gpd, which equates to approximately 650 gpd/acre assuming the park is approximately 4.5 acres. Based on this information, a delivery rate of 650 gpd / acre was applied to each location to calculate the estimated amount of effluent to potentially be used. Table 48 includes a summary of the estimated amount of effluent that may be used for each site.

Location / Feature	Area (Ac)	Estimated Use (GPD)	Estimated Use (MGD)
Selna-Mongini Park	4.5	2,930	.00245
Clarkdale Park	3.8	2,451	.00898
Valley View Cemetery	29.0	18,850	.02600
Total	40.3	26,181	.056

Table 48 - Estimated Effluent Usage

Based on the total estimated demand, the three (3) locations could be irrigated with approximately 0.026 mgd which is approximately 20% of the 0.13 mgd of effluent currently produced at the BWRf can be reused during late spring, summer, and early fall months.

Two potential reclaimed water alignments are discussed in the CIP section of this report. These potential projects include pipe alignments and associated infrastructure required to use non-potable water at the locations identified. Cost estimates associated with each project are included in the CIP section.

H. UNDERGROUND STORAGE FACILITIES

The use of underground storage facilities such as infiltration basins and wells to store effluent in an aquifer requires various permits including but not limited to an Underground Storage Facility (USF) Permit and Water Storage Permit (WSP) from ADWR. A brief description of the types of storage facilities and the required permits is summarized below. Criteria for such facilities is available in A.R.S. § 45-8811-.01.

Injection Wells: - Injection wells are structures used to recharge groundwater by injecting treated wastewater into underground aquifers. Treated wastewater is pumped into wells drilled in permeable rock or soil layers. This method can replenish groundwater supplies and benefit aquifer levels.

Structured Wetlands: - Structured wetlands are engineered systems that mimic natural wetlands to treat and recharge groundwater. These systems consist of shallow basins with aquatic plants that filter pollutants as treated wastewater flows through. Treated water percolates through the soil of the structured wetlands, recharging the underlying aquifers. In addition to ground water recharge structured wetlands provide some water quality benefit.

Percolation Ponds - Percolation ponds are specifically designed shallow ponds to store treated wastewater and, allow it to infiltrate into the soil and replenish aquifers. To function, percolation ponds must be constructed in areas with underlying permeable soils to allow the treated wastewater to seep through the soil before reaching the groundwater to maintain groundwater levels.

Below is a summary of the permits and permitting process that may be required for construction and operation of a recharge facility that can receive class A+ effluent from the BWRf. The information presented is based on research conducted and discussions with staff at various agencies potentially having jurisdiction, should structural recharge facilities be introduced to the Town's system. Included are the requirements for each permit including fees, application process, and general timelines.

The permits apply to ground water recharge locations and pertain equally to any permanent structural recharge devices including injection wells, structured wetlands, and percolation ponds. The following permits may be required.

1. Arizona Pollution Discharge Elimination System (AZPDES)
Permitting Agency: ADEQ
2. Pilot-Scale Underground Storage Facility (USF) Application
Permitting Agency: Arizona Department of Water Resources (ADWR)
3. Under Ground Storage Facility (USF) Permit
Permitting Agency: ADWR
4. Water Storage (WS) Permit
Permitting Agency: ADWR
5. Recovery Well (RW) Permit
Permitting Agency: ADWR
6. Long-term Storage Account
Permitting Agency: ADWR

Arizona Pollution Discharge Elimination System (AZPDES) Permit

Based on discussions with ADEQ staff, it was determined that such a project that may potentially impact the Verde River and will likely require an AZPDES permit as per the *County of Maui* case, the discharge of pollutants to navigable waters through groundwater becomes the “functional equivalent” of a point source discharge. If there is no physical barrier between the groundwater recharge stations and the Verde River an AZPDES permit will be required. Per the discussion with AZPDES staff, it was determined that with a complete application, an AZPDES permit may be approved for the project.

AZPDES permits typically have a duration of five (5) years and may be extended beyond five (5) years if a renewal application is received 180 days prior to the permit expiring. Completion of ADEQ Form 2A/2S is required in addition to a hydrogeologic study, geologic study, project site map, supplemental data, and other relevant information required to complete an AZPDES permit application.

Since less than 99,999 gallons per day will be discharged to the facility, the project may be classified as a minor facility. The typical permit review timeline for a minor facility is approximately six months and a public notice of the project is required as part of the review cycle. However, if a timely public objection is filed, the review process may be extended. Fees of up to \$22,000 may be expected for a minor facility project.

Pilot-Scale Underground Storage Facility (USF) Application

A Pilot-Scale USF is an optional permit and intended to allow applicants to test potential project sites and gather data that would be required to complete the application process for typical for underground storage facilities (USFs). While a Pilot-Scale is not required to obtain an USF permit, it may help to expedite the USF permit process. A Pilot-Scale application is required to be submitted to ADWR and to include: a narrative, a map showing facility components, a monitoring plan, a summary of localized geology and groundwater systems, a sworn financial feasibility statement, list of staff involved in the construction and

operation of the facility, affirmation that a floodplain permit, if necessary has been obtained for the area of construction, and evidence of legal access to the proposed site.

The typical permit review period is approximately 45 days, with permit approval typically expected at 75 days. The permit fees are like the USF permit described below.

Underground Storage Facility (USF) Permit

An USF permit is required to construct a recharge facility. The USF permit application process includes a preapplication meeting with ADWR staff to present and discuss the project. An executive summary, site and facility characteristics, geology and hydrogeology studies, unreasonable harm and hydrologic feasibility analysis, proof of technical and financial capability, and legal access to the project site will be required for the application.

A typical USF permit processing timeline may be expected to extend up to 295 days. This includes a 100-day administrative review period and a 195-day substantive review period. If a pre-determination hearing is required, processing may be extended an additional 120 days. Should additional information be required, processing could be extended another 74 days. In the final 15 days of review ADWR will issue a public notice of the project. If a member of the public submits a timely objection the permit approval process may be further extended.

After a USF permit is approved, construction of the project may begin. Once construction is completed a pre-recharge inspection will be conducted to ensure the recharge facility aligns with the approved USF permit. If no deficiencies are found, a notice to operate the facilities may be granted. However, should deficiencies be identified, the applicant may be required to modify the USF permit and possibly restart the USF permitting process. Fees of up to \$25,000 should be expected.

Water Storage (WS) Permit

A WS Permit is required to store water at a USF and requires the applicant verify their legal right to the source of water being stored. A preapplication meeting is recommended to address any questions or concerns prior to commencement of the WS permit application process. An initial \$350 in fees is required and additional fees may occur based on any costs associated with public notice of the project.

The permit process includes a 100-day administrative review of completeness followed by a 195-day review of substantive completeness. The review process may be extended should it be determined the application is incomplete or a pre-determination hearing is required. An incomplete application can result in a 75-day delay and if a pre-determination hearing is required, this may add 120 days to the application process.

Recovery Well (RW) Permit

A RW permit is not required for the completion of a groundwater recharge facility. However, if recovery of long-term storage credits earned from recharging groundwater is desired, a RW permit is required. The recovery well is only allowed to withdraw water from the same underground water basin the USF recharges to. Fees of up to \$10,000 may be expected.

To complete a RW permit application, the following is required: USF permit, a credit for long-term storage account, and an impact analysis report. The length of the RW permit processing time is similar to that of a WS or USF permit review process.

Long-term Storage Credit (LTSC) Account

A LTSC account is not required to construct, own, or operate a groundwater recharge facility. However, should the owner desire to receive credit(s) for recharging groundwater, a LTSC account and tracking of credits should be considered.

The process to open a LTSC account can be completed simultaneously with the WS permit review. To assign LTSCs to WS permit, payment of an initial fee of \$250 is required. The LTSCs will be assigned to a WS permit and will then be transferred to a long-term storage account and the credits will be available for use.

LTSCs allow the credit holder to withdraw equivalent volumes of water to what they have stored, subtracting water losses in the storage and recovery processes. Tracking and reporting of LTSCs is typically done on an annual basis. LTSC must be withdrawn from the same underground aquifer the storage occurred in and may be used at any time. LTSCs maintain their legal status and can only be used for the same approved applications as the water had prior to storing. An alternative option to LTSC is annual recovery. Annual recovery requires that water stored must be recovered within the year it was stored.

IV. SANITARY SEWER COLLECTION SYSTEM

A. CURRENT AND FUTURE DEMANDS

Data provided by the Town of Clarkdale for existing customers, wastewater influent, future development areas, and the existing collection system was used to determine existing sanitary sewer demand and estimate future sewer demands. Clarkdale's sewer connections are divided into two groups: residential and non-residential connections. The collection system conveys wastewater to the Wastewater Treatment Plant commonly referred to as the Broadway Water Reclamation Facility (BWRF) located at 375 S. Broadway. The plant is permitted to treat up to 0.35 million gallons per day (MGD) and has received an average influent flow of 0.14 MGD over the previous 5 years (2019-2023).

1. POPULATION AND FLOW PROJECTION

As previously stated, Clarkdale is in a period of growth with expected continued increases in population and utility customers. Increased sewer flows resulting from future developments depend on the availability and practicality of municipal sewer in growth areas. Gravity flow sewers are impractical in some areas due to topography and require sewage lift stations.

2. EXISTING WASTEWATER INFLUENT

Wastewater influent is the amount of sewage entering BWRF from the collection system. Wastewater influent represents the total sewer demand flow across Clarkdale for both residential and non-residential customers. Wastewater influent data for the previous 5 years (2019-2023) was used to determine monthly and average daily sewer flows and monthly high and low flows. Historically sewer flows do not vary seasonally with water usage, remaining more consistent throughout the year. Water usage increases during the summer months as the use of non-wastewater generating uses such as landscaping peak. Table 49 – Monthly Wastewater Influent (gallons) summarizes monthly and yearly sewer flows for the previous 5 years (2019-2023). Table 50 - Wastewater Influent: Average, Low and High Daily Averages(gallons) gives the average daily flows into the WWTP as well as the average daily flows for the high and low months for each of the previous 5 years (2019-2023).

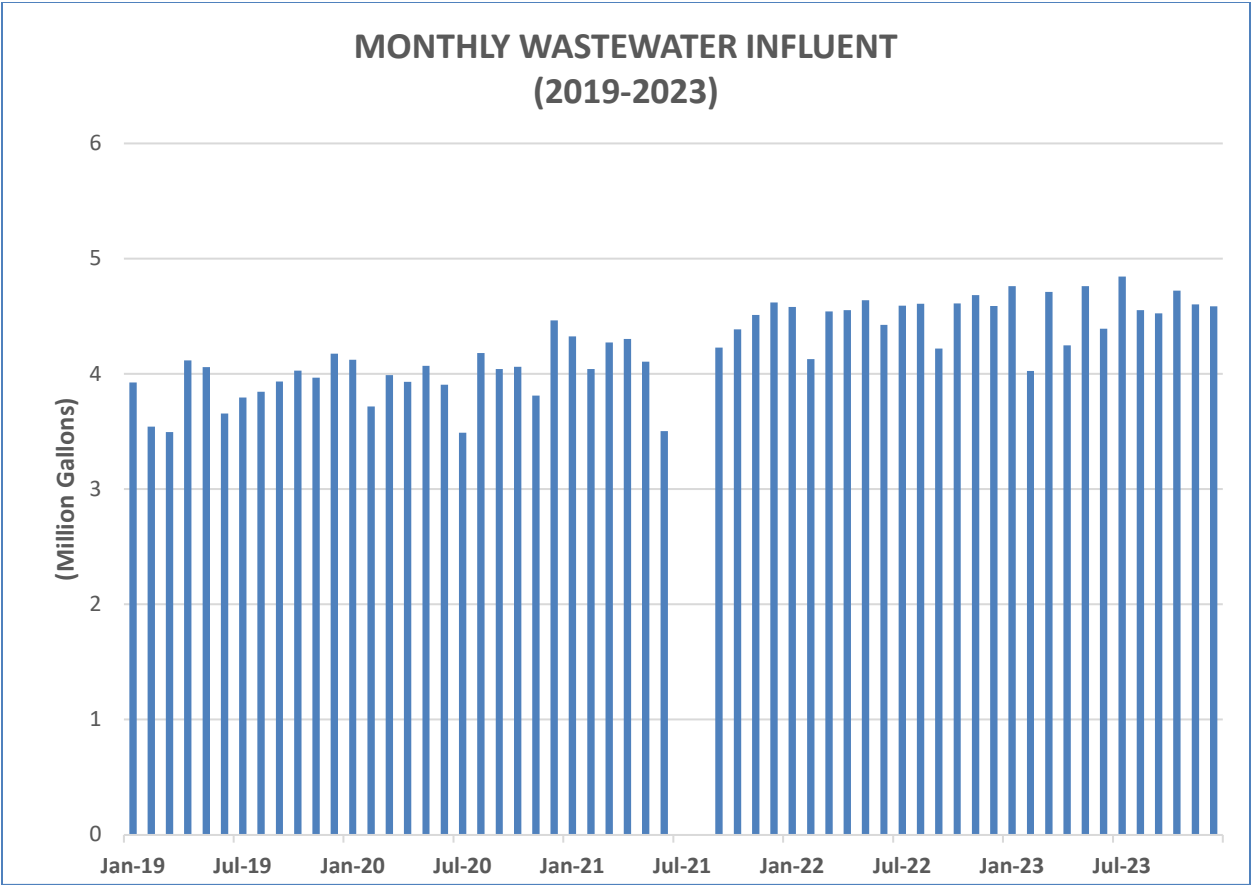
	2023	2022	2021	2020	2019
January	4,761,069	4,579,645	4,325,434	4,121,398	3,923,545
February	4,025,447	4,128,709	4,040,750	3,716,210	3,540,443
March	4,710,893	4,541,280	4,272,452	3,987,606	3,494,675
April	4,247,146	4,552,153	4,302,220	3,931,048	4,117,752
May	4,759,851	4,637,983	4,104,560	4,069,018	4,057,993
June	4,391,973	4,424,452	3,504,066	3,906,456	3,655,855
July	4,843,088	4,592,104	Missing	3,490,068	3,795,139
August	4,552,388	4,606,850	Missing	4,180,604	3,844,452
September	4,525,014	4,218,248	4,227,736	4,042,500	3,933,896
October	4,723,136	4,610,180	4,386,594	4,060,708	4,027,886
November	4,602,979	4,681,895	4,510,516	3,810,564	3,965,937
December	4,586,382	4,588,752	4,618,535	4,463,859	4,175,301
Yearly Total	54,729,366	54,162,251	*42,292,863	47,780,039	46,532,874

Table 49 – Monthly Wastewater Influent (gallons)

*Missing July and August 2021 influent data

	Average Daily (2019-2023)	% of WWTP Capacity	Low Month Average Daily	% of WWTP Capacity	High Month Average Daily	% of WWTP Capacity
January	140,072	40%	126,566	36%	153,583	44%
February	138,024	39%	126,444	36%	147,454	42%
March	135,528	39%	112,731	32%	151,964	43%
April	141,002	40%	131,035	37%	151,738	43%
May	139,545	40%	130,903	37%	153,544	44%
June	132,552	38%	116,802	33%	147,482	42%
July	134,842	39%	112,583	32%	156,229	45%
August	138,583	40%	124,015	35%	148,608	42%
September	139,649	40%	131,130	37%	150,834	43%
October	140,700	40%	129,932	37%	152,359	44%
November	143,813	41%	127,019	36%	156,063	45%
December	144,728	41%	134,687	38%	148,985	43%

Table 50 - Wastewater Influent: Average, Low and High Daily Averages(gallons)



3. CUSTOMER WATER USAGE AND WASTEWATER INFLUENT

Data provided by the Town of Clarkdale was used to compare customer water usage to wastewater influent. In Clarkdale, between 25% and 50% of total customer water usage results in wastewater influent. Since many of the residential neighborhoods around Clarkdale use septic sewer systems there are less municipal sewer connections than water customers. Water usage among septic users does not result in sewer influent to the WWTP as they are not connected to the collection system. Wastewater influent as a percentage of water sales vary seasonally with the lowest percentages occurring during the summer months when non-wastewater generating water usage is the highest. This percentage is affected by the volume of non-wastewater generating uses such as landscaping as well as other leaks/losses within the water distribution and sewer collection system. See Table 51 – Total Water Sales vs Total WW Influent below. For planning purposes an average % of water usage to wastewater flow per connection is calculated below in Table 52 - % of Water Usage to WW Flow per Connection. Approximately 68% of water usage among municipal sewer customers results in wastewater influent.

	2023	2022	2021	2020	2019	Monthly Average
January	51.2%	49.5%	48.9%	46.1%	41.6%	47.5%
February	47.2%	46.7%	45.5%	51.6%	49.6%	48.1%
March	40.4%	35.8%	38.6%	49.2%	48.7%	42.6%
April	43.4%	38.8%	39.7%	35.1%	49.9%	41.4%
May	30.9%	34.8%	31.4%	29.5%	33.3%	32.0%
June	31.3%	23.4%	19.2%	27.7%	35.6%	27.5%
July	32.3%	29.8%	Missing	18.5%	23.1%	25.9%
August	23.8%	25.6%	Missing	28.6%	32.1%	27.5%
September	32.9%	29.8%	25.3%	21.0%	31.2%	28.0%
October	36.6%	38.4%	36.6%	28.1%	32.3%	34.4%
November	30.2%	34.0%	41.1%	28.6%	40.9%	35.0%
December	46.0%	45.6%	36.3%	35.3%	54.6%	43.6%
Yearly Average	37.2%	36.0%	36.3%	33.3%	39.4%	

Table 51 – Total Water Sales vs Total WW Influent

2022 & 2023		
Average Daily Sewer Flow per Connection	128	gpd
Average Daily Water Demand per Connection	188	gpd
Average % of Water to Wastewater for Sewer Customers	68%	

Table 52 - % of Water Usage to WW Flow per Connection

4. ANTICIPATED SEWER DEMAND

Projections show continued growth around the Town and increased sewer demand. Anticipated demand areas were identified as part of the water demand analysis in Section II Water System - A.6. The anticipated demand areas that have available sewer on site or adjacent to the property were included in the anticipated sewer demand analysis. Additional daily sewer flow was calculated using the average daily, peak month daily sewer influent, and wastewater influent per connection. This calculation does not include a distinction for residential versus commercial connections as sewer flows for residential developments can be more accurately predicted with less variance than commercial developments. See Table 53 – Sewer Usage Per Connection and Table 54 – Anticipated Additional Sewer Flows.

2022 & 2023		
Average Influent	149,131	gpd
Average # Connections	1,163	
Average Daily Usage Per Connection	128	gpd/connection
Peak Month Influent (November)	154,748	gpd
Peak Month Average Daily Usage Per Connection	133	gpd/connection

Table 53 – Sewer Usage Per Connection

Development Area	# of Lots	Average Daily Additional Demand (gpd)	Peak Month Daily Additional Demand (gpd)
Centerville Lots	27	3,456	3,591
Mountain Gate Lots	115	14,720	15,295
Crossroads Lots	103	13,184	13,699
Plateau Subdivision	52	6,656	6,916
The Highlands at Clarkdale	48	6,144	6,384
Totals	345	44,160	45,885
	# of Rooms	ADEQ Unit Design Flow	Additional Average Daily Demand (gallons)
Taawaki Inn	44	60 gpd	2,640

Table 54 – Anticipated Additional Sewer Flows

Wastewater demand may also be increased by expanding the existing collection system and converting septic neighborhoods to municipal sewer. Potential areas for expanding the sewer collection system are included in the anticipated demand calculations below. Other areas within Clarkdale may potentially be able to tie into the existing system and will need to be evaluated further. These areas are discussed in A.6 Gravity Sewer Expansion later in this section. See Table 55 - Gravity Sewer Expansion Areas and Table 56 - Total Anticipated Sewer Demand.

Collection System Expansion Area	Additional # of Lots	Average Daily Additional Demand (gpd)	Peak Month Daily Additional Demand (gpd)
Black Hills	362	46,336	48,146
Foothills Terrace	152	19,456	20,216
Mingus Shadows	99	12,672	13,167
Totals	514	78,464	81,529

Table 55 - Gravity Sewer Expansion Areas

	Total gpd	% WWTP Capacity
Average Daily Influent + Anticipated Sewer Flows & Gravity Sewer Expansion	261,723	74.8%
Peak Month Daily Influent + Peak Anticipated Sewer Flows	278,552	79.6%

Table 56 - Total Anticipated Sewer Demand

5. FUTURE FULL BUILDOUT DEMANDS

Future full buildout sewer demands have been calculated using the available undeveloped land areas in Clarkdale. This analysis assumes that all the land zoned commercial and industrial would connect to the Town's sewer system and only the areas zoned residential with sewer mains on site or on adjacent properties would connect to the Town's sewer system. For simplicity of analysis a factor of 90% of the estimated full buildout water demand would be converted to wastewater effluent. This results in an additional 0.31 MGD at average daily demand and an additional 0.47 MGD at peak daily demand. It is important to note that full buildout demands cannot be accurately predicted, and this information should be used for planning purposes only. This analysis assumes that all available land will be developed, while only a percentage of land is typically developable. Individual usages vary based on development and cannot be accurately predicted. Any future developments in these areas should be further evaluated on a case-by-case basis to determine more accurately the additional demands that will be added to the collection system and WWTP. See Table 57 – Full Buildout Additional Sewer Demand. See the following page for areas associated with full buildout sewer demand.

Zoning	Available Acreage	Average Monthly Additional Sewer Demand (gallons)	Average Additional Daily Water Demand (gallons)	Peak Additional Monthly Sewer Demand (gallons)	Peak Additional Daily Sewer Demand (gallons)
Residential	306	8,067,045	265,218	11,293,863	371,305
Commercial	94	1,292,473	30,352	1,809,462	59,489
Industrial	256	781,495	18,352	1,094,093	35,970
Total	656	10,141,013	313,922	14,197,418	466,764

Table 57 – Full Buildout Additional Sewer Demand

6. GRAVITY SEWER EXPANSION

Much of the Town's population uses residential septic sewer systems due to the unavailability of municipal sewer. Potential construction of gravity sewer mains in existing septic neighborhoods could increase the customers and sanitary sewer demands. Due to topography, gravity sewer mains are not feasible in all areas. A previous study was prepared in June 2019 for the Town of Clarkdale by Southwestern Environmental Consultants, INC. titled "*Feasibility Study –Expansion of Water Distribution System and Sewer Collection System.*" The study is included in Appendix A12 for reference. Several areas around Clarkdale were identified where gravity sewer was possible based on topography. Currently there are no plans for the expansion of the collection system in these areas, but Ardurra identified the following three neighborhoods as the most practical areas for gravity sewer expansion based on potential new customers and the lineal footage of sewer main required to connect these neighborhoods to the existing collection system.

- Black Hills
- Mescal Spur and Reta St
- Mingus Shadows

It is estimated that these three areas could expand the collection system to an additional 613 residential customers. A map on the following page displays the potential sanitary sewer main. The number of potential customers was estimated using Yavapai County assessor's parcel information. Additional demands were estimated using the average sewer usage per connection. (See Table 55 - Gravity Sewer Expansion Areas for the estimated additional demands.) Upgrades and improvements to the existing Alamos and Mescal Lift station would likely be required as a part any project in these neighborhoods to expand the collection system. These calculations are for planning purposes only and it is important to note that the calculations assume all potential customers would connect to the proposed sewer; however, generally many customers with existing septic sewer systems do not opt to connect to the new sanitary sewer.



BLACK HILLS EXPANSION

- 362 POTENTIAL RESIDENTIAL CONNECTIONS
- APPROXIMATELY 22,000 LF OF 8" SEWER MAIN

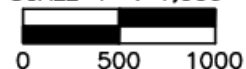


MESCAL SPUR AND RETA ST EXPANSION

- 152 POTENTIAL RESIDENTIAL CONNECTIONS
- APPROXIMATELY 9500' LF OF 8" SEWER MAIN



SCALE 1" : 1,000'



LEGEND

—	EX. 6" SEWER LINE	—	PROP. 8" SEWER MAIN
—	EX. 8" SEWER LINE	- - -	TOWN BOUNDARY
—	EX. 10" SEWER LINE	S	EX. MANHOLE
—	EX. 12" SEWER LINE		LIFT STATION
—	EX. 15" SEWER LINE		

DISCLAIMER

THIS MAP IS BASED ON BEST AVAILABLE DATA. THE TOWN OF CLARKDALE AND ARDURRA, INC ACCEPTS NO LIABILITY FOR INFORMATION CONTAINED IN THIS MAP.

PARCEL LINES AND OTHER BACKGROUND INFORMATION ARE FOR REFERENCE ONLY AND ARE NOT INTENDED FOR ANY OTHER USE.

SHEET

DRAWN BY:

1

DATE: SEPTEMBER 2024

SCALE: 1"=1000'

OF 1

JOB NO: 223351

CALRKDALE SEWER MASTER PLAN GRAVITY SEWER EXPANSION

YAVAPAI COUNTY

CLARKDALE



7. SEWER INFLOW AND INFILTRATION

Sewer system inflow refers to water that enters the sewer collection system as a result of a precipitation event. On average, Clarkdale receives approximately 12.7 inches of rainfall and 2 inches of snow, limiting the amount of inflow that the system can receive.

Sewer system infiltration is unwanted groundwater that enters the system through existing cracks, joints, and breaks within the collection system. Infiltration can occur in existing sewer mains and manholes. Visual inspection of existing manholes and camera inspections of existing sewer mains can be used to identify areas of infiltration.

Together sewer inflow and infiltration (I&I) can take up capacity in sewer mains and increase influent flows to the WWTP. This can result in increased cost associated with additional volume of wastewater treatment and require costly upgrades to the collection system. I&I is most likely to occur where mains cross drainage washes and open channels. Flow monitoring as well as regular sewer inspections can identify sources of I&I. Sources of I&I should be repaired as funding and scheduling allows.

Based on the consistent influent flow rates into BWRF during dry weather and wet weather months, a large amount of I&I into the collection system is not suspected at the present time. Should Town staff notice an increase of influent flow to the BWRF during wet periods, the sources of I&I in the system should be further investigated and addressed.

B. EXISTING SEWER INFRASTRUCTURE

The Town of Clarkdale's sewer collection system is comprised of approximately 22 miles of primarily gravity sewer mains and an estimated 27 miles of sewer services. The system also includes 358 known existing manholes and 4 Town operated lift stations. The collection system conveys wastewater flows to the Broadway Water Reclamation Facility located off South Broadway near the Verde River.

1. GRAVITY SEWER MAINS

Existing sewer mains within the Town of Clarkdale range in size from 4" to 15". The Town does not have a thorough record of the existing sewer pipe materials and construction dates. The oldest sewer mains are assumed vitrified clay pipe (VCP) dating back to the 1910s. Various sections of the existing sewer mains have been replaced with polyvinyl chloride (PVC) as the primary replacement material. See Table 58 - Existing Sewer Mains Summary for approximate lengths and diameter of existing sewer mains. Town staff has mentioned the existence of 4" sewer mains in older sections of the Town. The locations and quantity of these sewer mains cannot be verified at this time. The Town estimates that the collection system includes approximately 27 miles of existing services of varying material and construction dates. According to Clarkdale Town Code Ch. 11 Sewer the Town is responsible for maintenance of the sewer service from the main to the property line, provided there is a Town approved cleanout located near the property line. If no cleanout exists, the property owner is responsible for maintenance of the sewer service to the sewer main.

Since Clarkdale was developed as a company town, older sections of sewer main were often placed within property boundaries and ran very close or even underneath existing buildings. Realignment of existing sewer mains should be done on a case-by-case basis as improvements or replacements to the system are made.

	Approximate LF
15-inch	8,697
12-inch	3,573
10-inch	1,636
8-inch	78,444
6-inch	23,755
4-inch	Unknown
Total	116,105 LF (22.0 miles)

Table 58 - Existing Sewer Mains Summary

2. MANHOLES

There are a total of 358 known manholes in Clarkdale's collection system, with general locations shown on the system map in Appendix C1. The age and conditions of existing manholes within the system vary widely. As they are replaced in the system, they are constructed to Maricopa Association of Governments (MAG) standards.

3. LIFT STATIONS

The Town operates four lift stations as a part of the collection system shown on the sewer system map in Appendix C1. See Table 59- Lift Stations below for the name and general location of each existing lift station.

Name	Location
89A Lift Station	1725 W. 89A
Alamos Lift Station	101 Alamos Dr.
Fiesta Lift Station	SE end of Fiesta St.
Mescal Lift Station	2051 State Rt 89A

Table 59- Lift Stations

89A Lift Station

The 89A lift station is located at the site of the Arsenic Treatment Plant. This lift station pumps backwash from the arsenic treatment process through a force main that runs along Old Jerome Highway and then west to a manhole on Hummingbird Lane.

89A Lift Station			
Depth	30.02'	Inlet Pipe Invert Elevation	Unknown
Diameter (O.D.) (ft)	6.5'	Force Main Size	3"
Diameter (I.D.) (ft)	6'	Force Main Material	HDPE
Wall Thickness (in)	3"	Pump Configuration	Duplex
Rim Cover Elevation	Unknown	Date Pump Installed	2023
Floor Elevation INV (ft below rim)	30.02'	Pump Manufacturer	Flygt
Wet Well Base Elev	Unknown	Pump Model	MP3102
Liquid Level Monitoring	Floats	Pump Type	Grinder
Lead Pump On Elevation (ft below rim)	27.75'	Date Motor Installed	2023
Lag Pump On Elevation (ft below rim)	26.75'	Pump Motor Power	6 HP
Pumps Off Elevation (ft below rim)	29.02'	Common Issues at L.S.	Inlet pipe undersized for backwash
High Alarm Elevation (ft below rim)	25.75'	Maintenance Recommendation	Replace Floats
Inlet Diameter	4"		

Table 60 - 89A Lift Station Data



Valve Vault



89A Lift Station Location

Alamos Lift Station

Located in southeast Clarkdale at the corner of Alamos Drive and Granite Springs Rd, this lift station pumps wastewater northwest to a manhole near Old Jerome Highway and Skyline Boulevard. From this manhole, wastewater gravity flows through the collection system until it gets to the Mescal Lift Station. Town staff noted that full-pipe grease logs are found regularly in the wet well. The Town currently has this wet well pumped quarterly to remove grease buildup.

Due to the redesign of the wet well in 2013, the influent inlet is only 1 foot above the base of the wet well and the inlet remains submerged. This surcharges the gravity sewer line leading into the wet well and results in grease accumulation seen regularly in the wet well. Discussed later in this master plan, it is recommended that this wet well be redesigned. It is recommended that Town staff pump down the level of this wet well weekly until the wet well is replaced to reduce the accumulation of grease.

Alamos Lift Station			
Wet Well Depth	15.44'	Inlet Pipe Invert Elevation	3503.48'
Diameter (O.D.) (ft)	6.5	Force Main Size	3"
Diameter (I.D.) (ft)	6	Force Main Material	C900 PVC
Wall Thickness (in)	3	Pump Configuration	Duplex
Rim Cover Elevation	3517.92'	Date Pump Installed	2013
Floor Elevation INV (top concrete fill)	3502.98'	Pump Manufacturer	Flygt
Wet Well Base Elevation	3497.92'	Pump Model	MP3102.170 HT
Liquid Level Monitoring	Floats	Pump Type	Grinder
Lead Pump On Elevation	3503.48'	Date Motor Installed	2013
Lag Pump On Elevation	3503.98'	Pump Motor Power	7.5 HP
Pumps Off Elevation	3502.98'	Common Issues at L.S.	Grease Accumulation
High Alarm Elevation	3504.48'	Maintenance Recommendation	Pump wet well down below influent invert weekly
Inlet Diameter	8"		

Table 61 - Alamos Lift Station Data



Check Valve, Gate Valve and Air Release Assembly



Alamos Lift Station

Fiesta Lift Station

Located at the southeast end of Fiesta Street in northeast Clarkdale. During site visits, it was reported by a resident that sewer odor is frequently present in the area. Staff noted that if the sewer main in Fiesta Street is flushed it would reduce the issue at this lift station. Pump float settings should be evaluated to see if the retention time can be reduced. This wet well is pumped out quarterly.

The force main discharges in a buried manhole located underneath a driveway in on Vista Lane.

Fiesta Lift Station			
Wet Well Depth	17.25'	Force Main Size	6"
Diameter (O.D.) (ft)	8'-10"	Force Main Material	DIP
Diameter (I.D.) (ft)	7.5	Pump Configuration	Duplex
Wall Thickness (in)	8"	Date Pump Installed	2021
Rim Cover Elevation	Approximately 3385'	Pump Manufacturer	Flygt
Liquid Level Monitoring	Floats	Pump Model	NP 3102
Lead Pump On Elevation (ft below rim)	14.0'	Pump Type	Grinder
Lag Pump On Elevation (ft below rim)	13.4'	Date Motor Installed	2021
Pumps Off Elevation	14.5'	Pump Motor Power	5 HP
High Alarm Elevation	12.5'	Common Issues at L.S.	Odor Issues
Inlet Diameter	12"	Maintenance Recommendation	Pump Wet Well Quarterly
Inlet Pipe Invert Elevation (ft below rim)	13.9'		

Table 62 - Fiesta Lift Station Data



Inside of Fiesta Lift Station



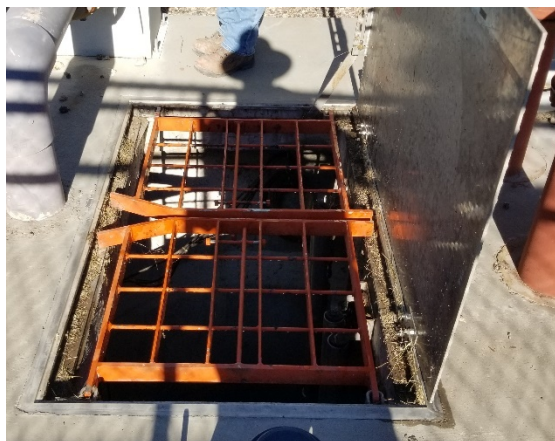
Wet Well and Valve Vault Location

Mescal Lift Station

The Mescal lift station is located at the corner of State Rt 89A and Mescal Spur in southeast Clarkdale. It pumps wastewater through a force main northwest along 89A, discharging to a manhole north of Lisa Street.

Mescal Lift Station			
Depth	12.13'	Inlet Pipe Invert Elevation	3515.30'
Diameter (O.D.) (ft)	7.33	Force Main Size	6"
Diameter (I.D.) (ft)	6	Force Main Material	C900 PVC
Wall Thickness (in)	8	Pump Configuration	Duplex
Rim Cover Elevation	3523.00'	Date Pump Installed	2013
Floor Elevation INV (top concrete base)	3510.87'	Pump Manufacturer	Flygt
Liquid Level Monitoring	Floats	Pump Model	NP3152.181
Lead Pump On Elevation	3514.17'	Pump Type	Chopper
Lag Pump On Elevation	3514.67'	Date Motor Installed	2013
Pumps Off Elevation	3511.87'	Pump Motor Power	20 HP
High Alarm Elevation	3515.17'	Common Issues at L.S.	Odor
Inlet Diameter	8" PVC	Maintenance Recommendation	

Table 63 - Mescal Lift Station Data



Mescal Lift Station Wet Well



Check Valve, Gate Valve, and Air Release Assembly

4. EXISTING VULNERABILITIES/DEFICIENCIES

The existing sewer collection system has several vulnerabilities and deficiencies that should be addressed as funding allows. Several existing sewer mains around Clarkdale have a history of issues due to poor condition or configuration. The Town's original layout makes many repairs difficult because of the location of existing gravity sewer collection infrastructure. Many sewer mains are located on private property and underneath existing houses, patios and decks.

Sewer Mains

3rd North Sewer

The existing sewer that serves the northwest side of 3rd North Street houses is at the back of the lots with building additions, decks, patios and other infrastructure constructed above the main. The sewer has backed up multiple times in recent years, but access to the main is restricted due to the encroachments over the top of the main. The project is currently under design and slated for relocation and replacement.

Patio Park

The sewer collection system in Patio Park has existing 4" Orangeburg pipe sewer mains with a history of backups and breaks. Orangeburg pipe is prone to deterioration, root intrusion and collapse. These runs are undersized for sewer mains as well. Staff has noticed sewer mains in this area seem to be flat and often retain wastewater, requiring regular flushing.

Lower and Upper Town

Lower and Upper town neighborhoods were constructed with shared sewer services to the main. When discovered, these shared laterals should be relocated with one service per property located within their property boundary. Several sewer mains in these neighborhoods were noted by Town staff to be undersized VCP.

Main Street

Main Street from North Broadway to 9th Street has a history of clogging and backing up. This section of sewer main is 8" VCP and requires regular flushing and maintenance.

Lift Stations

Alamos

Previously noted, the Alamos Lift Station accumulates grease and solids due to the influent gravity main being submerged within the wet well. This causes backing up into the influent gravity main. During normal operation the pumps should remain submerged, and the inlet pipe should be exposed. It is recommended that this wet well be pumped below the influent invert weekly until this wet well can be redesigned. The wet well should be replaced so that the inlet pipe is not submerged.

Fiesta

The Fiesta Lift Station is known to have an odor issue related to the sewer mains in Fiesta Street. Town staff noted regular flushing of these lines prevents odor issues. It is recommended that float settings in this wet well be evaluated to potentially lower retention times and minimize or eliminate odor issues.

C. COLLECTION SYSTEM CAPACITY ANALYSIS

The Town of Clarkdale does not have a model for their existing sewer collection system. The entire sewer collection system was not modeled as a part of this master plan. Collection system capacity analysis focused on trunk and main line sewer pipes identified during data collection. These sewer mains were analyzed using Bentley FlowMaster (CONNECT edition 10.03) to estimate flows and capacities for the existing sewer flows, as well as anticipated future demand. The Manning formula was used to calculate full flow capacity and depth-to-diameter (d/D). It is recommended that the Town has a sewer model created for their system for an in-depth capacity analysis and to model additional flows being proposed on the system.

1. HYDRAULIC CRITERIA

The Arizona Department of Environmental Quality (ADEQ) regulates the performance of sewer collection systems under Arizona Administrative Code (A.A.C.) R18-9-E301. For system modeling dry weather conditions were assessed. For dry weather conditions the maximum d/D ratio for any pipe shall be 0.75 (75%). Further, ADEQ also requires that all pipes in the collection system shall be designed to provide a minimum velocity of 2.0 ft/sec when flowing full and a maximum velocity of 10 ft/sec. ADEQ accepts Manning's roughness (n) value of 0.0013 for all pipes regardless of material.

2. SYSTEM FLOW CALCULATIONS

Flow data was not available for this analysis; therefore, wastewater flows were estimated based on assumed upstream population and unit design flows. Upstream population was based on number of parcels/lots. This did not account for vacant lots within the collection areas and for that reason the design flows used in this capacity analysis are conservative. Average flows were estimated using Arizona Administrative Code (A.A.C) Title 18 Chapter 9 Table 1. Unit Design flow. Peak flows were then calculated using Dry Weather Peaking Factor (DWPF) according to R18-9-E301. This peaking factor is based on estimated upstream population and applied to average flow conditions to simulate peak hourly in the system.

3. EXISTING SYSTEM ANALYSIS AND CAPACITY ASSESSMENT

The map on the following page shows the existing sewer mains that were included in the existing system analysis and capacity assessment. (See Table 64 - Existing Collection System Capacity Analysis Results for a summary of results from FlowMaster.) Analysis of these sewer mains did not show any deficiencies at the current demand.

Note, sewer flow metering was not done as a part of this master plan and these flow calculations are based on property lines and an assumed population density of 2.68 persons per household. Also, sewer line slopes are approximate based on topography and may not mimic the actual construction. Staff noted that several sewer mains seem to be constructed flat, but this cannot be confirmed at this time without the use of survey. Average flows in some areas may represent values higher than the total wastewater influent for the system as well as peak flows representing flows above the WWTP capacity. This analysis was done only to show the estimated capacities at several collection main lines around the system.

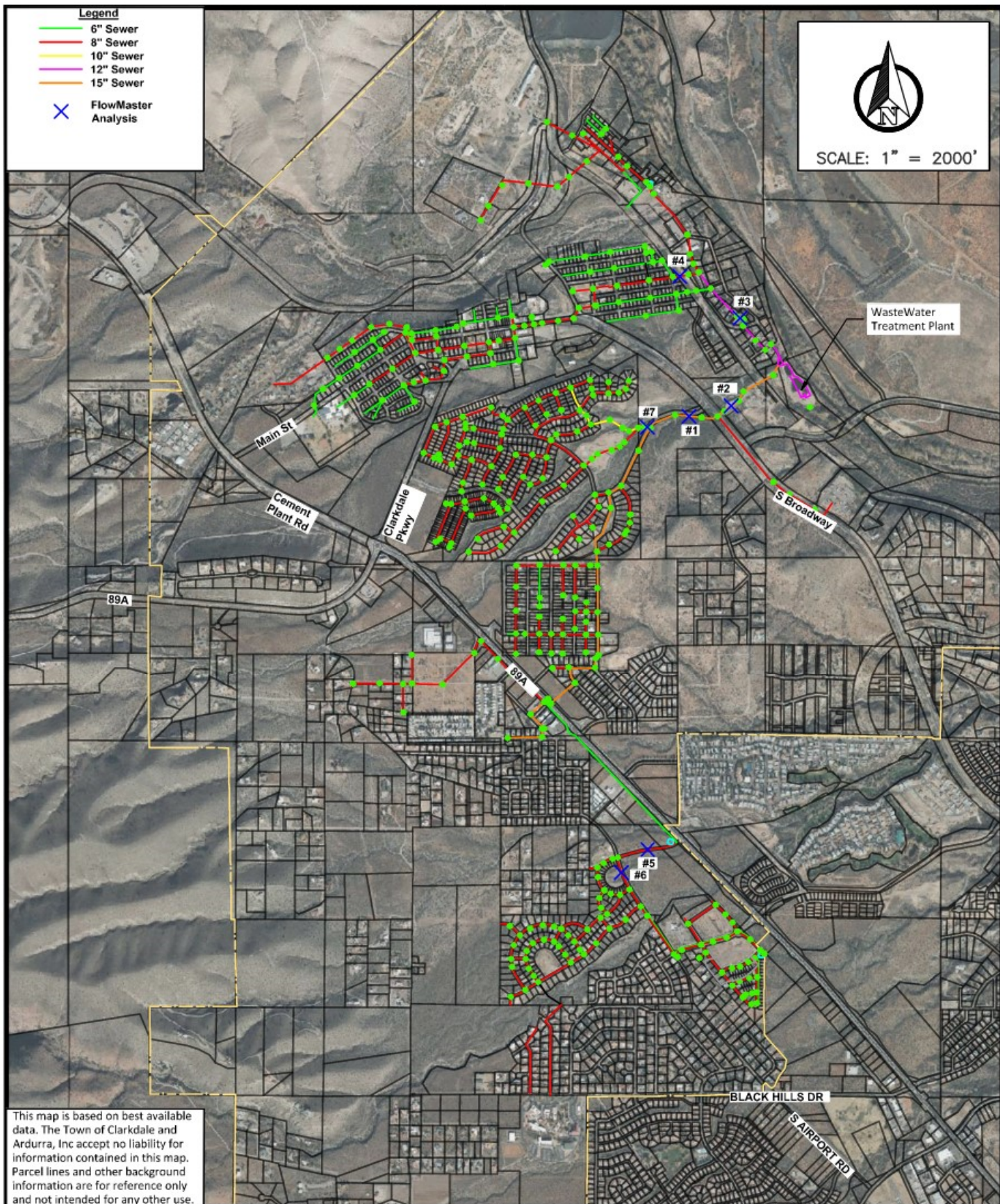
4. ANTICIPATED BUILDOUT SYSTEM ANALYSIS AND CAPACITY ASSESSMENT

Anticipated buildout system analysis and capacity assessment is based on the growth areas previously identified and the effect that this will have on the existing sewer collection system. This analysis focuses on the same trunk and main line sewers identified in the previous section. According to the results of this capacity analysis, the existing sanitary sewer collection system has room for expansion and there are no foreseen deficiencies associated with the anticipated buildout. (See Table 65 - Anticipated Demand

Collection System Capacity Analysis Results.) While the gravity sewer collection system has adequate capacity for the anticipated expansion of the system, future developments should be evaluated individually to determine the affect they will have on the collection system capacity.

5. GRAVITY SEWER EXPANSION ANALYSIS AND CAPACITY ASSESSMENT

The additional demands associated with the potential expansion to the gravity sewer collection system, previously discussed in Section V-A.6, were also analyzed. These additional demands were added to the Anticipated Demand scenario. Results show that the collection system sewer mains have the capacity for the Black Hills and Mescal Spur/Reta Street expansions with a maximum d/D (%) of 40.3% during peak flow conditions in the sewer mains used in the capacity analysis.



SHEET 1 OF <u>1</u>	DRAWN BY: CTO	SEWER MASTER PLAN FLOWMASTER ANALYSIS YAVAPAI COUNTY TOWN OF CLARKDALE	
	DATE: SEPTEMBER 2024		
	SCALE: AS SHOWN		
	JOB NO: 223351		

#	Diameter	Location	Approximate Slope (ft/ft)	Estimated Upstream Population	Average Flow (gpd)	Peaking Factor	Peak Flow (gpd)	Average Flow (gpm)	Peak Flow (gpm)	Full Flow Capacity (gpd)	d/D (%) Average Flow	d/D (%) Peak Flow
1	15"	Old Centerville/ South Broadway	0.005	2,318	185,440	2.15	398,876	128.8	277.0	2,952,062	17.0%	24.8%
2	15"	South Broadway/ WWTP	0.024	2,318	188,080	2.15	404,554	130.6	280.9	6,467,645	11.7%	16.9%
3	12"	Rincon Dr	0.004	1,356	108,480	2.29	248,455	75.3	172.5	1,456,276	18.5%	27.9%
4	8"	N 4th St	0.029	1,002	80,160	2.38	190,535	55.7	132.3	1,329,953	16.6%	25.6%
5	8"	Mescal Spur	0.035	705	56,400	2.50	141,000	39.2	97.9	1,461,070	13.4%	21.0%
6	8"	Old Jerome Hwy	0.012	659	52,720	2.56	134,963	36.6	93.7	855,515	16.8%	26.9%
7	10"	Old Centerville	0.010	1,450	116,000	2.27	263,546	80.6	183.0	1,416,002	19.4%	29.2%

Table 64 - Existing Collection System Capacity Analysis Results

#	Diameter	Location	Approximate Slope (ft/ft)	Estimated Upstream Population Existing	Anticipated Buildout Additional Population	Anticipated Buildout Average Flow (gpd)	Peaking Factor	Peak Flow (gpd)	Average Flow (gpm)	Peak Flow (gpm)	Full Flow Capacity (gpd)	d/D (%) Average Flow	d/D (%) Peak Flow
1	15"	Old Centerville/ South Broadway	0.005	2,318	785	248,240	2.08	516,861	172.4	358.9	2,952,062	19.6%	28.3%
2	15"	South Broadway/ WWTP	0.024	2,318	785	250,880	2.08	522,358	174.2	362.7	6,467,645	13.4%	19.2%
3	12"	Rincon Dr	0.004	1,356	139	119,600	2.26	270,734	83.1	188.0	1,456,276	19.4%	29.2%
4	8"	N 4th St	0.029	1,002	139	91,280	2.34	213,504	63.4	148.3	1,329,953	17.7%	27.1%
5	8"	Mescal Spur	0.035	705		56,400	2.50	141,000	39.2	97.9	1,461,070	13.4%	21.0%
6	8"	Old Jerome Hwy	0.012	659		52,720	2.56	134,963	36.6	93.7	855,515	16.8%	26.9%
7	10"	Old Centerville	0.010	1,450	437	150,960	2.20	332,476	104.8	230.9	1,416,002	22.0%	33.0%

Table 65 - Anticipated Demand Collection System Capacity Analysis Results

D. FUTURE COLLECTION SYSTEM IMPROVEMENTS

The sanitary sewer collection system capacity is not deficient in its current or anticipated demand state. Capacity assessment completed on the existing collection system at sewer main and trunk lines show that the system has adequate capacity for existing and anticipated flows in these locations. The system does contain existing vulnerabilities (previously discussed) that should be addressed as funding allows. Section VII Capital Improvement Projects gives potential projects and associated cost estimates. As the collection system expands, and the number of customers increases the system should be re-evaluated to ensure sufficient capacity in the affected areas. Future improvements to the system should be made with the following general recommendations.

1. SEWER MAINS

Sewer mains should be designed per ADEQ regulations. Gravity sewer replacements should be constructed primarily using PVC (SDR 35) with a minimum pipe diameter of 8" in most areas. Known 4" Orangeburg sewer mains and other undersized sewer mains should be replaced as funding and schedule allows. These replacements can coincide with larger replacement projects.

2. LIFT STATIONS

Improvements to the existing lift stations should be evaluated on a case-by-case basis, should the Town receive proposals for future developments or potential collection system expansions in existing septic neighborhoods. All improvements or upgrades to the existing lift stations should follow A.A.C R18-9-E301.4.01 regulations.

V. BROADWAY WATER RECLAMATION FACILITY (BWRF)

A. INTRODUCTION

The Town of Clarkdale's (Town's) Broadway Water Reclamation Facility (BWRF), located on Town-owned land and adjacent to the Verde River is permitted through the Arizona Department of Environmental Quality (ADEQ) to treat and distribute up to 0.35 million gallons per day (MGD) or 400 AF / yr of Class A+ reclaimed water at full capacity. Examining and maximizing reclaimed water opportunities is addressed in Section IV of this report.

Ardurra's scope related to the BWRF was to conduct an in-person site assessment, conduct interviews with plant operational staff, conduct an overall condition assessment of the existing facility for the purposes of identifying operational enhancements, development of a CIP list for planning future needs, and recommendations for adding additional capacity.

Ardurra performed a desktop analysis of the existing plant to identify any process or hydraulic bottlenecks or areas of operational improvement, taking in to account all information received during the data gathering and collection phase. Ardurra also performed an analysis and recommendations for future expansion of the wastewater treatment plant based on anticipated growth.

B. BACKGROUND

The BWRF was originally constructed prior to 1972 as an aerated lagoon, with subsequent improvements up until 2012. In 2013, the outdated lagoon system began to pose a significant water quality threat to the adjacent Verde River, designated by Congress as a Wild and Scenic River. In 2013, a new wastewater treatment plant design was underway, consisting of enclosed treatment tanks, therefore eliminating any potential of illicit discharge to the Verde River.

The \$5.5 million infrastructure project replaced an outdated lagoon treatment system with a recycled and refurbished mechanical wastewater treatment facility. After it was determined that the original plan to construct a new plant was cost-prohibitive, Clarkdale officials decided to purchase and refurbish a decommissioned wastewater treatment plant from a subdivision in Surprise, AZ. The 2013 project was funded by the Water Infrastructure Finance Authority of Arizona (WIFA), who subsequently awarded the Town of Clarkdale the WIFA's Clean Water (for wastewater infrastructure) Project of the Year award.

1. ADEQ PERMITS FOR BWRF

The Arizona Department of Environmental Quality (ADEQ) issued the Town two (2) permits to operate the BWRF. The permits include the following:

Type III Recycled General Permit for a Reclaimed Water Agent LTF ID #94873 - This ADEQ issued permit allows for the Town to act as the agent for the reuse of reclaimed / recycled water per AAC R18 – 9 -7. This would allow the Town to determine who can reuse reclaimed water. It would be the responsibility of the Town to maintain contracts with the designated end users to guarantee the reclaimed water is being used appropriately and that the end users are in compliance with the requirements and regulations of AAC R18-9-708. The permit is valid for five years per AAC R18 -9-709. The permit is currently active until 8/26/2027.

Aquifer Protection Permit (APP) No. 105414, LTF No. 55479 – This ADEQ permit authorizes the Town of Clarkdale to operate the BWRF. This permit became effective Nov. 4, 2013 and is valid for the life of the treatment facility. Tertiary treatment of effluent is obtained through use of tertiary filters and chlorine

disinfection. This permit also authorized the Town to produce a maximum average monthly flow of 0.35 MGD of Class A+ effluent, which may be reused for beneficial use.

2. SITE INFORMATION

The BWRP is located at 375 S. Broadway Street, in the Town of Clarkdale. The plant property consists of a 9.86-acre parcel bounded to the east by the Verde River, north by Deception Gulch, west by two parcels owned by the Town of Clarkdale totaling approximately 11.14 acres, and to the south by private property and East Tuzigoot Road.

The BWRP site is surrounded by a chain link fence topped with three strands of barbed wire, which runs along around the entire plant site. Site access is provided via the main access drive from South Broadway Street and traverses through adjacent Town owned property. This is the only form of ingress/egress to the plant site.

The BWRP site has been graded to be relatively flat with most of the treatment plant elevation at or around EL 3,360.0. The natural topography slopes from west to east, as elevations drop towards the Verde River. The plant site itself is located within Zone AE (100-year) as shown in the figure below. According to the current plant construction record drawings dated 10/24/2013 by SEC, Inc the site grading provided elevations above the 100-year Base Flood Elevation (BFE), but not the 500-year BFE.



3. TREATED EFFLUENT DISPOSITION

The BWRP discharges A+ quality effluent through an effluent booster pump station located on the treatment plant site through a pipeline to the Town's VRIC Irrigation site. Additional descriptions of those facilities may be found in Section IV of this report. All recommendations appearing throughout the condition assessment and recommendations for future improvements will be in accordance with maintaining A+ effluent.

C. DESIGN CRITERIA

1. EXISTING BWRf BASIS OF DESIGN

Constructed in 2013, the current BWRf configuration was designed and constructed based on the following design criteria as documented in the record drawings for the Wastewater Treatment Plant Improvements project dated Oct 24, 2013.

Parameter	Value	Unit
Average Daily Flow	350,000	gpd
Peak Day Flow	420,000	gpd
Hourly Peaking Factor	2.2	
CBOD5	275	mg/l
TSS	250	mg/l
TKN	45	mg/l

Table 66 – Existing BWRf Basis of Design

2. INFLUENT CHARACTERISTICS

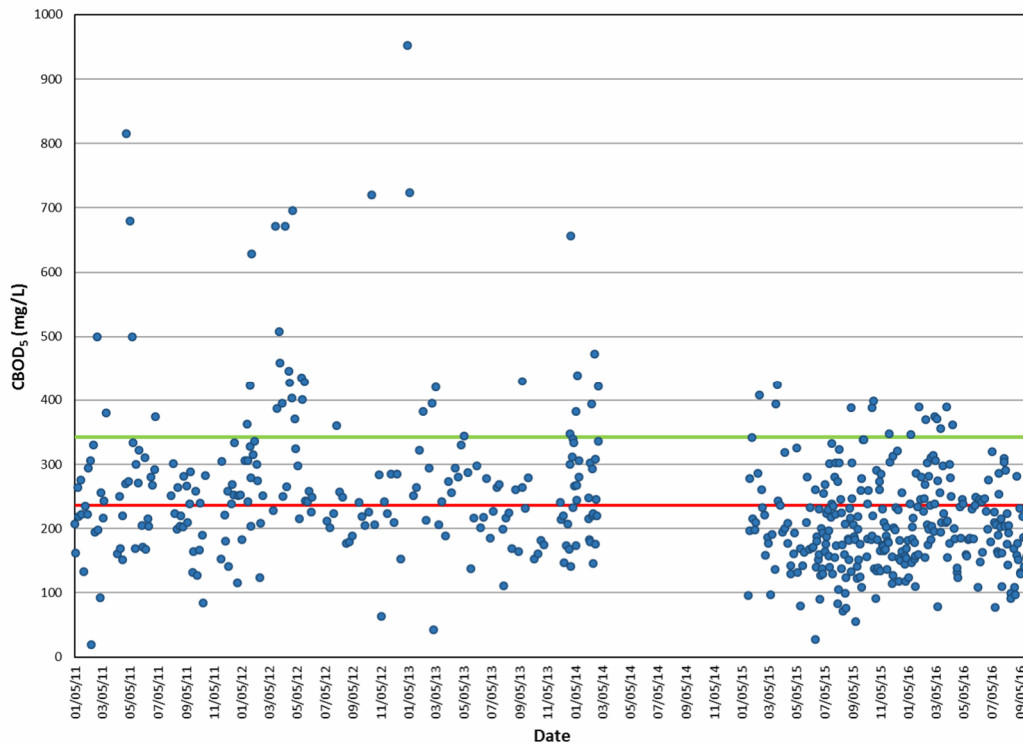
At the time of this report, sufficient influent data was not available to analyze existing influent data, due to certain constituent not being required to be tested for the current permit. However, prior to any preliminary process design or expansion of treatment capacity, we recommend sampling and collecting the above input parameters for several months overlapping seasonal changes from the BWRf to:

1. Validate the original design criteria as presented in Table 66 – Existing BWRf Basis of Design; and,
2. Develop design influent characteristics for the currently developed and undeveloped areas within the BWRf Service Area.

Typical design organic loading parameters are calculated as the average value of each parameter plus one or two standard deviations depending on the condition of the data set and available plant redundancy. With the availability of sufficient data, design influent characteristics for developed areas within the BWRf Service Area would be based on existing BWRf influent data. Wastewater from the currently undeveloped areas are likely to have higher organic loadings due to lower base infiltration rates, low flow plumbing fixtures, etc., so design influent characteristics for these areas should be based on influent data from the similar new growth areas.

BWRf influent wastewater samples need to be collected and analyzed for an extended duration of sample information will be documented (analyte description, location, sampler type and frequency, composite or grab, laboratory information, sampling period, etc.), results would then be presented for each sample parameter in graphical format in the form of scatter plot data for influent CBOD5, TSS, and TKN at the

BWRF. A sample graph is shown below for CBOD₅. The red line represents the average of the parameter, and the green line represents the average value plus one standard deviation



3. FLOW PROJECTIONS

The average daily influent flow from 2022 and 2023 averaged 149,131 gpd with a peak month flow of 154,748 gpd. Recent monthly flows for April and May 2024 have been consistent at approximately 153,000 gpd. Overall flow projections are discussed in Section IV, Part 5 Current and Future Demands and summarized below. These values are used to help determine future plant sizing and phasing. Based on the projections presented above, the anticipated ADF is 575,645 gpd with a Peak Average Daily Influent flow of 745,316 gpd.

	Average Daily Influent (gpd)	Peak Average Daily Influent (gpd)
Current Existing Flow	149,131	154,748
Additional Sewer Flows	46,800	55,442
Future Converted Septic	65,792	68,362
Sub-Total Existing Service Area	261,723	278,552
Future New Developments	313,922	466,764
Anticipated Ultimate Flow	575,645	745,316

Table 67 – Total Anticipated and Full Buildout Sewer Demand

4. BWRf DESIGN CRITERIA

As previously discussed, increased loadings for flows originating from future undeveloped areas will utilize a higher planned pollutant loading resulting from low flow potable fixtures. Due to the nature of the BWRf Service Area, approximately 45% of the buildout influent flow (0.26 MGD) will be from existing developed areas and 55% of the buildout influent flow (0.31 MGD) will be from areas of future growth. As a result, a composite influent loading is necessary to determine the design influent parameters for planning a BWRf expansion. With the absence of current influent data, we utilized the original design concentrations. The influent parameters shown in Table 66 – Existing BWRf Basis of Design are applied to flows from currently developed areas and the influent parameters shown in Table 68 – BWRf Undeveloped Area Influent Characteristics are applied to flows resulting from future growth.

Parameter	Value	Unit
CBOD5	350	mg/l
TSS	300	mg/l
TKN	65	mg/l

Table 68 – BWRf Undeveloped Area Influent Characteristics

The loadings presented in Table 69 – Influent Loadings were used to calculate design influent parameter concentrations for the ultimate BWRf for planning purposes and are presented in Table 70 – Design Influent Parameters.

	Flow (MGD)	BOD5 Loading (lb/day)	TSS Loading (lb/day)	TKN Loading (lb/day)
Developed Area	0.262	622	565	102
Undeveloped Area	0.314	937	803	174
Composite Loading	0.576	1,559	1,368	276

Table 69 – Influent Loadings

Parameter	Value	Unit
CBOD5	316	mg/l
TSS	277	mg/l
TKN	56	mg/l

Table 70 – Design Influent Parameters

Composite loadings for the ultimate/buildout planning period result in higher design influent parameter concentrations than loadings from the current influent flow. These higher design influent parameter concentrations will be used for the BWRP planning for future expansions. The composite loadings may reduce the capacity rating of the current biological treatment capacity.

D. EXISTING PLANT FACILITIES

The existing BWRF is operated by the Town staff and contract operators. The plant is well run by knowledgeable staff who maintain a well-kept record of operational data and prioritize efforts to optimize plant operations. In addition to regulatory effluent water quality testing, routine process control tests conducted by plant staff include:

- Settling test
- Temp & pH
- Mixed liquor
- Examination of sludge characteristics
- Microbiology investigation
- F/M ratio

The BRWF is a conventional activated sludge plant of circular modular design whereas the biological treatment, clarifier, and digester are all located within a common wall steel tank structure. This is commonly referred to as the biological treatment unit (BTU) throughout previous drawing sets. The plant was manufactured by Smith & Lovelace and furnished as a complete operating unit. Preliminary treatment consists of a manual bar screen followed by a comminutor before the influent pump station where flow is pumped to biological treatment and then flows by gravity to the clarifier. Clarifier effluent flows by gravity to tertiary filtration and then to the effluent pump station. Immediately after the effluent pump station, chlorine is added for disinfection before being pumped to the reuse site. Biosolids are dewatered via belt filter press and the cake is sent to a landfill. A standby generator provides critical backup power should there be a power outage. In the following sections, more detailed information for each process area is provided.

1. PRELIMINARY TREATMENT - INFLUENT BAR SCREEN & COMMUNUTOR

Influent flow enters the plant through a 12" Vitrified Clay Pipe, then to an existing junction structure and from there through an 18-inch ductile iron pipe gravity line directly to a manual bar screen. The manual screen is constructed of 304 SS, with 2-inch nominal clear spacing, 2.0 ft wide; covering the complete channel width, and extending to the top of the influent channel with a perforated drying plate integrally connected to the bar rack. The bar screen appears to be in good condition and removing large objects and rag accumulation as intended. While no bypass channel is provided, the headworks structure was constructed with a 15-inch containment curb. Should the bar screen become blinded under normal design flows, influent flow levels could rise above the bar screen and screenings drying rack and flow over the grating into the downstream channel to the influent lift station wet well without having an illicit discharge.

The hydraulic nature of the 18" intake pipe and channels within the headworks have been reviewed and will not create a bottleneck when the plant is operating at its anticipated ultimate daily peak flow of 745,316 gallons (Table 67).

The existing headworks does not have grit removal; however, the design of the headworks structure provided an inlet and outlet channel for a future grit removal system. While the exact type of intended grit removal system is unknown (not shown on the drawings) it appears to be set up for an inground Smith & Lovelace Pista Grit type system.

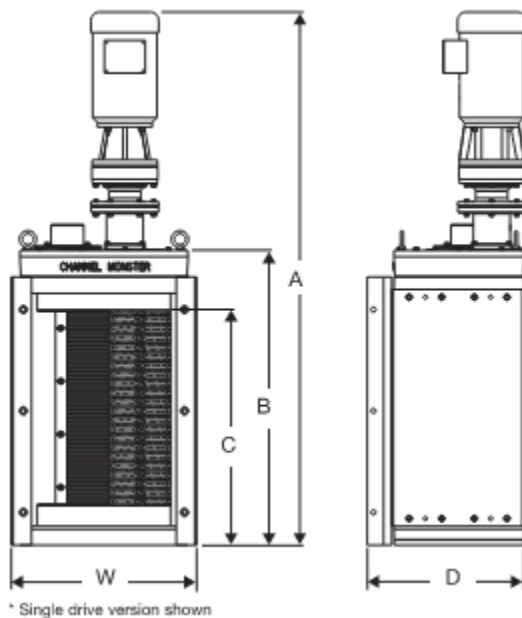
Downstream of the manual bar screen and future grit removal diversion channels is a single JWC Environmental 5 hP Model CMD 1810-XDS2.0 "Channel Monster" to grind up any material that may pass through the bar screen. The comminutor is designed to pass the full width of the channel. A bypass channel with isolation gates is provided should the comminutor require maintenance. The Channel

Monster has been in service for more than 10 years. Improvements to the design in new models have increased efficiency and reduced maintenance. Additionally, material that passes the coarse bar screen will eventually end up in the treatment plant. Often, these small ground up pieces conglomerate and cause downstream problems that will be exacerbated with increased flows.

The control panel for the comminutor is located adjacent to the headworks structure in a painted enclosure, mounted to a stainless steel Unistrut rack. The controls appear to be in good shape and operating as designed at the time of the site visit.

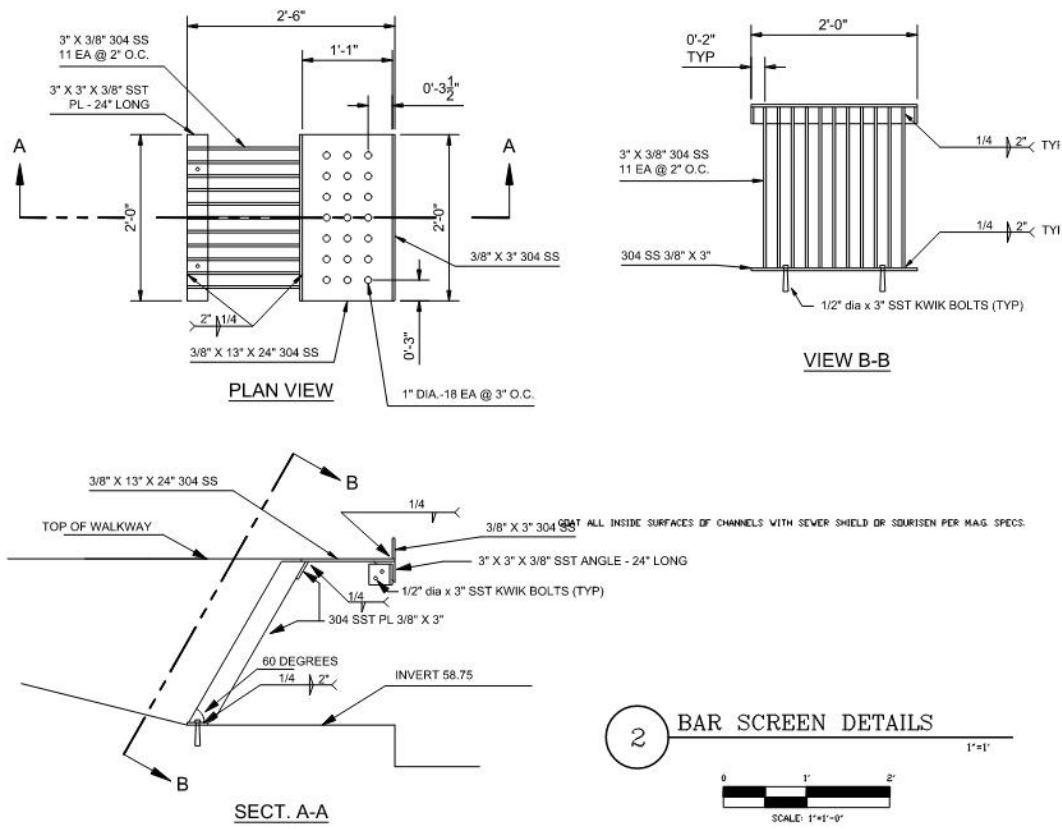
Comminutor Operating Parameters	A (Inches)	B (Inches)	C (Inches)	D-Min. (Inches)	W- Min. Channel Width (Inches)	Max Flow Coil Drum (GPM)	Max Flow Perf Drum (GPM)	Weight (lbs)
	60	30.5	22.75	21.75	21	1848	1655	1093.4

Table 71 - Comminutor Operating Parameters



Bar Screen Operating Parameters	Width (Ft)	Height (Ft)	Installation Angle (Degrees)	Bar Width (In)	Bar Nominal Spacing (In)	Free Flow Area (ft2)	Screen to Open Channel Area Ratio
	2'-0"	2'-0"	60	21.75	2	3.3125	0.828

Table 72 - Bar Screen Operating Parameters



Influent Bar Screen and Comminutor



Comminutor Top View

2. INFLUENT LIFT STATION

The influent lift station is a below grade rectangular cast-in-place concrete wet well structure, common wall constructed with the headworks in 2013 as part of the most recent major BWRf construction project. The lift station is approximately 8 feet long, 10 feet wide and 14 feet deep. The lift station is configured to accommodate four (4) submersible pumps. Two (2) Flygt Model 3127.180 pumps are currently installed with space to add two (2) more pumps in the future. The existing pumps were relocated from the Desert Oasis WWPT in Surprise, AZ, along with much of the other process equipment. The existing pump hatches appear to be in good shape and are equipped with secondary safety grates for fall protection. The ductile iron riser pipes from each pump combine in a single discharge header above grade, before going below grade. Once underground, the 8-inch force-main that leads to the BTU splits into two 8-inch force-mains, while transitioning to PVC, with the ability to isolate each force-main with a valve.

The influent pumps are operated automatically based on wet well level via float controls. The pumps are run at constant speed and operate in the lead/lag mode configuration with lag mode operating as the redundant pump and high-level alarm just above the lag pump “on” level. Table 73 - BWRf Influent Lift Station Data below provides design criteria and analysis of the existing influent lift station:

BWRf INF Lift Station			
Pump Station Elevation	3350	Pump Make	Flygt
Pumping Rate	605 gpm	Pump Model	3127.180-202mm
Pumping Pressure	44' head	Pump Impeller	202 mm
Inlet Diameter	N/A	Outlet Diameter	3.94"
Number of Pumps	2 (room for additional pump in future expansion)	Pump Motor HP/Power	10 hp
Pump Year Installed	2013	RATED CURRENTS @ 480V	15 A
Pump Type	Submersible	Lift Station Wet Well Capacity/Dimensions	8'X10'X13.7'deep 8,198 gallons

Table 73 - BWRf Influent Lift Station Data



Wet Well and Discharge Piping



Wet Well Cover

3. BIOLOGICAL TREATMENT & CLARIFICATION

Raw influent is pumped directly to a fabricated steel circular modular concentric wastewater treatment plant manufactured by Smith & Lovelace, Model R. A flow meter is located on the side of the treatment plant to measure incoming raw sewerage flow. A bypass system is also provided to allow maintenance and repair of the flow meter without taking the plant off-line. The biological treatment unit was relocated from Surprise, AZ to Clarkdale and constructed on a cast in place concrete foundation. This configuration combines the benefits of modular design with the space efficiency of a concentric layout. The plant features a concentric circle design, often referred to as a “bulls-eye” layout.

The surrounding outer treatment stages are arranged in concentric partial rings around the clarifier. These stages include both the biological treatment reactors, commonly referred to as aeration basins and aerobic digester, as well as a separate compartment for the central core that houses the clarifier.

The biological treatment occurs in several separate stages. The first two stages involve anoxic zone wastewater treatment for denitrification, and is a process designed to enhance the removal of nitrogen compounds, particularly nitrates and nitrites, from wastewater. This method is crucial for preventing nutrient pollution in water bodies, which can lead to issues like eutrophication and is required to meet A+ reclaimed water. The biological treatment is provided in three (3) stages as described below.





Stage 1 – Anoxic Zone 1. Raw wastewater enters the first anoxic zone, where it combines with mixed liquor from the Aeration Zone (Stage 3) via a 10-inch recycle return line. This mixture contains a high concentration of denitrifying bacteria. In the absence of free oxygen, these bacteria use the oxygen bound in nitrates (NO_3^-) and nitrites (NO_2^-) as electron acceptors to break down organic matter. This process converts nitrates and nitrites into nitrogen gas (N_2), which is harmlessly released into the atmosphere. A submersible mixer is located in the first stage anoxic zone to ensure thorough mixing of the wastewater and mixed liquor recycle, promoting efficient denitrification.

Stage 2 – Anoxic Zone 2. Partially denitrified wastewater enters the second anoxic zone, where additional denitrification occurs. This stage ensures that any remaining nitrates are converted to nitrogen gas. A submersible mechanical mixer ensures thorough mixing of the wastewater and sludge, promoting efficient denitrification. An additional airlift pump is located in Anoxic Zone 2 to provide mixed liquor

recycle (MLR) flows for further reduction of remaining ammonia into nitrates and provide operational flexibility and optimization of F/M ratio. By utilizing anoxic conditions, the process reduces the need for aeration, which lowers overall energy consumption.

Stage 3 – Aeration Zone. The effluent from Anoxic Zone 2 flows to the aerobic zone for further treatment and polishing before clarification. This zone is mostly responsible for removing CBOD5. Multistage centrifugal blowers pump air through coarse bubble diffusers that supply required oxygen to the process. The structural walkway supports around the clarifier weir circumference also serve as the main air distribution header. Two-inch (2") air drops are located radially outward from clarifier walkway in the aeration zone. Air flow to each 2-inch drop is controlled manually via a ball valve for isolation and to fine tune the volume of air for various plant conditions. The operations staff have determined, through full scale process tests, the optimum air valve settings throughout the aeration basin. Their optimized approach generally favors a “tapered” defined by fewer air drop valves open at the beginning of the aeration basin with more open valve positions towards the end.



Mixed liquor from the third biological treatment stage then enters the secondary clarifier into a central feed well. Flow is distributed radially, allowing for even settling by providing quiescent environment where the biological solids (activated sludge) can settle out from the treated wastewater. This step is essential for ensuring the clarity and quality of the effluent before being sent for further treatment. A rotating arm with scrapers collects the settled sludge from the bottom and directs it to a sludge hopper. The clarified water is collected from the top via controlled v-notch weirs and a launder trough and directed to the effluent channel. Waste and return sludge from the clarifier is pulled from the sludge hopper. The operator controls these flows via air-lift pump with both volume of air and time of operation. At the time of the site visit the clarifier was working properly, although it is now showing signs of age.

The last treatment compartment in the “bulls-eye” plant is the aerobic digester and is designed to reduce the volume of sewage sludge and make it suitable for disposal or further use. Aerobic digestion is a biological process that uses oxygen and microorganisms to break down organic matter in wastewater sludge. This process helps in reducing the volume of sludge, eliminating pathogens, and converting organic materials into stable substances.

Concentrated sludge through sedimentation (secondary clarifier) increases the concentration of organic matter. The concentrated sludge pumped from the clarifier sludge hopper via airlift pump to the digester. The digester is then aerated to provide the necessary oxygen for the microorganisms. Aeration is achieved through the same blowers and air header that serves the aerobic zone 3. The microorganisms rapidly consume organic matter, leading to a reduction in sludge volume. As the readily available organic matter depletes, microorganisms start consuming their own cells, further reducing sludge volume and stabilizing the remaining sludge. As a matter of regular operation, plant staff will decant the digester to continuously thicken the digester, making more room available for additional biomass. The volume of the aerobic digester appears to have adequate sludge capacity.



The existing plant tank was relocated from Surprise, AZ and recoated when erected at the BWRF. While the plant is well maintained, the tank will require recoating that can only be achieved through removing the tank from service. Without the addition of a second or subsequent treatment trains, a full tank inspection and recoating is not possible. Additionally, the structural integrity of the steel dividing wall between the aeration basin and the aerobic digester is a concern as the movement in the wall shape has been observed. Optimization of the treatment process places more air volume at the end of the aeration train, which appears to put more dynamic loading on the Divider Wall No. 4. Plant staff have reduced air volumes to reduce potential stress on the wall. If/when a second BTU is constructed and this BTU can be removed from service for maintenance, we recommend adding structural gussets and supports to the dividing wall.

Two Gardner-Denver model GD741 multi-stage centrifugal blowers powered by 150Hp constant speed motors provide air to the aeration basin and aerobic digester. One blower serves as a duty unit while the other as standby. The blowers were refurbished blowers from Desert Oasis. The blowers appear to be in good mechanical condition and are well maintained. From field observations, the bearings are not original and have been fairly recently replaced. Discharge from each blower is combined in a single header leading to the circular modular plant. The blowers are manually operated, with operations staff alternating the equipment to balance run times. Manual discharge pressure and temperature gauges provide data to monitor equipment performance.

The blowers are located in an enclosed CMU building with rollup door for access. The building appears to be in good shape, providing necessary storage of spare parts and equipment. There is no room to add any additional equipment to the existing blower building for expansion. Controls are mounted in a single control panel that appears to be furnished with the original plant and relocated to the BWRP. No emergency stop buttons were observed in the blower room, near the equipment.



Blowers Control Panel



Multi-Stage Centrifugal Blower



Motor and Blower

4. EFFLUENT FILTERS

Clarified effluent is piped to the exterior of the circular modular tank and leads to the tertiary filters. The original design included an option to inject polymer to the clarified effluent prior to filtration. Current plant operation does not utilize polymer injection due to maintenance nuisances such as clogging of polymer lines. Additionally, the polymer system has not been needed to produce A+ effluent. The original equipment has been removed.

The BWRP acquired and installed a used tertiary filter as part of the major plant upgrade in 2013. The filter was originally manufactured by Kruger and is also known as the Hydrotech Discfilter. It's a highly efficient and compact filtration system customarily used in wastewater treatment. It is designed to remove suspended solids from wastewater, providing high-quality effluent suitable for various applications, including reuse and discharge.



The core of the system consists of multiple filter discs mounted on a central drum. Each disc is covered with a polyester microscreen media that captures suspended solids. As the wastewater passes through the filter media on both sides of the discs, suspended solids are trapped on the surface of the media. The filtered water, now free of suspended solids, flows into the collection tank. The central drum supports the filter discs and facilitates the flow of water through the system. An automated backwash system cleans the filter media to maintain filtration efficiency. As solids accumulate on the filter media, the water level in the central drum rises. A level sensor detects this rise and triggers the backwash process. Filtered

effluent is pumped to backwash spray nozzles utilizing a nearby vertical multistage centrifugal pump, which cleans the filter media by spraying water at high pressure. The dislodged solids are washed into a sludge trough, removed from the system and flow via the 4" BW pipe to the belt press filtrate pump station. The disc filter maintains 100% filtration capacity even during the backwash cycle, ensuring continuous operation. An advanced control system monitors and adjusts the operation of the disc filter to ensure optimal performance.

Due to the age of the filter, regular maintenance is required. Plant staff appear to keep the filter in proper working order and perform routine maintenance. At the time of the site visit, the media showed signs of wear and may be due for replacement. The control panel is also showing signs of wear and may be due for replacement.

There is only one tertiary filter, creating an operational vulnerability should the filter require significant maintenance activity. In the event of such maintenance requiring the filters to be taken offline, a bypass loop exists and would be utilized to maintain plant operation. However, the lack of filtration would reduce effluent quality. Accordingly, due to the importance of keeping this process in service, it is best practice to provide redundancy to avoid degradation of effluent quality at any time. The addition of a second filter would be relatively easy as the previous project included pipe stub for a second disc filter.

Tertiary Disc Filters		
Loading Area of Discs	132	SF
Peak Day Loading Rate	2.2	GPM/SF
Backwash Pumping Rate	40	GPM
Backwash Discharge Rate	30	GPM

Table 74 - Hydrotech Disc Filter Operative Capacities



Multi-Stage Centrifugal Blower



Multi-Stage Centrifugal Blower

5. BWRf EFLUENT LIFT STATION & PLANT WATER SYSTEM

Broadway Water Reclamation Facility Effluent Lift Station

Filtered effluent flows from the tertiary filters via gravity to a reinforced concrete effluent pump station wet well. The wet well was constructed as part of the 2013 BWRf project. The structure can accommodate three (3) effluent pumps (two currently occupied, one empty for future use/expansion) and also houses a plant water pump (described later in this section). The existing two (2) effluent pumps were relocated from the old effluent pump station on the BWRf site. The pumps are connected to a single header with isolation valves for service. A blind flange is located at the end of the header to accommodate a future third pump. The effluent pump station is controlled by an ultrasonic level transducer and turbidity is monitored for quality compliance. From the BWRf, treated effluent is pumped to a ground storage tank that is part of the reuse system. Additional detail on the reuse system operation and future disposition may be found in Section III – Reclaimed Water System.

The wet well structure appears to be in good condition. The pumps are well maintained, but due to their age, major repairs may become more likely. The discharge piping and pump baseplates are showing signs of corrosion and should be recoated soon to maintain pipe integrity and longevity. Additionally, the wet well should be inspected and cleaned as appropriate.

BWRf Pump Station			
Pump Station Elevation	3361	Pump Make	Simflo
Pumping Rate	400 gpm	Pump Model	SB10C-5
Pumping Pressure	220' Head	Pump Motor Make	Nidec Motor Corp
Inlet Diameter	N/A	Pump Motor Model	BF40
Outlet Diameter	6"	Pump Motor Year Installed	2013
Number of Pumps	2 (room for additional pump in future expansion)	Pump Motor HP/Power	30 HP, 1800 RPM
Pump Year Installed	2013	Pump Discharge Size	6"
Pump Type	Vertical Turbine	Recommended Maintenance	
Lift Station Wet Well Capacity/Dimensions	6'X13'X14.5' deep 8,460 gallons		

Table 75 - BWRf Effluent Lift Station Data



BWRf Effluent Lift Station Pumps

Plant Process Water System

The plant water system consists of a single vertical turbine pump that draws treated effluent from the effluent pump station wet well. The plant water system is used at various locations around the plant for general washdown, tertiary filter backwash, and belt filter press cleaning. To help maintain system pressure and reduce pump short cycling, the plant water system is equipped with a 528-gallon bladder style hydropneumatic tank. The plant water system is controlled by a pressure switch that initiates pump operation based on an adjustable set point. The largest intermittent demand on the plant water system is the belt filter press wash water. If a future expansion does not require an additional or bigger belt filter press, a plant water system expansion may not be necessary.

Plant Process Water Booster Pump			
Pump Station Elevation	3360'	Pump Make	Goulds
Pumping Rate	100 gpm	Pump Model	7WALC
Pumping Pressure	115' Head	Pump Motor Make	Baldor
Inlet Diameter	6"	Pump Motor Model	12E712W742G1
Outlet Diameter	4"	Pump Motor Year	
Number of Pumps	1	Pump Motor HP/Voltage	7.5 HP, 230V
Pump Type	Vertical Turbine		

Table 76 – Plant Process Water Booster Pump



Process Water Pump



Plant Process Water System

Hydropneumatic Tank			
Tank Elevation	3360'	Tank Make	John Wood Company
Capacity	525 gallons	Tank Type	Bladder Type Expansion Tank
Tank Diameter	48"	Tank Model	JBER 25-017
Observed Operating Pressure	62psi	Year Installed	2013
Maximum Design Pressure	125 psi	Recommended Maintenance	

Table 77 - Plant Process Water System Hydropneumatic Tank



Hydropneumatic Tank

6. EFFLUENT RESERVOIRS

The North Reservoir is concrete lined with curb surround and served as an aeration pond while the South Reservoir (earthen) served as the stabilization pond prior to the current BWRP plant constructed in 2013. A significant portion of the South Reservoir was filled-in to construct the BWRF treatment plant, filters, solids dewatering and their support systems.

Parameter	Description
North Reservoir Volume	650,000 gal
South Reservoir Volume	1,660,000 gal
Total Volume	2,310,000 gal
Days at ADF	6.6 days

Table 78 - Effluent Reservoirs

At the present time, both reservoirs are utilized in emergency or maintenance situations. Should the plant not be able to handle incoming flows (either due to failure or higher than the plant's capacity), flow can be diverted to the North Pond and held until such time as flow can be pumped back through the treatment process by use of temporary pumps. Both the North and the South Reservoirs can be utilized to store treated plant effluent should there be an inability to utilize the effluent pump station (equipment failure) or should there be an issue at the reuse receiving facility. Both reservoirs appear to be in good condition and appropriately maintained and should continue their present day uses. For future plant expansions, any redundancy found in the use of the reservoirs will diminish as the addition of more process trains and equipment would also provide inherent redundancy.



Effluent Reservoirs

7. EFFLUENT DISINFECTION

The BWRP maintains a target chlorine residual of 8 mg/L utilizing a single Prominent Sigma/ 1 Basic motor-driven metering pump with a multi-layer safety diaphragm housed within a shed separate from the sodium hypochlorite bulk storage. The pump storage shed includes a controller with the option of a second pump, however, only one pump was noted to be operating within the shed during the onsite visit. Chlorine is provided in the form of a 12.5% sodium hypochlorite solution housed within a yellow plastic shed resting upon a perforated raised floor acting as a secondary form of containment should leaks occur. The sodium hypochlorite is pumped to the effluent pipeline and injected at a location directly adjacent to the metering pump shed. The metering pump provides sodium hypochlorite at a rate of roughly 23 gallons per day given an effluent flow rate of 350,000 gallons per day. The current system looks to be in good condition and of newer construction relative to the age of the rest of the plant.

Ideally redundancy is ideal for the disinfection system in the event of maintenance or downtime of the pump in current operation. Considering the space and already outfitted control and electrical system capable of operating in a duplex arrangement, this should be taken into consideration and included as an option during Phase I plant expansion.





8. BELT FILTER PRESS

Excess biosolids generated as part of the normal operation of the BWRf are aerobically digested in the circular-modular treatment tank. From the aerobic digester, waste sludge flows by gravity to belt press feed pump. The belt filter press is a skid mounted; self-contained unit as manufactured by Phoenix Process Equipment Company. The skid is located on a concrete slab and includes the belt press feed pump, washwater pump, air compressor, and polymer mixing and injection ring. Dewatered sludge cake is discharged from the BFP to a discharge chute where it is conveyed via 9-inch screw conveyor to a dumpster or dump truck where the biosolids are taken to a landfill for disposal.

The BFP is housed under a canopy structure. Plant staff have utilized heavy fabric to cover the sides to reduce weather elements (summer sunlight and winter cold & rain). The skid mounted equipment was in working order, and is well maintained, however, it is showing signs of wear.



Parameter	Description
Manufacturer/Model	Phoenix/LC800LS (serial #0712847)
Size	0.8 meter
Belt Press Feed Pump	Progressing cavity/30-45 gpm
Sludge Conveyor	9-inch dia by Keystone Conveyor Corp

Table 79 – Belt Press

The polymer system is a separate equipment item from the BFP skid and housed in a small, separate reinforced fiberglass structure. The polymer system is furnished by Velodyne (model VH-1P-300-D) and includes polymer feed pump, dilution water system, mechanical mixing pump, solenoids, and controls for a complete system. The polymer system control panel is connected to the BFP control panel in order to make process adjustments from a single location.



The polymer system appears to be in good condition and well maintained. Because of the nature of polymer systems and frequency of use, they often require maintenance. The polymer system's location is in a relatively small enclosure, making maintenance difficult. Additionally, the polymer enclosure requires heat in the winter to keep the lines from freezing and pipes free of blockages.

Although the frequency of the BFP operation is relatively low, having only one unit does create redundancy concerns and adding a second BFP could be cost prohibitive. Accordingly, discussions with plant staff and the climate of Clarkdale present an opportunity to employ a relatively old, but simple technology. Gravity sludge drying beds would be an option to allow not only redundancy, but potentially lower operational costs. More is discussed in the Capital Improvement Projects section below.

9. FILTRATE PUMP STATION

Backwash from the tertiary filter and filtrate from the belt filter press are routed by gravity to a standalone pump station. The pump station is routed to the aeration basin for treatment. The backwash pump station consists of a circular wet well with submersible pumps and simple float level controls. The pump station appears to be well maintained and was in working order at the time of visit. Some riser pipe corrosion was observed in the wet well and should be recoated in the future to prevent further deterioration.

Parameter	Description
Manufacturer/Model	Flygt DP 3057 MT
No.	2
Wet Well Diameter & Depth	5' diam/10' deep
Recommended Maintenance	Drain and recoat wet well interior

Table 80 – Filtrate Pump Station



Filtrate Pump Station Wet Well Interior

10. ELECTRICAL & INSTRUMENTATION

Electrical power is provided by Arizona Public Service (APS) via an underground feeder to a pad mounted transformer providing 277/480V, three phase, 600A rated service. The main distribution section and automatic transfer switch (ATS) was relocated from Desert Oasis WWTP. Standby power is provided via 350KW diesel generator.

The current WWTP last underwent a major expansion in approximately 2013. A major part of that project was the repurposing of many wastewater treatment components, including their subsequent electrical panels from the Desert Oasis WWTP in Surprise, AZ. Although “new” to Clarkdale, many of these electrical components are nearing 20 years of service. Most appear to be in working order. A detailed condition assessment should be completed before the next major project to determine what components are recommended for replacement. Below is list of the major items that were repurposed.

- Incoming Main Service Entrance and ATS Section
- 350KW Diesel Standby Generator
- Influent Pump Control Panel
- Package WWTP Control Panel
- Tertiary Filter Control Panel

Equipment around the plant is fed power through an underground duct bank system. The previous phase of construction appears to have been constructed for future expansion to accommodate two additional biological treatment units identical to the existing.

The BWRf SCADA system consists of remote I/O modules at various vendor panels (effluent pumps, BTU, etc.) that are connected to an overall plant PLC located in the PLC cabinet in the office building. An operator terminal computer is used to access equipment status. A radio antenna is mounted on an adjacent pole with a connection signal to the Town Hall WAN.

11. EXISTING VULNERABILITIES/DEFICIENCIES

BWRF has the following vulnerabilities that should be addressed as funding and schedule allow. Major process units around the facility lack redundancy, making maintenance on key equipment difficult and leaves the facility vulnerable to failures. The following key process units lack redundancy in the plant:

- Influent Bar Rack
- Comminutor
- Biological Treatment
- Secondary Clarifier
- Tertiary Filters
- Disinfection/Chemical Feed

Influent Bar Rack: The existing influent bar rack does not have a bypass channel. Should the bar screen become obstructed influent is able to flow over the height of the bar screen and remain contained in the channel.

Comminutor: There is a bypass channel that allows for the maintenance of the comminutor, however, this allows material that flows through the bar screen to be passed down stream without the use of the comminutor. This can lead to downstream issues in the facility that only worsen with higher flows.

Biological Treatment and Secondary Clarifier: The existing biological treatment and secondary clarifier are housed in the existing concentric plant that was relocated from a different WWTP and has remained in service since 2013. In the facility's current configuration, it cannot be taken out of service for necessary maintenance. Should the existing BTU/secondary clarifier fail, or be taken offline, the facility would no longer be functional. As discussed previously, the plant has coating and structural concerns but cannot be fully inspected while in service. It is recommended that a second plant be added to the facility to allow for needed repairs as well as redundancy against potential failures.

Tertiary Filters: The effluent filter is functional in its existing state. An existing bypass can be utilized to keep the BWRF in operation should this filter go out of service. However, this would result in a lower quality effluent from the facility. It is recommended that a redundant filter be constructed to protect against failures and any substantial maintenance that the existing filter requires.

Disinfection: The existing disinfection system lacks redundancy, which is critical to maintaining the quality of effluent produced by the facility. A second unit is recommended.

E. FUTURE BWRf IMPROVEMENTS

Current project drivers for improvements at the BWRf include aging infrastructure requiring greater frequency of maintenance, and future growth that will exceed the capacity of the current plant. Although not identified at this time, another potential future driver for improvements is often due to more stringent effluent regulatory requirements that require additional treatment. At the present time, the plant is operating just under 50% of its design capacity.

Although the existing facility is meeting current treatment requirements, many components of the system were provided as refurbished equipment and relocated to Clarkdale from other communities. While providing significant capital cost savings, more extensive maintenance is required on a more frequent interval/basis. Additionally, many of the plant components do not have redundancy, creating a challenging environment to repair and maintain the refurbished equipment. The lack of redundancy puts the facility at a higher risk of treatment excursions should a vulnerable process unit suffer a failure and require repair or replacement. Table 81 - BWRf Major Process Equipment Summary presents a summary of the major process equipment items, their origin, and current redundancy.

Process Unit	Year/Origin	Redundancy	Notes
Influent Bar Rack	2013 Upgrades	No	Passive hydraulic bypass around
Comminutor	2013 Upgrades	No	Existing manually operated bypass channel
Influent Lift Pumps	2013/Relocated from Surprise WWTP	Yes	Have redundant influent pump
Biological Treatment	2013/Relocated from Surprise WWTP	No	Originally manufactured in 2003
Secondary Clarifier	2013/Relocated from Surprise WWTP	No	Originally manufactured in 2003
Blowers	2013/Relocated from Surprise WWTP	Yes, have standby blower	Originally manufactured in 2003
Tertiary Filters	2013/Relocated from Surprise WWTP	No	Originally manufactured in 2003
Effluent Pumps	2013/Relocated the previous BWRf effluent pump station	Yes	Original effluent pumps existing prior to 2013
Disinfection/Chemical Feed	E, I&C (2013), Pump, Injector, and Tank unknown	No	E and I&C for additional pump installed in 2013

Table 81 - BWRf Major Process Equipment Summary

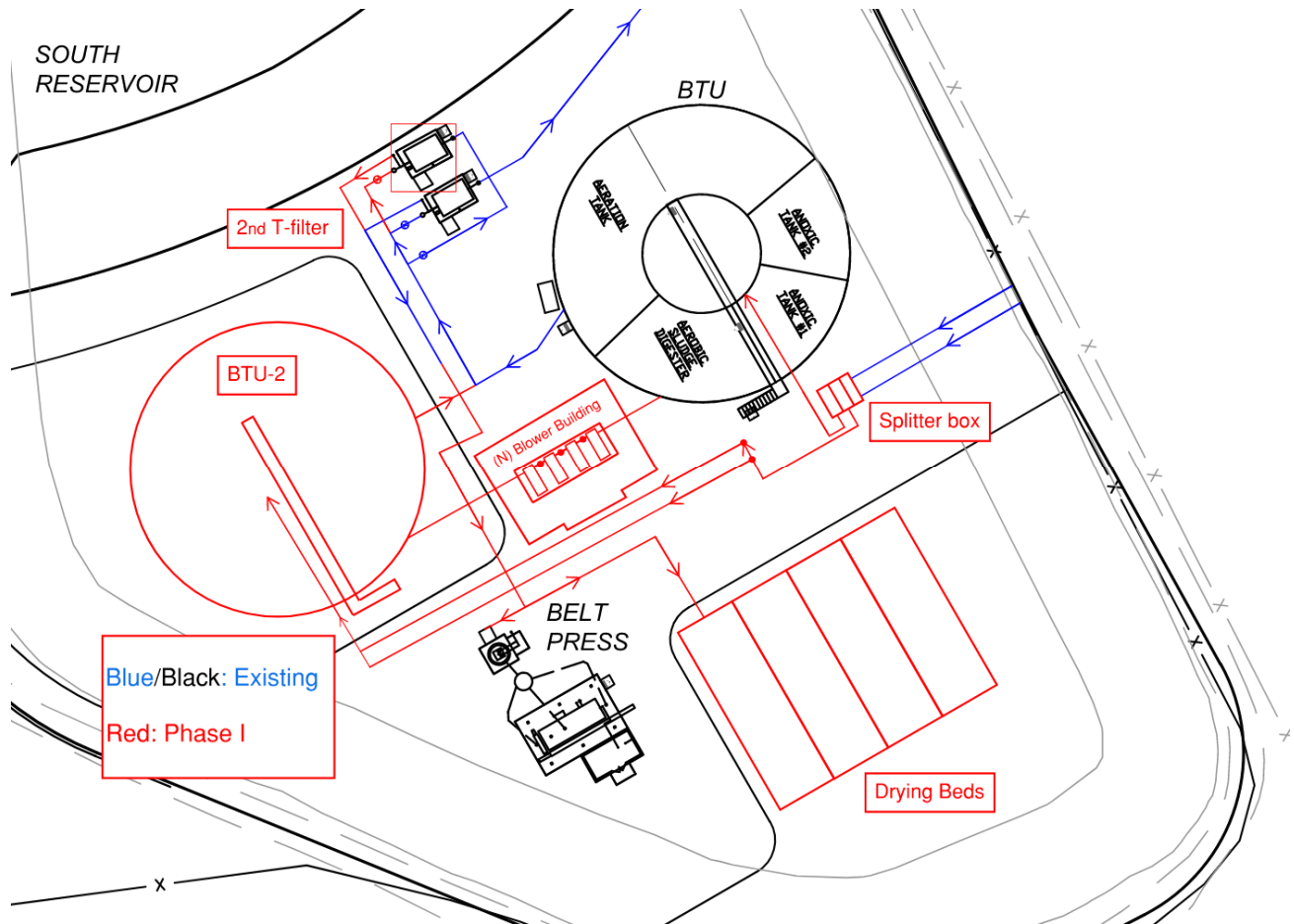
While the current flows are below 50% of the plant capacity, we recommend the Town consider adding redundant treatment systems where appropriate to accommodate imminent preventive maintenance and repair of the existing treatment processes. This will also have the added benefit of accommodating additional future flow from new development. We have divided these recommendations into two major phases summarized below.

Phase I will address the provision of process redundancy as well as capacity increases for future development. Phase I is included in the CIP Section with associated cost estimates. While presented as a single project, opportunities exist to address each process area as separate multiple phases which could be achieved through additional workshops with Town staff.

Phase II addresses options to provide redundancy at full plant buildout as well a replacement and/or addition of equipment that may be at the end of its useful life.

1. PHASE I IMPROVEMENTS

Provided As-Built drawings provided by the Town identified two onsite locations for additional modular plants to be constructed. Each phase will include the addition of one modular plant in each previously marked location with associated equipment and appurtenances. With a second modular plant online prior to flows reaching the capacity of the existing plant, the existing plant can be taken offline for necessary rehabilitation work (as mentioned in Section VI.D.3), which will address structural concerns between the aeration and digester wall, inspection and recoating the BTU, inspecting and replacing air diffusers as required, and address any other areas of concern discovered after draining and inspection of the plant that may not be known at this time. Phase I incorporates additional modifications to existing facilities as



described below:

- Headworks
 - Replacement of Comminutor or potential addition of a redundant new comminutor in the bypass location to provide redundancy.
 - A recommended feature would be the addition of an automated barscreen prior to the influent wet well and lift station. However, after a preliminary investigation, that would require additional channel improvements (removal of knockouts currently shown, etc), and construction of a new channel adjacent to the current one. Additional details and specifics should be addressed during preliminary stages of the Phase I design.

- Influent Wet Well and Pumps

The current firm (assuming largest pump is out of service) hydraulic capacity of the influent lift station is 605 gpm (0.87 MGD) with just one of the two existing pumps. The ultimate projected hourly peak flow of the BWRP is approximately 880 gpm (using a 2.2 peaking factor). To meet the peak hourly flow requirement, we recommend adding two smaller sized “jockey” pumps instead of similar sized pumps. The proposed capacity of each is 250 gpm each or 0.350 MGD. Incorporating jockey pumps can optimize energy usage, reduce wear-and-tear on the existing pumps, and enhance flow control through the plant. This strategic adjustment not only meets current and future flow requirements but also supports sustainable and cost-effective plant operations. Exact pump selection is not suitable at this time and would require diurnal flow analysis with high/low flow events. This would provide pertinent flow information that would allow selection of pumps that would better match incoming flows.

Influent Hydraulic Flow		
	Average Daily Flow	Peak Hour (2.2PF)
Current Plant Capacity	0.35 MGD/243 gpm	0.77 MGD/534 gpm
Ultimate ADF	0.576 MGD/400 gpm	1.267 MGD/880 gpm

Table 82 - Influent Flows

- New Flow Splitter Box

Efficient flow split control will be vital to plant operation as additional modular units are added to the BWRP. Currently, raw sewage is fed to the plant through two redundant 8” force mains that tee off the line just before entering the existing modular plant (BTU-1). The tee was installed along with additional piping and stub-outs to support an additional BTU onsite. This method of flow splitting will not be sufficient for controlling flows with a second (BTU-2), or third (BTU-3), modular plant running simultaneously with BTU-1 because different pipe configurations to each BTU provide different hydraulic losses, creating uneven flow distribution. With varying flows throughout the day, utilizing a valve to balance flows is not possible as headlosses vary at different flow rates and partially open valves often become clogged over time in wastewater service. A splitter box is commonly recommended to address this issue.

The installation site must be carefully selected and prepared. According to as-built drawings, a location on the pipe run between the 90-degree bend on the INF feed line and the modular plant inlet seems to be a reasonable location to install the splitter box. The force main must be temporarily shut down, and the flow diverted or managed during installation. Given the system’s existing INF feed line redundancy, installation and construction of the splitter box should have minimal interference with BTU-1 daily operations. The splitter box will be designed with stub outs for Phase II expansions, as well.

Once the splitter box is installed and securely connected, the system can be tested by gradually reintroducing flow into the force main and monitoring the splitter box for signs of leakage or malfunction. Adjustments may be necessary to optimize the flow distribution and ensure that the splitter box functions as intended. Detailed documentation and maintenance plans should be established to ensure the long-term reliability of the splitter box.

- Second Biological Treatment Unit (BTU-2)

A second, identical Smith & Loveless Model R Oxigest modular plant (MP2) will be erected onsite in the lot to the west of BTU-1. Construction to erect BTU-2 should be completed with minimal interference to

daily operations of BTU-1. The initial intent of Phase I will be to get BTU-2 online, tested, and functioning. Once completed, the focus will shift to rehabilitation of BTU-1, that has been in service since 2013 and should be taken offline for maintenance. Based on projections, a single BTU should have sufficient capacity to handle maximum flows during construction. BTU-2 should be able to sufficiently manage flows in solo operation while rehabilitation work is completed on BTU-1. Offline investigation of BTU-1 will be needed to identify deficiencies of the operational zones.

- Blower Building

The addition of more modular plants will require an additional multistage centrifugal blower for each modular plant added to the system. A three-BTU system will require a minimum of four blowers (three duty, one standby) depending on the setup. The existing blower building currently houses two blowers (duty and standby) that supply air to BTU-1. There is insufficient space to install additional blowers in this building, which leaves two options: 1) construct a second blower building to house additional blowers included in Phase I and II expansions, or 2) demolish the existing blower building and erect a new, larger building capable of housing four blowers. Provided As-Built drawings show a second onsite blower building location (Option 1) just to the west of the existing blower building. Option 1 allows for minimal interference to BTU-1 operations during construction and would essentially mirror the existing plant and blower building.

Option 1 also presents challenges such as the design of air supply lines. The existing structure combines the discharge from each blower into a single header that protrudes through the blower building wall closest to BTU-1 and feeds into the BTU. The header from the proposed blower building No. 2 would need to be connected to the header from blower building No. 1 to allow for full blower redundancy.

Option 2 simplifies these issues by locating all the blowers in a single new building. The existing building would be demolished, and temporary blowers would be needed during construction to allow the existing blowers to be taken offline. The new blower building would house a total of four blowers (three duty, one standby) with combined discharge through a single header, similar to the existing design. Operators could manage the aeration system without having to walk between different buildings and simplify flow split and control. The building can be designed to have additional storage space, an upgraded SCADA control system, emergency stop(s), and other operational amenities. Air supply lines from an undetermined three-way flow split will branch off from the combined header protrusion and located to supply BTU-1 and BTU-2 with a blind flange for proposed BTU-3. The BTU-1 and BTU-2 supply lines should be fairly simple, short runs given the proximity to both BTUs.

Both options provide features to consider during preliminary design. The costs presented at the end of this section are for Option 1.

- Tertiary Filter Addition

To achieve redundancy for the plant's current operating parameters, an additional, identical disc filter should be installed utilizing the existing piping stub outs for installation. A backwashing pump must be installed adjacent to the new filter and will provide water from the filtered effluent line. For future planning of Phase II, stub outs should be provided for a third filter. Considerations for control and electrical service to be provided for the pump should be anticipated during design.

Initial operation of the new redundant system should alternate filter use as necessary to avoid fouling of filters; however, once flows reach 20% their combined capacity, they can both be placed in continuous operation. Existing infrastructure allows for the installation of additional filters without taking the existing filter offline by utilizing existing isolation valves. Additional isolation valves will be installed on the effluent side of the filters for operational purposes.

- Disinfection

The current disinfection system's maximum operating point with one pump in operation is 6 gph providing roughly three times the theoretically required 50 gallons of sodium hypochlorite per day for the anticipated ultimate plant buildout capacity of approximately 750,000 gpd. The current pumps feed rate can also accommodate the peak hourly flow considering a peaking factor of 2.2. Currently, the BWRP only has one pump. To achieve redundancy on identical site and maintain A+ grade effluent in the event of taking the existing pump offline, an additional metering pump should be installed utilizing the existing E and I&C infrastructure installed in 2013.

Given the age of the system, a more thorough review of operating conditions should be assessed with regards to system optimization or maintenance. Specific consideration should be given to the injector, E and I&C equipment, piping insulation, and general spacing of components.

- Effluent Pump Station

The effluent pump station has been pre-equipped for installation of a third identical pump; however, installing a third pump to accommodate additional flow provides little benefit as the system head conditions (combination of dynamic losses due to force main velocity and static head) is approaching the current pump's capability. Both existing pumps discharge to a single 6" header where disinfectant is added before effluent is pumped to the VRIC site. The pumps are currently adequate for the ultimate average daily flow (~400 gpm), but not the ultimate daily peak (~500 gpm) or the ultimate peak hour (~900 gpm). Operating two pumps simultaneously would not provide sufficient flow rates to keep up with the ultimate peak hour flow but may keep up with the ultimate peak daily flow, at greatly reduced efficiencies. Current observed operating pressures were observed at approximately 90 psi. Additional analysis is recommended during the preliminary design phase of Phase I to determine the most economical solution. One option is to utilize the existing polishing pond as storage during periods of flow when the effluent pump station cannot keep pace. Another option is to add an additional 6-inch forcemain that would reduce the overall system head conditions, providing for additional pumping capacity at more optimal efficiencies. Corresponding improvement may be necessary to the disinfection chemical feed system as that system is sized based on the flowrate of the effluent pump station.

Effluent reuse capacity of the VRIC and/or other proposed recharge locations would also need to be considered. The effluent lift station will need to be reevaluated once options for alternative reuse have been selected by the Town. Replacement of pipeline from the effluent station to the VRIC will likely need to be included in future effluent station improvements. The existing wet well appears to be in good shape but some minor repairs, maintenance, and recoating should be performed on existing pumps due to their age.

- Drying Beds

As an option to provide redundancy for current solids handling and dewatering, drying beds are viewed as a solution that can be installed at the location pictured in the Phase I construction figure. Sludge drying beds are relatively inexpensive and low maintenance. They would be designed to cover approximately 10,000 sf with four 10'x25' sections to meet the current solids loading rate of 730lbs/day. The sizing is based on the requirement for the sludge drying bed loading rates to be 27.5lbs/sf yr.

The perimeter of the drying bed would have an 8' wide 8:1 grade perimeter dike that would transfer to a 1:1 slope at the top of the dike to keep surface water from entering the drying bed. The drying beds would have a sloped bottom from the side to the center to drain any sludge decant. Within the drying beds a layer of sand would rest above the drain followed by a layer of gravel for the sludge to dry on top of. The

depth of the drying beds is based on the maximum allowable sludge cake thickness of 24 inches and to allow for a 12-inch gap between the sludge layer and the influent sludge pipe.

Operations staff would need to account for the removal of the dried sludge cake manually using a front-end loader or some other equipment. Consideration would be given to adding concrete or other hardened surface ramps to support the wheels of the proposed machinery to reduce overall maintenance.

The addition of the sludge drying beds, in combination with the current belt filter press capacity would provide ample dewatering capacity at ultimate buildout. Should BTU-3 be constructed, the most logical location would be in the location proposed for the sludge drying beds. At that time, the Town can evaluate if a second belt filter press is more desirable than relocation of the sludge drying beds based on historical use.

Ancillary systems required for the sludge drying bed include a secondary polymer system. Static polymer mixers typically require a 20-psi pressure differential for best results. Accordingly, because these pressures cannot be achieved by gravity draining of the aerobic digester, the addition of a drying bed feed pump will be necessary.

- Electrical and Instrumentation Improvements

The existing electrical service entrance and transformer will require upgrades to meet the additional electrical load as the total current load will almost double. During the Phase I design process, a detailed condition assessment of the existing electrical panels should be conducted to identify components that need to be upgraded to ensure a reliable system. In addition to an additional or larger replacement distribution section, the anticipated vendor supplied panels include:

- o New Muffin Monster
- o Biological Treatment
- o Tertiary Filter

Other existing panels, following favorable condition assessment, that will require modification include:

- o Influent Lift Station
- o Effluent Lift Station

Additional generator capacity will also be required. Following the detailed condition assessment, a determination can be made with input from the Town on the most economic selection for additional generation capacity with potential installation of paralleling switchgear or to simply replace the existing generator with a larger size and upgraded ATS.

Absent input from the Town, the existing instrument architecture could be maintained while bringing the SCADA software licensing up to date, depending on the age and date of the current system. Included in the budget presented below, we anticipate updates to the main PLC, workstation, server, and data historian. A fiber optic loop may be considered to new and old panels using fiber optic patch panels to enhance reliability and avoid premature damage or degradation of cables and terminations to reduce SCADA related failures.

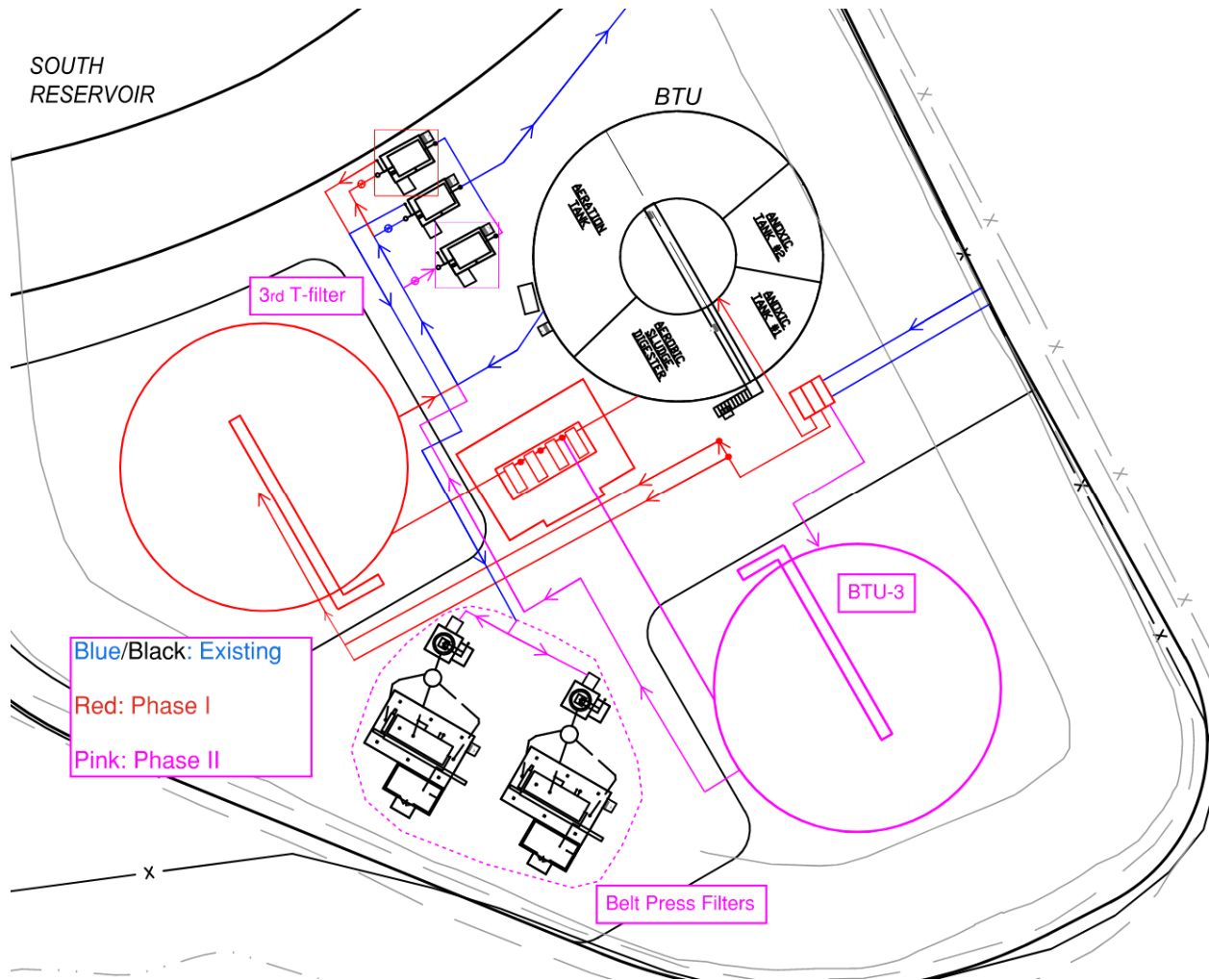
New control panel design would include materials compatible with the environment that generally include NEMA 4X stainless steel. Any panels with thermally sensitive equipment will include cabinet heaters and/or climate control systems.

- Operations Building

The existing operations building appears to serve its intended purpose, which is to provide space for the overall plant PLC cabinet, operator terminal, unisex bathroom, and area for a desk and reference materials and documentation. We understand the building has not had any major updates since it was constructed and would anticipate it is due for updates.

2. PHASE II IMPROVEMENTS

Phase II will be focused on the construction of a third modular plant (MP3) in the location shown on the southwestern portion of the BWRF site. Much of the Phase I work accounts for auxiliary support for MP3 to be constructed. With Phase I complete, the BWRF should be pre-equipped to provide ample baseline aeration requirements, power, and influent flow control split to allow MP3 to be brought online/into service once erected. Belt press improvements and a third tertiary filter are other aspects of Phase II.



To achieve operation redundancy for the ultimate buildout plant operating parameters, a third equivalent disc filter (for a total of three filters) should be installed utilizing the existing piping stub outs and isolation valves for installation. A backwashing pump shall be installed adjacent to the new filter and will provide water from the filtered effluent line. For future planning of Phase II, stub outs should be provided for a third filter. Considerations for control and electrical necessary to operate the pump should be anticipated during design.

For solids handling improvements, the sludge drying beds will require relocation to make room for BTU-3. The Town could evaluate the beneficial use of the drying beds and either opt to fill in part of the old effluent stabilization pond or purchase a second belt filter press.

Cost estimates for Phase II are not provided in this report as these are optional recommendations to be implements at some point in the future. We suggest re-evaluating this necessity after Phase I is completed and a better understanding of future growth and flows are known.

VI. CAPITAL IMPROVEMENT PROJECTS

Improvements to address the previously identified deficiencies have been identified as CIP projects below. Other improvements listed could expand the capabilities of the systems and deliver the services to more customers. CIP projects listed address the short- and long-term infrastructure needs based on the master plan. Projects in each category are put in the order of importance based on conversations with staff.

Construction cost estimates have been provided for the CIP projects listed below. The following costs are approximate as construction cost estimating can be highly variable depending on many factors outside of the control and scope of those estimating the costs. Once projects have been selected for implementation, detailed cost estimates should be performed with designed construction plans to more accurately determine costs.

A. WATER SYSTEM

STORAGE

To address future storage deficiencies and to address the condition of the existing tanks, the following improvement projects are recommended. CIP are summarized in Table 83 - Water Storage CIP below.

Project Name	Estimated Cost	Priority	Timing
89A Tank Replacement (1-1.5 MG)	\$4.3 Million	Very High	1-2 years
Haskell Springs Tanks Bypass Connection	\$100,000	Very High	Completed Prior to Finishing MP
Haskell Springs North Tank Recoating and Rehab	\$350,000	High	1-2 years
Haskell Springs North Tank Improvements	\$175,000	Medium	1-2 years
Haskell Springs South Tank Recoating	\$300,000	Medium	2-5 years
Haskell Springs South Tank Improvements	\$200,000	Medium	1-2 years
Mountain Gate Tank Recoating	\$300,000	Medium	2-5 years
Mountain Gate Tank Improvements	\$300,000	Medium	2-5 years

Table 83 - Water Storage CIP

89A Tank Replacement

Replace the existing tank, approximately 500,00 gallons (wooden roof), with a new bolted steel tank with a capacity of 1-1.5 MG. The project would include demolition of the existing tank and removing it from the system. This tank is currently planned to be part of the Clarkdale Water Campus project.

Haskell Springs Tanks Bypass Piping Connection

To be able to take one of the Haskell Springs Tanks offline for maintenance, a bypass line should be installed to separate the tanks as needed. The Town has hired a contractor and has competed this work prior to the completion of this Master Plan.

Haskell Springs North Tank Improvements

To improve the Haskell Springs North tank this project would include adding a tank mixer and replacing the level transducer, target board and valves.

Haskell Springs North Tank Recoating and Rehab

To rehabilitate this tank to working order, work would require the repair and replacement of roof beams inside the tank, removing the existing interior tank coating, and then recoating the inside of the tank.

Haskell Spring South Tank Improvements

Improvements to the Haskell Springs South tank would include adding a tank mixer and replacing the level transducer, target board, and valves.

Haskell Springs South Tank Recoating

To bring this tank back into operating condition, the tank should have its interior coating replaced, including removal of the existing coating.

Mountain Gate Tank Recoating

The interior coating of this tank is showing signs of deterioration. This project would remove and replace the existing interior coating.

Mountain Gate Tank Improvements

The improvements to the Mountain Gate Tank include replacing the level transducer and installing a CI2 Residual Analyzer. It also includes adding a site effluent flow meter and tank mixer.

SUPPLY

To address the existing vulnerability of the Town's water supply and to provide additional supply for known future growth, it is recommended to drill/outfit additional wells and to expand the production capabilities of the Mountain Gate Well. The following improvement projects are recommended:

Project Name	Estimated Cost	Priority	Timing
89A Well Site Replacement	\$1.3 Million	High	1-2 years
Haskell Springs Well	\$160,000	Medium	1-2 years
Mountain Gate Well Improvements	\$450,000	Medium/High	5 Years+
Mescal Well Improvements and Transmission Line	\$4.0 Million	Low	5 Years+
Cemetery Well	TBD	Low	1-2 years
Additional Well	\$1.3 Million	Medium	5 Years+

Table 84 - Water Supply CIP

89A Well Replacement

This project involves redrilling and outfitting the 89A well near the existing 89A well. The well will be drilled to a depth of 925 feet and tested for arsenic and yield. Should the arsenic level be high, or the yield is lower than desired, the well will be drilled to an additional depth of 475 feet and retested. It is anticipated that the 15-inch borehole will be drilled using the air rotary method. The well will include a surface casing and a 10-inch steel casing pipe. Once yield and quality are known, the well will be outfitted with the pump and necessary discharge piping. Final configuration will depend on the quality and output of the new well. The desired pumping capacity for this well is 300+ gpm.

Haskell Springs Well

The Haskell Springs Well needs to have a generator plug and disconnect installed for temporary emergency power in times of outages. The well also needs Cl₂ Residual Analyzers. The Haskell Springs well pump and VFD should also be replaced.

Mountain Gate Well Improvements

The Mountain Gate Well improvements would include removal and replacement of the existing well pump and replacing the column pipe with a larger diameter pipe. Increasing the pump size and pumping rate at this well will need to be completed after the Arsenic Treatment Plant capacity has been increased and can handle the additional production from Mountain Gate. The Mountain Gate Well also needs to have a generator plug and disconnect installed for temporary emergency power in times of outages.

Mescal Well Improvements and Transmission Line

Mescal Well has been already drilled and tested. The well is estimated to be able to produce 300 to 400 gpm. The water from the well is high in arsenic and will need to be treated. The well will need to be outfitted including all pumps, pipes and electrical equipment. The project would include the installation

of a 1.5 mile 8" transmission line from the well to the existing ATP at the 89A Arsenic Treatment Plant. There are plans for the plant to be expanded, which would give the Town the flexibility to run the Mountain Gate Well and Mescal Wells at the same time or either of the wells independently.

Additional Well

Once the 89A well is in service and the Mountain Gate well is upgraded, the Town should explore adding an additional well to the system. One option would be to investigate putting the north Haskell Springs well back into service. Depending on well location and treatment requirements, the cost could vary greatly, due to water quality and waterline connections. The above cost is an estimated cost to drill and outfit a well in the Clarkdale area, assuming no treatment is needed, and additional water mains are not needed.

Cemetery Well

The Cemetery Well is being redrilled. Final configuration for the well pump, treatment requirements, and connection of this well to the distribution system will be determined once the water quality and yield of the well is known. Once the scope of the project is more defined, cost estimating can be performed to determine budgets.

DISTRIBUTION & FIRE FLOW

The following projects address known distribution vulnerabilities and provide fire flow to the areas identified as fire flow deficient.

Project Name	Estimated Cost	Priority	Timing
Panorama Booster Pump Station Replacement	\$376,650	Medium	5 years+
89A Booster Pump Station Flow Meter	\$22,000	Medium	1-2 years
Haskell to 89A Waterline Flow Meter	\$22,000	Medium	1-2 years
Black Hills Neighborhood Waterline Replacements	\$9.5 Million	Medium	2-5 years
Centerville and Mingus Shadows Neighborhoods Waterline Replacements	\$3.1 Million	Medium	2-5 years
2.5" Fire Hydrant Replacements	\$50,000	High	1-2 years
Valley View PRV	\$110,000	High	1-2 years
12" Main on Clarkdale Pkwy	\$725,000	High	1-2 years
Panorama Way Water Main	\$721,000	Medium	5 years +
Richard St/Kerrie Lee Dr Water Main	\$853,000	Medium	5 years +
S 9th St Water Main Replacement	\$600,000	Medium	5 years +
Austin Way/Skyline Blvd PRV Connection	\$223,500	Medium	5 years +
Old Centerville/Ave Macias PRV Connection	\$720,000	Medium	5 years +
Susan Ave/Jerry St Water Mains	\$600,000	Medium	5 years +
Calle Figueroa Water Main	\$200,000	Medium	5 years +
Patio Park - Fiesta St/ Siesta St Water Main	\$1.2 Million	Medium	5 years+
Upper Crossroads Water Services	\$300,000	High	5 years +

Main/N 7th St PRV Gate Valves	N/A	High	Immediate
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Table 85 - Water - Distribution/Fire Flow CIP**Panorama Booster Pump Station Replacement**

The current Panorama Booster Pump Station should be replaced in its entirety. This project would include the removal of the existing booster pump station, building/doghouse, and the hydropneumatic tank on top of the hill on Panorama Way. Construction of the new booster pump station would include a new building, piping/connections, and site grading a new access road.

89A Booster Pump Station Flow Meter

The 89A Booster Pump Station needs a flow meter to be able to track the amount of water that is pumped from the Mountain Gate Tank to the Haskell Springs Distribution Area and Tank.

Haskell Springs Tank to 89A Flow Meter

To be able to track the amount of water that is transferred from Haskell Springs Wells/tanks to the 89A site, a flow meter would need to be installed on the gravity line entering the 89A site.

Black Hills Neighborhood Waterline Replacements

This replacement project would include approximately 34,000 LF of pipe, 55 valves, pavement replacement, 30 fire hydrant replacements, and 325 services from the main to the meter.

Centerville and Mingus Shadows Neighborhoods Waterline Replacements

The replacement project would include 9,000 LF of pipe, 34 valves, pavement replacement, 20 fire hydrant replacements, and 140 services from the main to the meter.

2.5" Fire Hydrant Replacements

If the Black Hills Waterline Replacement project is not selected for implementation, the Town should replace the existing 2.5" fire hydrants. This project would include the removal and replacement of four fire hydrants with new standard hydrants. Improvements would include removal and replacement of pavement, landscaping and other surface improvements in the area of the existing hydrants.

12" Main on Clarkdale Pkwy Replacement

This replacement project would include 3,550 LF of pipe, pavement replacement, and valves. The proposed water main would replace the existing from the 89A site northeast along Clarkdale Parkway to near the intersection of 3rd South Street and South 15th Street. This waterline would be constructed parallel to the existing water main. The existing water main would be abandoned once the proposed water line was in use.

Panorama Way Water Main

This project is contingent on the Panorama Booster Pump Station replacement. Once the booster pump station is replaced and sized to supply fire flow, approximately, 2800 LF of 8" water main would need to be replaced, including existing valves, fire hydrants, and services from the main to the customers meters.

Richard Street/Kerrie Lee Drive Water Main

Replacement of the existing water main from Richard Street at Lanny Avenue to Sam Court, along Old Jerome Highway and down Kerrie Lee Drive. Approximately 1,700 LF of waterline replacement.

Patio Park – Fiesta Street/Vista Lane Water Mains

Fire flow in this neighborhood would require upsizing approximately 1,400 LF of existing water main. The project would be constructed using primarily 8" PVC as well as the replacement of valves, fire hydrants and services from the water main to the meter. While fire flow can be achieved with 1,400 LF replacement, this project can be implemented as a part of a larger replacement project. An additional 2,400 LF of water would be required to replace the entire neighborhood. The cost above represents the estimated cost of replacing the entire neighborhood.

South 9th Street Water Main

This project replaces approximately 2,000 LF of undersized water mains including valves, fire hydrants and services from the main to the meter in order to provide fire flow to this area. This project would require the removal and replacement of existing pavement to facilitate the construction of the new water main. As previously mentioned, should this project be chosen for implementation further investigation to verify the extent of the replacement would be required. The quantity and cost estimate reflect the replacement of the entire run as shown in Appendix A5 Fire Flow System Improvements.

Austin Way/Skyline Boulevard PRV Connection

A PRV connection between Austin Way and Skyline Boulevard would provide additional flow to Mescal Spur, Lisa Street, Skyline Boulevard, and portions of the Black Hills Neighborhood. The purpose of this project would be to provide fire flow to these areas identified as fire flow deficient. The scope of the project would be a new PRV station and approximately 500 LF of 8" water main as required to make the connection to the existing water mains.

Valley View PRV

A new PRV station is needed on the waterline on Valley View Road to provide an additional feed line to the Centerville neighborhood. This would provide a looped system, which would allow the neighborhood to stay in service due to line breaks and would increase the available fire flow. The PRV station would be constructed on the existing 8" water main.

Old Centerville/Avenue Marcias PRV Connection

This project consists of a new PRV station and 450 LF of 8" water main to connect the existing mains. This water main would replace the existing undersized 2.5" water mains. 8" water mains would provide adequate fire flow rates and would decrease pressure drops during high usage.

Susan Avenue/Jerry Street Water Mains

This project would consist of the replacement of approximately 2250 LF of existing 4" water main with 8". This project would include necessary valves, replacement of existing fire hydrants and services from the water main to the meter. This project could be included with a larger replacement project; but should the Black Hills Neighborhood not be selected for implementation; it is recommended that this project coincide with the replacement of the existing 2.5" fire hydrants.

Calle Figueroa Water Main

This project is needed to provide fire flow to this portion of the Centerville neighborhood. Once the additional connections are made to Centerville, an additional 700 LF of 8" water main on Calle Figueroa would provide fire flow capacity. This project could coincide with a larger replacement project in Centerville, or as a standalone project to replace the existing 1.5" water mains.

Upper Crossroads Subdivision Water Services

This project would consist of the replacement of all the water services to the properties in the Upper Crossroads Subdivision. Replacement would include services from the main to the meter, for the existing houses and vacant lots. Service replacement would require the removal and replacement of pavement for each service. Construction should also include a final chip seal of the streets to cover up the pavement trench patches.

Main/North 7th Street PRV Gate Valves

This project includes the installation of gate valves to replace the existing valves located in this PRV station. This will require a large portion of the Town's water system to be shut off during installation. The Town has already purchased the valves, and the installation will be completed by Town staff.

B. ARSENIC TREATMENT

To provide a backup treatment facility, expand the pumping capacity of the Mountain Gate well or provide treatment for future wells with elevated arsenic levels the following projects are recommended:

Project Name	Estimated Cost	Priority	Timing
Arsenic Treatment Plant Expansion	\$6 Million	High	1-2 years
Arsenic Treatment Plant Improvements	\$80,000	Medium	1-2 years

Table 86 – Arsenic Treatment CIP

Arsenic Treatment Plant Expansion (\$6 Million)

- Construct a new filter building sized to include four (4) new filter vessels with piping, valves, and controls to interconnect with the existing filter building. This provides 1200 gpm firm capacity.
- Replace valves and actuators as needed. Replace all air release and pressure relief valves.
- Replace existing instrumentation and gauges. Upgrade SCADA components and data to provide real-time water quality values, equipment status, flows, and other information needed to operate the ATP.
- Replace the existing 4" backwash drain piping with 6" PVC.

This project is currently planned to be part of the Clarkdale 89A Water Campus project.

Arsenic Treatment Plant Improvements

The Arsenic Treatment Plant needs to have a generator plug and disconnect installed for temporary emergency power in times of outages. The well also needs Cl2 Residual Analyzers.

C. EFFLUENT MANAGEMENT

RECLAIMED WATER DISTRIBUTION

Section III Reclaimed Water System identified five locations for non-potable water reuse. Two alignments were identified and are shown in the figure on the following page. The following includes potential locations and infrastructure that may be required for reclaimed water use:

Project Name	Estimated Cost	Priority	Timing
Alignment #1 Phase 1 – Selna Mongini Park	\$861,000	Medium	2-5 years
Alignment #1 Phase 2 – Town Park	\$524,000	Medium	5 years+
Alignment #2 Phase 1 – Valley View Cemetery	\$770,000	Low	5 years+
VRIC Improvements	\$475,000	High	Immediate

Table 87 - Reclaim Water Distribution CIP

ALIGNMENT #1

Phase 1 Selna-Mongini Park

The elevation of the Selna-Mongini Park is approximately 3,462 feet. To serve the park, a potential alignment may include a pipeline connecting at the VRIC and extending approximately 3,100 feet east along Miller Road to North Broadway across the proposed Bitter Creek Bridge to the park. Per the Sunrise study, this alignment would require a 6-inch forcemain and potentially a booster pump station with a flow rate of 150 gpm and a 500-gallon hydropneumatic tank. A hydraulic analysis is recommended to confirm the need and determine the capacity of both the booster pump station and hydropneumatic tank.

Phase 2 Town Park

Town Park is located west of Selna-Mongini Park and south of Main Street. To serve the park, the same 6-inch pipeline serving Selna-Mongini Park could be extended an additional 2,000 feet along Main Street to Clarkdale Park. Since this would be a continuation of the main serving the Selna-Mongini Park, a hydraulic analysis is recommended to confirm the need and determine the capacity of both the booster pump station and hydropneumatic tank as the elevation of the Town Park (approximately 3,582 feet) is higher than the Selna-Mongini Park.

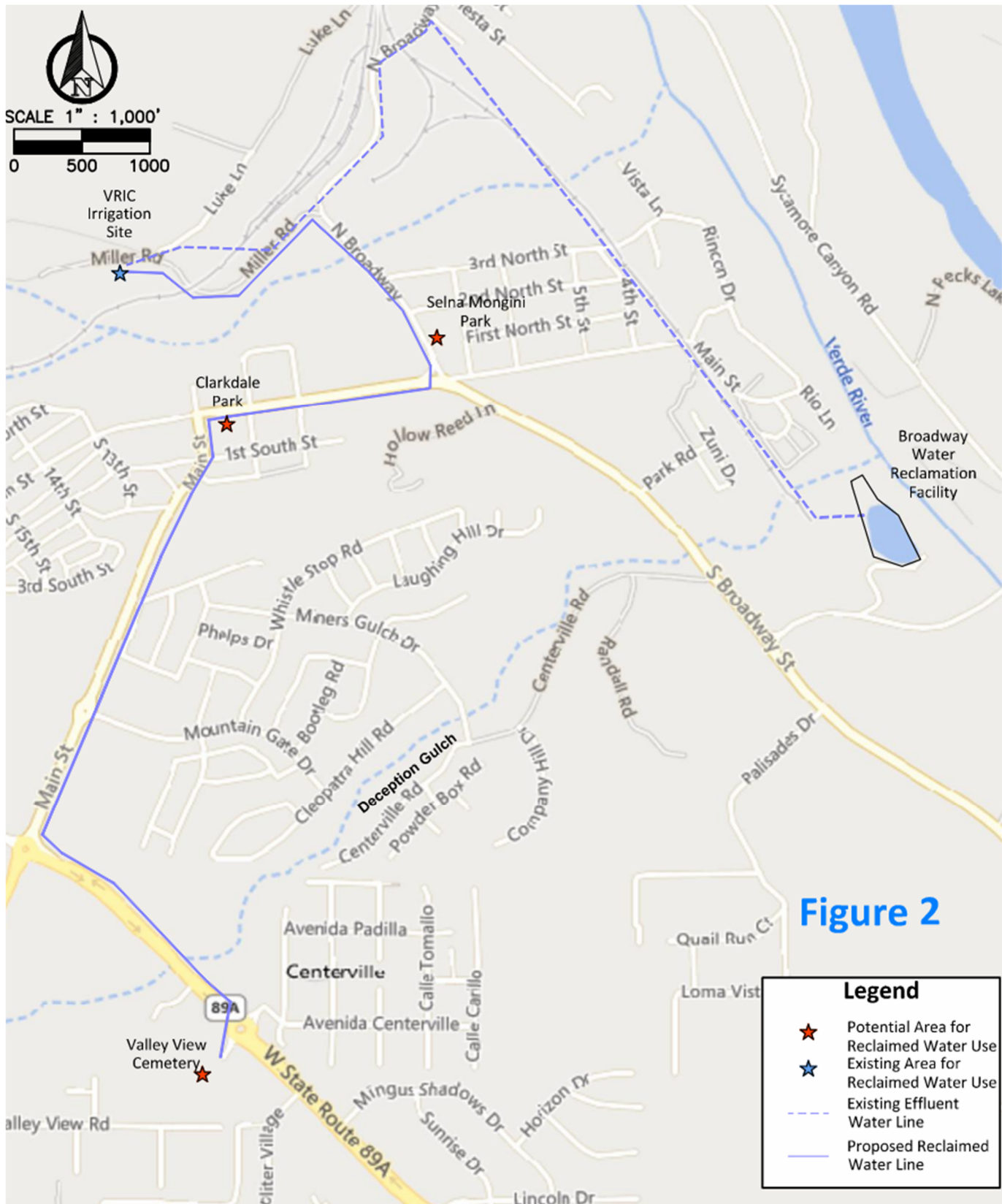
ALIGNMENT #2

Phase 1 Valley View Cemetery

The Valley View Cemetery is located between Old Jerome Highway and Route 89A and north of Lanny Lane. The cemetery is the largest of the locations identified and is estimated to encompass approximately 29 acres of irrigation area. To serve the cemetery with recycled water, a pipeline would need to be extended approximately 5,800 feet along Main Street and Route 89A. A hydraulic analysis is recommended to confirm the VRIC Booster Pump Station, has sufficient capacity and pressure to convey the estimated flows to the cemetery as the elevation of the cemetery is approximately 160 feet higher than the VRIC.

VRIC Improvements

The VRIC Improvements include replacement of the level transducer, Mercoid switches, level transducer, effluent sprinkler pumps (one currently on order) and flow meter. Also, the pump to the truck fill also needs to be replaced or rebuilt and a check valve needs to be installed. The tank also needs to be drained, cleaned, and interior coating needs repair. Also, the existing altitude valve should be replaced.



D. SANITARY SEWER COLLECTION SYSTEM

To address the deficiencies and vulnerabilities of the existing sanitary sewer collection system the following projects are recommended:

Project Name	Estimated Cost	Priority	Timing
3rd North Sewer Replacement	\$2 Million	Very High	Immediate - Currently Under Design
Alamos Lift Station Wet Well Replacement/Modifications	\$50,000	Very High	Immediate
Patio Park Gravity Sewer Replacement	\$2.5 Million	High	Within 5 Years
Main Street Sewer Replacement North Broadway - 9th Street	\$500,000	High	2-5 years

Table 88 - Sanitary Sewer Collection System CIP

3rd North Sewer Replacement

The 3rd North Sewer Replacement project is currently under design. The project consists of relocation and replacement of approximately 1,650 LF of gravity sewer main and 10 manholes.

Patio Park Sewer Replacement

The project would consist of replacement of approximately 6,700 LF of Orangeburg pipe with 8" SDR 35 PVC pipe, 25 manholes, and 54 sewer services to the property line. These totals represent the replacement of the entire Patio Park sanitary sewer system and the connection to Luke Lane. Should this project not get selected for implementation, it is recommended that known sections of 4" Orangeburg sewer main be replaced in a standalone project. This single replacement would be approximately 350 LF of 8" sewer main.

Alamos Lift Station Wet Well Replacement/Modifications

The existing Alamos Lift Station has a submerged inlet causing collection system surcharging and operational issues. The existing wet well should be replaced or modified to move the pumps lower than the gravity sewer inlet. The pumps must remain submerged for cooling and the inlet pipe should not be submerged during normal operation. The project would include full wet well replacement, extension of guiderails, extension of discharge piping, and possible extension of pump cables. Instead of replacing the wet well, the concrete that was added to the bottom of the wet well in 2013 could be removed to allow the lowering of the pumps.

Main Street from North Broadway to 9th Street

This project would require replacement of approximately 1,700 LF, seven existing manholes and five sewer services to the property line. The project would include removal and replacement of asphalt.

E. BROADWAY WATER RECLAMATION FACILITY

To address existing vulnerabilities and expand the capabilities of the facility to accommodate future developments the following

Project Name	Estimated Cost	Priority	Timing
Entire Phase I BWRF Improvements	\$18.2 million	Medium/High	2-5 years
Belt Filter Press Building	\$900,000	Medium	5 years+

Table 89 – BWRF CIP

Phase I BWRF Improvements (\$18.2 million)

This project and associated cost represent all the Phase I improvements as previously outlined in Section VI.E.1. Should the Phase I Improvements not be selected for implementation in their entirety, the projects in the following cost estimate can be chosen individually to upgrade key processes and equipment around the existing facility.

Town of Clarkdale BWRP Treatment Plant
PRELIMINARY PHASE I OPINION OF PROBABLE CONSTRUCTION COST

DESCRIPTION	QTY	UNITS	TOTAL COST
Mobilization, Bonds, Insurance, Permits, and Demobilization	5	%	\$648,273
Headworks and Influent			\$214,360
New Comminutor	1	LS	\$133,975
New Influent Jockey Pumps	2	LS	\$80,385
Biological Treatment Unit #1 Maintenance			\$803,850
Structural Repairs/Improvements	1	LS	\$133,975
Coatings	1	LS	\$535,900
Misc. Mechanical Improvements	1	LS	\$133,975
Biological Treatment Unit #2			\$4,573,610
Splitter Box	1	LS	\$401,925
Smith and Loveless Circular Modular Plant +Blowers	1	LS	\$4,019,250
Modular Plant Foundation	126	CY	\$152,435
Blower Buildings			\$224,740
Building 1 Improvements	1	LS	\$66,988
New Blower Building #2	280	SF	\$157,752
Filter Redundant Unit			\$325,809
Filter	1	LS	\$309,063
Filter Backwash Pump	1	LS	\$16,747
Disinfection			\$76,366
Sodium Hypochlorite Pump	1	LS	\$9,378
General Upgrades/Maintenance	1	LS	\$66,988
Effluent Pump Station Maintenance			\$66,988
Misc Pipe/Mechanical/Instrumentation Repairs	1	LS	\$66,988
Sludge Drying Beds			\$348,335
Drying Bed Cells	4	EA	\$214,360
Pump and Polymer System	1	LS	\$133,975
Operations Building			\$107,985
Operations Building Rehab	400	SF	\$107,985
Site Civil Improvements	8.0	%	\$1,037,237
Piping & Valves	15.0	%	\$1,944,820
Electrical and Instrumentation	20.0	%	\$2,593,093
Subtotal			\$12,965,465
Contingency	40	%	\$5,186,186
Grand Total			\$18,151,651

APPENDIX A: WATER SYSTEM

A1 Existing Water System Map

A2 Existing Pressure Zone Map

A3 Existing System Peak Day Demand Static Pressures

A4 Existing System Fire Flow Analysis

A5 Fire Flow System Improvements

A6 Proposed System Improvements Peak Day Demand Static Pressures

A7 Well Pump Curves

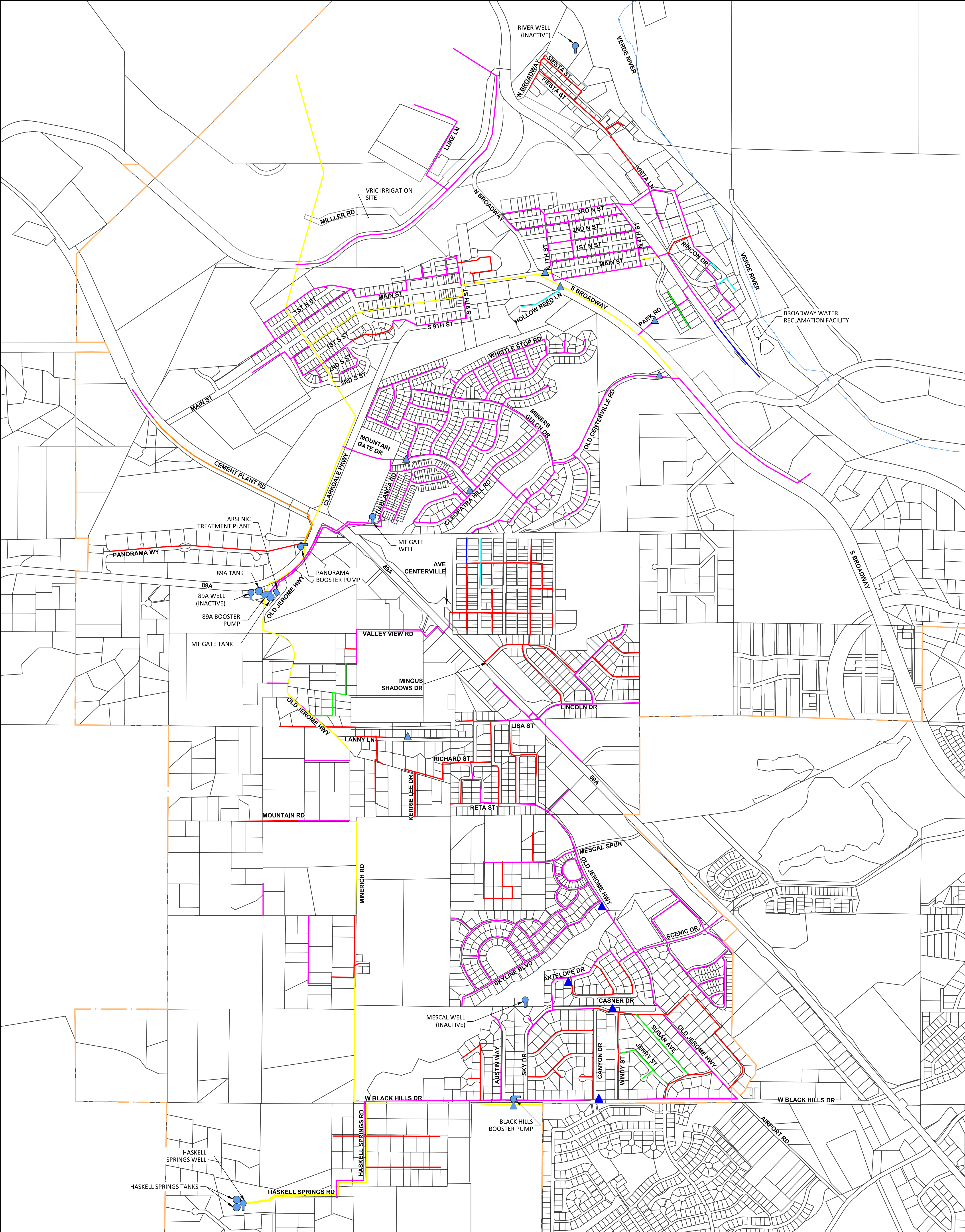
A8 Drought and Water Shortage Preparedness Plan

A9 Well Siting Memo Matrix New World Engineering (2024)

A10 Tank Inspection Reports

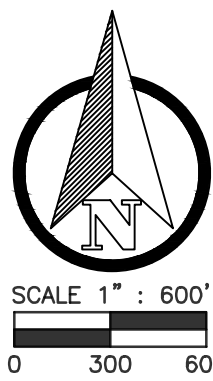
A11 Water and Wastewater Rate Study (2023)

A12 Feasibility Study - Expansion of Water Distribution and Sewer Collection System(2019)



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LEGEND				
—	2" OR SMALLER WATER LINE	---	TOWN BOUNDARY	
—	2.5" WATER LINE		PUMP	
—	4" WATER LINE		WELL	
—	6" WATER LINE		TANK	
—	8" WATER LINE		EX. PRV	
—	10" WATER LINE		PROP. PRV	
—	12" WATER LINE			

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A1	DESIGN BY:	
SHEET	DRAWN BY:	CTO
1	CHECKED:	
OF 1	DATE:	OCTOBER 2024

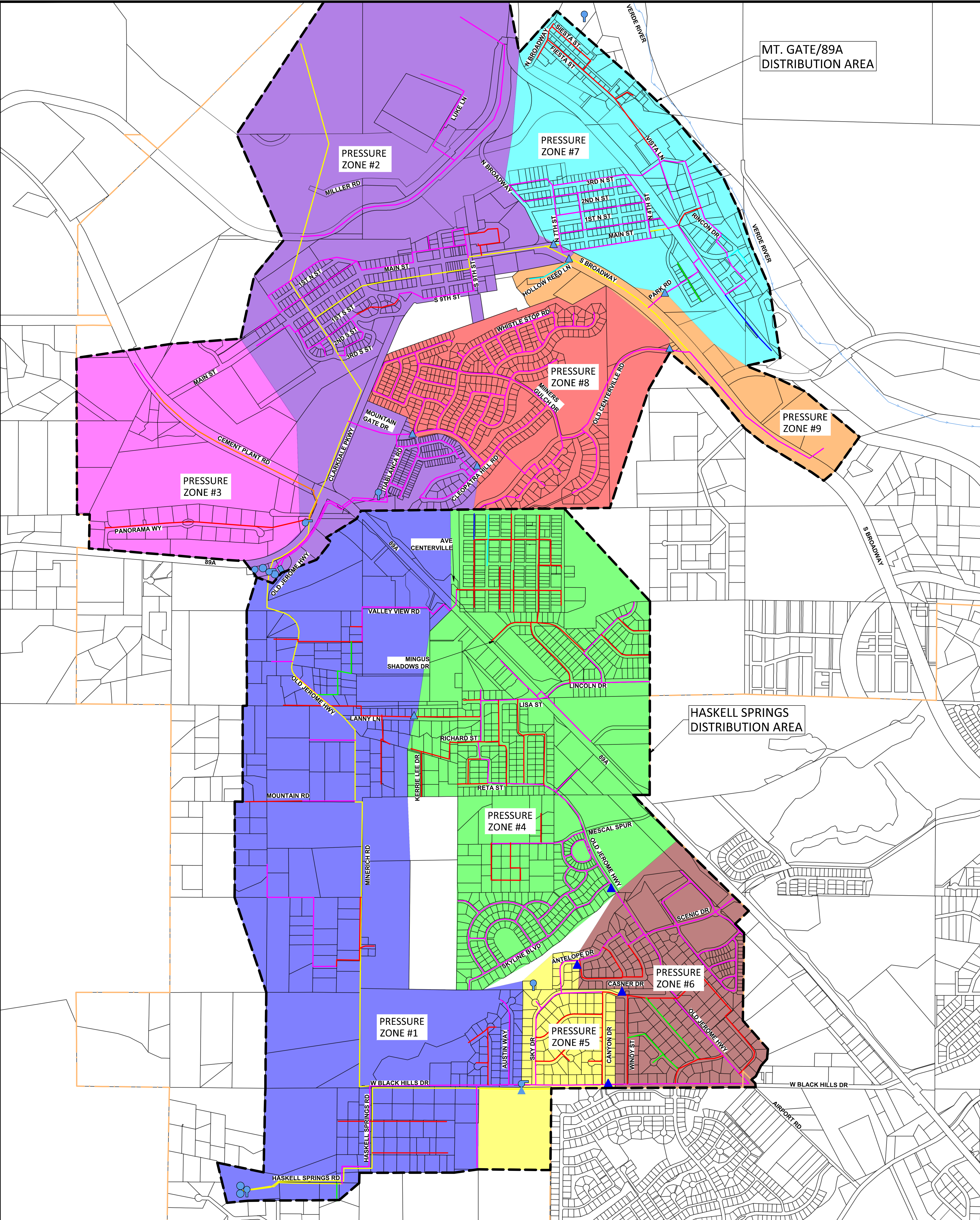
CLARKDALE WATER MASTER PLAN
EXISTING WATER SYSTEM MAP
YAVAPAI COUNTY
CLARKDALE



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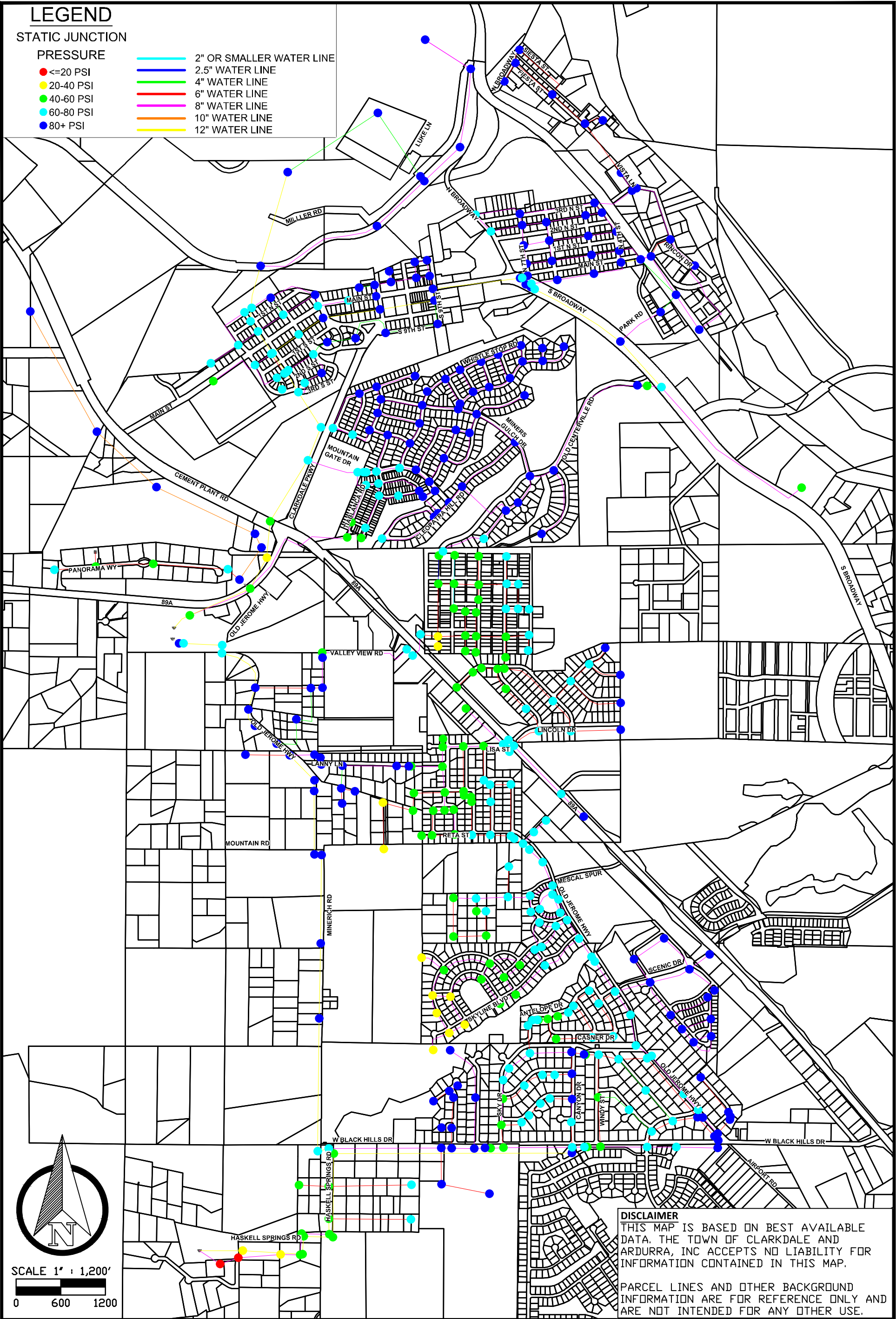
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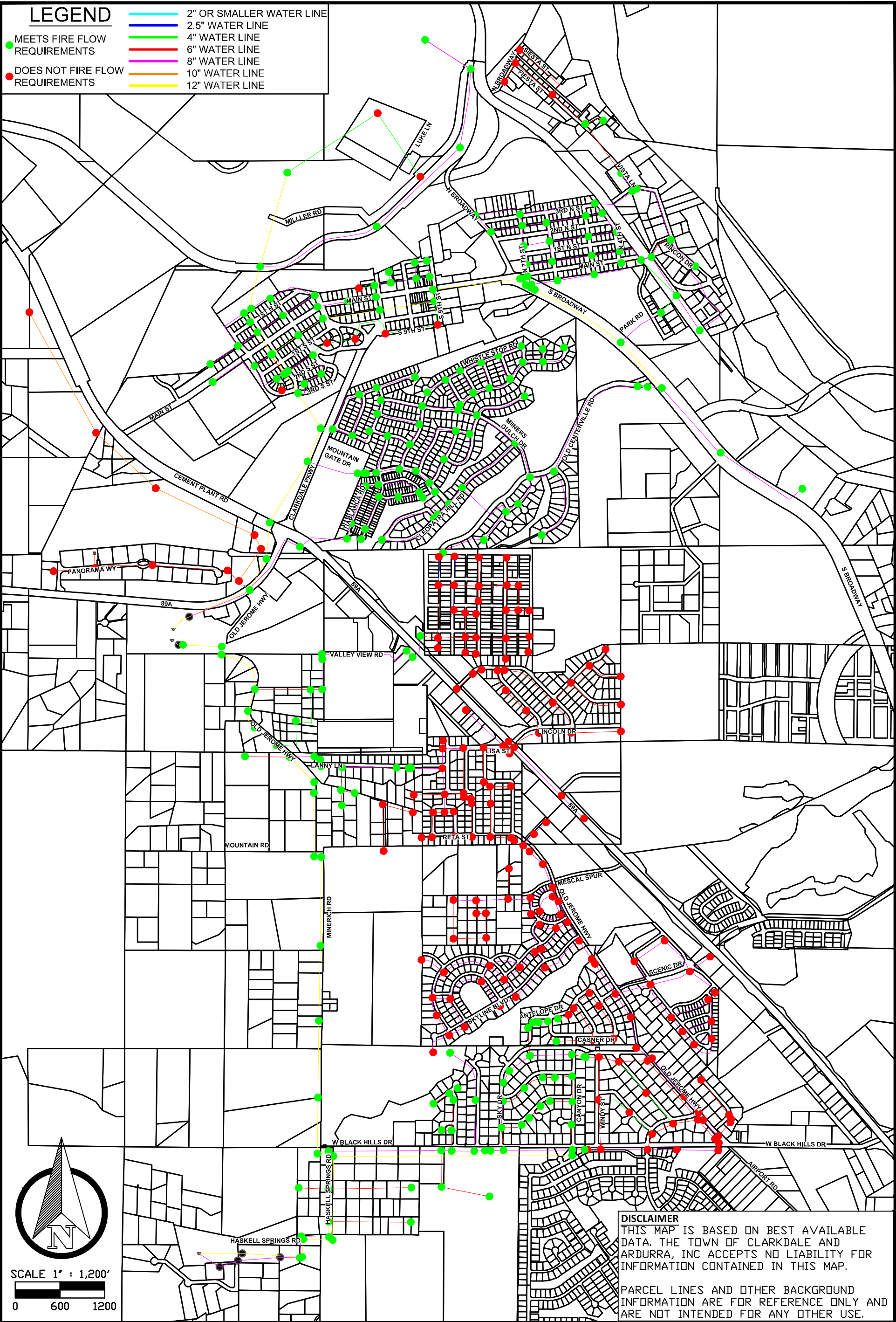


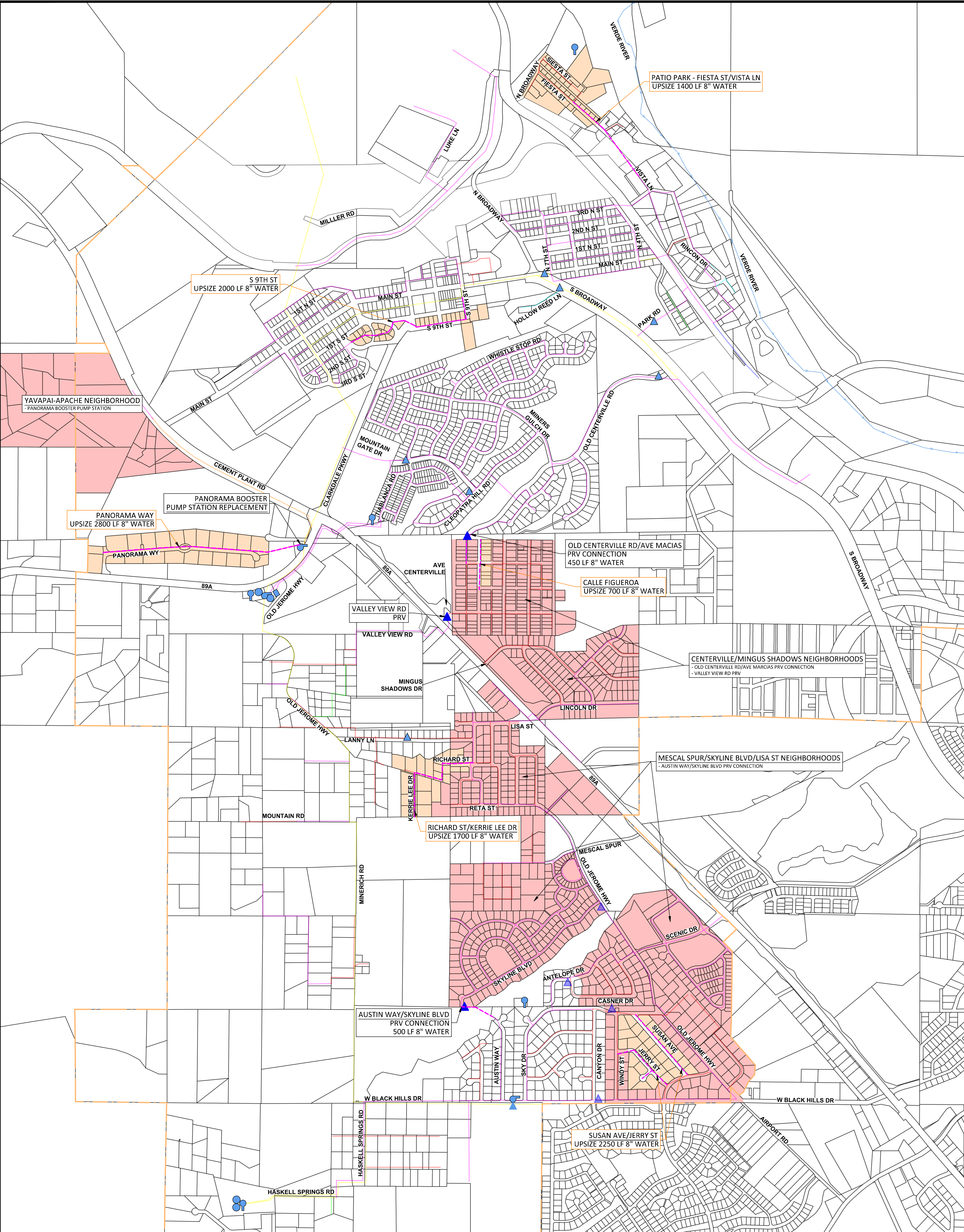
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DWG. A2	JOB NO.: 223351	CLARKDALE WATER MASTER PLAN							
SHEET 1	DESIGN BY: CTO	EXISTING PRESSURE ZONE MAP							
OF 1	CHECKED:	YAVAPAI COUNTY	CLARKDALE						
	DATE: OCTOBER 2024								



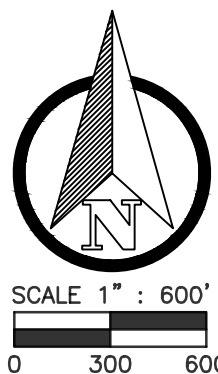




DISCLAIMER
THIS MAP IS BASED ON BEST AVAILABLE DATA. THE TOWN OF CLARKDALE AND ARDURRA, INC ACCEPTS NO LIABILITY FOR INFORMATION CONTAINED IN THIS MAP.

PARCEL LINES AND OTHER BACKGROUND INFORMATION ARE FOR REFERENCE ONLY AND ARE NOT INTENDED FOR ANY OTHER USE.

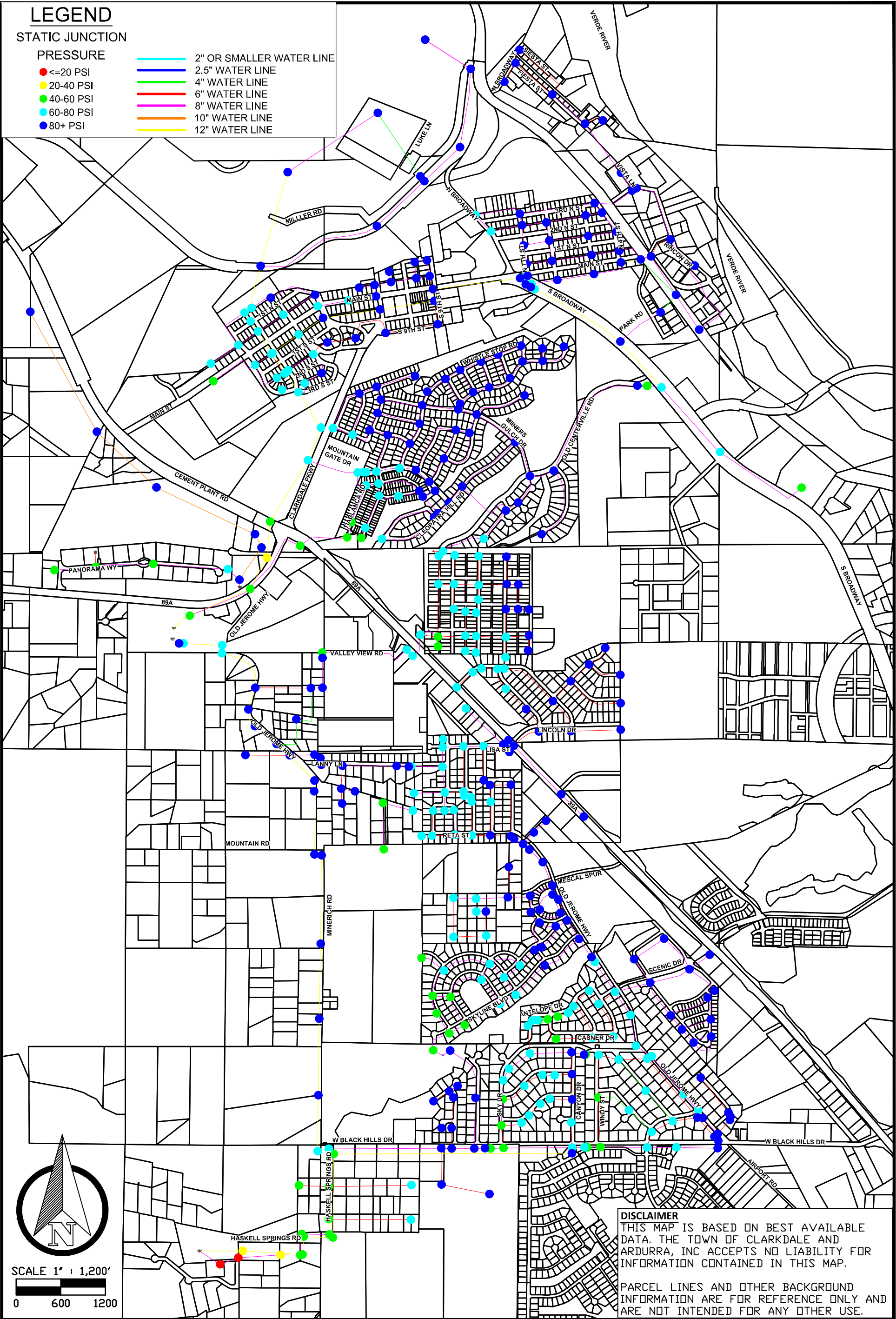
ALL QUANTITIES LISTED ARE APPROXIMATE AND FOR PLANNING PURPOSES ONLY.



LEGEND

- EX. 2" WATER LINE
- EX. 2.5" WATER LINE
- EX. 4" WATER LINE
- EX. 6" WATER LINE
- EX. 8" WATER LINE
- EX. 10" WATER LINE
- EX. 12" WATER LINE
- FIRE FLOW DEFICIENT AREA
- TOWN BOUNDARY
- PUMP
- WELL
- TANK
- EX. PRV
- PROP. PRV
- UNDERSIZED WATER MAIN

DWG.	JOB NO.:	223351	CLARKDALE WATER MASTER PLAN		 O: 928.774.4636 124 N ELDEN STREET FLAGSTAFF, AZ 86001 www.ardurra.com	NO.	DATE	BY	REVISION
A5	DESIGN BY:		FIRE FLOW SYSTEM IMPROVEMENTS						
SHEET	DRAWN BY:	CTO							
1	CHECKED:								
OF 1	DATE:	NOVEMBER 2024	YAVAPAI COUNTY	CLARKDALE					



Appendix A7

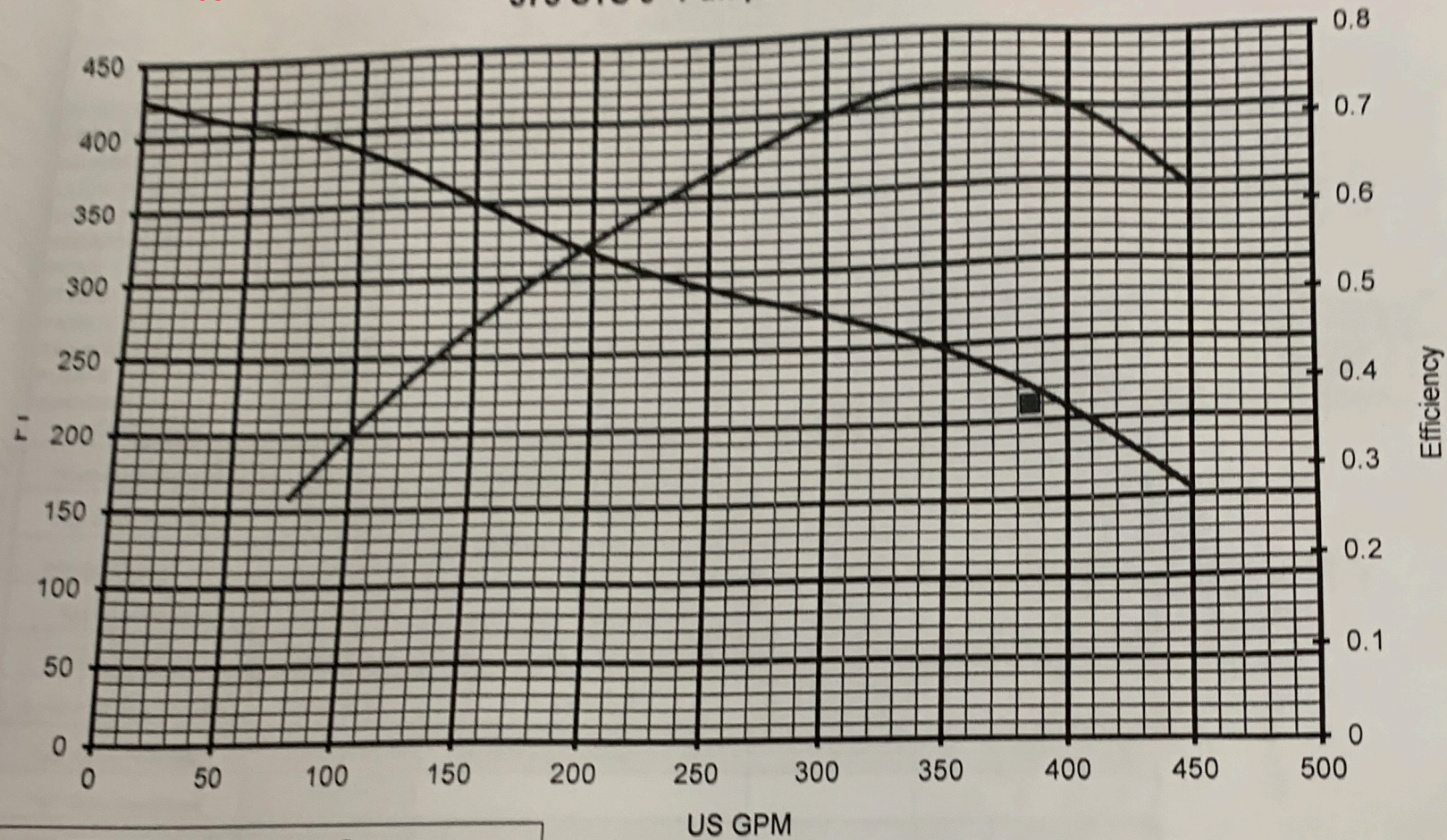
Haskell Springs Well

Approximate
Operating Point
385 gpm
205 TDH



Franklin Electric
Bluffton, Indiana 48714 • www.franklin-electric.com

375 STS 6" Pump Performance



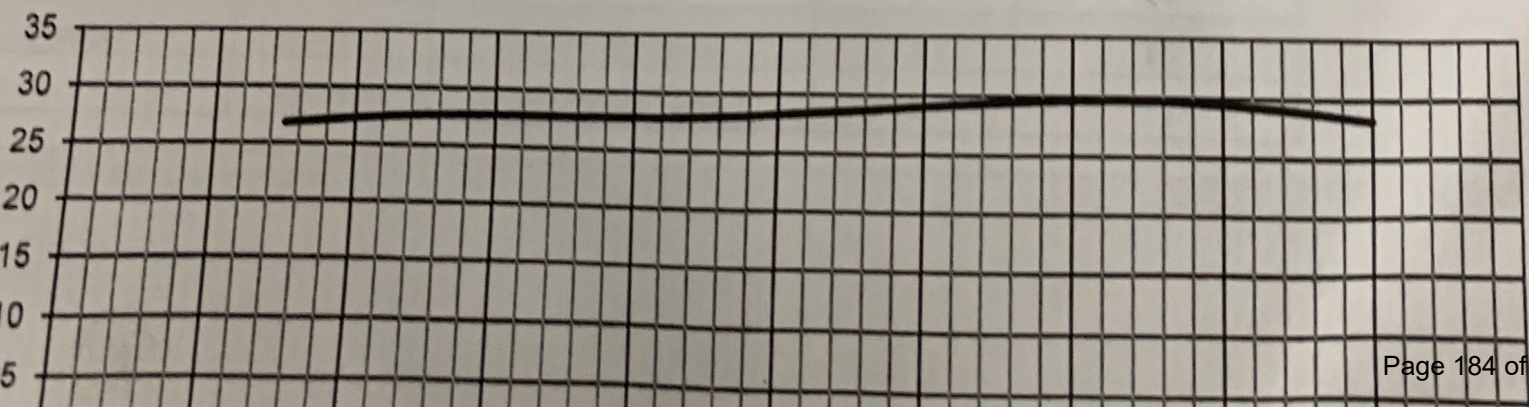
- 375STS6 Performance Curve
- 375STS6 0 RPM Performance Curve
- Design Point
- 6" Actual Performance
- Efficiency

Max Power on Curve: **29.7 HP**

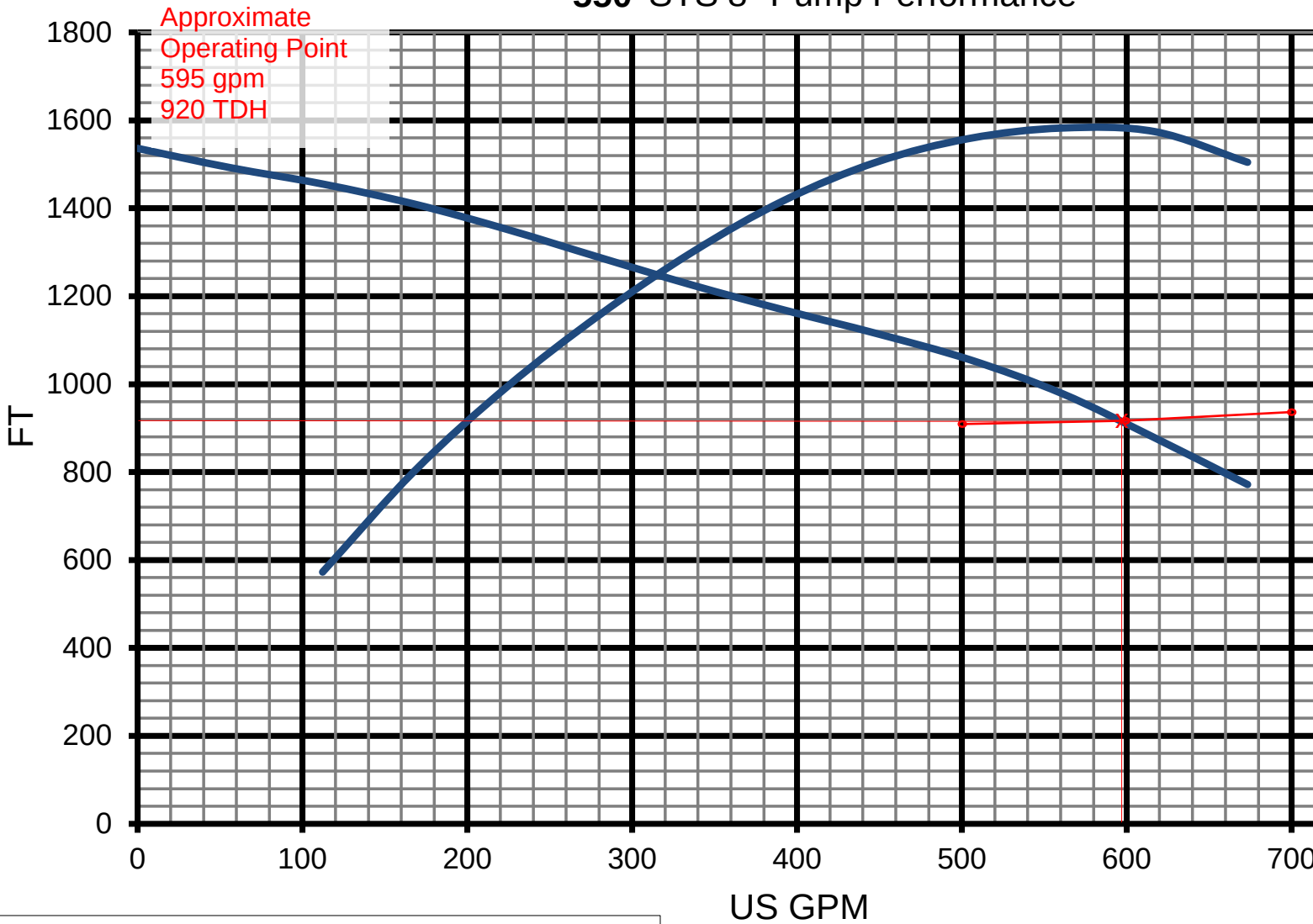
Motor Selection: **6in 5-40HP**

- 6 A trim impellers
- 0 B trim impellers
- 0 C trim impellers

Power Required



550 STS 8" Pump Performance



8" Actual Performance

Design Point

550STS6 0 RPM Performance Curve

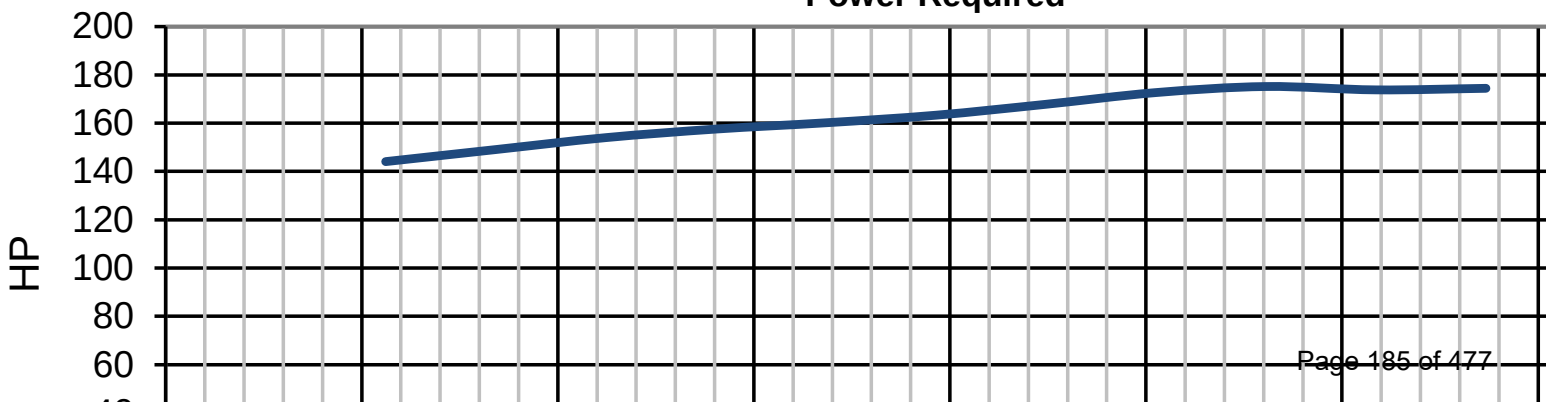
550STS6 Performance Curve

Efficiency

Max Power on Curve: **175.2 HP**

Motor Selection: **8in 40-200HP**

Power Required



Town of Clarkdale

Founded 1912 – Incorporated 1957



Drought and Water Shortage Preparedness Plan

**Adopted
November 14, 2006**

Town of Clarkdale
Drought and Water Shortage Preparedness Plan

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Executive Summary

1. In adherence to the Arizona Drought Preparedness Plan issued by the Governor of Arizona, the Town of Clarkdale herewith submits its Drought and Water Shortage Preparedness Plan (DWSPP).
2. The Town of Clarkdale recognizes the necessity for protection of its water supply by monitoring water use to existing, pending, and future development within its water service areas in order to ensure the continuing economic development and stability of the Town, and to promote the health safety and welfare of all citizens, visitors and users of the Clarkdale Municipal Water Utility. This Drought and Water Shortage Preparedness Plan (DWSPP) addresses the options and drought mitigation strategies to reduce the impact of drought and other water shortages to the Clarkdale Municipal Water Utility users.

Definitions

1. Commercial Provision - An agreement between the Town of Clarkdale and a commercial customer where compliance with the Stage Level may cause unreasonable economic hardship. Requests for provision shall be in written form to include the nature of the business and the economic impact the provision will cause. The Public Works Director will consider the provision on a case-by-case basis. Under Demand Reduction Strategy III, new Commercial Provisions may only be considered by the Town Council.
2. Contracted Operator – Any person, company or organization under legal contract with the Town of Clarkdale to monitor, maintain, affect repair of and/or facilitate operations of the Clarkdale Municipal Water Utility.
3. Demand Reductions - Demand reductions are all measures taken by the water utility to reduce the use of potable water in response to water drought or supply insufficiency conditions. Demand reduction includes measures which would restrict water further than a normal, conservation minded desert lifestyle.
 - a. Water demand reduction during a drought may incorporate both voluntary measures and mandatory ones, such as curtailment of irrigation water use and, in extreme cases, rationing of available supplies. Many of the organizational demand management responses to a drought condition, including conservation measures, are appropriate for responding to a short-duration supply insufficiency. Generally, responses to a systemic failure will be more rapid and may omit intermediate steps normally associated with an incremental drought response plan.
 - b. It is evident that drought is not a constant or totally predictable condition in occurrence or duration. Rather, there are levels of drought and levels of drought impact, and therefore, levels of demand reduction response.
4. Drought - Water drought is a long period of abnormally low precipitation (rain or snow), especially one that adversely affects growing or living conditions. Water drought can be

caused by seasonal or multi-year weather conditions, and is usually systemic and regional in nature and of indeterminable length.

5. DWSPP – Drought and Water Shortage Preparedness Plan.
6. Effluent - Effluent is an outflow from a sewer or sewage system and remains effluent until it acquires the characteristics of ground water and surface water. Effluent that is reused is treated to a quality suitable for non-potable applications such as landscape irrigation, decorative water features, and non-food crops. Such water remains effluent until it acquires the characteristics of groundwater or surface water.
7. Emergency Authority - The Public Works Director, or a certified operator acting under the direction of the Public Works Director, has the authority to make operational adjustments and/or changes to the potable water and reclaimed water system for the purpose of protecting the system from damage, maintaining water supply, or restoring the system to operation after a system failure.
8. Even-Numbered Address – Any street address ending in zero (0), two (2), four (4), six (6) or eight (8).
9. Fountain - Any fountain or water feature that is solely or partially used for decorative purposes.
10. Irrigate - To supply land or crops with water by means of pipes or hoses.
11. Odd-numbered address – Any street address ending in one (1), three (3), five (5), seven (7) or nine (9).
12. Potable Water - Water suitable for drinking or cooking purposes from both health and aesthetic considerations, and which meets the quality standards prescribed in the U.S. Public Health Service Drinking Water Standards, published in 42 CFR Part 72, and which is approved for drinking purposes by the Town of Clarkdale Municipal Water Utility.
13. Reclaimed Water – Recycled wastewater treated to improve its quality. Reclaimed water can serve in many capacities where it is unnecessary to use high-quality potable (or drinking) water. Non-potable uses include but are not limited to: irrigation, wetland restoration, industrial washing and cooling, fire protection, dust control, car washing and geothermic energy production.
14. Safe Production Capability – Water resources available measured in gallons per day (GPD), based on seventy-five percent (75%) of available capacity.
15. Supply Insufficiency - Supply insufficiency occurs when water available in an area is not sufficient to meet immediate unrestricted demand. A supply insufficiency may be system-wide or very localized and can be of relatively short duration. Supply insufficiencies can be caused by unforeseen increases in water demand, failure of a localized part of the storage or delivery system, water quality problems or any number of other natural or man-made situations that result in an inability to provide a sufficient, unrestricted supply of water.

16. Surcharge – To charge an additional fee, cost or levy to a Clarkdale Municipal Water Utility user for violation of any prohibition of the Town of Clarkdale Drought and Water Shortage Preparedness Plan.
17. Total Production Capability - The total water resources available measured in gallons per day (GPD) based on potable water production and distribution components.
18. Wasting Water - To use or expend water thoughtlessly or carelessly. Examples include, but are not limited to, allowing water to run into the street/gutter, allowing water to pool, irrigating during precipitation events, and failing to repair water leaks. A representative of the Clarkdale Municipal Water Utility shall make the determination of Wasting Water.
19. Water Conservation Enforcement Aid – Town employees, working under the direction of the Public Works Director or his/her designee, charged with the responsibility of educating the public regarding the Town's Drought and Water Shortage Prepared Plan, and enforcing water restrictions related thereto. The Water Conservation Enforcement Aid enforces compliance with the DWSPP by field inspections of perceived violations, verbally informing users of the DWSPP's prohibitions, and by delivering written warnings and/or written surcharge notifications to users violating those prohibitions.
20. Water Demand Reduction Strategies - An effort initiated to ensure the availability of adequate water resources for the future, and in times of emergency.

Purpose and Objective

1. The purpose of the DWSPP is to provide strategies and procedures for periods of time when the Town's normal and customary water supplies may not be able to meet the Town's needs due to below normal rainfall or other issues that have affected the municipality's water supply. A DWSPP plan is also a resource that can be used should a meteorological drought last for several years.
2. The objective of the plan is to provide ways for the Town, businesses, and residents to aid in water demand reduction when a water supply insufficiency occurs, and to provide a framework for operations of the Cottonwood Municipal Water Utility during times of drought and water shortage.

Authority

1. Mayor: The Mayor, upon the recommendation of the Public Works Director, after notification to the Town Council, is hereby authorized to declare and suspend Demand Reduction Strategies and elements of Strategies. These may be initiated and suspended based upon Resource Status Levels, or other pertinent information, which evaluate the relationship between water demand and municipal safe production capability. The Mayor may also authorize exemptions to Strategies and/or elements of strategies when necessary for the protection and preservation of the public health, welfare and safety.

2. Public Works Director: The Public Works Director of the Municipal Water Utility Department, and/or his/her designee or contracted operator, has emergency authority to take operational measures deemed necessary to protect the potable water systems.
3. Exemptions: This DWSPP is applicable to ALL users of the Town of Clarkdale Municipal Water Utility, regardless of whether they live within – or with out – the corporate limits of the Town. **Private well owners and private ditch operators**, however, who operate water systems, the sources of which are not supplied or maintained by the Town of Clarkdale Municipal Water Utility, are **EXEMPT** from this Plan.

Best Practices/Industry Standards

1. Preparedness: The DWSPP provides Town leaders the opportunity to react quickly and implement appropriate restrictions early, while making allowances to suit situational needs. During drought, water shortage, or at all other times, the ultimate goal for the municipality is to protect and preserve public health, welfare and safety and minimize adverse impacts.
2. Responsiveness to Citizens: Clarkdale's goal is to continue to provide sufficient water to meet the needs of its citizens. Should water shortage conditions arise, the Town of Clarkdale wants to be sensitive to the needs of its citizens and water customers and wants to be sure that residential customers and business interests have the opportunity to respond in an informed manner. Shortages should be handled in a manner that minimizes the disruption of the economy so that jobs are protected and regional economic stability is preserved. The citizens of Clarkdale should expect competent implementation of demand reduction measures when they are necessary.
3. Equity and Fairness During Water Shortages: The impacts and hardships caused by drought or other water shortages should be shared equitably and in proportion to the magnitude of the shortage. Not all uses of water are the same. Some uses, such as reserves for fire suppression, critical cooling applications, and medical necessity will have to take priority over less universally beneficial applications of the available resource, such as lawn and park irrigation, maintenance of decorative fountains or water features, and cooling of outdoor recreation areas.
4. Public Education: In order to effectively provide ways for the residents and businesses to participate in water demand reduction when a water supply shortage occurs, the Town must provide the public with education and information about the Drought and Water Shortage Preparedness Plan and the Town's Demand Reduction Strategies.
5. Water Conservation: Water conservation, by its very nature, should be a normal component of a well run water utility, which seeks to maintain a reliable water resource, and is particularly applicable to communities like Clarkdale, that are located in desert environments. Water conservation should be an on-going practice of the citizens of the community.
6. Proactive Approach: Effective conservation programs can extend the existing water supply, reduce the costs of finding and delivering additional water, and minimize the damage to the natural ecosystem caused by removing groundwater. For customers, conservation efforts can

decrease overall household operating expenses. For both the utility and customers, conservation activities are exercises in responsible behavior.

7. Common Practice of the Town: As part of the Best Practices / Industry Standards provisions, it shall be the practice of the Town of Clarkdale to mirror – to the degree possible under the prevailing facts and circumstances – the requirements of Water Resource Status Level I, and its corresponding Demand Reduction Strategy I – “Water Alert” as more thoroughly delineated in Town Code Sections 19-1-6-3.a and 19-1-7-5.
8. Adherence Mandatory: Adherence to Water Resource Status Levels I, II, and III, and their corresponding Demand Reduction Strategies I, II, and III – “Water Alert”, “Water Emergency”, and Water Crisis”, are mandatory whenever any one of those particular Demand Reduction Strategies have been declared, and are strictly enforced.
9. Encouragement: As part of the Best Practices / Industry Standards concepts in this Plan, the Town of Clarkdale strongly encourages all Town of Clarkdale Municipal Water Utility users to adhere to Water Resource Status Level I, and its corresponding Demand Reduction Strategy I – “Water Alert” – (Town Code Sections 19-1-6-3.a and 19-1-7-5) – requirements ON A DAILY BASIS, regardless of whether that particular Status Level or Reduction Strategy have been ordered by the Town Manager and/or the Public Works Director.
10. New Landscaping for Commercial Projects: New landscaping for commercial projects should only be accomplished with plant materials that require little or no supplemental irrigation water. For such new projects, daily irrigation for purposes of plant establishment should only be allowed for landscaping that is required under the landscaping codes of the Town. A thirty (30)-day Landscape Water Permit shall be obtained through the Clarkdale Municipal Water Utility prior to landscape installation and shall be prominently posted at the irrigation site.

Water Resource Status Level Descriptions

1. Water Resource Status Levels provide comparisons between water demands and safe water production capabilities of the Clarkdale Municipal Water Utility at a given point in time.
2. Resource Status Levels may trigger the implementation of Demand Reduction Strategies, the violation of which may result in SURCHARGES being added to a Town of Clarkdale Municipal Water Facility user’s utility bill, as further provided in Town Code Section 19-1-10 of this Drought and Water Shortage Preparedness Plan.
3. Water Resource Status Level Descriptions:
 - a. Resource Status Level I:

Resource Status Level I is in effect at times when water demand exceeds safe production capability for five (5) consecutive days and/or during the months of May, June, July, August and September, beginning May, 2007.
 - b. Resource Status Level II:

Resource Status Level II is in effect when water demand exceeds safe production capability by more than twenty percent (20%).

c. Resource Status Level III:

Resource Status Level III is in effect when water demand exceeds maximum production capability, when a temporary or permanent failure of any major supply or distribution facility occurs in the water distribution system, or when the amount of water in storage may impair fire protection for the Town.

Demand Reduction Strategies

1. The Demand Reduction Strategies outlined in this plan incorporate a variety of measures to reduce the use of potable water in response to water drought or supply insufficiency conditions. Demand reduction includes measures which would restrict water further than a normal conservation minded desert lifestyle.
2. COMPLIANCE WITH DEMAND REDUCTION STRATEGIES IS MANDATORY, FOR ALL CLARDALE MUNICIPAL WATER UTILITY USERS, AND ANY VIOLATION OF THE DEMAND REDUCTION STRATEGIES MAY RESULT IN SURCHARGES BEING ADDED TO A TOWN OF CLARKDALE MUNICIPAL WATER FACILITY USER'S UTILITY BILL, AS FURTHER PROVIDED IN SECTION 19-1-10 OF THIS DROUGHT AND WATER SHORTAGE PREPAREDNESS PLAN.
3. Water demand reduction during a drought may incorporate both voluntary and mandatory measures. Many of the organizational demand reduction strategies to a drought condition, including conservation measures, are appropriate for responding to a short-duration supply insufficiency. Generally, responses to a systemic failure will be more rapid and may omit intermediate steps normally associated with an incremental drought response plan.
4. It is evident that drought is not a constant or totally predictable condition in occurrence or duration. Rather, there are levels of drought and levels of drought impact, and therefore, levels of demand reduction strategies. This plan includes three levels of Demand Reduction Strategies, as follows:
5. **DEMAND REDUCTION STRATEGY I**
"WATER ALERT"
Goal: The goal of Strategy I is to reduce water demand to a level where safe production capability exceeds water demand. Demand Reduction Strategy I is designed to work in concert with Resource Status Level I. The following measures are mandatory:
 - a. Water shall be conserved both inside and outside the home using best practices available to minimize waste.
 - b. Landscaping for residential uses shall be accomplished with plant materials that require little or no supplemental irrigation water.

- c. Outdoor water usage shall not occur between the hours of 9:00am – 5:00pm. Watering days shall be coordinated with your address. Even numbered addresses may irrigate on Wednesday, Friday and Sunday. Odd numbered addresses may irrigate on Tuesday, Thursday and Saturday. For places where there is no discernable address, the even date schedule should be followed (right-of-ways, medians, etc.). No irrigation shall be allowed on Monday.
- d. Automobile washing shall only be undertaken with a bucket and hose with shut off nozzle, other water saving devices such as a pressure washer, or at carwashes that recycle or re-circulate water.
- e. No person shall waste water (see definitions section under “wasting water”).
- f. Cooling of outdoor areas with water or misting devices is prohibited.
- g. Restaurants shall serve water to customers upon request only, and shall display table tents or other types of public notice to this affect.
- h. Hotels shall wash a customer’s linens if a stay is in excess of one night on request only, and the hotel shall display notice to this affect.
- i. Construction projects are required to use reclaimed water or effluent for construction and dust control purposes.
- j. Requests for Commercial Provisions must be made to the Clarkdale Public Works Director.

6. **DEMAND REDUCTION STRATEGY II**

“WATER EMERGENCY”

Goal: The goal of Strategy II is to reduce water demand to a level where safe production capability exceeds water demand for ten (10) consecutive days. Demand Reduction Strategy II includes all Demand Reduction Strategy I requirements (Town Code Section 19-1-7-5), with the following additional, mandatory measures:

- a. Sidewalks, driveways, parking areas, tennis courts, patios, or other similar paved surfaces shall not be washed down with water.
- b. Water shall not be added to fountains, water features, recreational swimming pools, spas, or wading pools holding more than one hundred (100) gallons of water.
- c. No new landscaping for commercial projects shall be installed.
- d. Landscaping not installed, which was required by the Town of Clarkdale to meet the Landscaping Requirements of the Clarkdale Town Code or Zoning Code, will not delay a Certificate of Occupancy to be issued, providing its installation is delayed as a result of a suspension of new landscaping permits and a surety is provided that is acceptable to the Community Development Department.

7. **DEMAND REDUCTION STRATEGY III**
“WATER CRISIS”

Goal: The goal of Strategy III is to reduce water demand to a level deemed necessary to recover from the loss of supply due to a temporary or permanent failure of any major supply or distribution facility in the water distribution system or to increase water in storage to a point where fire protection for the Town is not impaired. Demand Reduction Strategy III includes all Demand Reduction Strategy II requirements (Town Code Section 19-1-7-6), with the following additional, mandatory measures:

- a. No potable water shall be used for outdoor purposes.
- b. No potable water may be used in violation of any other restriction deemed necessary by the Clarkdale Town Council for the purpose of protecting the welfare of the citizens of Clarkdale.
- c. Water system connection permits shall not be issued and permitted new connections shall not be activated.
- d. No new Commercial Provisions shall be allowed unless approved by the Clarkdale Town Council.

Demand Reduction Strategy Implementation

1. The Clarkdale Municipal Water Utility shall monitor the projected supply and demand for water on a daily basis during periods of emergency or drought and shall recommend to the Mayor and Town Manager the extent of the demand reduction measures required to prudently plan and supply water to the water utility customers.
2. The Mayor, upon the recommendation of the Public Works Director, or his/her designee, is hereby authorized to declare and suspend the Demand Reduction Strategies and elements of Strategies that are set forth in this Plan. The Strategies may be initiated and suspended based upon Resource Status Levels, or other pertinent information, which evaluate the relationship between water demand and municipal safe production capability.
3. The declaration of any change in the Demand Reduction Strategy level may be made by:
 - a. Providing notice to the members of the Town Council; and,
 - b. Issuance of a Press Release to radio stations and newspapers of general circulation in the community; and
 - c. Appropriate postings on the Town of Clarkdale web site; and
 - d. Appropriate signage at strategic locations throughout the Town, that clearly advise citizens that the prevailing Demand Reduction Strategy is then existing (i.e., “Water Alert” – Water Emergency” – or “Water Crisis”); and

- e. Personal notice delivered by Town Water Conservation Enforcement Aids.
- 4. The Demand Reduction Strategy designated shall become effective immediately upon announcement by the Mayor.
- 5. The Notice of Demand Reduction shall give the extent, terms and conditions respecting the use and consumption of water. Upon such declaration and issuance of Press Releases, due and proper notice shall be deemed to have been given to each and every Clarkdale Municipal Water Utility user.
- 6. This implementation may require the reallocation of current staff to enforce the provisions of this Plan. In addition, the Town may hire Water Conservation Enforcement Aids to provide this enforcement that are hereby authorized and empowered to enforce the provisions of this Plan. The Clarkdale Municipal Water Utility has emergency authority to take operational measures deemed necessary to protect the potable water systems.

General Powers of Common Council

- 1. Pursuant to A.R.S. § 9-240(B)(28)(a), the Town has the power to “make, amend or repeal all ordinances necessary or proper for the carrying into effect of the powers vested in the [Town], or any department or officer thereof.” *Id.*
- 2. Pursuant to A.R.S. § 9-511(A), the Town may engage in any business or enterprise which may be engaged in by persons by virtue of a franchise from the Town, and may construct, purchase, acquire, own and maintain **within or without its corporate limits** any such business or enterprise [including] sites and rights-of-way for public utility . . . purposes, and for the location thereon of waterworks . . .” *Id.*(emphasis added).

Violations, Warnings, Surcharges

- 1. All Demand Reduction Strategies of the Plan shall be enforced, administratively, by the Town of Clarkdale Municipal Water Utility.
- 2. Enforcement of the Plan may require the reallocation of current Town of Clarkdale Municipal Water Utility staff to enforce the provisions of this Plan. In addition, the Town may hire Water Conservation Enforcement Aids to provide this enforcement that are hereby authorized and empowered to enforce the provisions of this Plan.
- 3. Enforcement shall consist of public education forums, on-site inspections by Water Conservation Enforcement Aids, written warnings, and, as a last result, the addition of surcharges to the monthly utility bills of any Town of Clarkdale Municipal Water Utility user found in violation of the Plan.
- 4. Violations of this Plan shall result in the levying of the following surcharges:

- a. A surcharge of **\$ 25.00** (twenty-five dollars) shall be assessed to the account of record for a violation of **Demand Reduction Strategy I “Water Alert”**, pursuant to Town Code Section 19-1-7-5.
- b. A surcharge of **\$ 50.00** (fifty dollars) shall be assessed to the account of record for a violation of **Demand Reduction Strategy II “Water Emergency”** – pursuant to Town Code Section 19-1-7-6.
- c. A surcharge of **\$ 100.00** (one hundred dollars) shall be assessed to the account of record for a violation of **Demand Reduction Strategy III “Water Crisis”** – pursuant to Town Code Section 19-1-7-7.
- d. Surcharges shall double for every repeat violation that occurs within a calendar year..
- e. Each succeeding surcharge under the prevailing strategy level may be twice the previous surcharge assessed for the previous violation during the same calendar year.
- f. The Notice of Water Use Violation Form shall include information relating to all the provisions of Section 19-1-10 (4).

Appeal of Assessment of Surcharge

1. The assessment of a surcharge may be informally appealed, in writing, within fourteen (14) calendar days of the notice of the surcharge assessment.
2. The written appeal shall be received by the Town of Clarkdale Water Utility Department within said fourteen (14) calendar day time limit, or the right to such appeal shall be permanently waived.
3. The written appeal shall be reviewed by a Water Utility Appeals Committee, which shall be comprised of the following members:
 - a. Two (2) members of the general public, each of which must be at least twenty-one (21) years of age at the time of appointment, and who must be users of the Clarkdale Municipal Water Utility.
 - b. The Town of Clarkdale Finance Director.
4. The two (2) members of the general public shall be appointed by the Town Manager, and shall serve at the pleasure of the Town Manager for a period not to exceed three (3) years. They may be removed and replaced – at any time – as the Town Manager determines appropriate.
5. The Water Utility Appeals Committee shall determine whether the appeal has merit, taking in to account all the available facts and circumstances. In assessing the merits of any appeal, the Water Utility Appeals Committee shall have full authority to review all documentation of the account of record under appeal.

6. The Water Utility Appeals Committee shall have the authority to hear testimony on behalf of the appellant and the Water Utility.
7. The Arizona Rules of Evidence do not apply in the appeal process.
8. The Water Utility Appeals Committee shall render a written decision to the appellant within ten (10) calendar days after receipt of the appeal.
9. Decisions of the Water Utility Appeals Committee are final.
10. All surcharge-related correspondence shall be addressed to:

Town of Clarkdale Water Utility Department
PO Box 308
890 Main Street
Clarkdale, AZ 86324

Tracking of Surcharges

1. All surcharges collected for violations of this Plan shall be forwarded by the Clarkdale Municipal Water Utility to the Town Finance Department.
2. The Town Finance Director, or his/her designee, shall credit the received funds back to the Clarkdale Municipal Water Utility.

Plan Amendments

1. In an effort to meet the purpose, objectives and goals of this Plan, the Town may amend this Plan pursuant to prevailing facts and circumstances at any given point in time.
2. If any provision of this Plan is found to be in violation of any Arizona law, statute, ordinance, case opinion or regulation by any court of record, the remaining provisions of this Plan shall remain in full force to the degree possible under Arizona law.

MEMORANDUM

TO: Mr. Michael Janes, Engineering Manager, Ardurra
CC: Matrix Project File No. 23-1135
FROM: Scot Journell, P.E., Project Manager
DATE: September 2, 2024
RE: Hydrogeologic Evaluation and Well Siting Analysis,
Clarkdale Water and Wastewater Master Plan,
Clarkdale, AZ

Matrix New World Engineering, Land Surveying and Landscape Architecture, PC (Matrix) has conducted a Hydrogeologic Evaluation and Well Siting Analysis in support of the Clarkdale Water and Wastewater Master Plan prepared by Ardurra.

Hydrogeologic Data Review

Matrix reviewed existing hydrogeological data for the Town of the Clarkdale Water Service Area (Service Area) and nearby areas. The review included information available from the Arizona Department of Water Resources (ADWR) the United States Geological Survey (USGS), the Arizona Geological Survey (AZGS), Matrix files and the Town of Clarkdale. The review included well as-built information, water level data, depth to bedrock data, aquifer test data, geologic maps, geologic cross-sections, and other hydrogeologic information.

Matrix utilized this data to prepare maps of the Service Area depicting well locations, surficial geology, underlying formations, perforated intervals of wells, and depth to bedrock. The regional location of the town limits and Service Area are shown on Figure 1. Figures 2 and 3 show the Service Area. Wells within the Service Area are shown on Figure 4.

Groundwater surface elevation contours developed from ADWR Groundwater Site Inventory (GWSI) data from 2021 and 2022 are shown on Figure 5. The contoured data shows that groundwater moves southeast, east and northwest into the Service Area from the upland areas to the east. The groundwater gradients across the major portion of the Service Area range from 0.0189 ft of elevation change per ft of distance (ft/ft) to 0.0000 ft/ft. The groundwater surface contours are influenced by a hydrologic boundary along the east side of the Service Area to the west of Haskel Springs.

Stratigraphy

The geologic units present at the ground surface are shown on Figure 6. Quaternary Period gravels present along the Verde River are mapped by DeWitt (2008) as Terrace Gravel (Qt). Fill areas resulting from mining or other activities of man are mapped as Artificial Fill (Qa).

The Gravel unit (Tvg), exposed in the hillside areas along the east side of the Service Area, is described by DeWitt (2008) as silty limestone containing pebbles and cobbles that was deposited in the late Tertiary Period. This unit is described on ADWR Driller's Logs as conglomerate. DeWitt describes the unit as variable in thickness. This unit is water bearing in areas where it is submerged below the groundwater surface.

The Tvg was deposited by debris flows and stream flows into the Verde Basin. These flows carried boulders, cobbles and gravels that were mixed with silt and clay. Zones with lower silt and clay content typically have greater hydraulic conductivity.

The Tvg outcrops are adjoined on the west by the Fonglomerate unit (Qf) deposited in the Quaternary Period. The Qf is described by DeWitt (2008) as poorly sorted gravel and debris flows and minor landslide deposits that vary in thickness from approximately 100 to 130 ft. This unit is also described on ADWR Driller's Logs as conglomerate.

The Verde Formation (Tvs and Tvls) is present at the ground surface in the areas west of the Qf unit. DeWitt (2008) describes the formation as fine-grained clastic and chemically precipitated strata deposited in a lacustrine environment during the late Tertiary Period. Undifferentiated portions of the formation are mapped as Tvs and where differentiated, the limestone units are mapped as Tvls. This unit is water bearing in areas where it is submerged below the groundwater surface.

The Hickey Formation (Thb) is comprised of multiple volcanic flows that include basalt andesitic basalt, dacite and interbedded tuffaceous sedimentary rocks deposited during the early Tertiary Period (DeWitt, 2008). This formation is exposed at the surface in the upland areas north and east of the Service Area. The Thb is generally not water bearing due to the poor hydraulic conductivity of the formation.

Paleozoic Era formations are present below the Thb in some areas. These include the Permian age Supai Formation (Ps), Mississippian age Redwall Limestone (Mr), Devonian age Martin Formation (Dm), and Cambrian age Tapeats Sandstone (Ct). The Ps, Mr and Dm are water bearing in areas where they are submerged. The Ct is typically not water bearing due to poor hydraulic conductivity. The Haskell Springs area wells produce water from the Paleozoic formations.

These units and formations are shown in the subsurface on Figure 7 cross-section. The trace of the cross-section is shown on Figures 4 and 8. The cross-section shows the elevations of the units penetrated by the borings for the depicted wells. The elevations of units and formations shown below the wells were inferred from the boring logs for other wells in and near the Service Area. The Quaternary age surface units mapped by DeWitt (2008) are combined into the Qal unit shown on the cross-section.

Structure

DeWitt (2008) maps the inferred location of the Airport Fault in the Tvg to the east of the cross-section. Review of boring logs shows that this fault, or a splay of this fault, extends through the area to the west of Well No 55-576515 as shown on Figure 7. The down dropped west block of the fault extends eastward through Well No. 202370. DeWitt infers the location of the Bridgeport Fault to the west of the Airport Fault. Review of boring logs shows that this fault or a splay of this fault extends through the area to the west of Well No 55-531578. Well No. 55-533110 is east of down dropped block.

Review of boring logs shows the presence of Tvg and Verde Formation in the downdropped area, or graben, formed by the two faults. These faults, as shown on Figure 7, are interpreted as extensions of the Airport Fault and the Bridgeport Fault. Similar graben structures that trend from southeast to northwest along the west side of the Verde Valley are mapped by Blasch (2005) and Lindberg (2010).

The depth to the top of the Thb within the graben area is indicated by the AV72-3 boring. This boring is within the graben, approximately 1.5 miles south of the Service Area, in the northeast one-quarter of Section 9 in Township 15 North (T15N), Range 3 East (R3E). The DeWitt (2008) information for this boring shows that the Verde Formation is present from 110 to 1780 ft below ground surface (bgs). The Tvg extends from 1780 to 1990 ft bgs where the top of the Thb was encountered. The boring extended in the Thb to a depth of 2078 ft bgs. The depth to groundwater in nearby wells is approximately 300 ft bgs, giving a saturated thickness of the Verde Formation/Tvg aquifer of 1778 ft at this location. The saturated thickness and depth of the Thb, inferred from the AV72-3 boring, are used on Figure 7. Wells within the Service Area do not extend through the Thb.

Several wells northwest of the Service Area, in Section 12, T16N, R2E, penetrated Paleozoic formations below the Thb. Well No. 55-530152, is approximately ½ mile northwest of the Service Area. The Driller's Log for this boring shows Tvg extending from the surface to 405 ft bgs. The underlying Thb extends from 405 to 845 ft bgs. The Ps is logged from 845 to 925 ft bgs. The Mr extends from 925 to 945 ft bgs and the Dm extends from 945 to 965 ft bgs.

Comparison of Thb elevations in the AV72-3 boring, Well No. 55-533110, and Well No. 55-530152 shows vertical offsets of the unit. The top of the Thb in Well No. 55-530152 is 640 ft higher than at Well No. 55-533110 and is 1585 ft higher than at the AV72-3 boring. These differences indicate the possible presence of a buried fault in the Bitter Creek area.

Aquifer Characteristics

The primary aquifer within the Service Area includes saturated portions of the Tvg and the Verde Formation. Most of the existing wells produce water from this Tvg/Verde aquifer. Wells in the Haskell Springs area produce water from the Paleozoic aquifer which includes saturated portions of the Mr and Dm. Some wells near the Verde River produce water from saturated portions of the Qal.

The saturated thickness of the Tvg/Verde aquifer within the Service Area is greatest between the Airport and Bridgeport Faults. The estimated saturated thickness in this area is approximately 1700 ft.

The Mescal and the Mt Gate Wells are constructed in the Tvg/Verde aquifer. Aquifer test data from the time of well construction (Southwest Groundwater Consultants Inc, 2010) shows transmissivities of 12,000 gallons per day per ft (gpd/ft) at the Mt. Gate well and 1900 gpd/ft at the Mescal Well. The calculated hydraulic conductivities for the aquifer are 2.85 ft/dy at the Mescal Well and 13.8 ft/dy at the Mt Gate Well. The differences in transmissivities and hydraulic conductivities are consistent with the difference in production rates. SGC (2010) indicated a pumping rate of 300 to 400 gpm for the Mescal Well and 1400 gpm for the Mt Gate Well. Aquifer test data for other locations in the Service Area was not located in the Matrix review.

Several factors may contribute to the difference in hydraulic conductivity between the two wells. The presence of gravel zones with less silt and clay would increase the hydraulic conductivity of the Tvg unit. The presence of fractures in the Verde Formation and Tvg unit due to younger movements of nearby faults would typically increase hydraulic conductivity. Older fractures may, in some cases, be sealed by chemical deposition of carbonate and silica.

Specific capacity provides an indirect assessment of hydraulic conductivity ranges. Specific capacity is also influenced by aquifer thickness and well efficiency. The specific capacity calculated for the aquifer test conducted at the Mt Gate well was 5.32 gallons per minute per ft of drawdown (gpm/ft) and for the Mescal Well it was 0.677 gpm/ft. Matrix reviewed Pump Completion Reports for other wells within and near the Service Area to determine specific capacities. The range of specific capacities are shown in Table 1.

Table 1 Specific Capacities of Wells in the Service Area

Water Bearing Unit	Range of Specific Capacities (gpm/ft)	Median Value Specific Capacity (gpm/ft)
Tvg	0.0613 to 0.7000	0.4000
Verde Formation	0.4210 to 1.3333	0.5000
Paleozoic Formations	0.1200 to 15.0	1.1500
Tvg and Verde Formation (Mescal, Mt Gate wells)	0.677 to 5.32	NA

The specific capacities for wells screened in the Tvg are very low at some locations. At other locations favorable gravel zones and/or fractures are present and specific capacity is higher. The range of specific capacities for wells perforated only in the Verde Formation is typically higher than in the Tvg wells. The highest specific capacities occur in the Paleozoic formations.

The ADWR information for the well at the 89A Tank site, ADWR No. 55-609072, indicates a well depth of 925 ft bgs and pump capacity of 200 gpm. Interview information from water system personnel indicates the static water level was 434 ft bgs in 2023. Based on this information the approximate specific capacity would have been 0.4292 gpm/ft or higher. This exceeds the median value for wells perforated in the Tvg. This indicates that favorable gravel zones and/or fractures may be present at this location.

The log from Well No. 55-214584, located approximately 2/3 of a mile north of cross-section Well No. 55-591584, shows 7 ft of water level rise during drilling, indicating the possible presence of confined conditions. Confined conditions are also present in the Haskell Springs area. Comparison of water surface elevations in the Haskell Springs area and areas to the east shows the presence of a hydrologic boundary. This boundary is shown on Figure 8.

Water Quality

Clarkdale Water System data shows arsenic levels in raw water produced from the Mt Gate well range from 0.024 to 0.036 mg/L. Arsenic data from the ADEQ Safe Drinking Water Database for two water systems operating near the Clarkdale Water System shows similar levels. Arsenic data for raw water produced by these systems is summarized in Table 2.

Table 2 Range of Arsenic Levels - Water Systems

Water System Name	System Number	Range of Arsenic Levels in Raw Water (mg/L)
Clarkdale	AZ0413024	0.024 - 0.036
Bent River	AZ0413267	0.029 - 0.039
On the Greens	AZ0413268	0.022 - 0.029

Analytical data developed for the Clarkdale Arsenic Treatment Feasibility Study is summarized in Table 3. The arsenic levels reported for the Mt Gate and Mescal wells exceed the Primary Drinking Water Standard maximum contaminant level (MCL). The total iron level reported for the Mescal well exceeds the Secondary Standard. The turbidity reported for the Mescal well exceeds the standard required for systems using filtration. The iron and turbidity exceedances may be related to the unused status of this well.

Table 3 Water Quality Data – 2022 Samples

Analyte	Mountain Gate	Mescal	Haskell Springs	Drinking Water Standard
pH	8.0	8.0	7.0	6.5-8.5 (S)
Temp	23°C	28°C	14°C	NL
Conductivity	430	311	552	NL
Dissolved Organic Carbon*	<1.0	<1.0	<1.0	NL
Total Organic Carbon	<1.00	<1.0	<1.00	NL
TDS	267	219	344	500 (S)
TSS	<2.0	31	<2.0	NL
Turbidity (NTU)	<1.0	23	<1.0	1-5 **
Total Alkalinity	202	172	237	NL
Total Arsenic	0.031	0.023	0.003	0.010 (P)
Arsenic III	<0.0010	0.0048	<0.0010	NL
Arsenic V	0.031	0.019	0.003	NL
Barium	<0.010	0.013	0.018	2 (P)
Boron	0.17	<0.10	<0.10	NL
Bromine	<0.50	<0.50	<0.50	NL
Calcium	7.9	6.2	62	NL
Chloride	15.6	7.4	15	250 (S)
Fluoride	0.34	0.28	0.15	4 (P) 2 (S)
Iron Dissolved	<0.050	0.24	<0.050	NL
Iron Total	<0.050	1.6	<0.050	0.3 (S)
Lead	<0.0010	0.003	<0.0010	0.015 (P)
Magnesium	12	2.1	32	NL
Manganese	<0.020	0.038	<0.020	0.05 (S)
Nitrate*	0.58	0.2	0.82	10 (P)
Nitrite*	<0.10	<0.10	<0.05	1 (P)
Phosphate	<0.05	0.11	<0.05	NL
Potassium	4.4	1.9	<1.0	NL
Sodium	78	77	14	NL
Silica	13	9.5	12	NL
Sulfate	18.6	3.31	55.2	250 (S)

Notes

= exceeds Drinking Water Standard

* 24 hr hold time exceeded ** treatment standard where filtration required

(P)=Primary Standard-Maximum Contaminant Level (S)=secondary standard (non-mandatory) NL=not listed

units=milligrams per liter unless stated otherwise

Owen-Joyce and Bell (1983) reported arsenic levels of 1 to 240 mg/l in Verde Formation water samples. The lower values occur in clean limestones and the higher values occur in clayey limestones and red clay beds. Review of well information indicates that large thicknesses of clean limestone beds are not present in the Service Area.

Water produced from the Mr and Dm at the Haskell Springs Well meets the MCL for arsenic. Arsenic data for water produced from the Tvlg was not located by Matrix's search of available data. The Tvlg depositional processes were different from that of the Verde Formation, indicating the potential for lower arsenic levels in the Tvlg.

Information from discussions with water system personnel indicates that the arsenic level for water produced from the 89A Tank site well was below the MCL. This indicates that water produced from a well at this location may be useful for blending.

Water Level Decline Trends

Matrix review of ADWR data from the Groundwater Site Inventory Database (GWSI) shows static water levels in the Service Area are declining. The lowest decline rates are present in the southeast part of the Service Area. The decline rates for GWSI well locations in and near the Service Area are shown in Table 4. The well locations and decline rates are shown on Figure 8. The GWSI data hydrographs for wells in and near the Service Area are plotted on Figures 9, 10 and 11.

Table 4 Water Level Data

ADWR Well No. (55-)	Well Name	Date Measured	Static Water Level (ft bgs)	Annual Decline Rate (ft/yr)	Area	Average Decline Rate in Area (ft/yr)
525162	School	4/18/24	302.70	2.37	Northwest	4.44
549644	Hoover	3/9/22	656.60	6.45		
560635	Longhurst	3/9/22	758.40	6.12		
609072	89A/tank	3/10/22	434.30	1.88		
202370	Mt Gate	6/5/24	480.00	5.38		
202140	Mescal	3/10/22	455.50	4.69	Southeast	2.2
506580	Cottonwood	4/16/24	254.50	+0.04		
642366	Hamdverger	4/18/24	275.90	0.09		
650113	Bell	4/19/04	236.80	0.06		
609073	Haskel 1	3/10/22	168.20	3.18	Haskell Springs	3.18

Well Siting Analysis

The initial Matrix review of hydrological data and well siting options, as described in the 3/12/24 email to Ardurra, identified the 89A well/tank site as the best option for the location of a new well. The selection of this location is confirmed based upon the results of the hydrogeologic data review and well siting analysis conducted for the current scope of work.

Matrix identified the four hydrogeological characteristics and one facilities characteristic listed below for evaluation of potential well site locations, as described below.

- Aquifer Properties
- Groundwater Quality
- Water Level Decline Trends
- Pumping Impacts
- Existing Infrastructure

Aquifer Characteristics

Potential well yields are determined by the hydraulic conductivity and thickness of the aquifer. The Paleozoic aquifer has good hydraulic conductivity but is limited in thickness and areal extent. The Tvg/Verde aquifer has lower hydraulic conductivity but has greater saturated thickness. This aquifer is present in most of the Service Area. The Tvg/Verde aquifer is prioritized for potential well site locations due to thickness and areal extent.

Groundwater Quality

The available data indicates that arsenic levels for water produced from the Verde Formation, within and near the Service Area, exceed the MCL. Review of the available data did not identify any locations within the Service Area where lower Verde Formation arsenic levels may be present. Information from water

system staff indicates that the 89A Tank site well produced water that was below the MCL for arsenic. This location was prioritized based on this information.

Arsenic data for water produced from the Tvg was not located by Matrix review. It is possible that this unit could produce water with lower arsenic levels than the Verde Formation due to the difference in depositional history between the units. If arsenic levels are lower in the Tvg, areas along the east side of the service area could be prioritized due to greater Tvg thickness.

Water Level Decline Trends

The lowest rates of water level decline occur in the southeast part of the Service Area. This area is prioritized based on the average decline rate of 2.2 ft/yr. Average decline rates in the 89A Tank site area are 4.44 ft/yr and the rate in the Haskell Springs area is 3.18 ft/yr.

Potential Well Sites

Based upon the rationale for the three criteria described above, Matrix selected two areas for potential well sites. The 89A Tank site was selected as Area A based in the presence of the Tvg/Verde aquifer, water level decline trend and water quality. Area B was selected based upon presence of the Tvg/Verde Aquifer and favorable water level decline trend. The need for arsenic treatment for water produced from Area B is likely. Area A and B are shown on Figure 12.

Pumping Impacts

Area A and B were evaluated for water level impacts due to pumping at these locations. For this evaluation a proposed new well was placed near the center of the area. Matrix estimated the impact of a new well pumping 400 gpm, for 20 years, at these locations using Theis analyses. This method is based on the Theis equation for non-equilibrium flow in an isotropic, homogeneous, unconfined aquifer. The aquifer properties determined from testing of the Mt Gate well were used in these analyses. The average annual decline rate for the area at each well was projected forward 20 years. The estimated static water level after 20 years of pumping is shown in Table 5.

Table 5 Estimated Water Levels – 20 years of Pumping

Area	Well	Static Water Level (ft bgs)	Water Level Decline Due to Pumping New Well (ft)	20-Year Projection of Annual Decline Rate (ft)	Estimated Static Water Level After 20 Years Pumping (ft bgs)
A - New Well at 89A Tank Site Location	New well	434	92	89	615
	Mt Gate	480	22	89	591
	Mescal	456	12	44	512
B - New well near center of area	New Well	490	92	44	626
	Mt Gate	480	17	44	541
	Mescal	456	16	17	489

Existing Infrastructure

Favorable infrastructure includes 3-phase electrical power, nearby water mains with additional capacity, and existing arsenic treatment facility. These features are present at the 89A Tank site location. Existing arsenic treatment facilities are not present in Area B. The presence of nearby water mains with additional capacity is not likely in Area B. The specific location with 3-phase electrical power in Area B was not determined.

Site Ranking

Areas A and B are ranked by characteristics in Table 6. The Mescal well site and Haskell Springs area are included in the table to provide comparison. Area A, the 89A Tank site, is ranked highest and Area B is ranked second highest. Based upon this ranking, the 89A Tank site is selected as the most favorable location for the proposed well.

Table 6 Potential Well Site Ranking

Proposed Location	Potential Yield	Groundwater Quality	Annual Decline	Pumping Impact	Existing Infrastructure	Score
A (89A Tank site)	3	3	2	3	5	16
B (89A, Sections 29, 30)	3	2	4	4	1	14
C Mescal Well Site	3	2	3	2	1	11
Haskell Springs	2	4	1	1	1	9

1= very unfavorable, 2= not favorable, 3= favorable, 4= very favorable, 5= excellent

Data Gaps

A data gap is present in the area shown on Figure 12 between Bitter Creek and the northwest boundary of the Service Area. The data gap is due to uncertainty regarding the depth of the Paleozoic aquifer in this area. Two wells northwest of the Service Area encountered the Paleozoic aquifer at depths of 765 to 940 ft. Vertical offset in Thb elevations between these wells and wells to the west of the data gap area indicates the possible presence of a fault. If the fault is located west of the Service Area boundary, the Paleozoic aquifer may be accessible in the data gap area.

Another data gap is the absence of arsenic data for water produced from the Tvq unit. The difference in depositional history between the Verde Formation and the Tvq indicates that lower arsenic levels may be present in saturated portions of the Tvq unit.

Recommendations

Based upon the results of this work, Matrix recommends the 89A Tank site as the best option for location of a new well. Matrix recommends the collection and analysis of water samples during drilling to assist in addressing the water quality data gap for the Tvq unit and to assist in the design of screened zones within the well.

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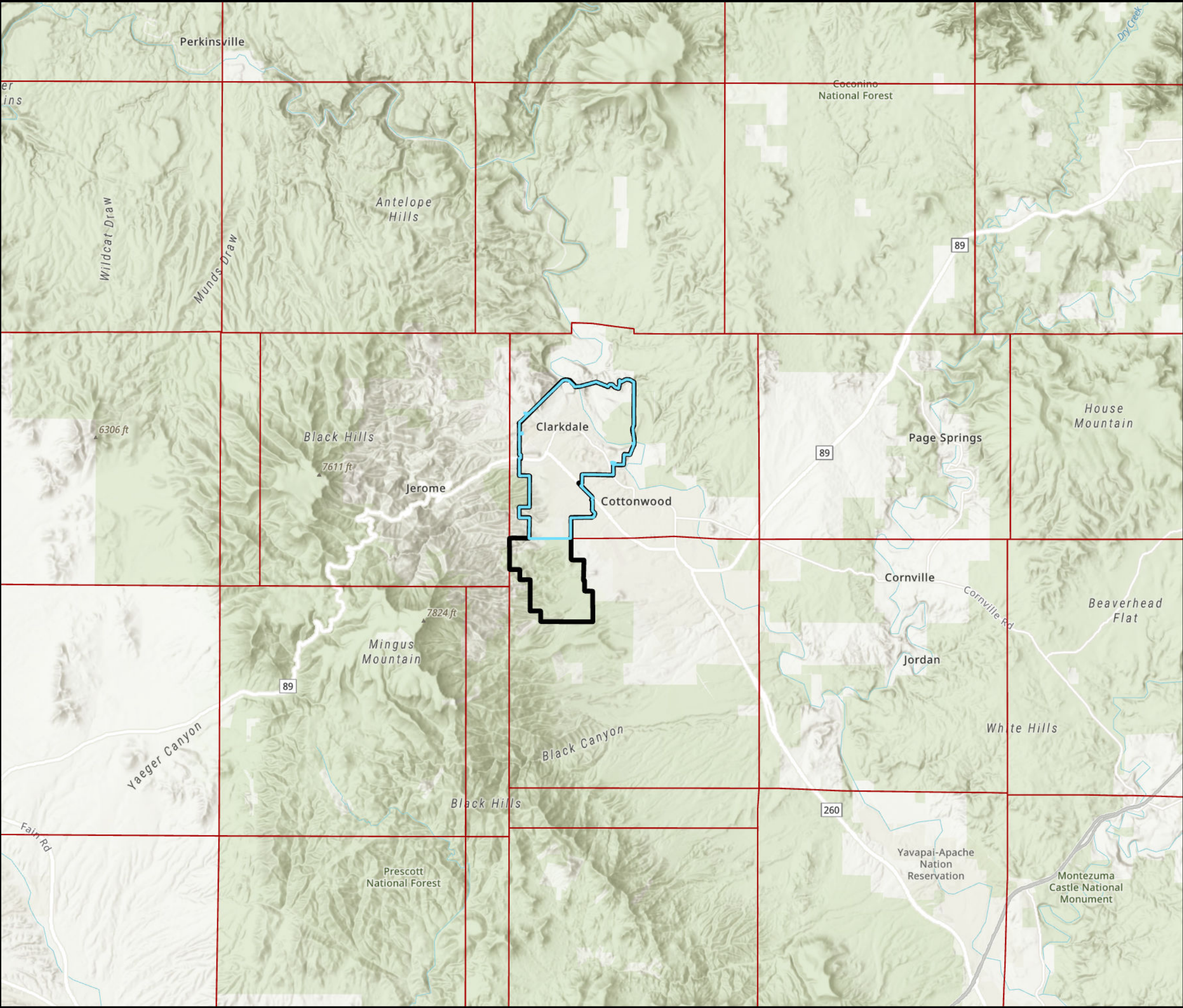
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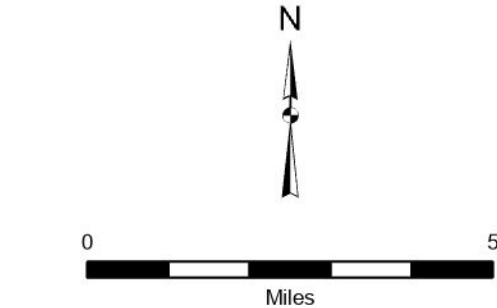


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EXPLANATION

- Clarkdale Boundary
- Clarkdale Service Area Boundary



Notes
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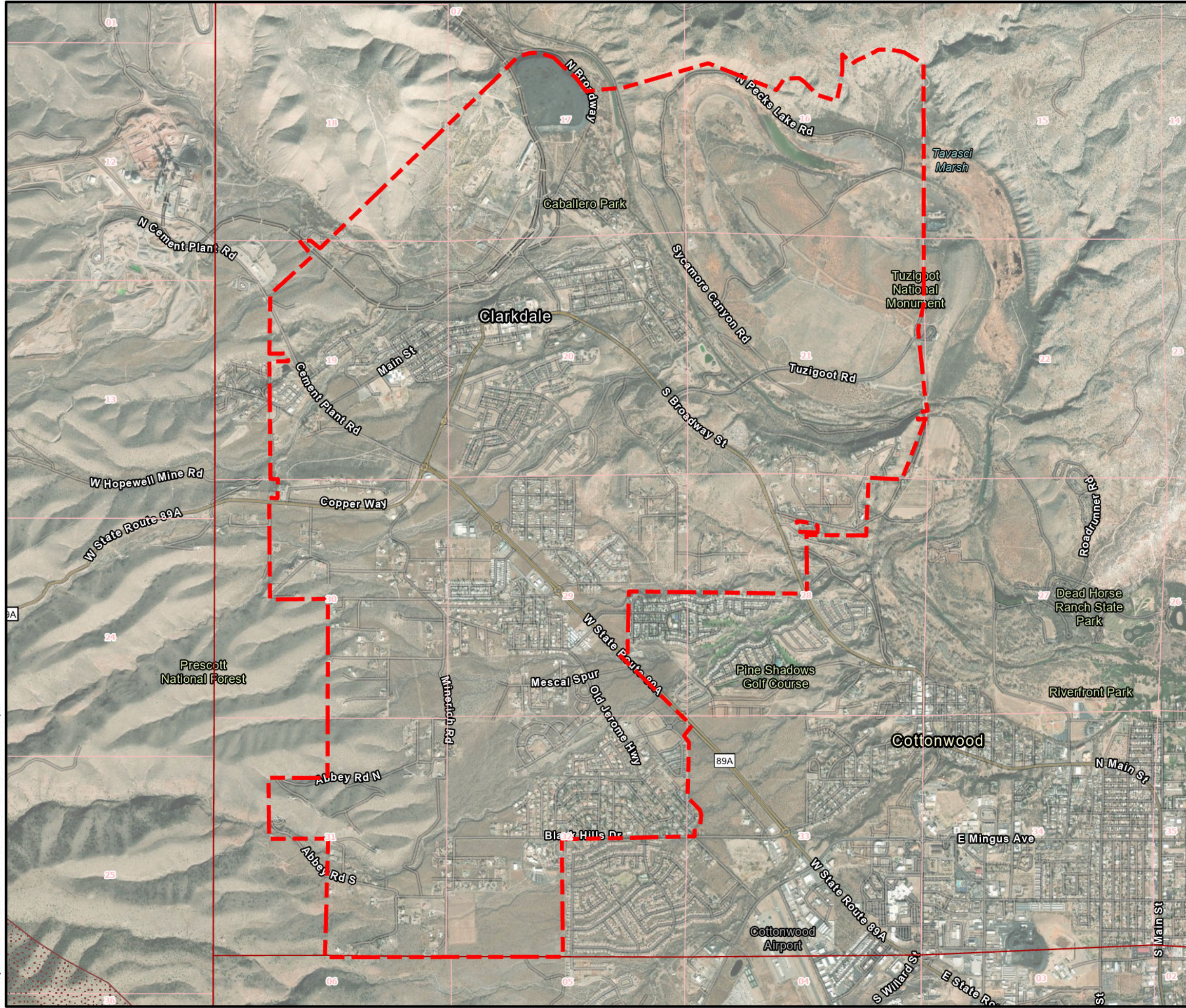
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	DATE: 07/26/2024	SJ	DATE: 07/26/2024
PROJECT NUMBER:		23-1135	

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Matrix New World Engineering, PC
3033 North 44th Street, Suite 270
Phoenix, Arizona 85018
Tel: 602-955-5647
Fax: 602-955-7585
www.mnw.com

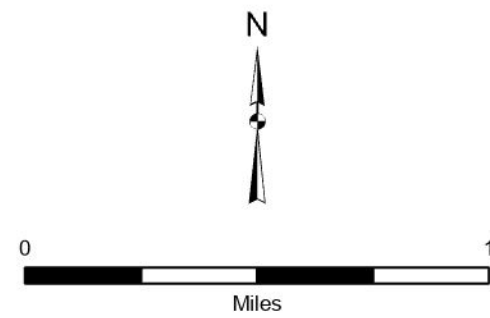
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FIGURE NUMBER:	
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EXPLANATION

 Clarkdale Service Area Boundary

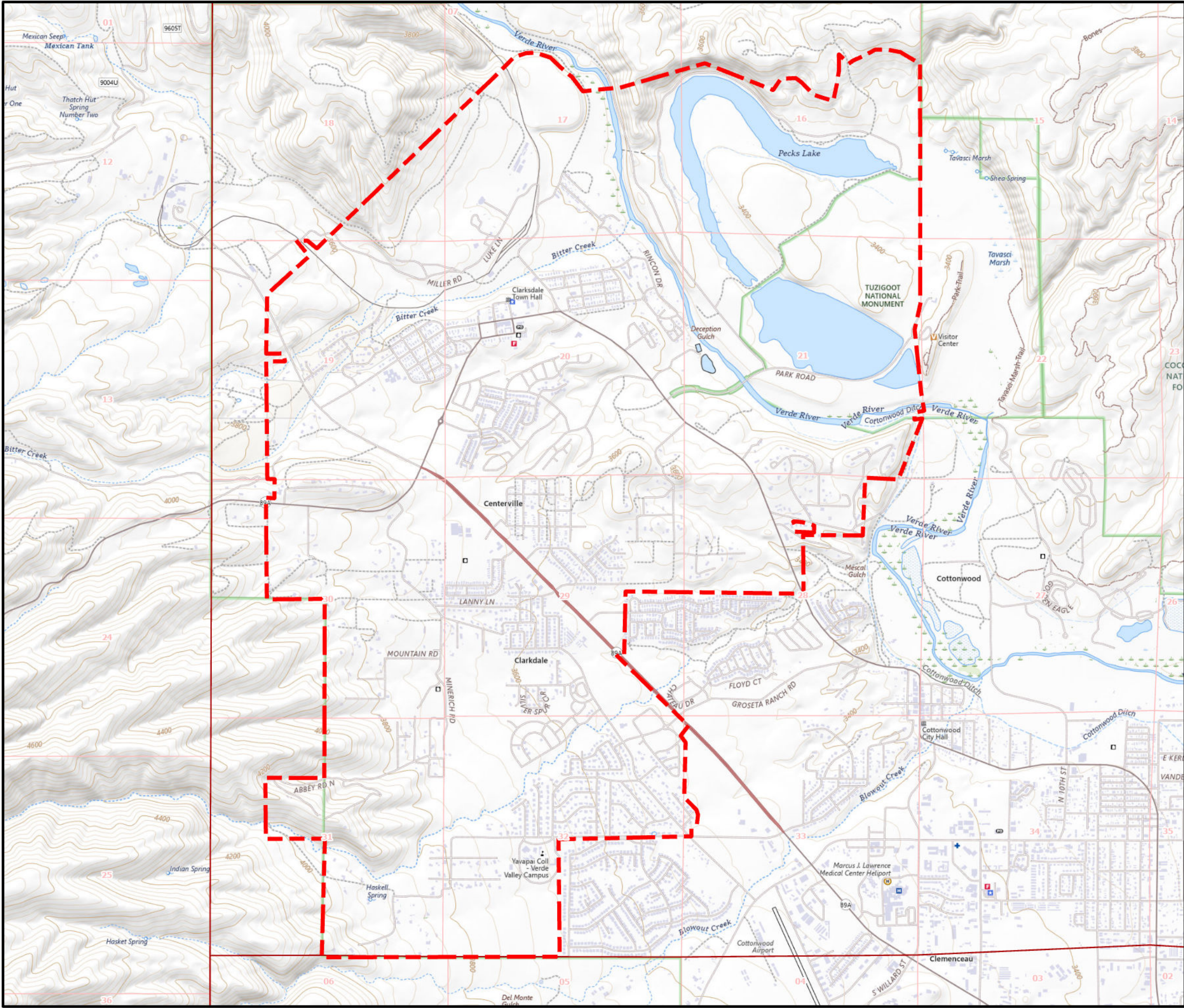


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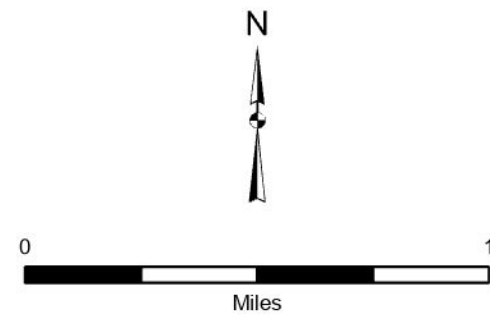
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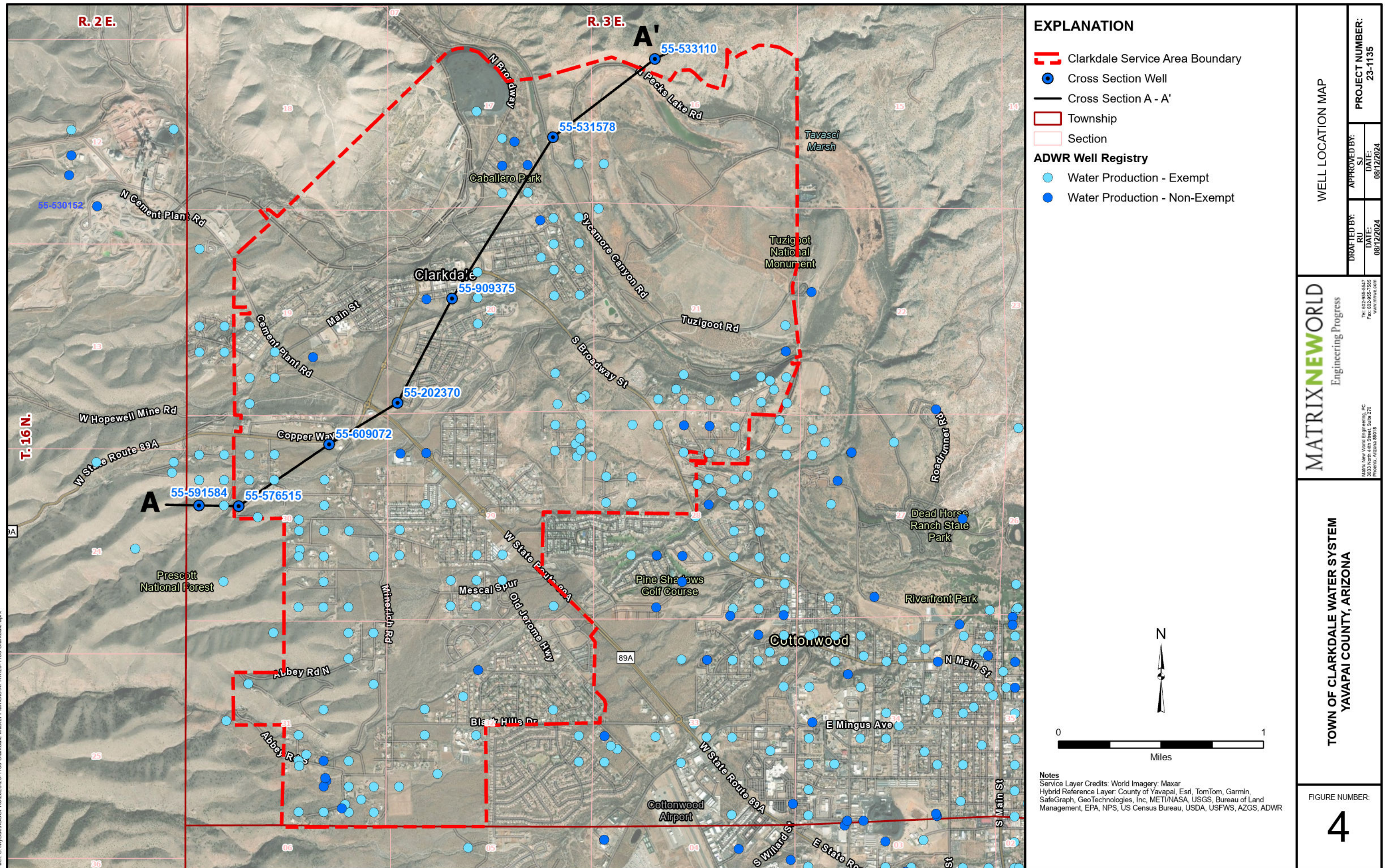
EXPLANATION

 Clarkdale Service Area Boundary

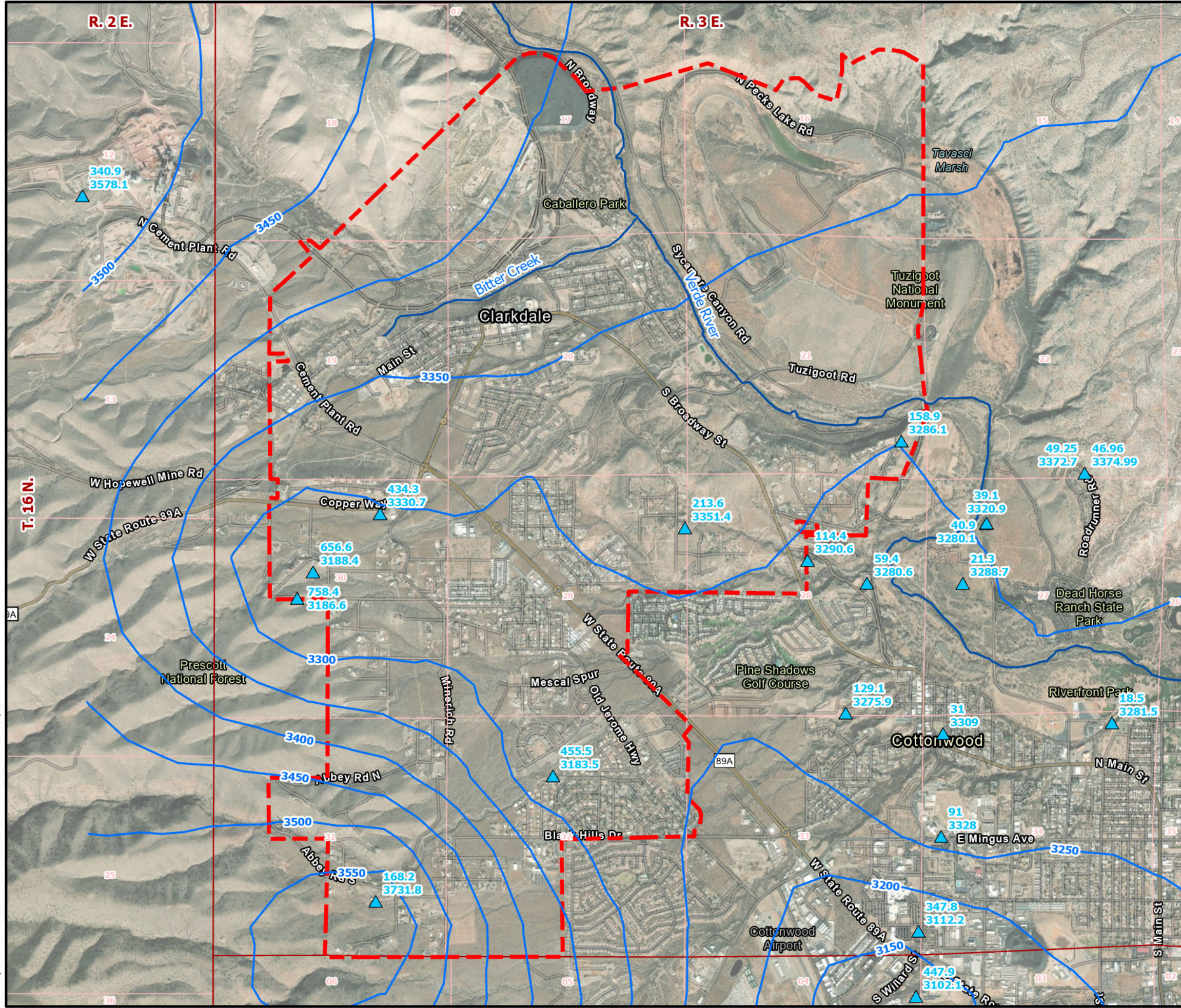


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MATRIX NEWORLD Engineering Progress	SERVICE AREA TOPOGRAPHIC MAP		PROJECT NUMBER: 23-1135	
	DRAFTED BY: RU	APPROVED BY: SJ	DATE: 08/12/2024	DATE: 08/12/2024
TOWN OF CLARKDALE WATER SYSTEM YAVAPAI COUNTY, ARIZONA		FIGURE NUMBER:		
		3		



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EXPLANATION

Clarkdale Service Area Boundary

Groundwater Elevation Countours (ft amsl)

Oct. 2021 - Mar. 2022 Static Groundwater Level

99 Depth to Groundwater (ft bls)

1123 Water Level Elevation (ft amsl)

Township

Section

Flow Regime

Ephemeral

Intermittent

Perennial

Miles

Notes

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ft amsl - Feet Above Mean Sea Level
ft bls - Feet Below Land Surface

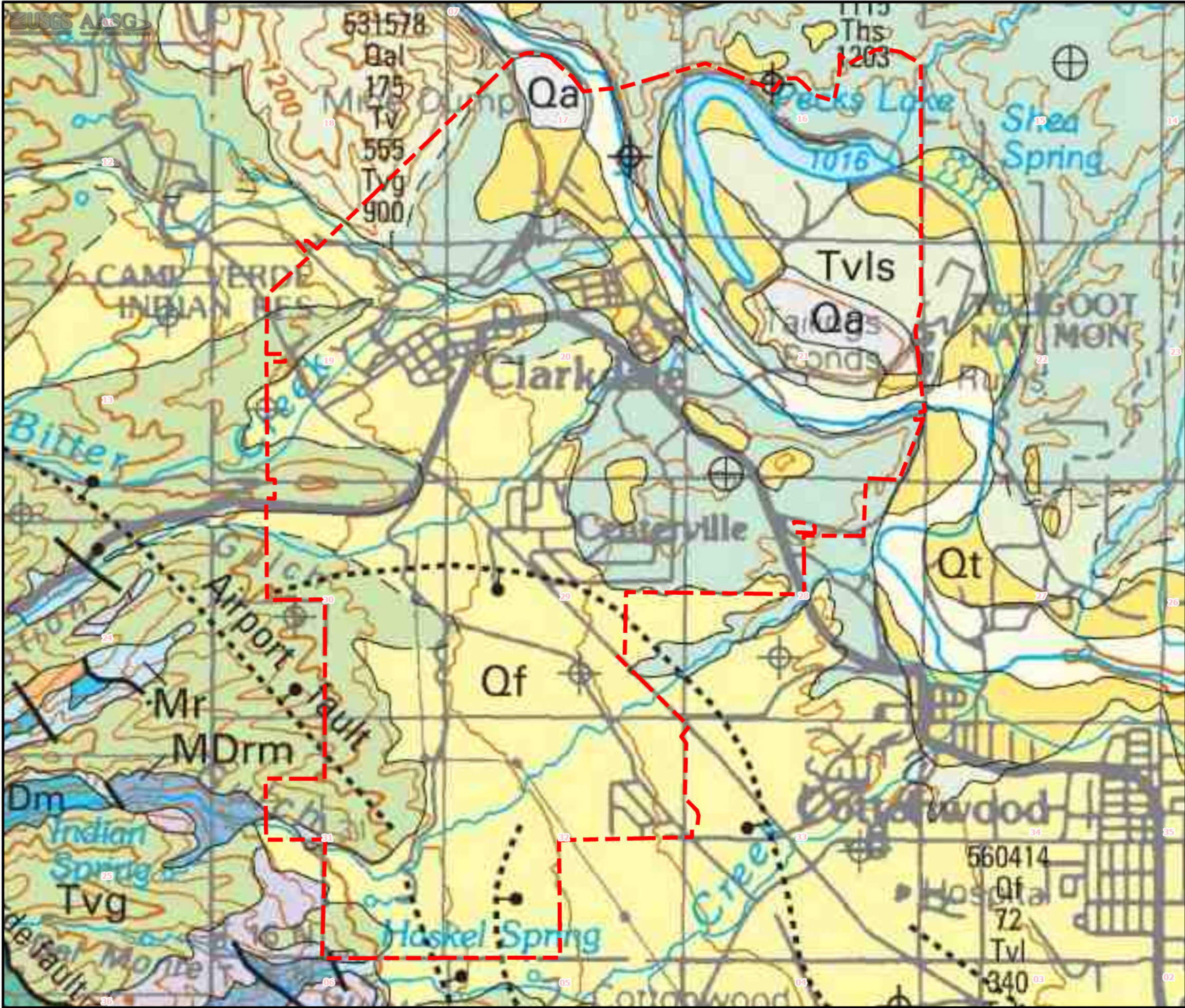
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Matrix New World Engineering, PC
3033 North 44th Street, Suite 270
Phoenix, Arizona 85018
Tel: 602-955-5547
Fax: 602-955-5555
www.mnw.com

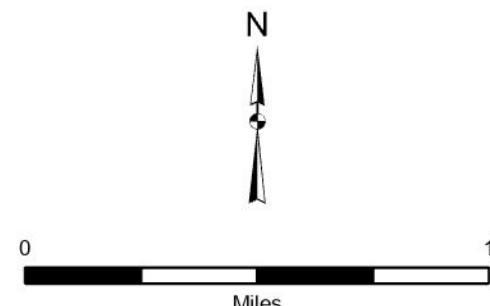
**TOWN OF CLARKDALE WATER SYSTEM
YAVAPAI COUNTY, ARIZONA**

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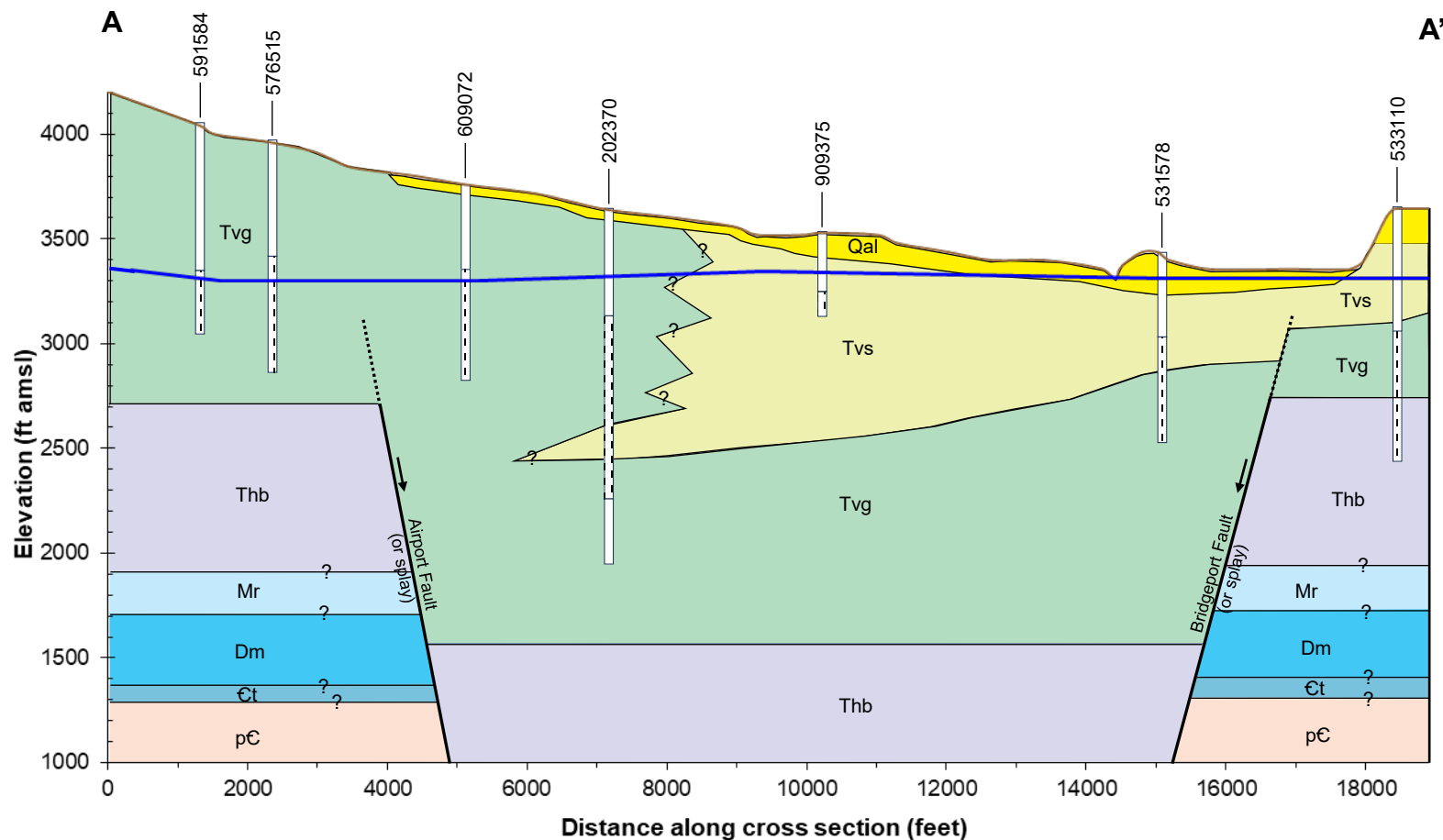
EXPLANATION

- Clarkdale Service Area Boundary
- township
- section



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SURFICIAL GEOLOGY MAP	PROJECT NUMBER: 23-1135	
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	TOWN OF CLARKDALE WATER SYSTEM YAVAPAI COUNTY, ARIZONA	
FIGURE NUMBER: 6		



Explanation

Qal Alluvium (Holocene-Pleistocene)	Mr Redwall Limestone		Fault
Tvg Verde Gravel	Dm Martin Formation		Fault (displacement may not be present)
Tvs Verde Formation (undifferentiated)	Ct Tapeats Sandstone		Contact (queried where inferred)
Thb Hickey Formation	pC Proterozoic Plutonic Units (undifferentiated)		Ground Surface
			Groundwater Surface
			3x Vertical Exaggeration

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Engineering Progress

August 28, 2024

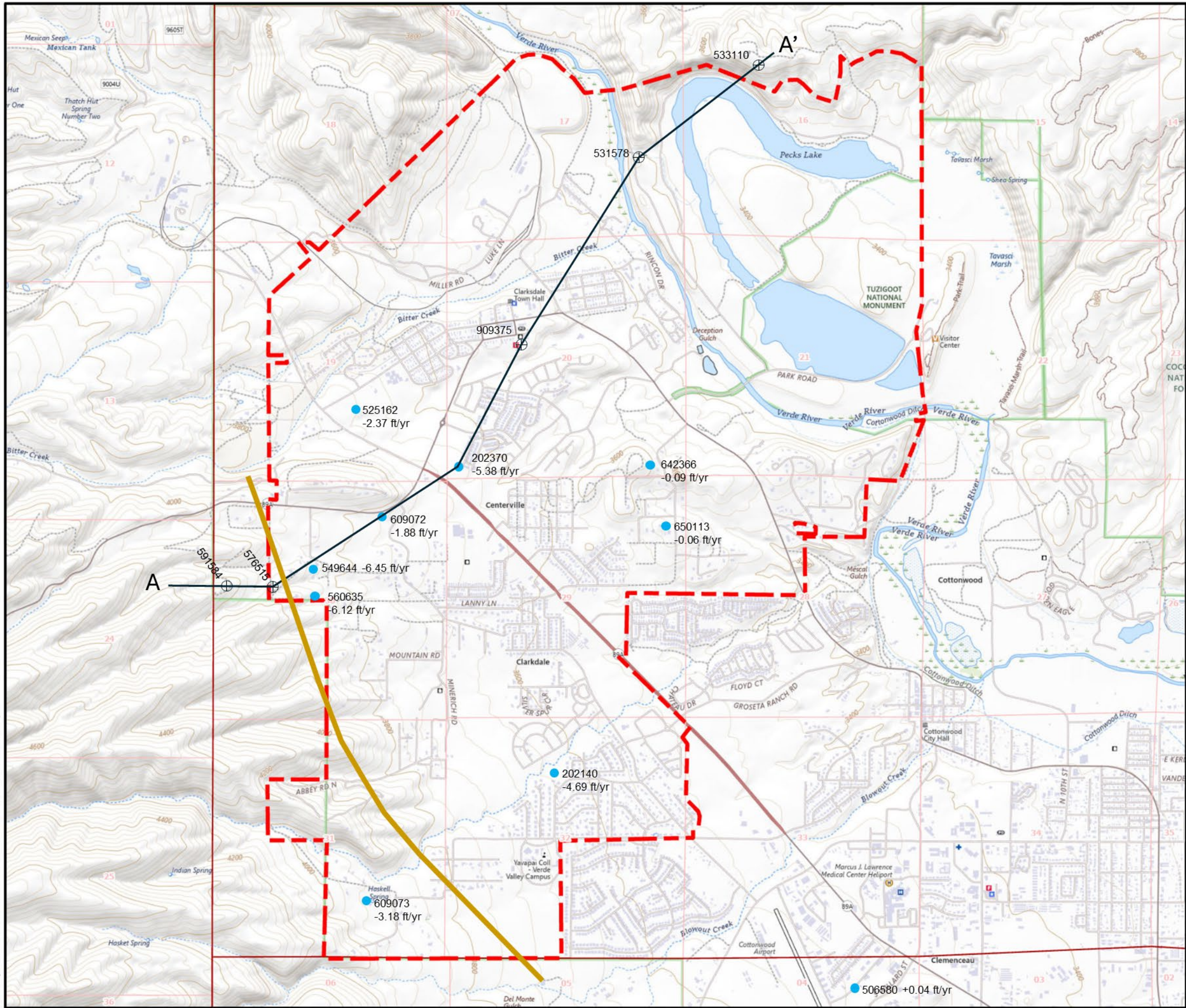
Project 23-1135

GEOLOGIC CROSS-SECTION TOWN OF CLARKDALE WATER SYSTEM

Yavapai County, Arizona

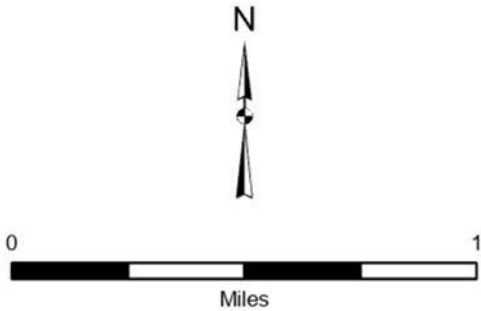
**Figure
7**

Path: S:\MyDocs\ISG\PRJ\2023\23-1135 Clarkdale Master Plan\GIS\APRX\23-1135 Clarkdale.aprx



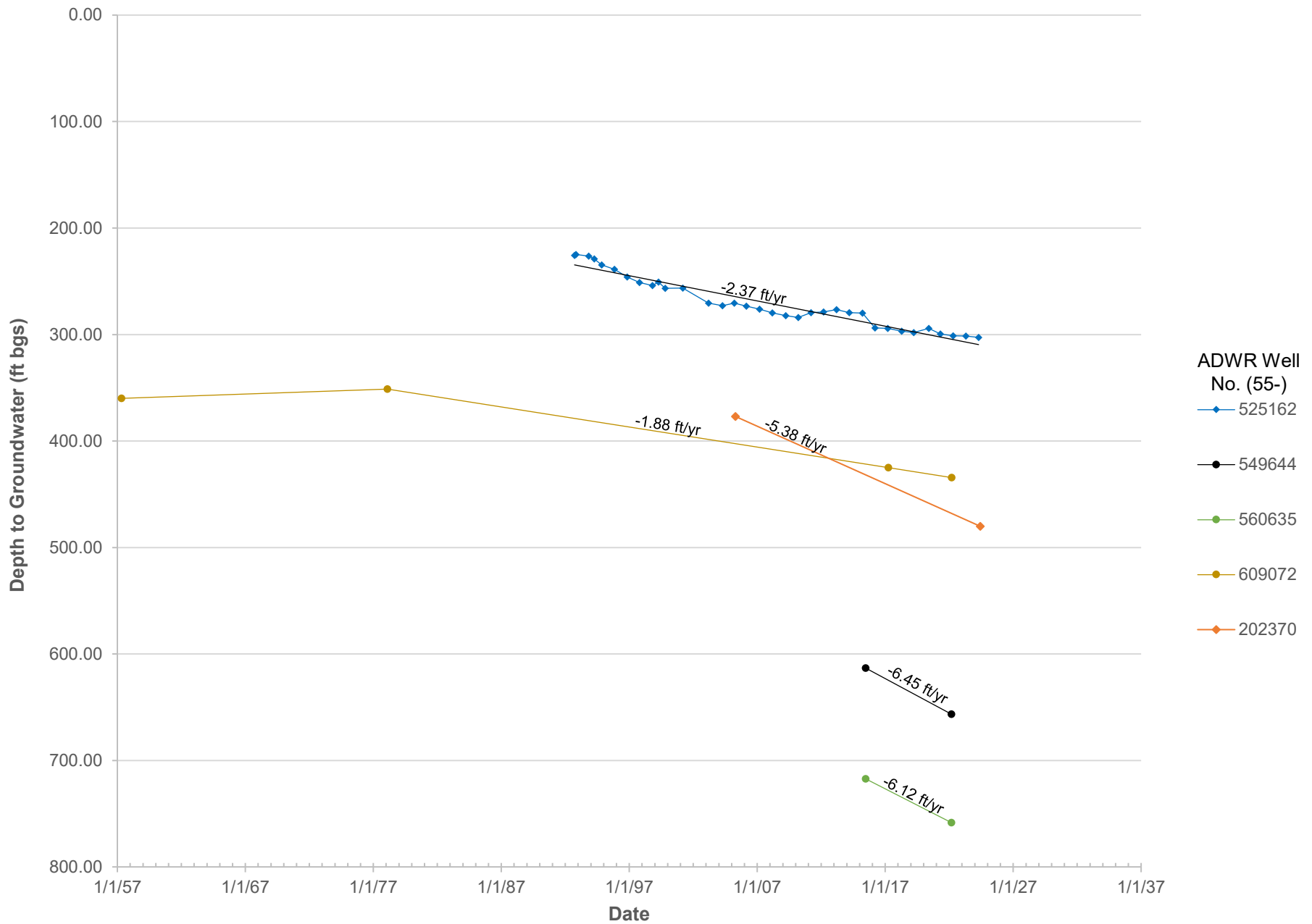
EXPLANATION

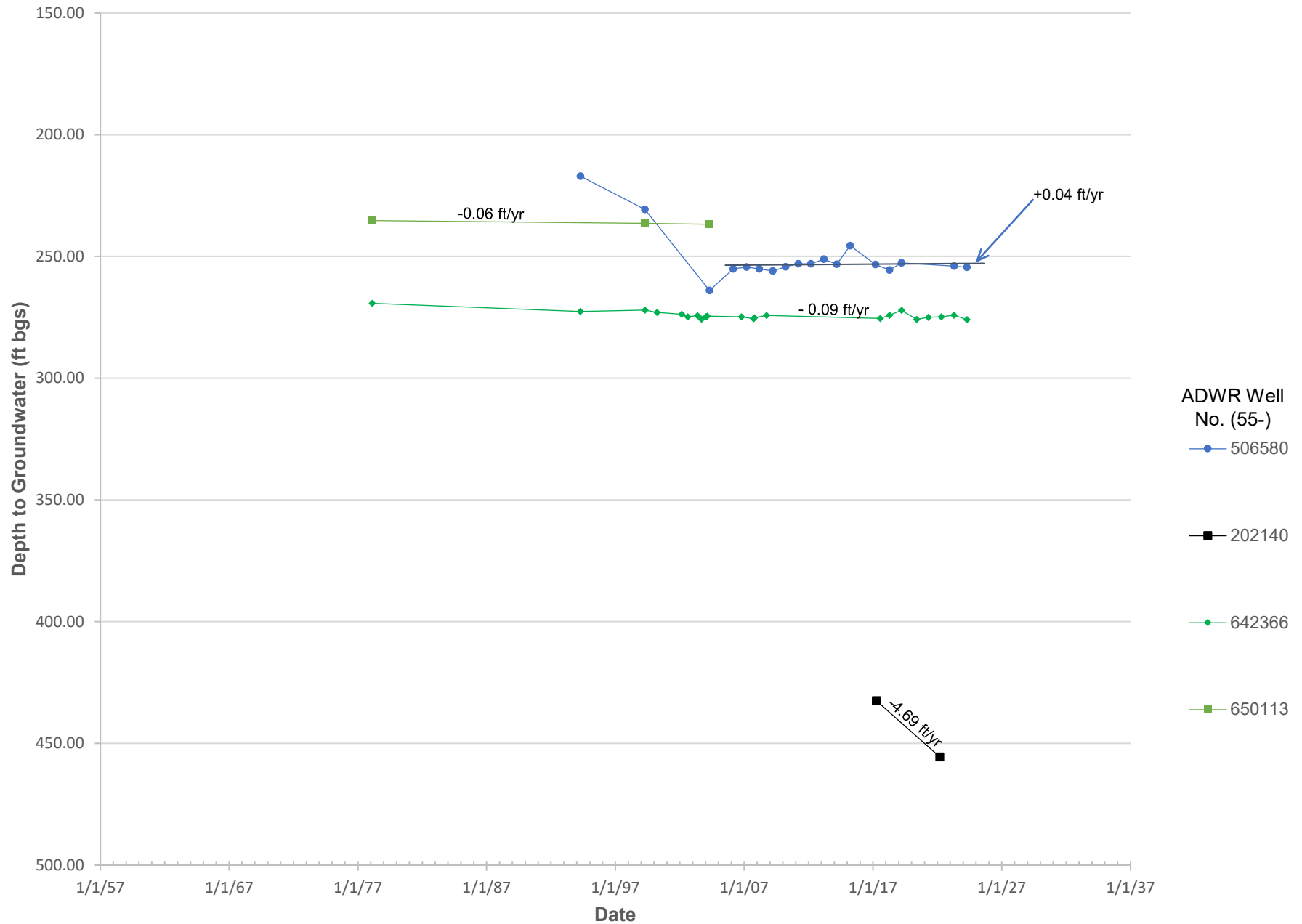
- Clarkdale Service Area Boundary
- GWSI Well
ADWR No. 55-
Annual Rate of Decline
- Cross-section A – A'
- Hydrologic Boundary



Notes
Service Layer Credits: USGSTopo: USGS The National Map; National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; USGS Global Ecosystems; U.S. Census Bureau TIGER/Line data; USFS Road data; Natural Earth Data; U.S. Department of State HII; NOAA National Centers for Environmental Information, AZGS, ADWR

MATRIX NEW WORLD Engineering Progress	GWSI Well Locations		PROJECT NUMBER: 23-1135	
	DRAFTED BY: RU	APPROVED BY: SJ	DATE: 08/12/2024	DATE: 08/12/2024
TOWN OF CLARKDALE WATER SYSTEM YAVAPAI COUNTY, ARIZONA		FIGURE NUMBER: 8		





MATRIX**NEW****WORLD**

Engineering Progress

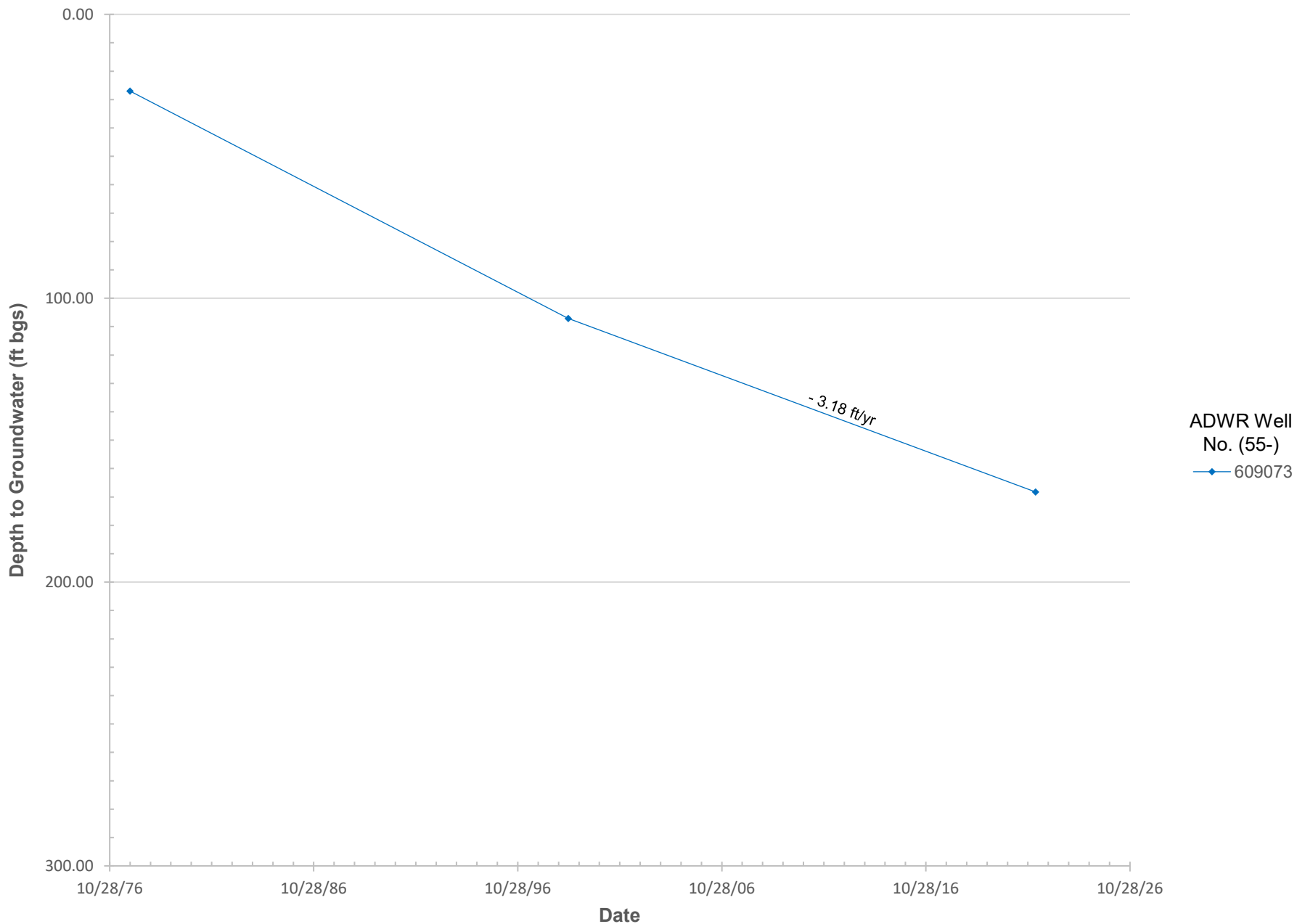
August 26, 2024

Project 23-1135

SOUTHEAST AREA WELLS - WATER LEVEL HYDROGRAPHS TOWN OF CLARKDALE WATER SYSTEM

Yavapai County, Arizona

**Figure
10**



MATRIX**NEW****WORLD**

Engineering Progress

August 26, 2024

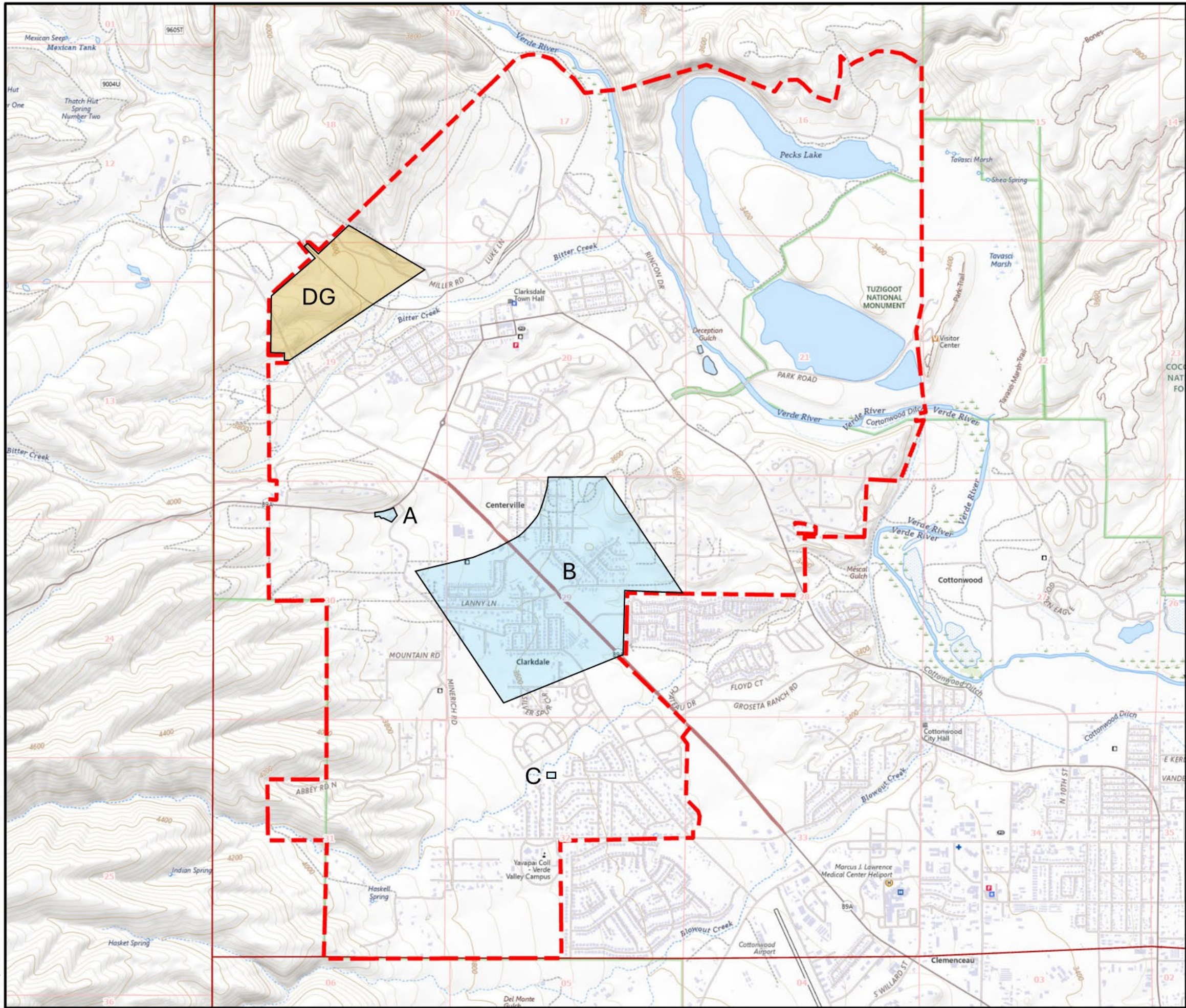
Project 23-1135

**HASKELL SPRINGS WELL - WATER LEVEL HYDROGRAPH
TOWN OF CLARKDALE WATER SYSTEM**

Yavapai County, Arizona

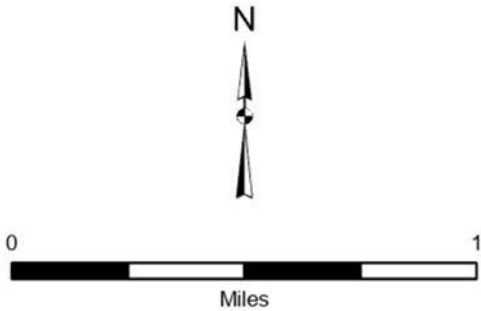
**Figure
11**

Path: S:\MyDocs\ISG\CP\120223\123-1135 Clarkdale Master Plan\GIS\APRX\123-1135 Clarkdale.aprx



EXPLANATION

- Clarkdale Service Area Boundary
- A Potential Well Site Area
- DG Data Gap Area (potential future exploration)



Notes
Service Layer Credits: USGSTopo: USGS The National Map; National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; USGS Global Ecosystems; U.S. Census Bureau TIGER/Line data; USFS Road data; Natural Earth Data; U.S. Department of State HIU; NOAA National Centers for Environmental Information, AZGS, ADWR

Potential Well Site Areas

MATRIX

NEWORLD

Engineering Progress

TOWN OF CLARKDALE WATER SYSTEM

YAVAPAI COUNTY, ARIZONA

FIGURE NUMBER:

12

DRAFTED BY: SJ

APPROVED BY: SJ

PROJECT NUMBER: 23-1135

DATE: 08/30/24

DATE: 08/30/24



Rubicon Applied Divers

Field Report

Clarkdale- Haskell North

7/16/2024

Submitted To:

Clarkdale Municipal Water System

890 Main Street
Clarkdale, AZ 86324

Phone: 928-639-2450

Email: ethan.pebworth@clarkdale.az.gov

Submitted By:

Rubicon Applied Divers

7429 Teaswood Dr
Conroe, TX 77304

Office Phone: 602-258-1116

Office Fax: 480-214-0118

Cell Phone: 602-334-6523

Email: smoses@rubiconfab.com

Operations

Cell Phone: 360-875-1169

Email: tara@rubiconfab.com



Arizona

License No. 160416*



California License No. 942354*



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Introduction

The following is a report of the inspection done by Rubicon Applied Divers, Inc. commercial dive team on 7/16/2024 .

Methods Used by Rubicon Applied Divers:

All the equipment used for the inspection and/or cleaning, including the gear physically on the diver, is disinfected with a 200ppm chlorine mixture prior to entering the tank or reservoir. The diver is fully encapsulated in a dry suit, Kirby Morgan helmet, and rubber gloves to ensure that we do not introduce any contaminants in your water supply.

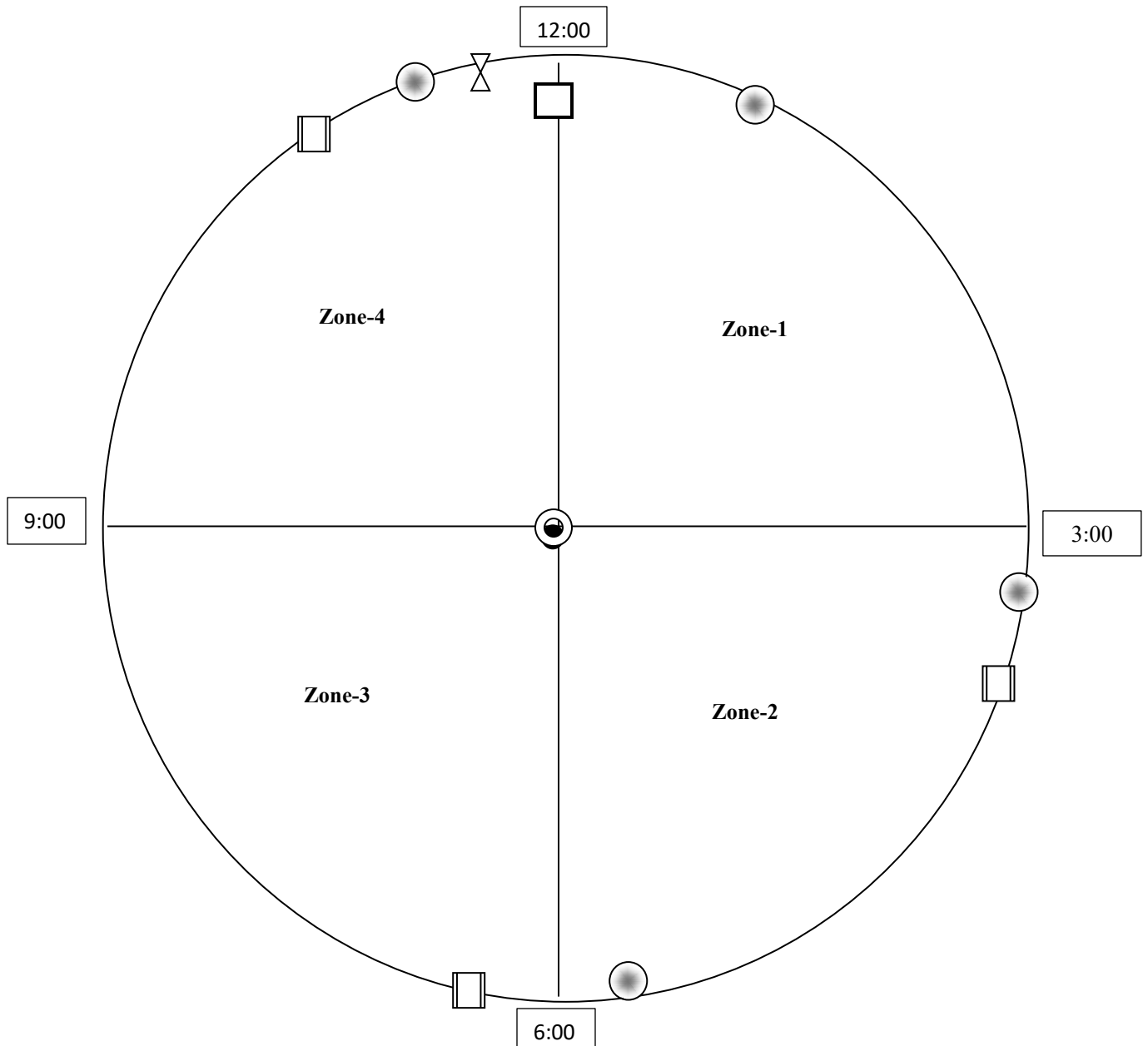
If the diver is conducting a cleaning, he or she will stand on the ladder at the bottom of the tank and clean a section to stand before stepping on the bottom as to not stir up sediment in the tank. Cleanings are done using a vacuum like method, Rubicon Applied Divers has a variety of pumps, different sized hoses, and vacuum heads to best meet the requirements of every client.

Inspections are recorded using high quality video and audio equipment and stored digitally. If the diver is conducting a cleaning, he/she will record a few minutes of the cleaning process. Once the recorded part of the inspection begins the diver will start at the entry to the tank or reservoir moving clockwise around the structure. As the diver moves through the tank/reservoir they will be describing all structural areas, penetrations, condition of the tank, and sediment buildup. Digital photos will also be taken of all areas discussed and they will be included in the report with descriptions.

Overview

Clarkdale Municipal Water System contracted Rubicon Applied Divers to perform a leak detection and inspection two tanks located in Clarkdale, AZ. The Haskell tanks are co-located in a fenced gravel lot. Haskell North is a welded steel potable water tank with a nominal capacity of 744KG, a diameter of 65', and height of 30'. The dive team performed an initial exterior inspection, the panels, coating, and exterior plumbing appeared to be in good condition. Once the diver entered the tank, he noted the walls above the waterline, ladder, ceiling, and support beams displayed significant corrosion and delamination. Below the waterline, the condition of the ladder and coating improved, the coating was intact with minimal staining on the walls. The interior ladder, hardware, and penetration points in the tank appear to be in good condition. Sediment in the tank was composed of a light sand-based material, less than 1/4" in depth. The coating on the floor appeared to be intact. During the inspection the diver noted several heavily corroded rafters scattered on the floor along with large chunks of rust and coating which appears to have fallen from the ceiling.

Structure Diagram



	Entry Hatch		Column
	Inlet / Outlet Pipe		Vent
	Drain		Liquid Level Indicator
	Overflow		Man Way
	Capped Off Penetration / Water Tap		

Exterior Photos/ Descriptions

Exterior Shell	
Material	Steel
Grade	On ☒ Below ☐ Tower ☐
Exposed Seams/Joints	Satisfactory ☒ Acceptable ☐ Failing ☐
Corrosion	0-20% ☒ 20-60% ☐ 60-100% ☐
Exterior Ladder	Cage ☒ Fixed Rail ☐ None ☐
Height (ladder)	N/A
Description	Welded steel, appears to be in good condition



Exterior Roof	
Shape	Dome ☐ Flat ☒
Safety Rail	Yes ☐ No ☒
Platform	Yes ☐ No ☒
Seams/Joints	Satisfactory ☒ Acceptable ☐ Failing ☐
Corrosion	0-20% ☒ 20-60% ☐ 60-100% ☐
Exposed Aggregate	Yes ☐ No ☒
Description	Welded steel, appears to be in good condition

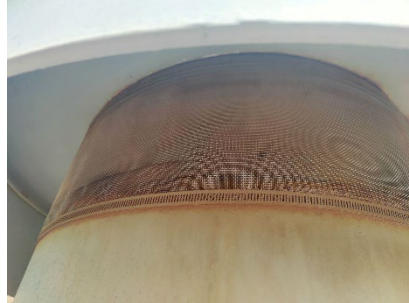


Exterior Vents	
Condition	Good ☒ Decent ☐ Rough ☐
Screen Coverage	Full ☒ Partial ☐ None ☐
Seams/Joints	Satisfactory ☒ Acceptable ☐ Failing ☐
Corrosion	0-20% ☒ 20-60% ☐ 60-100% ☐
Cap/Cover	Yes ☒ No ☐
Description	Capped center vent, screen intact, light staining



Access Hatch		
Shape	Round ☒ Square ☐	
Lid Material	Steel	
Secured	Yes ☒ No ☐	
Interior Ladder	Yes ☒ No ☐	
Gasket	Intact ☐ Cracking ☒ N/A ☐	
Hatch Size	Approx. 24"	
Description	Hinged steel cover, appears to be in good condition	

Additional Exterior Photos

		
Foundation	Electronics	Possible Fill
		
Inlet/Outlet	Ladder & LLI	Underside of Vent

Interior Photos/Descriptions

Interior Ladder	
Material	Steel
Corrosion	20% ☒ 20-60% ☐ 60-100% ☐
Seams/Welds	Satisfactory ☒ Acceptable ☐ Failing ☐
Staining	Yes ☒ No ☐
Coating	Blistering ☐ Peeling ☐ Satisfactory ☒ N/A ☐
Description	Heavy corrosion above waterline, coating below waterline intact



Interior Shell	
Material	Steel
Construction	Bolted ☐ Welded ☒ N/A ☐
Corrosion	20% ☒ 20-60% ☐ 60-100% ☐
Staining	Yes ☒ No ☐
Coating	Blistering ☐ Peeling ☐ Satisfactory ☒ N/A ☐
Description	Light staining, coating appears to be in good condition



Floor	
Material	Steel
Construction	Bolted ☐ Welded ☒ N/A ☐
Corrosion	20% ☒ 20-60% ☐ 60-100% ☐
Staining	Yes ☒ No ☐
Seams/Joints	Satisfactory ☒ Acceptable ☐ Failing ☐
Sediment Buildup/Makeup	Approx. 1/4" sand-based material
Coating	Blistering ☐ Peeling ☐ Satisfactory ☒ N/A ☐
Description	Light layer of sediment, large pieces of rust scattered around tank
Cleaning	Completed ☐ Recommended ☒ Unnecessary ☐



Support Column	
Material	Steel
Corrosion	20% ☒ 20-60% ☐ 60-100% ☐
Seams/Joints	Satisfactory ☒ Acceptable ☐ Failing ☐
Base Plates	Good ☒ Decent ☐ Failing ☐
Staining	Yes ☒ No ☐
Coating	Blistering ☒ Peeling ☒ Satisfactory ☐ N/A ☐
Description	Single center column, blistering and peeling coating throughout



Interior Roof	
Material	Steel
Corrosion	20% ☐ 20-60% ☒ 60-100% ☐
Seams/ Joints	Satisfactory ☐ Acceptable ☒ Failing ☐
Support Beams	Corroding ☒ Satisfactory ☐ N/A ☐
Staining	Yes ☒ No ☐
Coating	Blistering ☐ Peeling ☒ Satisfactory ☐ N/A ☐
Description	Significant coating delamination, heavy corrosion on rafters



Liquid Level Indicator		
Base Welds	Satisfactory ☒ Failing ☐ N/A ☐	
Base Connection	Satisfactory ☒ Failing ☐ N/A ☐	
Guide Wires	Satisfactory ☒ Failing ☐ N/A ☐	
Float	Satisfactory ☒ Failing ☐ N/A ☐	
Exterior Reading	Accurate ☒ Inaccurate ☐ N/A ☐	
Description	Corrosion noted on base plate, both guidewires connected	

Manways	
Material	Steel
Corrosion	20% ☒ 20-60% ☐ 60-100% ☐
Gasket	Intact ☒ Cracking ☐ N/A ☐
Seams/Joints	Satisfactory ☒ Acceptable ☐ Failing ☐
Staining	Yes ☒ No ☐
Coating	Blistering ☐ Peeling ☐ Satisfactory ☒ N/A ☐
Description	Two manways, light staining, gaskets appear to be intact



Inlet/Outlet	
Material	Steel
Corrosion	20% ☒ 20-60% ☐ 60-100% ☐
Location	Approx. 2:00
Seams/Joints	Satisfactory ☒ Acceptable ☐ Failing ☐
Obstruction	None ☒ Partial ☐ Full ☐
Coating	Blistering ☒ Peeling ☐ Satisfactory ☐ N/A ☐
Description	Pipe enters through lower wall, slight rim, minor blistering on interior



Cathodic Protection	
Material	Sacrificial Anode ☐ ICCP ☒ Other ☐
% Wasted	20% ☐ 20-60% ☐ 60-100% ☐ N/A ☒
Number	N/A
Location(s)	N/A
Description	Several wires hang down from ceiling terminating at various point, porcelain weights on end of wires



Additional Interior Photos

	
LLI Base	Telemetry
	
Column Base	Drain
	
Dollar Plate	Inlet/Outlet

Additional Interior Photos

	
Corroded Rafter	Corroded Rafter
	
2nd Manway	Mud Gate
	
Rafters	Blistering Coating on Column

Recommendations

Rubicon Applied Divers has been in business for over twenty years, based on our experience we fully agree with AWWA recommendations that potable reservoirs and storage tanks should be cleaned and inspected at least every three years. Periodic inspections are used to identify and evaluate current and potential water quality problems. Rubicon Applied Divers uses the following rating system with our repair recommendations;

Necessary, repairs should be addressed before the next inspection.

Necessary Urgent, repairs should be addressed within the next 12-18mos.

Necessary Critical, repairs should be addressed within the next 6mos.

Rubicon Applied Divers make the following recommendations:

- 1- Continue current cleaning and inspection practices
- 2- **Necessary- have dive team return to remove large debris from tank and conduct further assessment of ceiling.**

Conclusion

Based upon the results of the underwater inspection, it appears that the tank is in fully operational condition and should continue to provide water with proper maintenance.



Rubicon Applied Divers

Field Report

Clarkdale- Haskell South

7/16/2024

Submitted To:

Clarkdale Municipal Water System
890 Main Street
Clarkdale, AZ 86324
Phone: 928-639-2450
Email: ethan.pebworth@clarkdale.az.gov

Submitted By:

Rubicon Applied Divers
7429 Teaswood Dr
Conroe, TX 77304
Office Phone: 602-258-1116
Office Fax: 480-214-0118
Cell Phone: 602-334-6523
Email: smoses@rubiconfab.com
Operations
Cell Phone: 360-875-1169
Email: tara@rubiconfab.com



Arizona

License No. 160416*



California License No. 942354*



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Introduction

The following is a report of the inspection done by Rubicon Applied Divers, Inc. commercial dive team on 7/16/2024 .

Methods Used by Rubicon Applied Divers:

All the equipment used for the inspection and/or cleaning, including the gear physically on the diver, is disinfected with a 200ppm chlorine mixture prior to entering the tank or reservoir. The diver is fully encapsulated in a dry suit, Kirby Morgan helmet, and rubber gloves to ensure that we do not introduce any contaminants in your water supply.

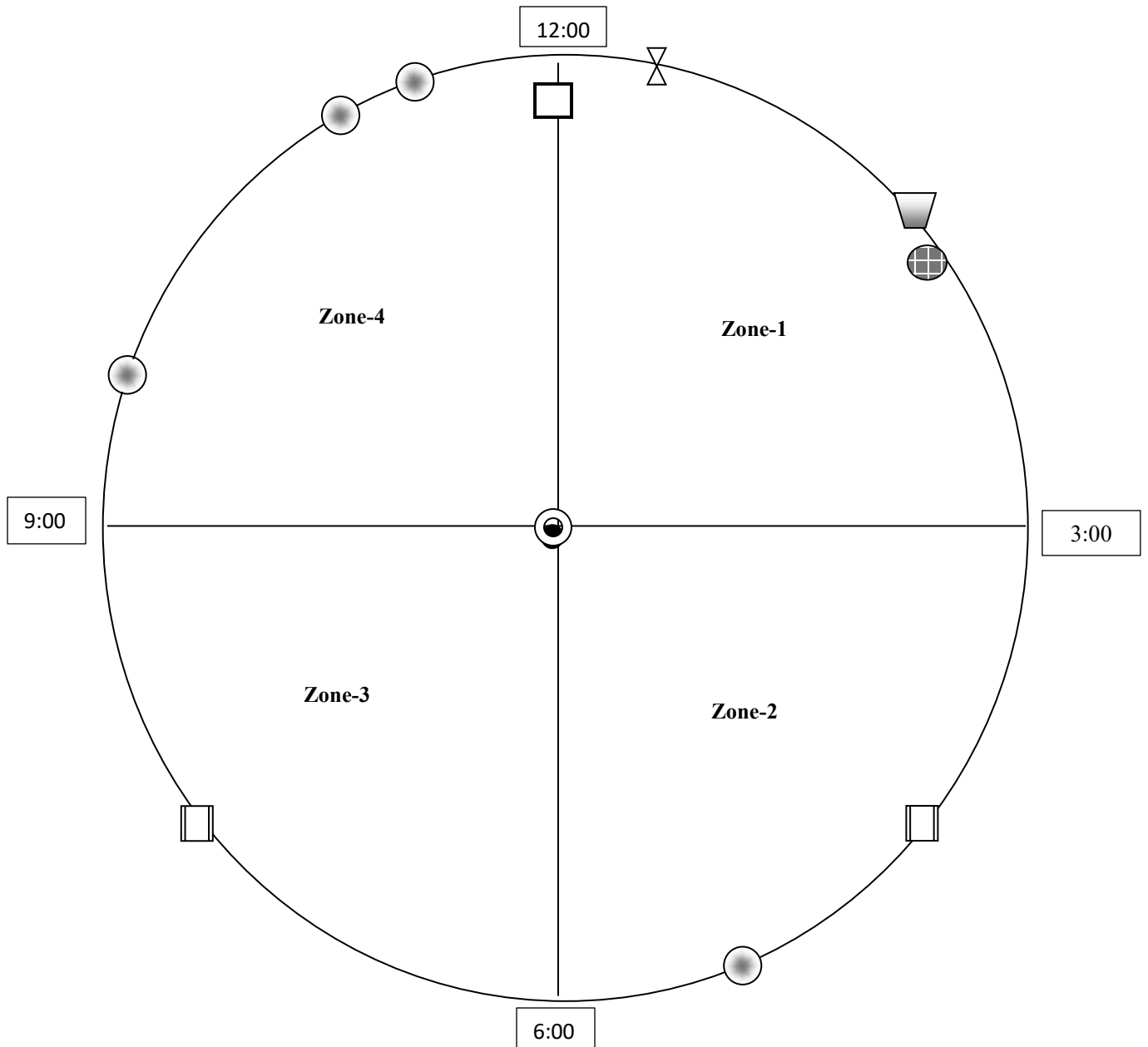
If the diver is conducting a cleaning, he or she will stand on the ladder at the bottom of the tank and clean a section to stand before stepping on the bottom as to not stir up sediment in the tank. Cleanings are done using a vacuum like method, Rubicon Applied Divers has a variety of pumps, different sized hoses, and vacuum heads to best meet the requirements of every client.

Inspections are recorded using high quality video and audio equipment and stored digitally. If the diver is conducting a cleaning, he/she will record a few minutes of the cleaning process. Once the recorded part of the inspection begins the diver will start at the entry to the tank or reservoir moving clockwise around the structure. As the diver moves through the tank/reservoir they will be describing all structural areas, penetrations, condition of the tank, and sediment buildup. Digital photos will also be taken of all areas discussed and they will be included in the report with descriptions.

Overview

Clarkdale Municipal Water System contracted Rubicon Applied Divers to perform a leak detection and inspection two tanks located in Clarkdale, AZ. The Haskell tanks are co-located in a fenced gravel lot. Haskell South is a welded steel potable water tank with a nominal capacity of 552KG, a diameter of 56', and height of 30'. The dive team performed an initial exterior inspection, the panels, coating, and exterior plumbing appeared to be in good condition. Once the diver entered the tank, he noted the walls above the waterline, ladder, ceiling, and support beams displayed minor corrosion and delamination. Below the waterline, the condition of the ladder and coating improved, the coating was intact with minimal staining on the walls. The interior ladder, hardware, and penetration points in the tank appear to be in good condition. Sediment in the tank was composed of a light sand-based material, less than 1/2" in depth. The coating on the floor appeared to be intact.

Structure Diagram



	Entry Hatch		Column
	Inlet / Outlet Pipe		Vent
	Drain		Liquid Level Indicator
	Overflow		Man Way
	Capped Off Penetration / Water Tap		

Exterior Photos/ Descriptions

Exterior Shell	
Material	Steel
Grade	On ☒ Below ☐ Tower ☐
Exposed Seams/Joints	Satisfactory ☒ Acceptable ☐ Failing ☐
Corrosion	0-20% ☒ 20-60% ☐ 60-100% ☐
Exterior Ladder	Cage ☒ Fixed Rail ☐ None ☐
Height (ladder)	N/A
Description	Welded steel, appears to be in good condition



Exterior Roof	
Shape	Dome ☐ Flat ☒
Safety Rail	Yes ☐ No ☒
Platform	Yes ☐ No ☒
Seams/Joints	Satisfactory ☒ Acceptable ☐ Failing ☐
Corrosion	0-20% ☒ 20-60% ☐ 60-100% ☐
Exposed Aggregate	Yes ☐ No ☒
Description	Welded steel, appears to be in good condition



Exterior Vents	
Condition	Good ☒ Decent ☐ Rough ☐
Screen Coverage	Full ☒ Partial ☐ None ☐
Seams/Joints	Satisfactory ☒ Acceptable ☐ Failing ☐
Corrosion	0-20% ☒ 20-60% ☐ 60-100% ☐
Cap/Cover	Yes ☒ No ☐
Description	Capped center vent, screen intact, light staining



Access Hatch		
Shape	Round ☒ Square ☐	
Lid Material	Steel	
Secured	Yes ☒ No ☐	
Interior Ladder	Yes ☒ No ☐	
Gasket	Intact ☒ Cracking ☐ N/A ☐	
Hatch Size	Approx. 24"	
Description	Hinged steel cover, appears to be in good condition	

Additional Exterior Photos

		
Foundation	Ladder	Access Hatch
		
Inlet/Outlet	Manway	Underside of Vent

Interior Photos/Descriptions

Interior Ladder	
Material	Steel
Corrosion	20% ☒ 20-60% ☐ 60-100% ☐
Seams/Welds	Satisfactory ☒ Acceptable ☐ Failing ☐
Staining	Yes ☒ No ☐
Coating	Blistering ☐ Peeling ☐ Satisfactory ☒ N/A ☐
Description	Minor blistering, appears to be in good condition



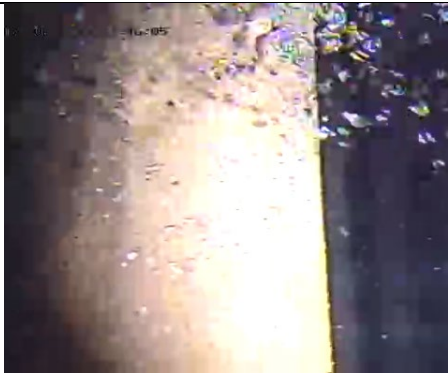
Interior Shell	
Material	Steel
Construction	Bolted ☐ Welded ☒ N/A ☐
Corrosion	20% ☒ 20-60% ☐ 60-100% ☐
Staining	Yes ☒ No ☐
Coating	Blistering ☐ Peeling ☐ Satisfactory ☒ N/A ☐
Description	Light staining, coating appears to be in good condition



Floor	
Material	Steel
Construction	Bolted ☐ Welded ☒ N/A ☐
Corrosion	20% ☒ 20-60% ☐ 60-100% ☐
Staining	Yes ☒ No ☐
Seams/Joints	Satisfactory ☒ Acceptable ☐ Failing ☐
Sediment Buildup/Makeup	Approx. 1/2" sand-based material
Coating	Blistering ☐ Peeling ☐ Satisfactory ☒ N/A ☐
Description	Light layer of sediment, coating below appears to be intact
Cleaning	Completed ☐ Recommended ☒ Unnecessary ☐



Support Column	
Material	Steel
Corrosion	20% ☒ 20-60% ☐ 60-100% ☐
Seams/Joints	Satisfactory ☒ Acceptable ☐ Failing ☐
Base Plates	Good ☒ Decent ☐ Failing ☐
Staining	Yes ☒ No ☐
Coating	Blistering ☒ Peeling ☒ Satisfactory ☐ N/A ☐
Description	Single center column, blistering and peeling coating throughout



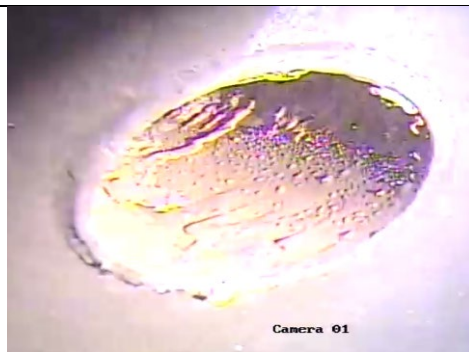
Interior Roof	
Material	Steel
Corrosion	20% ☐ 20-60% ☒ 60-100% ☐
Seams/ Joints	Satisfactory ☐ Acceptable ☒ Failing ☐
Support Beams	Corroding ☒ Satisfactory ☐ N/A ☐
Staining	Yes ☒ No ☐
Coating	Blistering ☒ Peeling ☐ Satisfactory ☐ N/A ☐
Description	Blistering in the coating and rust nodules on rafters, appears to be in fair condition



Manways	
Material	Steel
Corrosion	20% ☒ 20-60% ☐ 60-100% ☐
Gasket	Intact ☒ Cracking ☐ N/A ☐
Seams/Joints	Satisfactory ☒ Acceptable ☐ Failing ☐
Staining	Yes ☒ No ☐
Coating	Blistering ☐ Peeling ☐ Satisfactory ☒ N/A ☐
Description	Two manways, light staining, gaskets appear to be intact



Inlet/Outlet	
Material	Steel
Corrosion	20% ☒ 20-60% ☐ 60-100% ☐
Location	Approx. 5:00
Seams/Joints	Satisfactory ☒ Acceptable ☐ Failing ☐
Obstruction	None ☒ Partial ☐ Full ☐
Coating	Blistering ☒ Peeling ☐ Satisfactory ☐ N/A ☐
Description	Pipe enters through lower wall, slight rim, minor blistering on interior



Additional Interior Photos



LLI Base



Telemetry



Column Base



Drain



Dollar Plate



Inlet/Outlet

Recommendations

Rubicon Applied Divers has been in business for over twenty years, based on our experience we fully agree with AWWA recommendations that potable reservoirs and storage tanks should be cleaned and inspected at least every three years. Periodic inspections are used to identify and evaluate current and potential water quality problems. Rubicon Applied Divers uses the following rating system with our repair recommendations;

Necessary, repairs should be addressed before the next inspection.

Necessary Urgent, repairs should be addressed within the next 12-18mos.

Necessary Critical, repairs should be addressed within the next 6mos.

Rubicon Applied Divers make the following recommendations:

- 1- Continue current cleaning and inspection practices
- 2- **Necessary- have dive team return to perform an in-water cleaning to remove sediment.**

Conclusion

Based upon the results of the underwater inspection, it appears that the tank is in fully operational condition and should continue to provide water with proper maintenance.



Rubicon Applied Divers

Clarkdale- 89A

Survey Inspection

6/22/2023

Submitted To:

Clarkdale Municipal Water System

890 Main Street
Clarkdale, AZ 86324

Phone: 928-202-2152

Email: lisa.waldschmidt@clarkdale.az.gov

Submitted By:

Rubicon Applied Divers

7429 Teaswood Dr
Conroe, TX 77304

Office Phone: 602-258-1116

Office Fax: 480-214-0118

Cell Phone: 602-334-6523

Email: smoses@rubiconfab.com

Operations

Cell Phone: 360-875-1169

Email: tara@rubiconfab.com



Arizona License No. 160416*



California License No. 942354*

Introduction

The following is a survey report documenting the interior of tank 89A in Clarkdale, AZ.

Overview

Clarkdale Municipal Water System contracted Rubicon Applied Divers to perform a survey on their concrete and wood potable water tank. The tank is partially buried with a diameter of 100'. Upon entering the tank, the diver performed an initial inspection of the existing plumbing, roof, walls, and floor. There is a rubber coating on the concrete floor, walls, and columns which was noted to be approx. 80% blistered throughout. Sediment depth averaged between 1-2", there is also a fair number of dead insects and rodents on the floor of the tank. After the initial inspection, the diver went on to begin his survey. All of the vertical measurements are based off the overflow elevation at 13.8'. At the time of the survey there was 13' of water in the tank. There is a center column which is 8' in circumference and an outer ring of columns at the base of the slanted wall. The distance from the exterior wall to the intermediate column is 22', from the intermediate to the center column, the distance was measured at 23'.

Photos and Descriptions

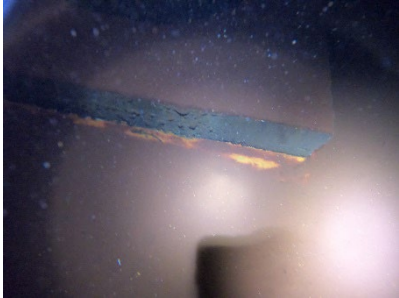
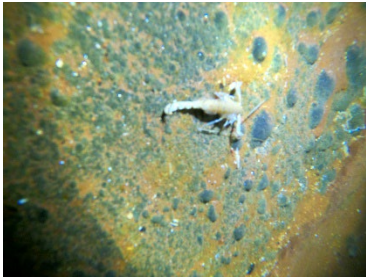
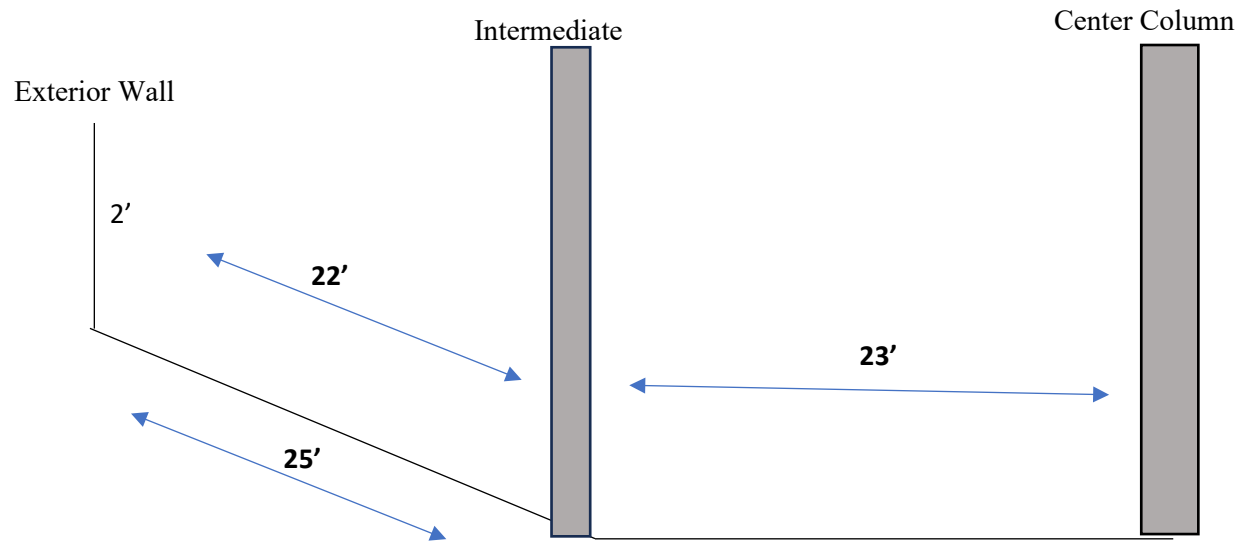
Blistering in Existing Coating		
		
Interior Plumbing and Apertures		
		
Desert Wildlife		
		

Diagram Drawn On-Site





Rubicon Applied Divers

Field Report

Clarkdale- Mountain Gate

12/11/2023

Submitted To:

Clarkdale Municipal Water System

890 Main Street
Clarkdale, AZ 86324

Phone: 928-639-2450

Email: ethan.pebworth@clarkdale.az.gov

Submitted By:

Rubicon Applied Divers

7429 Teaswood Dr
Conroe, TX 77304

Office Phone: 602-258-1116

Office Fax: 480-214-0118

Cell Phone: 602-334-6523

Email: smoses@rubiconfab.com

Operations

Cell Phone: 360-875-1169

Email: tara@rubiconfab.com



Arizona License No. 160416*



California License No. 942354*



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Introduction

The following is a report of the inspection done by Rubicon Applied Divers, Inc. commercial dive team on 12/11/2023 .

Methods Used by Rubicon Applied Divers:

All the equipment used for the inspection and/or cleaning, including the gear physically on the diver, is disinfected with a 200ppm chlorine mixture prior to entering the tank or reservoir. The diver is fully encapsulated in a dry suit, Kirby Morgan helmet, and rubber gloves to ensure that we do not introduce any contaminants in your water supply.

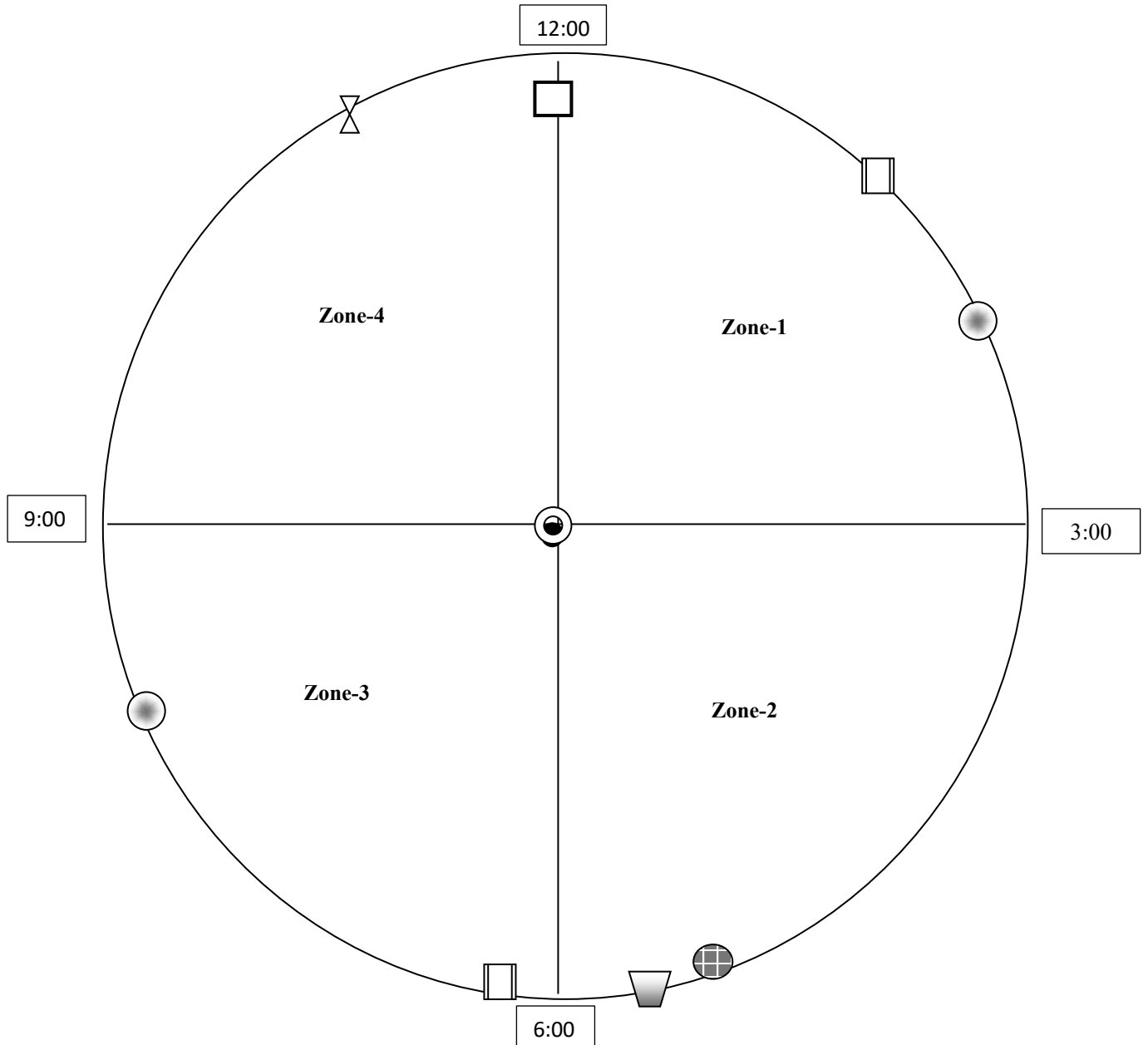
If the diver is conducting a cleaning, he or she will stand on the ladder at the bottom of the tank and clean a section to stand before stepping on the bottom as to not stir up sediment in the tank. Cleanings are done using a vacuum like method, Rubicon Applied Divers has a variety of pumps, different sized hoses, and vacuum heads to best meet the requirements of every client.

Inspections are recorded using high quality video and audio equipment and stored digitally. If the diver is conducting a cleaning, he/she will record a few minutes of the cleaning process. Once the recorded part of the inspection begins the diver will start at the entry to the tank or reservoir moving clockwise around the structure. As the diver moves through the tank/reservoir they will be describing all structural areas, penetrations, condition of the tank, and sediment buildup. Digital photos will also be taken of all areas discussed and they will be included in the report with descriptions.

Overview

Clarkdale Municipal Water System contracted Rubicon Applied Divers to clean and inspect two tanks located in Clarkdale, AZ. The Mountain Gate tank is a welded steel potable water tank with a nominal capacity of 700KG, a diameter of 90', and height of 16'. The dive team performed an initial exterior inspection, the panels, coating, and exterior plumbing appeared to be in good condition. Once the diver entered the tank, he noted the walls above the waterline, ceiling, and support beams displayed corrosion and staining throughout. Below the waterline staining, corrosion, and micro-blistering is present in the coating throughout. The interior ladder, hardware, and penetration points in the tank appear to be in good to fair condition. Sediment in the tank was composed of a light sand-based material approx. 1-2" in depth and was removed during the cleaning prior to the inspection. The panels and bolt seams on the floor appeared to be in fair condition although micro-blistering is present in the coating.

Structure Diagram



	Entry Hatch		Column
	Inlet / Outlet Pipe		Vent
	Drain		Liquid Level Indicator
	Overflow		Man Way
	Capped Off Penetration / Water Tap		

Exterior Photos/ Descriptions

Exterior Shell	
Material	Steel
Grade	On ☒ Below ☐ Tower ☐
Exposed Seams/Joints	Satisfactory ☒ Acceptable ☐ Failing ☐
Corrosion	0-20% ☒ 20-60% ☐ 60-100% ☐
Exterior Ladder	Cage ☒ Fixed Rail ☐ None ☐
Height (ladder)	N/A
Description	Welded steel, appears to be in good condition



Exterior Roof	
Shape	Dome ☐ Flat ☒
Safety Rail	Yes ☒ No ☐
Platform	Yes ☐ No ☒
Seams/Joints	Satisfactory ☒ Acceptable ☐ Failing ☐
Corrosion	0-20% ☒ 20-60% ☐ 60-100% ☐
Exposed Aggregate	Yes ☐ No ☒
Description	Welded steel, appears to be in good condition

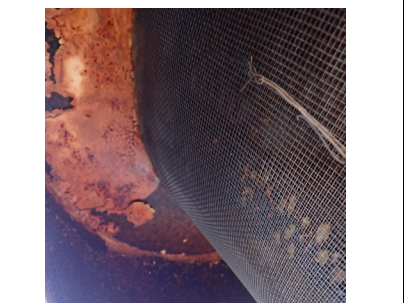


Exterior Vents	
Condition	Good ☐ Decent ☒ Rough ☐
Screen Coverage	Full ☐ Partial ☒ None ☐
Seams/Joints	Satisfactory ☐ Acceptable ☒ Failing ☐
Corrosion	0-20% ☐ 20-60% ☒ 60-100% ☐
Cap/Cover	Yes ☒ No ☐
Description	Capped center vent, screen intact, corrosion throughout



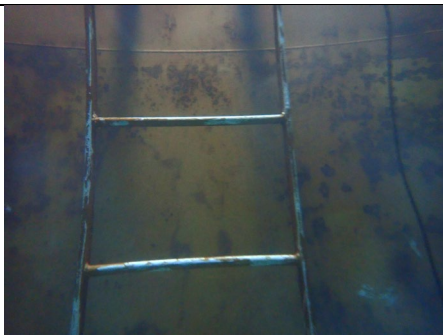
Access Hatch		
Shape	Round ☐ Square ☒	
Lid Material	Steel	
Secured	Yes ☒ No ☐	
Interior Ladder	Yes ☒ No ☐	
Gasket	Intact ☐ Cracking ☐ N/A ☒	
Hatch Size	Approx. 28" x 28"	
Description	Hinged steel cover, heavy staining and corrosion on underside of cover	

Additional Exterior Photos

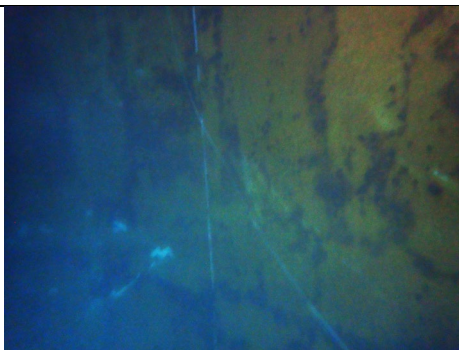
		
Foundation	Manway	Fill
		
Overflow & Drain	Inlet/Outlet	Underside of Vent

Interior Photos/Descriptions

Interior Ladder	
Material	Steel
Corrosion	20% ☒ 20-60% ☐ 60-100% ☐
Seams/Welds	Satisfactory ☒ Acceptable ☐ Failing ☐
Staining	Yes ☒ No ☐
Coating	Blistering ☐ Peeling ☐ Satisfactory ☒ N/A ☐
Description	Heavy staining, rungs and support brackets intact



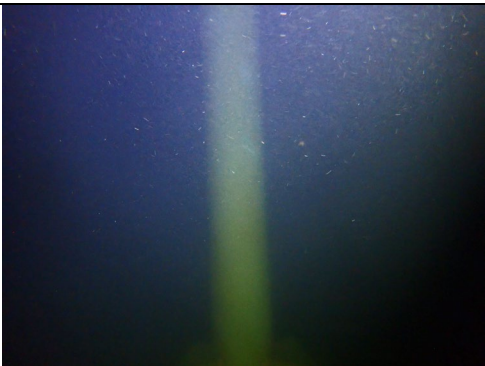
Interior Shell	
Material	Steel
Construction	Bolted ☐ Welded ☒ N/A ☐
Corrosion	20% ☐ 20-60% ☒ 60-100% ☐
Staining	Yes ☐ No ☐
Coating	Blistering ☒ Peeling ☐ Satisfactory ☐ N/A ☐
Description	Blistering and staining throughout, isolated areas of rust nodules primarily mid-wall



Floor	
Material	Steel
Construction	Bolted ☐ Welded ☒ N/A ☐
Corrosion	20% ☒ 20-60% ☐ 60-100% ☐
Staining	Yes ☒ No ☐
Seams/Joints	Satisfactory ☒ Acceptable ☐ Failing ☐
Sediment Buildup/Makeup	Approx. 1-2" sand-based material
Coating	Blistering ☒ Peeling ☐ Satisfactory ☐ N/A ☐
Description	Light staining, micro-blistering present throughout
Cleaning	Completed ☒ Recommended ☐ Unnecessary ☐



Support Column	
Material	Steel
Corrosion	20% ☒ 20-60% ☐ 60-100% ☐
Seams/Joints	Satisfactory ☒ Acceptable ☐ Failing ☐
Base Plates	Good ☒ Decent ☐ Failing ☐
Staining	Yes ☒ No ☐
Coating	Blistering ☒ Peeling ☐ Satisfactory ☐ N/A ☐
Description	Single center column, appears to be in good condition



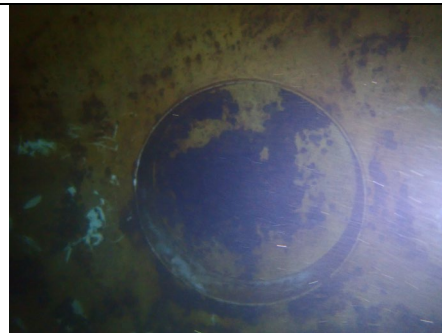
Interior Roof	
Material	Steel
Corrosion	20% ☒ 20-60% ☐ 60-100% ☐
Seams/ Joints	Satisfactory ☐ Acceptable ☒ Failing ☐
Support Beams	Corroding ☐ Satisfactory ☒ N/A ☐
Staining	Yes ☒ No ☐
Coating	Blistering ☒ Peeling ☐ Satisfactory ☐ N/A ☐
Description	Staining throughout, corrosion forming along weld seams, appears to be in fair condition



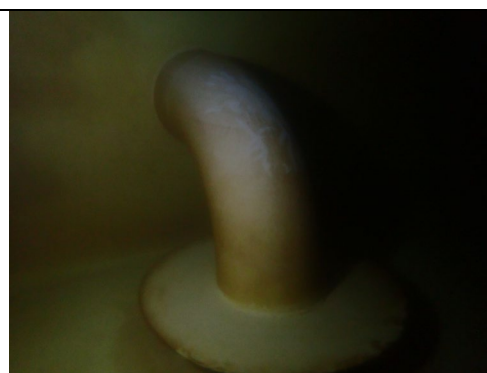
Liquid Level Indicator	
Base Welds	Satisfactory ☒ Failing ☐ N/A ☐
Base Connection	Satisfactory ☒ Failing ☐ N/A ☐
Guide Wires	Satisfactory ☐ Failing ☒ N/A ☐
Float	Satisfactory ☒ Failing ☐ N/A ☐
Exterior Reading	Accurate ☒ Inaccurate ☐ N/A ☐
Description	One guidewire disconnected at base, other one is secured and intact, float operating correctly



Manways	
Material	Steel
Corrosion	20% ☐ 20-60% ☒ 60-100% ☐
Gasket	Intact ☒ Cracking ☐ N/A ☐
Seams/Joints	Satisfactory ☐ Acceptable ☒ Failing ☐
Staining	Yes ☒ No ☐
Coating	Blistering ☒ Peeling ☐ Satisfactory ☐ N/A ☐
Description	Two manways, staining and blistering in coating on both



Inlet/Outlet	
Material	Steel
Corrosion	20% ☒ 20-60% ☐ 60-100% ☐
Location	Approx. 8:00
Seams/Joints	Satisfactory ☒ Acceptable ☐ Failing ☐
Obstruction	None ☒ Partial ☐ Full ☐
Coating	Blistering ☒ Peeling ☐ Satisfactory ☐ N/A ☐
Description	Pipe enters through lower wall, 90s down to terminate approx. 10" from floor, anti-vortex plate on end, micro-blistering in coating



Cathodic Protection	
Material	Sacrificial Anode ☐ ICCP ☒ Other ☐
% Wasted	20% ☐ 20-60% ☐ 60-100% ☐ N/A ☒
Number	N/A
Location(s)	N/A
Description	Several wires hang down from ceiling terminating at various point, porcelain weights on end of wires



Additional Interior Photos



LLI Base



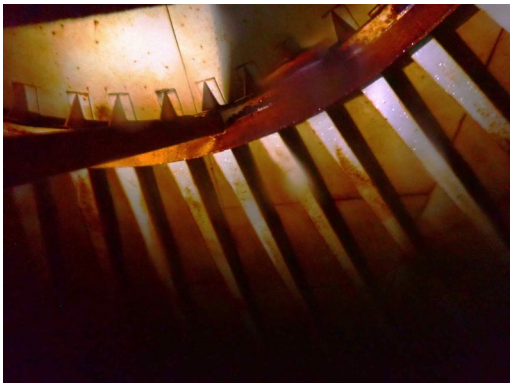
Telemetry



Column Base



Drain



Dollar Plate



Micro-Blistering around 2nd Manway

Recommendations

Rubicon Applied Divers has been in business for over twenty years, based on our experience we fully agree with AWWA recommendations that potable reservoirs and storage tanks should be cleaned and inspected at least every three years. Periodic inspections are used to identify and evaluate current and potential water quality problems. Rubicon Applied Divers uses the following rating system with our repair recommendations;

Necessary, repairs should be addressed before the next inspection.

Necessary Urgent, repairs should be addressed within the next 12-18mos.

Necessary Critical, repairs should be addressed within the next 6mos.

Rubicon Applied Divers make the following recommendations:

- 1- Continue current cleaning and inspection practices
- 2- **Necessary- install gasket around entry hatch.**
- 3- **Necessary- repair disconnected guidewire.**

Conclusion

Based upon the results of the underwater inspection, it appears that the tank is in fully operational condition and should continue to provide water with proper maintenance.

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Town of Clarkdale

**2023 Water and
Wastewater Rate Study
and Long-Term Financial
Plan**

January 2024 -- FINAL

Economists.com

5500 Democracy Drive, Suite 130 • Plano, Texas 75024 • Tel 972.378.6588 • Fax 972.378.6988 • www.economists.com

**TOWN OF CLARKDALE, ARIZONA
2023 WATER AND WASTEWATER RATE STUDY
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Appendix

Appendix A – Water and Wastewater Rate Model

Acknowledgements

Throughout the course of this rate study, Town employees expended considerable time and effort in aiding the project team. These employees included Susan Guthrie, Ruth Mayday, Virginia Smith, Julie Goucher, and Lou Andersen. The project team owes a debt of gratitude to the hard work, dedication, and professionalism of these individuals, without whom this project would not have been successfully completed.

The project team has relied upon the extensive data supplied by the Town. Thus, the veracity of the study is principally reliant upon the accuracy of this financial and customer data. Every effort has been made by the project team to validate the information contained herein prior to the preparation of the final study documents. **This report presents no assurance or guarantee that the forecast contained herein will be consistent with actual results or performances.** These represent forecasts based on a series of assumptions about future behavior and are not guarantees. Any changes in assumptions or actual events may result in significant revisions to the forecast and its conclusions. The cash flow projections and debt service coverage calculations are not intended to present overall financial positions, results of operations, and/or cash flows for the periods indicated, in conformity with guidelines for presentation of a forecast established by the American Institute of Certified Public Accountants.

Executive Summary

Background



In March 2023, the Town of Clarkdale, Arizona (“the Town”) engaged **economists.com** to complete a Water and Wastewater Rate Study and Long-Term Financial Plan. The Town identified numerous objectives for this study, including but not limited to the following:

- A comprehensive analysis and evaluation of the water and wastewater systems’ current cost of service and revenue requirements.
- A forecast of operating expenses over the next decade, taking into consideration salient factors such as cost of water and wastewater treatment, inflation, system growth, and increases in staffing levels.
- An estimate of current and forecast accounts, volumes, and billing units for the ten-year forecast period.
- A thorough assessment, review, and update of the water and wastewater system’s known capital improvement needs, as well as a determination of the need for funding capital requirements through the issuance of long-term debt.
- An evaluation of the current water and wastewater rate structures and revenue recovered versus the revenue requirement, both overall and for each customer class.
- The development of a rate structure that would recover the Town’s cost of service, ensure equitable, just, and reasonable treatment of identified customer classes, and maintain critical financial ratios.

The analysis and recommendation presented in this study achieve all the objectives outlined.

Water and Wastewater Rate Comparison

Table ES-1 compares the Town’s monthly water and wastewater charges to several cities or utilities located in Arizona. A billing volume of 5,000 gallons of water and 5,000 gallons of wastewater was applied for the residential comparison, as it represents typical usage levels for an average household on the Town’s system. A 5/8” meter size was used for the residential comparison.

The rate and customer cost data are based on published rates and ordinances posted by each municipality in their rate ordinance. These rates do not include sales tax, activation or other charges beyond the monthly base and volume charges. Additionally, where appropriate, certain cities that charge for service based on cubic feet of water have had their rates converted to an equivalent charge per 1,000 gallons.

Table ES-1

TOWN OF CLARKDALE			
MONTHLY RESIDENTIAL CHARGES -- 5,000 GALLONS WATER AND WASTEWATER			
	Water	Wastewater	Total
Clarkdale	\$ 48.14	\$ 54.00	\$ 102.14
Prescott	41.24	54.97	\$ 96.21
Prescott Valley	25.05	27.77	52.82
Cottonwood	40.45	48.75	89.20
Camp Verde	40.50	52.20	92.70
Jerome	41.05	52.67	93.72
Sedona	48.14	61.11	109.25
Chino Valley	32.01	60.00	92.01
Flagstaff	41.26	26.75	68.01
Winslow	29.57	38.88	68.45
Kingman	20.66	56.10	76.76
Page	18.83	31.96	50.79
Payson	60.78	54.00	114.78
Source: Cities' Websites; US Census Bureau & 2023 TML Water & Wastewater Rate Survey			

Water and Wastewater Customers and Volumes – Test Year & Ten-Year Forecast

Most of the water and wastewater accounts served by the Town are residential accounts. **Table ES-2** presents total water connections (customers) by customer class for the test year and forecast period. As demonstrated, overall water accounts are forecast to increase from **2,322** in the test year to **2,862** in FY 2033. **Table ES-3** presents total wastewater accounts by customer class for the test year and the projection period. Similarly, wastewater accounts are forecast to increase from **1,545** in the test year to **2,085** in FY 2033. The addition of these new connections will result in both non-recurring connection fees and increasing monthly water and wastewater revenues.

Table ES-2

TOWN OF CLARKDALE							
FORECAST TOTAL CUSTOMERS							
WATER Customer Classes							
	Residential	Multi-Family	Commercial	Government	Other	Industrial	Total
WATER Total Customers							
2020	1,633	297	34	24	9	6	2,002
2021	1,700	338	35	24	9	6	2,111
2022	1,797	338	34	24	11	6	2,210
Last 12 Months	1,835	335	34	24	12	6	2,245
2024	1,917	330	33	24	12	6	2,322
2025	1,977	330	33	24	12	6	2,382
2026	2,037	330	33	24	12	6	2,442
2027	2,097	330	33	24	12	6	2,502
2028	2,157	330	33	24	12	6	2,562
2029	2,217	330	33	24	12	6	2,622
2030	2,277	330	33	24	12	6	2,682
2031	2,337	330	33	24	12	6	2,742
2032	2,397	330	33	24	12	6	2,802
2033	2,457	330	33	24	12	6	2,862
WATER Annual New Customers							
2021	67	41	1	-	1	-	109
2022	98	-	(0)	-	2	-	99
Last 12 Months	38	(3)	(1)	-	1	-	34
2024	82	(5)	(1)	-	1	-	77
2025	60	-	-	-	-	-	60
2026	60	-	-	-	-	-	60
2027	60	-	-	-	-	-	60
2028	60	-	-	-	-	-	60
2029	60	-	-	-	-	-	60
2030	60	-	-	-	-	-	60
2031	60	-	-	-	-	-	60
2032	60	-	-	-	-	-	60
2033	60	-	-	-	-	-	60

Table ES-3

TOWN OF CLARKDALE			
FORECAST TOTAL CUSTOMERS			
WASTEWATER Customer Classes			
	Residential	Non-Residential	Total
WASTEWATER Total Customers			
2020	1,186	46	1,232
2021	1,279	41	1,320
2022	1,385	41	1,426
Last 12 Months	1,424	41	1,464
2024	1,504	41	1,545
2025	1,564	41	1,605
2026	1,624	41	1,665
2027	1,684	41	1,725
2028	1,744	41	1,785
2029	1,804	41	1,845
2030	1,864	41	1,905
2031	1,924	41	1,965
2032	1,984	41	2,025
2033	2,044	41	2,085
WASTEWATER Annual New Customers			
2021	94	(5)	89
2022	105	(0)	105
Last 12 Months	39	0	39
2024	81	0	81
2025	60	-	60
2026	60	-	60
2027	60	-	60
2028	60	-	60
2029	60	-	60
2030	60	-	60
2031	60	-	60
2032	60	-	60
2033	60	-	60

The Town's water and wastewater volumes are presented in **Table ES-4** and **Table ES-5**. Wastewater billing units are estimated by the project team based on average water usage per account. Detailed calculations of consumption billing units are presented in Section II of this report and in the rate model presented in **Appendix A**.

Table ES-4

TOWN OF CLARKDALE							
FORECAST BILLED CONSUMPTION							
WATER Customer Classes							
	Residential	Multi-Family	Commercial	Government	Other	Industrial	Total
WATER Annual Consumption							
2020	95,716,647	25,461,497	4,695,421	7,075,146	572,918	668,067	134,189,696
2021	114,959,831	33,202,960	5,392,174	8,705,634	1,059,940	701,203	164,021,742
2022	109,408,659	30,997,115	4,968,275	10,380,104	1,075,242	566,687	157,396,082
Last 12 Months	110,591,154	32,207,865	4,636,505	8,182,136	2,023,674	528,390	158,169,724
Test Year	114,164,374	32,207,865	4,636,505	8,182,136	2,023,674	528,390	161,742,944
2025	117,737,594	32,207,865	4,636,505	8,182,136	2,023,674	528,390	165,316,164
2026	121,310,814	32,207,865	4,636,505	8,182,136	2,023,674	528,390	168,889,384
2027	124,884,033	32,207,865	4,636,505	8,182,136	2,023,674	528,390	172,462,603
2028	128,457,253	32,207,865	4,636,505	8,182,136	2,023,674	528,390	176,035,823
2029	132,030,473	32,207,865	4,636,505	8,182,136	2,023,674	528,390	179,609,043
2030	135,603,693	32,207,865	4,636,505	8,182,136	2,023,674	528,390	183,182,263
2031	139,176,913	32,207,865	4,636,505	8,182,136	2,023,674	528,390	186,755,483
2032	142,750,133	32,207,865	4,636,505	8,182,136	2,023,674	528,390	190,328,703
2033	146,323,352	32,207,865	4,636,505	8,182,136	2,023,674	528,390	193,901,922

Table ES-5

TOWN OF CLARKDALE			
FORECAST WASTEWATER BILLING UNITS			
WASTEWATER Customer Classes			
	Residential	Non-Residential	Total
WASTEWATER Billing Units			
2024	89,568,711	5,760,506	95,329,217
2025	93,141,930	5,760,506	98,902,437
2026	96,715,150	5,760,506	102,475,657
2027	100,288,370	5,760,506	106,048,876
2028	103,861,590	5,760,506	109,622,096
2029	107,434,810	5,760,506	113,195,316
2030	111,008,030	5,760,506	116,768,536
2031	114,581,249	5,760,506	120,341,756
2032	118,154,469	5,760,506	123,914,976
2033	121,727,689	5,760,506	127,488,195

Water and Wastewater Capital Improvement Plan

One of the most critical components of a utility's revenue requirement and rate plan is the forecast Capital Improvements required to repair and maintain the system. Like most municipalities, Clarkdale maintains an extensive and detailed Capital Improvement Plan. Minor capital improvements are contained in the Town's budget and are funded annually. Major capital improvements have historically been funded primarily through debt issued by the Town.

Town staff and the project team worked together to develop the Town's forecast capital improvements needs in FY 2024 - 2028. The forecast CIP is summarized in **Table ES-6**. As the table reveals, the Town is forecast to invest **\$18,397,500** in total capital improvements in the next five years.

Table ES-6

TOWN OF CLARKDALE	
CAPITAL IMPROVEMENT PLAN FOR FUNDING THROUGH NEW BOND ISSUES	
FY 2024 - FY 2028	
SCENARIO:	2023 11 08 -- Scenario I -- Status Quo
WATER PROJECTS	
<u>Project Description</u>	
Treatment - Arsenic Plant Expansion	\$ 5,500,000
Production - Well 3 Reactivation	1,005,000
89A Reservoir Rehab	225,000
Arsenic Treatment Plant Backwash Tank & Lift Station	285,000
ATP Vessel Maintenance, Diagnostics, & Repair	250,000
Distribution - Mid Zone PRV	375,000
Infrastructure - Water Line Research	50,000
Distribution - Panorama Booster Station Rehab	330,000
Distribution - Water Storage Expansion	2,200,000
Haskell Springs Tank Coating	200,000
Haskell Well Pump Emergent Repairs	50,000
Rate Study and IIP (Infrastructure Plan)	150,000
Cellular Meter Program	562,500
Total Water	\$ 11,182,500
WASTEWATER PROJECTS	
<u>Project Description</u>	
Treatment - WWTP Expansion	\$ 6,050,000
Sludge Drying Beds	110,000
VRIC Property Rehab	150,000
First South Sewer	200,000
Third North Sewer Realignment	610,000
SCADA Upgrades	50,000
Reclaim Feasibility	45,000
Total Wastewater	\$ 7,215,000
Total Water and Wastewater Projects	\$ 18,397,500

The Town plans to use several different funding sources in order to pay for the Capital Improvement Plan. For water capital improvements, the Town plans to use Water Capacity Fees totaling \$963,645, Water Resource Development Fees totaling \$471,750, Fund Balance draw down totaling \$1,602,921, Grant totaling \$562,500, and long-term debt totaling \$8,000,000 from FY 2024 – FY 2028.

For wastewater capital improvements, the Town plans to use Sewer Capacity Fees totaling \$1,440,990, capital transfer in of \$650,000, and long-term debt totaling \$5,500,000 from FY 2024 – FY 2028.

It should be noted that if the Town materially revises its CIP, the rate plan may be subject to potentially significant revision.

Table ES-7 illustrates the annual forecast of long-term debt issuances required to fund CIP projects.

Table ES-7

TOWN OF CLARKDALE			
WATER/WASTEWATER FUTURE BOND ISSUES			
	Water	Wastewater	Total
2024	\$ -	\$ -	\$ -
2025	-	500,000	500,000
2026	2,000,000	-	2,000,000
2027	1,000,000	5,000,000	6,000,000
2028	5,000,000	-	5,000,000
2029	2,000,000	-	2,000,000
2030	-	-	-
2031	-	-	-
2032	2,000,000	-	2,000,000
2033	-	-	-
Total	\$ 12,000,000	\$ 5,500,000	\$ 17,500,000
Total 2024-2028	8,000,000	5,500,000	13,500,000
Total 2029-2033	4,000,000	-	4,000,000

Water and Wastewater Test Year and Forecast Net Revenue Requirement

Table ES-8 presents the Town's forecast Net Revenue Requirement for the ten-year period FY 2024 through FY 2033. Detailed calculations are presented in the rate model contained in **Appendix A** of this report.

Table ES-8

TOWN OF CLARKDALE							
CURRENT AND FORECAST NET REVENUE REQUIREMENT							
SCENARIO: 2023 11 08 – Scenario I – Status Quo							
	Operating Expenses	Capital Outlays	Debt Service	Total Cost of Service	Less Non-Rate Revenues	Net Revenue Requirement	
WATER Revenue Requirement							
2024	\$ 2,852,923	\$ 30,000	\$ 501,183	\$ 3,384,105	\$ 1,331,343	\$ 2,052,762	
2025	1,752,606	20,000	501,117	2,273,722	191,343	2,082,379	
2026	1,878,066	20,000	501,049	2,399,116	191,343	2,207,773	
2027	1,916,630	20,000	631,565	2,568,196	191,343	2,376,853	
2028	1,956,470	20,000	696,788	2,673,258	191,343	2,481,915	
2029	1,997,629	20,000	1,023,178	3,040,807	191,343	2,849,464	
2030	2,040,153	20,000	1,153,690	3,213,843	191,343	3,022,500	
2031	2,084,089	20,000	1,153,616	3,257,705	191,343	3,066,362	
2032	2,129,485	20,000	1,153,541	3,303,026	191,343	3,111,683	
2033	2,176,392	20,000	1,277,997	3,474,389	191,343	3,283,046	
WASTEWATER Revenue Requirement							
2024	\$ 1,703,064	\$ 30,000	\$ 218,518	\$ 1,951,582	\$ 921,938	\$ 1,029,644	
2025	1,017,739	20,000	218,449	1,256,188	121,938	1,134,250	
2026	1,056,075	20,000	251,025	1,327,100	121,938	1,205,162	
2027	1,168,222	20,000	250,953	1,439,175	121,938	1,317,237	
2028	1,202,839	20,000	577,339	1,800,178	121,938	1,678,240	
2029	1,238,604	20,000	577,263	1,835,867	121,938	1,713,929	
2030	1,275,558	20,000	577,184	1,872,742	121,938	1,750,804	
2031	1,313,740	20,000	577,103	1,910,843	121,938	1,788,905	
2032	1,353,193	20,000	577,019	1,950,213	121,938	1,828,275	
2033	1,393,961	20,000	576,933	1,990,894	121,938	1,868,956	
TOTAL Revenue Requirement							
2024	\$ 4,555,986	\$ 60,000	\$ 719,700	\$ 5,335,687	\$ 2,253,281	\$ 3,082,406	
2025	2,770,345	40,000	719,566	3,529,910	313,281	3,216,629	
2026	2,934,141	40,000	752,075	3,726,215	313,281	3,412,934	
2027	3,084,852	40,000	882,518	4,007,370	313,281	3,694,089	
2028	3,159,309	40,000	1,274,127	4,473,436	313,281	4,160,155	
2029	3,236,234	40,000	1,600,441	4,876,674	313,281	4,563,393	
2030	3,315,711	40,000	1,730,874	5,086,585	313,281	4,773,304	
2031	3,397,829	40,000	1,730,719	5,168,548	313,281	4,855,267	
2032	3,482,678	40,000	1,730,560	5,253,238	313,281	4,939,957	
2033	3,570,353	40,000	1,854,930	5,465,283	313,281	5,152,002	

Water and Wastewater Rate Design

This section of the reports presents the water and wastewater rate for the Town to consider. The rate design contained in this section is forecast to recover sufficient revenues to fund current and future operating expenses.

The rate design maintains the existing rate structure for water and wastewater and introduces necessary percentage adjustments. The average percentage adjustment for both water and wastewater from FY 2024 to FY 2029 is 6.4%. It is important to note that the Town has not adjusted rates since 2018.

Table ES-9 summarizes the water rate recommendations for the six-year period 2024 - 2029. The table reveals that the proposed water rate increases are higher in the years 2024 – 2025 with lower percentage adjustment after.

Table ES-10 summarizes the wastewater rate recommendations for the six-year period 2024 - 2029. The table reveals that the proposed wastewater rate increases are lower in the years 2024 – 2026 with higher percentage adjustment after.

Table ES-11 calculates the average impact on monthly residential and non-residential water and wastewater bills of the proposed rate design at various usage levels. The results of the analysis are included in **Appendix A**.

Table ES-9

TOWN OF CLARKDALE									
Proposed Water Rate Plan									
Scenario: 2023 11 08 – Scenario I -- Status Quo									
		Current	Effective Feb-24	Effective Jan-25	Effective Jan-26	Effective Jan-27	Effective Jan-28		
Water Rates									
Monthly Minimum Charge									
5/8" & 3/4"		\$ 28.30	\$ 30.85	\$ 33.62	\$ 35.98	\$ 38.50	\$ 41.19		
1"		46.96	51.19	55.79	59.70	63.88	68.35		
1 1/2"		93.93	102.38	111.60	119.41	127.77	136.71		
2"		150.52	164.07	178.83	191.35	204.75	219.08		
3"		301.04	328.13	357.67	382.70	409.49	438.16		
4"		475.64	518.45	565.11	604.67	646.99	692.28		
6"		951.29	1,036.91	1,130.23	1,209.34	1,294.00	1,384.58		
8"		1,502.79	1,638.04	1,785.46	1,910.45	2,044.18	2,187.27		
Volume Rate Per 1,000 Gal									
1,001	5,000	4.96	5.41	5.89	6.31	6.75	7.22		
5,001	10,000	5.15	5.61	6.12	6.55	7.01	7.50		
10,001	15,000	7.21	7.86	8.57	9.17	9.81	10.49		
15,001	20,000	7.46	8.13	8.86	9.48	10.15	10.86		
20,001	25,000	10.65	11.61	12.65	13.54	14.49	15.50		
25,001	30,000	10.85	11.83	12.89	13.79	14.76	15.79		
30,001	Above	11.00	11.99	13.07	13.98	14.96	16.01		

Table ES-10

TOWN OF CLARKDALE													
Proposed Wastewater Rate Plan													
<u>Scenario:</u>		2023 11 08 -- Scenario I -- Status Quo											
		Current		Effective Feb-24		Effective Jan-25		Effective Jan-26		Effective Jan-27		Effective Jan-28	
Wastewater Rates													
Residential													
Monthly Charge		\$	54.00	\$	56.70	\$	58.97	\$	61.33	\$	65.62	\$	70.21
Non-Residential													
Monthly Minimum Charge		\$	54.00	\$	56.70	\$	58.97	\$	61.33	\$	65.62	\$	70.21
Volume Rate/1,000 Gal													
5,001	Above		2.25		2.36		2.46		2.56		2.73		2.93

Table ES-11

TOWN OF CLARKDALE													
Impact on Monthly Bills													
Scenario: 2023 11 08 -- Scenario I -- Status Quo													
		Current	Effective Feb-24	Effective Jan-25	Effective Jan-26	Effective Jan-27	Effective Jan-28						
Water/WW Charge													
Residential - 5/8"													
5,000 Gal	Total	\$ 102.14	\$ 109.17	\$ 116.16	\$ 122.53	\$ 131.10	\$ 140.28						
	Increase -- \$		7.03	6.99	6.36	8.58	9.18						
	Increase -- %		6.9%	6.4%	5.5%	7.0%	7.0%						
10,000 Gal	Total	127.89	137.24	146.76	155.26	166.13	177.76						
	Increase -- \$		9.35	9.52	8.50	10.87	11.63						
	Increase -- %		7.3%	6.9%	5.8%	7.0%	7.0%						
15,000 Gal	Total	163.94	176.53	189.59	201.09	215.17	230.23						
	Increase -- \$		12.59	13.05	11.50	14.08	15.06						
	Increase -- %		7.7%	7.4%	6.1%	7.0%	7.0%						
Commercial - 5/8"													
25,000	Total	\$ 299.49	\$ 322.48	\$ 346.31	\$ 367.31	\$ 393.02	\$ 420.53						
	Increase -- \$		22.99	23.83	21.00	25.71	27.51						
	Increase -- %		7.7%	7.4%	6.1%	7.0%	7.0%						
50,000	Total	629.99	680.48	733.57	779.84	834.42	892.83						
	Increase -- \$		50.49	53.09	46.26	54.59	58.41						
	Increase -- %		8.0%	7.8%	6.3%	7.0%	7.0%						

SECTION I

Introduction

Background



In March 2023, the Town of Clarkdale, Arizona (“the Town”) engaged **economists.com** to conduct a Water and Wastewater Rate Study and Long-Term Financial Plan. The Town identified numerous objectives for this study, including but not limited to the following:

- A comprehensive analysis and evaluation of the water and wastewater systems’ current cost of service and revenue requirements
- A forecast of operating expenses over the next decade, taking into consideration salient factors such as cost of water and wastewater treatment, inflation, system growth, and increases in staffing levels
- An estimate of current and forecast accounts, volumes, and billing units for the ten-year forecast period
- A thorough assessment, review, and update of the water and wastewater system’s known capital improvement needs, as well as a determination of the need for funding capital requirements through the issuance of long-term debt
- An evaluation of the current water and wastewater rate structures and revenue recovered versus the revenue requirement, both overall and for each customer class
- The development of a rate structure that would recover the Town’s cost of service, ensure equitable, just, and reasonable treatment of identified customer classes, and maintain critical financial ratios

The analysis and recommendations presented in this study achieve all the objectives outlined.

In conjunction with Town staff, the project team evaluated alternative rate structures, which would enable the Town to achieve these objectives while continuing to provide ratepayers with a superior quality of municipal water and wastewater service.

Report Organization

This report is organized into the following sections:

Section I – Introduction - outlines objectives and scope of this rate study and long-term financial plan. Also presents the Town's current rate structure and a comparison of the Town's water and wastewater charges with other Arizona cities.

Section II – Water and Wastewater Test Year and Forecast Volumes – analyzes the Town's customer base, total accounts and current volumes of treated water and wastewater. This section presents totals for the current year and a forecast ten-years into the future.

Section III – Water and Wastewater Test Year and Forecast Revenue Requirement – outlines the process of analyzing the Town's current water and wastewater utility cost structure. The total current or "test year" revenue requirements are developed, and costs are functionalized. Using the test year as a basis, costs are forecast for a ten-year period.

Section IV – Water and Wastewater Rate Design – Presents the final rate recommendation for the Town, which would enable it to meet its revenue requirements over the next decade. Also presents an analysis of the impact of the rate scenario on each defined customer class.

Appendix A – Water and Wastewater Rate Model

Water and Wastewater Current Rates

Table I-1 summarizes the Town's current water and wastewater rate structure.

Table I-1

TOWN OF CLARKDALE				
CURRENT WATER AND WASTEWATER RATES				
WATER Rates All Classes			Wastewater Rates	
Monthly Charge			<u>Residential</u>	
5/8" & 3/4"	\$	28.30	Monthly Charge	\$ 54.00
1"		46.96		
2"		150.52		
3"		301.04		
4"		475.64	<u>Non-Residential</u>	
6"		951.29	Minimum Charge	\$ 54.00
8"		1,502.79		
Volume Rate (per 1,000 Gallons)			Volume Rate (per 1,000 Gallons)	
1,001	5,000	4.96	5,001	Above 2.25
5,001	10,000	5.15		
10,001	15,000	7.21		
15,001	20,000	7.46		
20,001	25,000	10.65		
25,001	30,000	10.85		
30,001	Above	11.00		

The monthly service charge for all water accounts includes a monthly minimum charge based on the size and type of meter serving the customer. Customers with a larger meter size are assessed a larger minimum charge based on their respective meter size. All water customers are billed based on a seven-tier system per 1,000 gallons of usage after the first 1,000 gallons. The higher the tier of usage the higher the cost per 1,000 gallons. This rate structure encourages water conservation.

Residential wastewater customers are billed based on a flat fee of \$54.00. Non-Residential wastewater customers are billed a base charge of \$54.00, which includes the first 5,000 gallons. After the first 5,000 gallons, Non-Residential customers pay \$2.25 per 1,000 gallons.

Water and Wastewater Rate Comparison

Table I-2 compares Clarkdale's monthly water and wastewater average bills to several cities and towns located in Arizona. The average residential user in the Town consumes approximately 4,900 gallons monthly. Volumes of 5,000 gallons water and 5,000 gallons wastewater, and a 5/8" meter size were used for the comparison as they represent typical usage levels for an average household in Clarkdale.

The rate data is based on published rates and ordinances posted by each municipality on their websites and the WIFA Rates Dashboard. These rates do not include sales tax, activation or other charges beyond the monthly base and volume charges. Additionally, where appropriate, certain cities that charge for service based on cubic feet of water have had their rates converted to an equivalent charge per 1,000 gallons. For 5,000 gallons of water usage and 5,000 gallons of wastewater service with a 5/8" meter, a residential ratepayer in Clarkdale pays approximately \$102.14 (not including taxes).

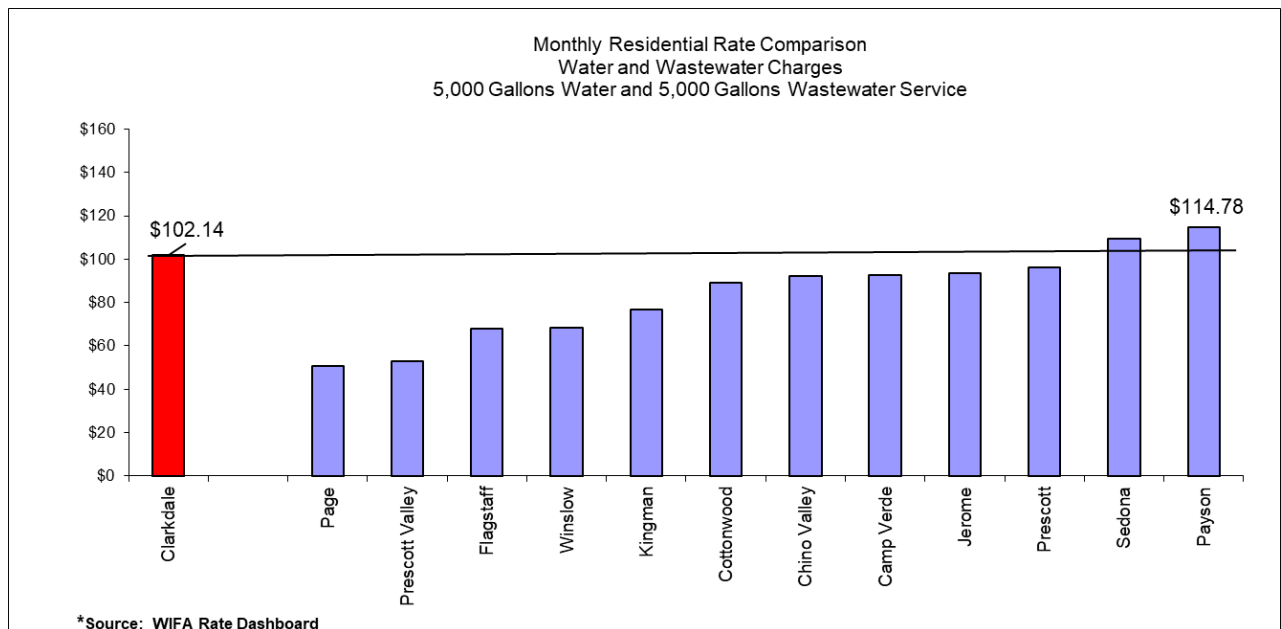
Table I-2

TOWN OF CLARKDALE			
MONTHLY RESIDENTIAL CHARGES -- 5,000 GALLONS WATER AND WASTEWATER			
	Water	Wastewater	Total
Clarkdale	\$ 48.14	\$ 54.00	\$ 102.14
Prescott	41.24	54.97	\$ 96.21
Prescott Valley	25.05	27.77	52.82
Cottonwood	40.45	48.75	89.20
Camp Verde	40.50	52.20	92.70
Jerome	41.05	52.67	93.72
Sedona	48.14	61.11	109.25
Chino Valley	32.01	60.00	92.01
Flagstaff	41.26	26.75	68.01
Winslow	29.57	38.88	68.45
Kingman	20.66	56.10	76.76
Page	18.83	31.96	50.79
Payson	60.78	54.00	114.78
Source: Cities' Websites; US Census Bureau & 2023 TML Water & Wastewater Rate Survey			

This type of comparison may have the unintended effect of discriminating against communities who choose to finance system expansions through current rates or revenue bonds, which are included in rates, as opposed to those who utilize general obligation bonds, which are funded through taxes. All else being equal, a Town that primarily or exclusively uses general obligation bonds will have a lower water rate per 1,000 gallons but a higher tax rate.

With these caveats in mind, **Chart I-3** presents a graphic comparison of residential water and wastewater monthly charges for 5,000 gallons.

Chart I-3



SECTION II

Water and Wastewater Test Year and Forecast Volumes



To accurately forecast future revenues and expenses, it is necessary to examine current water and wastewater utility conditions. The first step in developing cost of service rates is to analyze patterns of usage, both for the system as a whole and for specified customer classes.

For the Town of Clarkdale, water consumption records maintained by the Town were reviewed for a four-year period dating back to July 2019. These records provided information on the monthly water volumes distributed system-wide by account type as well as the number of accounts by meter size for each month and the associated revenues.

According to standard utility ratemaking methodology, to allocate revenue requirements equitably among system users, customers must be classified into relatively homogeneous groups with similar usage characteristics or service demands. Costs are then allocated to the customer classes in proportion to the usage characteristics of each class. For the water system, costs are typically allocated to customers based on their average and peak water demands. For the wastewater system, costs are allocated to customers based on their estimated wastewater flows, and in some cases, based on wastewater strengths.

After thoroughly examining volume and customer data, the project team made no revisions to the Town's rate classifications. The project team finds these customer class distinctions to be reasonable and appropriate for the Town of Clarkdale, meeting the criteria of homogenous groups with similar usage patterns.

In this section, the Town's functional customer classes and test year usage patterns will be thoroughly analyzed. A ten-year projection of customers and usage will also be presented. These forecasts, along with the revenue requirements, will form the basis of the rate design recommendations.

Water and Wastewater Customers and Meters – Test Year & Ten-Year Forecast

The Town's water and wastewater customers are categorized by customer class and are listed in **Table II-1**. The town has six water customer classes but only two wastewater customer classes. The Town has provided the project team with account data for all months from July 2019 through December 2022. The project team has used the December 2022 data as the basis for the test year.

The table lists all water and wastewater accounts by customer class managed by the Town of Clarkdale. As of December 2022, the Town maintained 2,322 water accounts and 1,545 wastewater accounts. **Table II-2** details

the growth projections used by the project team for the Town's water customers beginning in the Test Year and continuing through Fiscal Year 2033.

Table II-1

TOWN OF CLARKDALE			
RATE MODEL CUSTOMER CLASS			
WATER Accounts		WASTEWATER Accounts	
Residential	1,917	Residential	1,504
Multi-Family	330	Non-Residential	41
Commercial	33		
Government	24		
Other	12		
Industrial	6		
Total	2,322	Total	1,545

Table II-2

TOWN OF CLARKDALE							
FORECAST TOTAL CUSTOMERS							
WATER Customer Classes							
	Residential	Multi-Family	Commercial	Government	Other	Industrial	Total
WATER Total Customers							
2020	1,633	297	34	24	9	6	2,002
2021	1,700	338	35	24	9	6	2,111
2022	1,797	338	34	24	11	6	2,210
Last 12 Months	1,835	335	34	24	12	6	2,245
2024	1,917	330	33	24	12	6	2,322
2025	1,977	330	33	24	12	6	2,382
2026	2,037	330	33	24	12	6	2,442
2027	2,097	330	33	24	12	6	2,502
2028	2,157	330	33	24	12	6	2,562
2029	2,217	330	33	24	12	6	2,622
2030	2,277	330	33	24	12	6	2,682
2031	2,337	330	33	24	12	6	2,742
2032	2,397	330	33	24	12	6	2,802
2033	2,457	330	33	24	12	6	2,862
WATER Annual New Customers							
2021	67	41	1	-	1	-	109
2022	98	-	(0)	-	2	-	99
Last 12 Months	38	(3)	(1)	-	1	-	34
2024	82	(5)	(1)	-	1	-	77
2025	60	-	-	-	-	-	60
2026	60	-	-	-	-	-	60
2027	60	-	-	-	-	-	60
2028	60	-	-	-	-	-	60
2029	60	-	-	-	-	-	60
2030	60	-	-	-	-	-	60
2031	60	-	-	-	-	-	60
2032	60	-	-	-	-	-	60
2033	60	-	-	-	-	-	60

Table II-2 reveals that water accounts are forecast to increase an average of 60 new accounts annually through the study period. This translates to an increase in water accounts from 2,322 in the test year to 2,862 in FY 2033, an average annual increase of **2.35%**. This overall growth is illustrated further in **Chart II-3**.

Chart II-3

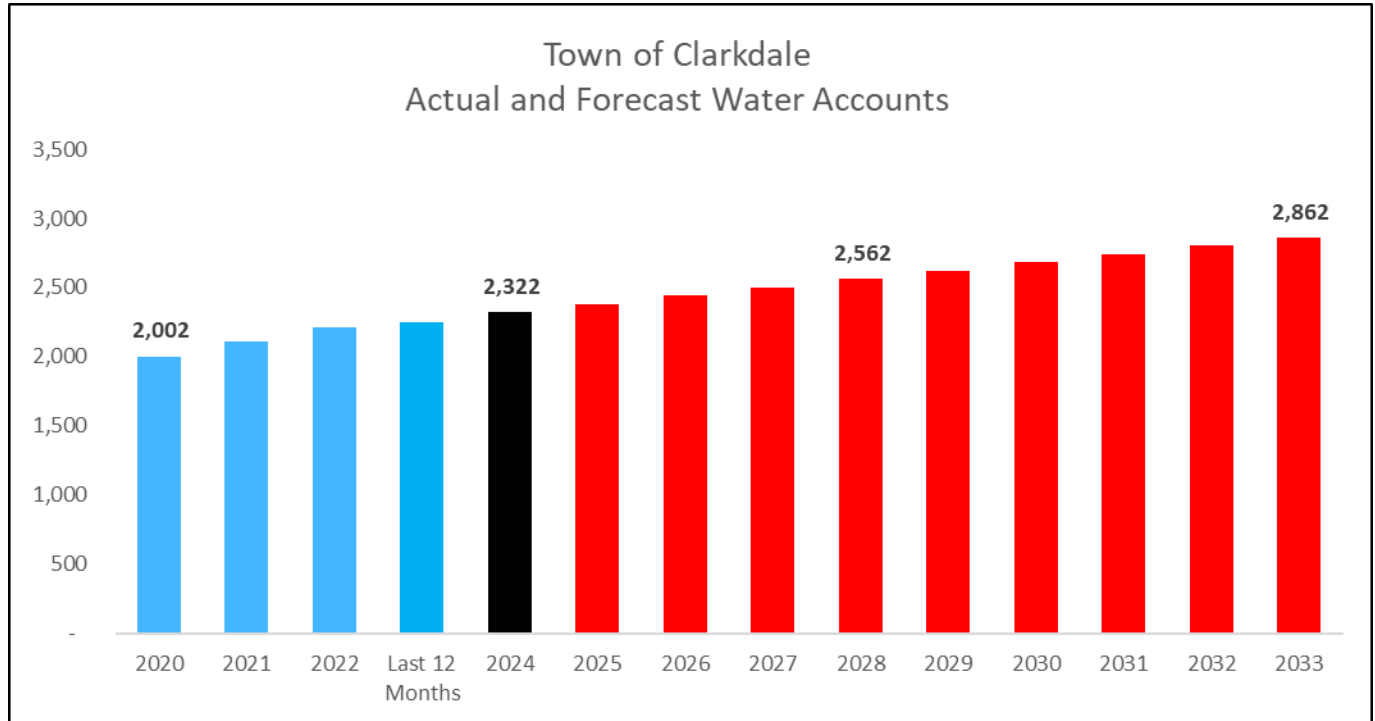


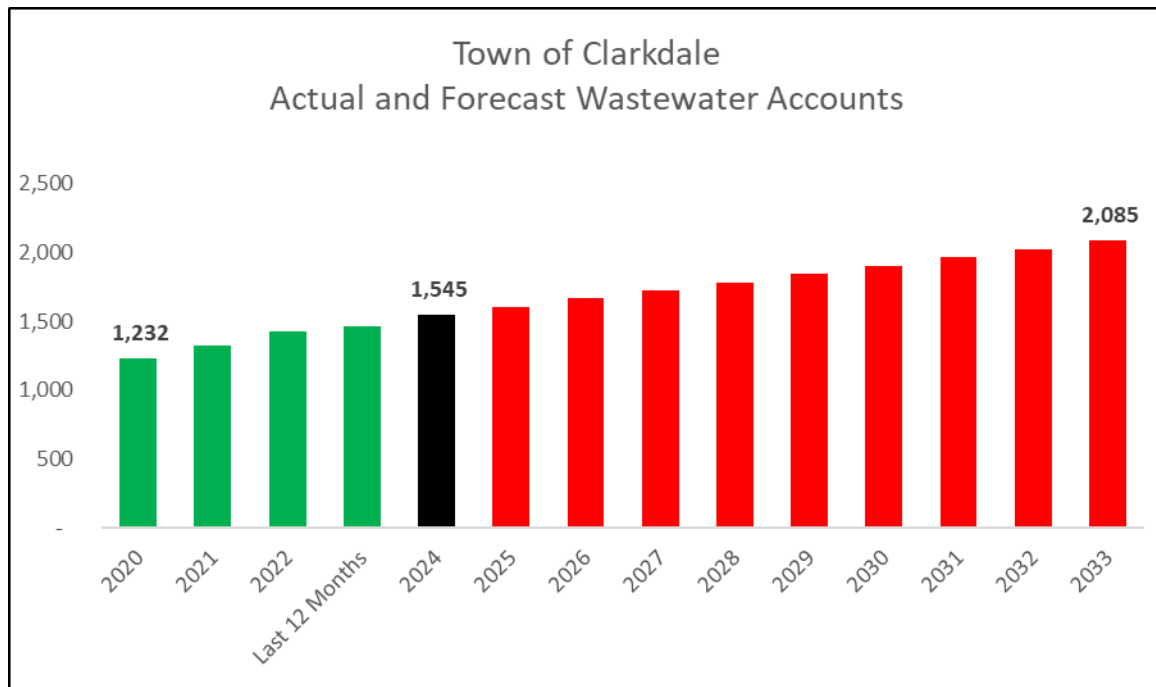
Table II-4 presents the project team's ten-year forecast of wastewater account growth. It reveals that the wastewater customer base is forecast to increase by an average of 60 accounts per year for the forecast period. Wastewater accounts are forecast to increase from 1,545 in the test year to 2,085 in FY 2033, for an average annual increase of **3.39%**.

Table II-4

TOWN OF CLARKDALE			
FORECAST TOTAL CUSTOMERS			
WASTEWATER Customer Classes			
	Residential	Non-Residential	Total
WASTEWATER Total Customers			
2020	1,186	46	1,232
2021	1,279	41	1,320
2022	1,385	41	1,426
Last 12 Months	1,424	41	1,464
2024	1,504	41	1,545
2025	1,564	41	1,605
2026	1,624	41	1,665
2027	1,684	41	1,725
2028	1,744	41	1,785
2029	1,804	41	1,845
2030	1,864	41	1,905
2031	1,924	41	1,965
2032	1,984	41	2,025
2033	2,044	41	2,085
WASTEWATER Annual New Customers			
2021	94	(5)	89
2022	105	(0)	105
Last 12 Months	39	0	39
2024	81	0	81
2025	60	-	60
2026	60	-	60
2027	60	-	60
2028	60	-	60
2029	60	-	60
2030	60	-	60
2031	60	-	60
2032	60	-	60
2033	60	-	60

Chart II-5 illustrates the overall growth of wastewater accounts.

Chart II-5



Water Billed Consumption – Ten-Year Forecast

Table II-6 and Chart II-7 present the project team's ten-year forecast of water consumption in gallons for the Town. Consistent with the growth of accounts presented above, the project team has tracked the increase in consumption for the customer classes impacted and grouped the other classes for which growth is not projected.

Despite account growth, consumption levels often decrease when rainfall levels are higher since a portion of water consumption is used for irrigation. Factors such as account growth, existing rate structure and rainfall totals each exercise various degrees of influence over the ultimate level of water consumption. Therefore, the development of the test year for the volume forecast requires that each of these factors be analyzed.

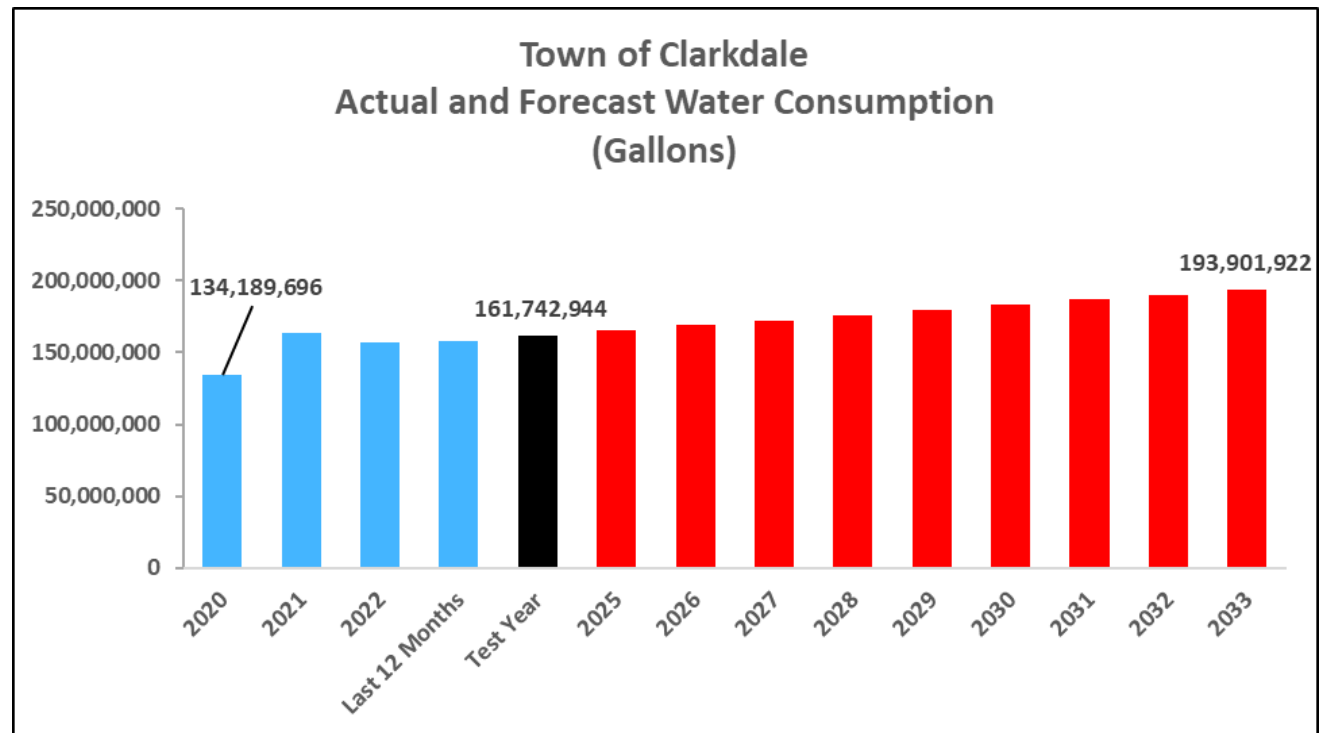
The project team's forecast is based on the following factors:

- Clarkdale's water and wastewater account growth is forecast to continue to increase by approximately 60 new accounts per year.
- Projections contained in this report include adjustments based on the impacts of normal customer growth and no drought restrictions and designed to forecast usage under normal conditions.
- Each new account added to the system will include both water and wastewater service.

Table II-6

TOWN OF CLARKDALE							
FORECAST BILLED CONSUMPTION							
WATER Customer Classes							
	Residential	Multi-Family	Commercial	Government	Other	Industrial	Total
WATER Annual Consumption							
2020	95,716,647	25,461,497	4,695,421	7,075,146	572,918	668,067	134,189,696
2021	114,959,831	33,202,960	5,392,174	8,705,634	1,059,940	701,203	164,021,742
2022	109,408,659	30,997,115	4,968,275	10,380,104	1,075,242	566,687	157,396,082
Last 12 Months	110,591,154	32,207,865	4,636,505	8,182,136	2,023,674	528,390	158,169,724
Test Year	114,164,374	32,207,865	4,636,505	8,182,136	2,023,674	528,390	161,742,944
2025	117,737,594	32,207,865	4,636,505	8,182,136	2,023,674	528,390	165,316,164
2026	121,310,814	32,207,865	4,636,505	8,182,136	2,023,674	528,390	168,889,384
2027	124,884,033	32,207,865	4,636,505	8,182,136	2,023,674	528,390	172,462,603
2028	128,457,253	32,207,865	4,636,505	8,182,136	2,023,674	528,390	176,035,823
2029	132,030,473	32,207,865	4,636,505	8,182,136	2,023,674	528,390	179,609,043
2030	135,603,693	32,207,865	4,636,505	8,182,136	2,023,674	528,390	183,182,263
2031	139,176,913	32,207,865	4,636,505	8,182,136	2,023,674	528,390	186,755,483
2032	142,750,133	32,207,865	4,636,505	8,182,136	2,023,674	528,390	190,328,703
2033	146,323,352	32,207,865	4,636,505	8,182,136	2,023,674	528,390	193,901,922

Chart II-7



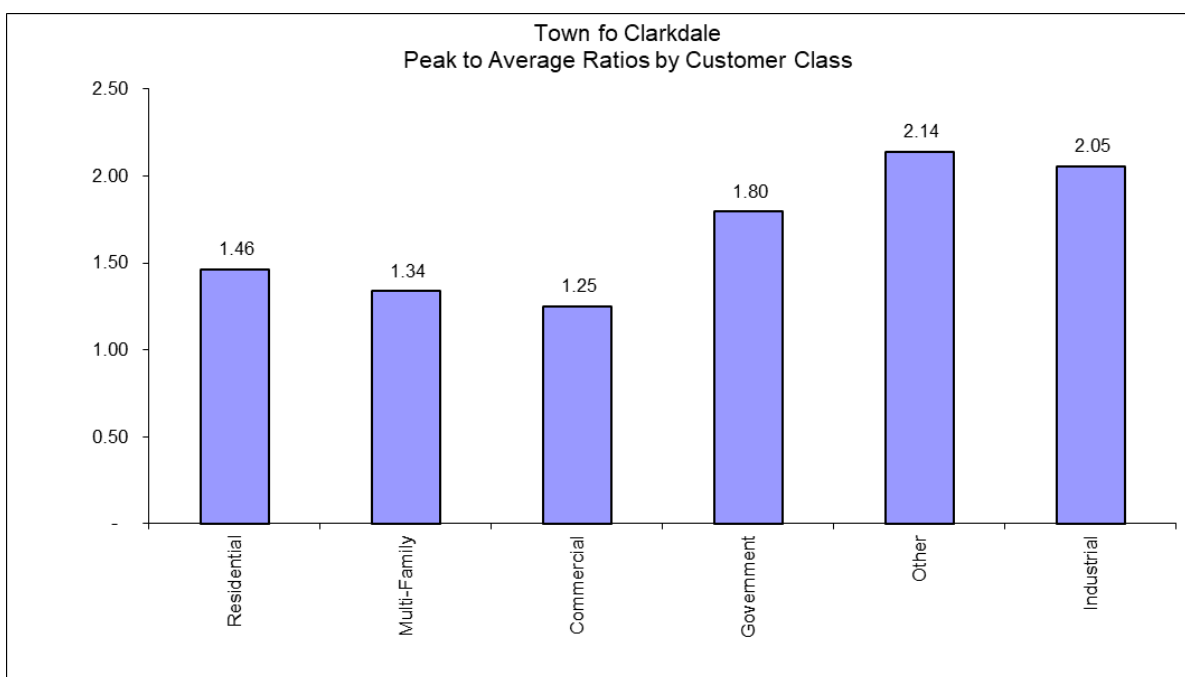
Peaking Factors

The cost of providing water to customers depends not only on the amount of water each class uses, but also on how that usage occurs over time. The maximum-day peaking requirements of a water utility's customers are an important influence on the utility's costs. Because water utilities attempt to meet all the demands of their customers, water systems are sized to meet customers' peak requirements. Therefore, during off-peak periods, there are costs associated with the unused capacity of the system. Ratemaking guidelines direct that these costs must be allocated to customers in proportion to the contribution of each customer class to the system peak. Thus, it is necessary to determine the peak rate of use relative to the average rate of use for each class. This ratio is called a **Peaking Factor**.

The calculation of peaking factors for individual classes relies on available pumping and consumption information as well as professional judgment. If customer meters could record daily flow rates for each customer, more refined information could be obtained on peaking factors. This is not feasible because of the enormous cost that would be imposed on the utility. Therefore, it is accepted practice in the water industry to develop peaking factor estimates based on standard formulas using system peak day information and monthly customer class use records. This is a conservative methodology, since customer class peaking factors based on peak months will inevitably be lower than the system-wide peaking factor, which is based on the peak day.

Based on AWWA guidelines, the customer class peaking factors calculated in this study are for non-coincidental peaks. The peaking factors developed for this analysis are based on actual monthly water consumption by customer class for the recent twelve-month period, January 2022 – December 2022. The calculations of the monthly peaking factors by customer class are shown in **Chart II-8**. The combined peak day to average ratio used in the rate model is **1.50**.

Chart II-8



Wastewater Flows – Test Year and Forecast

The forecast for billing units is derived using anticipated growth in accounts as depicted in **Table II-4**. The results of the forecast are presented in **Table II-9**.

Three points are notable about this table:

- First, many water accounts do not return wastewater to the system, particularly if they are using a septic system.
- Second, wastewater usage is not subject to the significant fluctuations experienced by water accounts. This is because the water volume fluctuation is due to outdoor usage that is not returned to the wastewater system.
- Third, the billing units are estimated by the project team based on average water usage per account.

Table II-9

TOWN OF CLARKDALE			
FORECAST WASTEWATER BILLING UNITS			
WASTEWATER Customer Classes			
	Residential	Non-Residential	Total
WASTEWATER Billing Units			
2024	89,568,711	5,760,506	95,329,217
2025	93,141,930	5,760,506	98,902,437
2026	96,715,150	5,760,506	102,475,657
2027	100,288,370	5,760,506	106,048,876
2028	103,861,590	5,760,506	109,622,096
2029	107,434,810	5,760,506	113,195,316
2030	111,008,030	5,760,506	116,768,536
2031	114,581,249	5,760,506	120,341,756
2032	118,154,469	5,760,506	123,914,976
2033	121,727,689	5,760,506	127,488,195

SECTION III

Water & Wastewater Forecast Revenue Requirement



In this section of the rate study and long-term financial plan, the Town of Clarkdale's test year and a 10-year forecast water and wastewater utility revenue requirements are developed. As noted in Section I, the test year consists of the Town's current fiscal year, July 1, 2023, through June 30, 2024.

The estimates presented in this section are based on the Town's Council-adopted budget for FY 2024, as well as a forecast of the Town's future capital improvements.

The calculation of a revenue requirement differs from a utility's budget in that it represents only that amount that must be raised through the Town's user rates. This means that non-rate revenue (such as

connection fees, late payment charges and interest) must be subtracted from the budgeted operating and capital expenditures to determine the net revenue requirement to be raised from rates.

As is typical for publicly owned utilities, Clarkdale's system revenue requirements were developed using the cash basis of ratemaking. Under the cash basis, as defined by the AWWA Manual M-1, system revenue requirements consist of cash expenditures and other financial commitments (such as debt service coverage or reserves) that must be met through system operating revenues and other revenue sources.

The following specific items are included in the Town's revenue requirements raised from rates:

O&M expenses

Operating Transfers

Capital Outlays Funded from Rates

Debt service -- Current

Debt Service – Forecast

All data used in the development of the revenue requirements was obtained from the financial statements, budgets and other information provided by Town staff.

Operating Expenses – Test Year

Table III-1 summarizes the test year FY 2024 Operating Costs by departmental category for water and wastewater for the Town.

Table III-1

TOWN OF CLARKDALE		
TEST YEAR OPERATING EXPENSES		
SCENARIO: 2023 11 08 -- Scenario I -- Status Quo		2024 Budget
WATER OPERATING EXPENDITURES & CAPITAL OUTLAYS		
P	Personnel	\$ 539,373
SU	Supplies	380,875
SE	Services	1,932,675
	SUB-TOTAL	\$ 2,852,923
WASTEWATER OPERATING EXPENDITURES		
P	Personnel	\$ 339,517
SU	Supplies	226,350
SE	Services	1,137,197
	SUB-TOTAL	\$ 1,703,064
Total Operating Expenses		\$ 4,555,986

As shown in Table III-1, the Town's operating expenses (net of Transfers, Capital outlays and Debt Service) for its water utility are forecast to be **\$2,852,923** in the test year, and **\$1,703,064** for the wastewater utility. **Table III-2** and **Table III-3** present the FY 2024 operating budget, transfers, and capital outlays in detail allocated by functional category. These totals are derived from the Town's FY 2024 budget. Capital outlays and debt service are examined in detail separately later in this section.

Table III-2

TOWN OF CLARKDALE						
WATER Operating Expenses, Transfers and Capital Outlays						
SCENARIO: 2023 11 08 -- Scenario I -- Status Quo						
Water Budget Line Item						
		Net Budget	Supply/ Treatment	Distribution	Admin	Customer Billing
Expense Category Code						
	<u>Operating & Maintenance</u>					
P	Personnel	\$ 539,373	\$ 188,781	\$ 188,781	\$ 107,875	\$ 53,937
SU	Supplies	380,875	133,306	133,306	76,175	38,088
SE	Services	1,932,675	676,436	676,436	386,535	193,267
	Total Operating & Maintenance	2,852,923	998,523	998,523	570,585	285,292
	Transfers	-	-	-	-	-
	Capital Outlays	30,000	-	30,000	-	-
	Total WATER Operating Expenses, Transfers and Capital Outlays	2,882,923	998,523	1,028,523	570,585	285,292

Table III-3

TOWN OF CLARKDALE						
WASTEWATER Operating Expenses, Transfers and Capital Outlays						
SCENARIO: 2023 11 08 -- Scenario I -- Status Quo						
Water Budget Line Item						
		Net Budget	Treatment	Collection	Admin	Customer Billing
Expense Category Code						
	<u>Operating & Maintenance</u>					
P	Personnel	\$ 339,517	\$ 118,831	\$ 118,831	\$ 67,903	\$ 33,952
SU	Supplies	226,350	79,223	79,223	45,270	22,635
SE	Services	1,137,197	398,019	398,019	227,439	113,720
	Total Operating & Maintenance	1,703,064	596,072	596,072	340,613	170,306
	Transfers	-	-	-	-	-
	Capital Outlays	30,000	-	30,000	-	-
	Total WASTEWATER O&M Exp., Transfers and Capital Outlays	1,733,064	596,072	626,072	340,613	170,306

Operating Expenses and Capital Outlays – Ten Year Forecast

Table III-4 presents the water and wastewater utility operating expense and capital outlays forecast for the ten-year period FY 2024 – FY 2033. Details behind these calculations can be found in the rate model contained in Appendix A. This forecast is based on the following set of assumptions:

- For FY 2025 and FY 2026, the water and wastewater operating expenses are assumed to increase at a 4% rate of inflation, returning to 3.0% per year after 2026.
- Certain operating expenses are one-time expenses budgeted in the FY 2024 budget and will go away in FY 2025 and after, additional details on these expenses can be found in Appendix A.
- In addition to anticipated inflationary increases, there are other factors that are considered when forecasting various expense items. One such factor is that certain expense categories are expected to increase at rates greater than the average inflation rate. Account growth and volume growth will also affect certain expense categories, and some of the expense items are vulnerable to a combination of these greater than average increases. Items that are affected by general inflation, premium escalation, and account growth are primarily energy related items such as gas and electric expenses, fuels, and lubricants.
- Certain personnel related expenses such as insurance are projected to increase at a higher rate annually.
- Certain water and wastewater expenses are forecast to increase at a rate which reflects both inflation and the growth of new accounts.

Table III-4

TOWN OF CLARKDALE									
FORECAST OPERATING EXPENSES AND CAPITAL OUTLAYS									
SCENARIO: 2023 11 08 -- Scenario I -- Status Quo									
	Water			Wastewater			Total Water & Wastewater		
	Operating Expense	Capital Outlays	Total	Operating Expense	Capital Outlays	Total	Operating Expense	Capital Outlays	Total
2024	\$ 2,852,923	\$ 30,000	\$ 2,882,923	\$ 1,703,064	\$ 30,000	\$ 1,733,064	\$ 4,555,986	\$ 60,000	\$ 4,615,986
2025	1,752,606	20,000	1,772,606	1,017,739	20,000	1,037,739	2,770,345	40,000	2,810,345
2026	1,878,066	20,000	1,898,066	1,056,075	20,000	1,076,075	2,934,141	40,000	2,974,141
2027	1,916,630	20,000	1,936,630	1,168,222	20,000	1,188,222	3,084,852	40,000	3,124,852
2028	1,956,470	20,000	1,976,470	1,202,839	20,000	1,222,839	3,159,309	40,000	3,199,309
2029	1,997,629	20,000	2,017,629	1,238,604	20,000	1,258,604	3,236,234	40,000	3,276,234
2030	2,040,153	20,000	2,060,153	1,275,558	20,000	1,295,558	3,315,711	40,000	3,355,711
2031	2,084,089	20,000	2,104,089	1,313,740	20,000	1,333,740	3,397,829	40,000	3,437,829
2032	2,129,485	20,000	2,149,485	1,353,193	20,000	1,373,193	3,482,678	40,000	3,522,678
2033	2,176,392	20,000	2,196,392	1,393,961	20,000	1,413,961	3,570,353	40,000	3,610,353

Existing Debt Service

The City currently has three bond issues outstanding in the Test Year that were issued to fund both water and wastewater system improvements. Debt service on these issues is currently being paid from contributions from the City's Utility System Revenue. The debt service requirement for the current debt in the Test Year is \$719,700. None of the current outstanding bonds are retiring in the next ten years.

Table III-5 presents debt service for the debt currently outstanding.

Table III-5

TOWN OF CLARKDALE					
CURRENT DEBT SERVICE					
SCENARIO: 2023 11 08 -- Scenario I -- Status Quo					
Debt Service					
	1	2	3		
	Series	Series	Series		
	910152-12	920235-13	920264-16	Total Debt	Service
WATER Debt Service					
2024	\$ -	\$ 46,851	\$ 454,332	\$	501,183
2025	-	46,838	454,279		501,117
2026	-	46,825	454,224		501,049
2027	-	46,812	454,169		500,981
2028	-	46,798	454,113		500,911
2029	-	46,784	454,056		500,840
2030	-	46,770	453,998		500,768
2031	-	46,755	453,939		500,694
2032	-	46,740	453,879		500,619
2033	-	40,673	453,818		494,491
WASTEWATER Debt Service					
2024	\$ 218,518	\$ -	\$ -	\$	218,518
2025	218,449	-	-		218,449
2026	218,379	-	-		218,379
2027	218,307	-	-		218,307
2028	218,232	-	-		218,232
2029	218,156	-	-		218,156
2030	218,077	-	-		218,077
2031	217,996	-	-		217,996
2032	217,912	-	-		217,912
2033	217,826	-	-		217,826
TOTAL Debt Service					
2024	\$ 218,518	\$ 46,851	\$ 454,332	\$	719,700
2025	218,449	46,838	454,279		719,566
2026	218,379	46,825	454,224		719,428
2027	218,307	46,812	454,169		719,288
2028	218,232	46,798	454,113		719,144
2029	218,156	46,784	454,056		718,996
2030	218,077	46,770	453,998		718,845
2031	217,996	46,755	453,939		718,690
2032	217,912	46,740	453,879		718,531
2033	217,826	40,673	453,818		712,317

Capital Improvement Plan

Like most towns, Clarkdale maintains an extensive and detailed capital improvement program to repair, maintain and expand its water and wastewater system. Minor capital improvements are contained in the Town's budget. Major capital improvements are funded through a series of debt issued by the Town.

Town staff and the project team worked together to develop the Town's forecast capital improvements needs in FY 2024 – FY 2028. The forecast CIP is presented in **Table III-6**. As the table reveals, the Town is forecast to spend **\$18,397,500** in total capital improvements in the next five years.

Table III-6

TOWN OF CLARKDALE

CAPITAL IMPROVEMENT PLAN FOR FUNDING THROUGH NEW BOND ISSUES

FY 2024 - FY 2028

SCENARIO:2023 11 08 -- Scenario I -- Status Quo

WATER PROJECTS

Project Description		
Treatment - Arsenic Plant Expansion	\$	5,500,000
Production - Well 3 Reactivation		1,005,000
89A Reservoir Rehab		225,000
Arsenic Treatment Plant Backwash Tank & Lift Station		285,000
ATP Vessel Maintenance, Diagnostics, & Repair		250,000
Distribution - Mid Zone PRV		375,000
Infrastructure - Water Line Research		50,000
Distribution - Panorama Booster Station Rehab		330,000
Distribution - Water Storage Expansion		2,200,000
Haskell Springs Tank Coating		200,000
Haskell Well Pump Emergent Repairs		50,000
Rate Study and IIP (Infrastructure Plan)		150,000
Cellular Meter Program		562,500
Total Water	\$	11,182,500

WASTEWATER PROJECTS

Project Description		
Treatment - WWTP Expansion	\$	6,050,000
Sludge Drying Beds		110,000
VRIC Property Rehab		150,000
First South Sewer		200,000
Third North Sewer Realignment		610,000
SCADA Upgrades		50,000
Reclaim Feasibility		45,000
Total Wastewater	\$	7,215,000

Total Water and Wastewater Projects	\$	18,397,500
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The Town plans to use several different funding sources in order to pay for the Capital Improvement Plan. For water capital improvements, the Town plans to use Water Capacity Fees totaling \$963,645, Water Resource Development Fees totaling \$471,750, Fund Balance draw down totaling \$1,602,921, Grant totaling \$562,500, and long-term debt totaling \$8,000,000 from FY 2024 – FY 2028.

For wastewater capital improvements, the Town plans to use Sewer Capacity Fees totaling \$1,440,990, capital transfer in of \$650,000, and long-term debt totaling \$5,500,000 from FY 2024 – FY 2028.

The Town is forecast to issue additional revenue bonds during the 2029-2033 period as future capital projects are developed. Annual forecast debt issuances are presented in **Table III-7**.

Table III-7

TOWN OF CLARKDALE			
WATER/WASTEWATER FUTURE BOND ISSUES			
	Water	Wastewater	Total
2024	\$ -	\$ -	\$ -
2025	-	500,000	500,000
2026	2,000,000	-	2,000,000
2027	1,000,000	5,000,000	6,000,000
2028	5,000,000	-	5,000,000
2029	2,000,000	-	2,000,000
2030	-	-	-
2031	-	-	-
2032	2,000,000	-	2,000,000
2033	-	-	-
Total	\$ 12,000,000	\$ 5,500,000	\$ 17,500,000
Total 2024-2028	8,000,000	5,500,000	13,500,000
Total 2029-2033	4,000,000	-	4,000,000

Debt Service – Forecast

Table III-8 presents current and forecast debt service, assuming that the Town issues new water and wastewater debt in FY 2025-2033 to fund the CIP projects according to the schedule presented in Table III-7. It is projected that newly-issued bond will be repaid entirely with Utility System Revenues. Future revenue debt is assumed to have a 25-year term, 4.0% interest rate and level principal and interest payments.

These assumptions are preliminary in nature and subject to change. Should the Town Council choose to issue more or less revenue debt than assumed in this study, or should different finance terms be available at the time the debt is issued, then the rate plans contained in this study may require revision.

Table III-8

TOWN OF CLARKDALE						
CURRENT AND FORECAST DEBT SERVICE						
SCENARIO: 2023 11 08 -- Scenario I -- Status Quo						
Year	Water		Wastewater		Total	
	Current	Forecast	Current	Forecast		
2024	\$ 501,183	\$ -	\$ 218,518	\$ -	\$ 719,700	
2025	501,117	-	218,449	-	719,566	
2026	501,049	-	218,379	32,646	752,075	
2027	500,981	130,584	218,307	32,646	882,518	
2028	500,911	195,877	218,232	359,107	1,274,127	
2029	500,840	522,338	218,156	359,107	1,600,441	
2030	500,768	652,922	218,077	359,107	1,730,874	
2031	500,694	652,922	217,996	359,107	1,730,719	
2032	500,619	652,922	217,912	359,107	1,730,560	
2033	494,491	783,506	217,826	359,107	1,854,930	

Non-Rate Revenues

Although sales revenues constitute most of the revenue received by the Town for water and wastewater service, a certain amount of revenue is accrued from non-rate sources. These revenues include other general revenues, surcharges, penalty charges, and miscellaneous revenues. These non-rate revenues are subtracted from the overall budget to determine the revenue requirement to be raised from rates. In FY 2024, there are several one-time fund balance appropriation transfers to pay for one-time expenses. These non-rate revenue transfers will go away after FY 2024. Additional details on these transfers can be found in Appendix A. Non-rate revenues are presented in **Table III-9**.

Table III-9

TOWN OF CLARKDALE

FORECAST NON-RATE REVENUES

SCENARIO:

2023 11 08 -- Scenario I -- Status Quo

	Water	Wastewater	Total Water & WW
2024	\$ 1,331,343	\$ 921,938	\$ 2,253,281
2025	191,343	121,938	313,281
2026	191,343	121,938	313,281
2027	191,343	121,938	313,281
2028	191,343	121,938	313,281
2029	191,343	121,938	313,281
2030	191,343	121,938	313,281
2031	191,343	121,938	313,281
2032	191,343	121,938	313,281
2033	191,343	121,938	313,281

Net Revenue Requirement

Table III-10 presents the test year and ten-year forecast for the Town's net revenue requirement to be raised from rates. Detailed calculations are presented in the rate model contained in **Appendix A** of this report.

Table III-10

TOWN OF CLARKDALE

CURRENT AND FORECAST NET REVENUE REQUIREMENT

SCENARIO: 2023 11 08 -- Scenario I -- Status Quo

	Operating Expenses	Capital Outlays	Debt Service	Total Cost of Service	Less Non-Rate Revenues	Net Revenue Requirement
WATER Revenue Requirement						
2024	\$ 2,852,923	\$ 30,000	\$ 501,183	\$ 3,384,105	\$ 1,331,343	\$ 2,052,762
2025	1,752,606	20,000	501,117	2,273,722	191,343	2,082,379
2026	1,878,066	20,000	501,049	2,399,116	191,343	2,207,773
2027	1,916,630	20,000	631,565	2,568,196	191,343	2,376,853
2028	1,956,470	20,000	696,788	2,673,258	191,343	2,481,915
2029	1,997,629	20,000	1,023,178	3,040,807	191,343	2,849,464
2030	2,040,153	20,000	1,153,690	3,213,843	191,343	3,022,500
2031	2,084,089	20,000	1,153,616	3,257,705	191,343	3,066,362
2032	2,129,485	20,000	1,153,541	3,303,026	191,343	3,111,683
2033	2,176,392	20,000	1,277,997	3,474,389	191,343	3,283,046
WASTEWATER Revenue Requirement						
2024	\$ 1,703,064	\$ 30,000	\$ 218,518	\$ 1,951,582	\$ 921,938	\$ 1,029,644
2025	1,017,739	20,000	218,449	1,256,188	121,938	1,134,250
2026	1,056,075	20,000	251,025	1,327,100	121,938	1,205,162
2027	1,168,222	20,000	250,953	1,439,175	121,938	1,317,237
2028	1,202,839	20,000	577,339	1,800,178	121,938	1,678,240
2029	1,238,604	20,000	577,263	1,835,867	121,938	1,713,929
2030	1,275,558	20,000	577,184	1,872,742	121,938	1,750,804
2031	1,313,740	20,000	577,103	1,910,843	121,938	1,788,905
2032	1,353,193	20,000	577,019	1,950,213	121,938	1,828,275
2033	1,393,961	20,000	576,933	1,990,894	121,938	1,868,956
TOTAL Revenue Requirement						
2024	\$ 4,555,986	\$ 60,000	\$ 719,700	\$ 5,335,687	\$ 2,253,281	\$ 3,082,406
2025	2,770,345	40,000	719,566	3,529,910	313,281	3,216,629
2026	2,934,141	40,000	752,075	3,726,215	313,281	3,412,934
2027	3,084,852	40,000	882,518	4,007,370	313,281	3,694,089
2028	3,159,309	40,000	1,274,127	4,473,436	313,281	4,160,155
2029	3,236,234	40,000	1,600,441	4,876,674	313,281	4,563,393
2030	3,315,711	40,000	1,730,874	5,086,585	313,281	4,773,304
2031	3,397,829	40,000	1,730,719	5,168,548	313,281	4,855,267
2032	3,482,678	40,000	1,730,560	5,253,238	313,281	4,939,957
2033	3,570,353	40,000	1,854,930	5,465,283	313,281	5,152,002

Water Utility Cost Functionalization

Once the total water and wastewater system costs have been identified, the next step in the rate development process is to isolate the costs associated with each system function. Some of these expenditures are a function of base water demand; others are based on the peak demands placed on the system. Certain costs are associated with serving customers regardless of the volume of water use or wastewater discharge. The basic steps used to allocate the Town's water revenue requirements include the following:

1. Each system's costs (revenue requirements) are categorized by utility function (i.e., treatment, distribution, administrative, customer). This process is known as *functionalization*.
2. Functionalized costs are classified based on the service characteristics or the types of demand served by the utility (base and maximum day). This process is known as *classification*.
3. Costs by service characteristic are allocated to customer classes in proportion to the service demands demonstrated by each class.

This three-step process allows for the allocation of system costs in the same terms as customer classes. The approaches described in this section follow standard industry practices. Water system costs are allocated to the following functions:

Treatment – the process by which raw water is converted to potable water

Distribution – the lines that carry water to individual customers' properties

Administration – miscellaneous overhead and other non-operating costs

Customer Billing – the processes involved in billing and providing other services to customers

The project team allocated operating budget line-item expenses individually to system functions based on general guidelines, specific research, and input from Town staff. The results of the allocation process for the test year are presented in **Table III-11**. The rate model presented in Appendix A includes a detailed listing of the allocations by line item.

Table III-11

TOWN OF CLARKDALE			
TEST YEAR WATER COST FUNCTIONALIZATION			
SCENARIO: 2023 11 08 – Scenario I – Status Quo			
Function	Revenue Requirement	Percent	
Treatment	\$ 605,693	29.5%	
Distribution	927,903	45.2%	
Administration	346,110	16.9%	
Customer	173,055	8.4%	
Total	2,052,762	100.0%	

Water Utility Cost Classification

The allocation of functionalized water system costs to service characteristics follows the base-extra capacity cost allocation method recommended by AWWA. Using this method, costs are segregated into the following categories:

Base costs – capital costs and O&M expenses associated with service to customers under average demand conditions. This category does not include any costs attributable to variations in water use resulting from peaks in demand. Base costs tend to vary directly with the total quantity of water used.

Maximum Day/Extra Capacity costs – costs attributable to facilities that are designed to meet peaking requirements. These costs include capital and operating charges for additional plant and system capacity beyond that required for average usage.

Customer Billing costs – costs associated with any aspect of customer service, including billing, accounting, and meter services. These costs are independent of the amount of water used and the size of the customer's meter and are not subject to peaking factors.

Limitations in the availability of information resulted in the decision not to attempt to allocate costs further to the maximum hour component.

According to AWWA Manual M-1 (p. 12), in the base-extra capacity method, care must be taken in separating costs between those devoted to base capacity and those devoted to extra capacity. Based on general industry standards, the Town's peak to average capacity factor is assumed to be 1.5. The peak to average factor is calculated by dividing the volume on the peak day of the year by the average daily volume. This means that facilities designed to meet maximum-day requirements, such as the treatment and distribution functions, are allocated 50.00% to base, and 50.00% to extra capacity.

All customer service-related costs are allocated 100% to customer billing. Administration costs are generally not directly assignable to individual classifications. Therefore, it is standard rate-making practice to allocate these costs on an indirect basis to service characteristics.

The rate model in Appendix A provides the detailed allocations of costs to service characteristics. The system-wide costs by service characteristic are shown in **Table III-12**. As with cost functionalization, these percentages are not expected to change significantly in the forecast period.

Table III-12

TOWN OF CLARKDALE		
TEST YEAR WATER COST CLASSIFICATION		
SCENARIO: 2023 11 08 -- Scenario I -- Status Quo		
Function	2024 Revenue Requirement	Percent
Base	\$ 1,224,670	59.66%
Maximum Day	612,335	29.83%
Customer	<u>215,758</u>	<u>10.51%</u>
Total	2,052,762	100.0%

Water Utility Cost Allocation

Allocation of costs by service characteristic to customer classes is based on the proportionate use levels of each characteristic by each class. The water utility costs for Test Year 2024 by customer class are presented in **Table III-13**. Total water utility costs by customer class for the entire term of the study are summarized in **Table III-14**. Overall cost calculations are presented in detail in the rate model contained in **Appendix A**.

Table III-13

TOWN OF CLARKDALE		
TEST YEAR WATER COST ALLOCATION		
SCENARIO: 2023 11 08 -- Scenario I -- Status Quo		
Function	2024 Revenue Requirement	Percent
Residential	\$ 1,478,541	72.0%
Multi-Family	364,212	17.7%
Commercial	47,776	2.3%
Government	117,693	5.7%
Other	35,403	1.7%
Industrial	9,137	0.4%
Total	2,052,762	100.0%

Table III-14

TOWN OF CLARKDALE							
FORECAST WATER COST ALLOCATION							
SCENARIO: 2023 11 08 -- Scenario I -- Status Quo							
Year	Residential	Multi-Family	Commercial	Government	Other	Industrial	Total
2024	\$ 1,478,541	\$ 364,212	\$ 47,776	\$ 117,693	\$ 35,403	\$ 9,137	\$ 2,052,762
2025	1,512,634	361,353	47,405	116,792	35,130	9,066	2,082,379
2026	1,616,667	374,880	49,183	121,187	36,450	9,406	2,207,773
2027	1,753,831	395,101	51,840	127,747	38,421	9,913	2,376,853
2028	1,844,724	404,067	53,020	130,668	39,297	10,139	2,481,915
2029	2,132,641	454,543	59,647	147,016	44,211	11,406	2,849,464
2030	2,277,155	472,608	62,022	152,882	45,973	11,859	3,022,500
2031	2,324,836	470,167	61,705	152,115	45,740	11,798	3,066,362
2032	2,373,484	468,038	61,429	151,448	45,538	11,745	3,111,683
2033	2,518,705	484,594	63,606	156,827	47,153	12,161	3,283,046

Wastewater Utility Cost Functionalization and Classification

Wastewater system costs are allocated to the following functions:

Treatment -- the costs associated with treating wastewater volume discharges

Collection -- the lines that transport wastewater from customers' properties to the wastewater treatment plant

Administration -- miscellaneous overhead and other non-operating costs

Customer Billing -- the processes involved in billing and other services to customers

As was the case for the water system, wastewater utility operating budget line-item expenses are allocated individually to functions. The results of the allocation process are presented in **Table III-15**. The rate model in **Appendix A** presents a detailed listing of the cost allocations by line item. As with the water utility, these percentages are not forecast to change significantly during the next ten years.

Table III-15

TOWN OF CLARKDALE			
TEST YEAR WASTEWATER COST FUNCTIONALIZATION			
SCENARIO: 2023 11 08 -- Scenario I -- Status Quo			
Function	2024 Revenue Requirement	Percent	
Treatment	\$ 314,484	30.5%	
Collection	445,601	43.3%	
Administration	179,705	17.5%	
Customer	89,853	8.7%	
Total	1,029,644	100.0%	

Wastewater Utility Cost Allocation

Allocation of wastewater utility costs by service characteristic to customer classes is performed in the same manner as described for the water utility. The wastewater utility costs for Test Year 2024 by customer class are presented in **Table III-16**. Total wastewater utility costs by customer class are summarized in **Table III-17**. The rate model in **Appendix A** presents a detailed listing of the cost calculations by line item.

Table III-16

TOWN OF CLARKDALE		
TEST YEAR WASTEWATER COST ALLOCATION		
SCENARIO: 2023 11 08 -- Scenario I -- Status Quo		
Function	2024 Revenue Requirement	Percent
Residential	\$ 971,114	94.3%
Non-Residential	58,530	5.7%
Total	1,029,644	100.0%

Table III-17

TOWN OF CLARKDALE			
FORECAST WASTEWATER COST ALLOCATION			
SCENARIO: 2023 11 08 -- Scenario I -- Status Quo			
Year	Residential	Residential	Total
2024	\$ 971,114	\$ 58,530	\$ 1,029,644
2025	1,071,773	62,478	1,134,250
2026	1,141,020	64,142	1,205,162
2027	1,249,586	67,650	1,317,237
2028	1,593,889	84,351	1,678,240
2029	1,630,549	83,380	1,713,929
2030	1,668,281	82,523	1,750,804
2031	1,707,134	81,771	1,788,905
2032	1,747,157	81,118	1,828,275
2033	1,788,401	80,556	1,868,956

SECTION IV

Water and Wastewater Rate Design



Rate design involves determining charges for each class of customers that will generate a desired level of revenue. Over the course of the engagement, the project team has participated in numerous conversations and meetings with Town staff at which alternative rate plans were discussed. As a result of these conversations and work sessions, the project team has developed the alternative long-term rate plan presented in this section.

The plan is designed to allow the Town to recover sufficient revenues to meet all operating and capital obligations, including the debt service required to fund the Town's forecast capital improvements.

Rate Design

The rate design maintains the existing rate structure for water and wastewater and introduces necessary percentage adjustments. The average percentage adjustment for both water and wastewater from FY 2024 to FY 2029 is 6.4%. It is important to note that the Town has not adjusted rates since 2018.

Some of the advantages of this scenario are:

- Consistent and easy to understand,
- Fair treatment of all customer classes,

Table IV-1 summarizes the water rate recommendations for the six-year period 2024 - 2029. The table reveals that the proposed water rate increases are higher in the years 2024 – 2025 with lower percentage adjustment after.

Table IV-2 summarizes the wastewater rate recommendations for the six-year period 2024 - 2029. The table reveals that the proposed wastewater rate increases are lower in the years 2024 – 2026 with higher percentage adjustment after.

Table IV-3 calculates the average impact on monthly residential and non-residential water and wastewater bills of the proposed rate design at various usage levels. The results of the analysis are included in **Appendix A**.

Table IV-1

TOWN OF CLARKDALE							
Proposed Water Rate Plan							
Scenario: 2023 11 08 – Scenario I – Status Quo							
	Current	Effective Feb-24	Effective Jan-25	Effective Jan-26	Effective Jan-27	Effective Jan-28	
Water Rates							
Monthly Minimum Charge							
5/8" & 3/4"	\$ 28.30	\$ 30.85	\$ 33.62	\$ 35.98	\$ 38.50	\$ 41.19	
1"	46.96	51.19	55.79	59.70	63.88	68.35	
1 1/2"	93.93	102.38	111.60	119.41	127.77	136.71	
2"	150.52	164.07	178.83	191.35	204.75	219.08	
3"	301.04	328.13	357.67	382.70	409.49	438.16	
4"	475.64	518.45	565.11	604.67	646.99	692.28	
6"	951.29	1,036.91	1,130.23	1,209.34	1,294.00	1,384.58	
8"	1,502.79	1,638.04	1,785.46	1,910.45	2,044.18	2,187.27	
Volume Rate Per 1,000 Gal							
1,001 5,000	4.96	5.41	5.89	6.31	6.75	7.22	
5,001 10,000	5.15	5.61	6.12	6.55	7.01	7.50	
10,001 15,000	7.21	7.86	8.57	9.17	9.81	10.49	
15,001 20,000	7.46	8.13	8.86	9.48	10.15	10.86	
20,001 25,000	10.65	11.61	12.65	13.54	14.49	15.50	
25,001 30,000	10.85	11.83	12.89	13.79	14.76	15.79	
30,001 Above	11.00	11.99	13.07	13.98	14.96	16.01	

Table IV-2

TOWN OF CLARKDALE							
Proposed Wastewater Rate Plan							
Scenario: 2023 11 08 – Scenario I – Status Quo							
	Current	Effective Feb-24	Effective Jan-25	Effective Jan-26	Effective Jan-27	Effective Jan-28	
Wastewater Rates							
Residential							
Monthly Charge	\$ 54.00	\$ 56.70	\$ 58.97	\$ 61.33	\$ 65.62	\$ 70.21	
Non-Residential							
Monthly Minimum Charge	\$ 54.00	\$ 56.70	\$ 58.97	\$ 61.33	\$ 65.62	\$ 70.21	
Volume Rate/1,000 Gal							
5,001 Above	2.25	2.36	2.46	2.56	2.73	2.93	

Table IV-3

TOWN OF CLARKDALE		Impact on Monthly Bills					
Scenario:		2023 11 08 -- Scenario I -- Status Quo					
		Current	Effective Feb-24	Effective Jan-25	Effective Jan-26	Effective Jan-27	Effective Jan-28
Water/WW Charge							
Residential - 5/8"							
5,000 Gal	Total	\$ 102.14	\$ 109.17	\$ 116.16	\$ 122.53	\$ 131.10	\$ 140.28
	Increase -- \$		7.03	6.99	6.36	8.58	9.18
	Increase -- %		6.9%	6.4%	5.5%	7.0%	7.0%
10,000 Gal	Total	127.89	137.24	146.76	155.26	166.13	177.76
	Increase -- \$		9.35	9.52	8.50	10.87	11.63
	Increase -- %		7.3%	6.9%	5.8%	7.0%	7.0%
15,000 Gal	Total	163.94	176.53	189.59	201.09	215.17	230.23
	Increase -- \$		12.59	13.05	11.50	14.08	15.06
	Increase -- %		7.7%	7.4%	6.1%	7.0%	7.0%
Commercial - 5/8"							
25,000	Total	\$ 299.49	\$ 322.48	\$ 346.31	\$ 367.31	\$ 393.02	\$ 420.53
	Increase -- \$		22.99	23.83	21.00	25.71	27.51
	Increase -- %		7.7%	7.4%	6.1%	7.0%	7.0%
50,000	Total	629.99	680.48	733.57	779.84	834.42	892.83
	Increase -- \$		50.49	53.09	46.26	54.59	58.41
	Increase -- %		8.0%	7.8%	6.3%	7.0%	7.0%

Table IV-4 presents a summary of the forecast revenues, expenses and net revenues for the water and wastewater fund for the ten-year period FY 2024 – FY 2033.

Table IV-4

TOWN OF CLARKDALE FORECAST REVENUES AND EXPENSES										
Scenario:	2023 11 08 -- Scenario I -- Status Quo									
	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Fund Balance, Revenues and Expenses										
Revised Beginning Fund Balance	\$ 4,855,274	\$ 4,578,409	\$ 4,476,347	\$ 4,473,386	\$ 4,501,139	\$ 4,423,861	\$ 4,323,655	\$ 4,330,195	\$ 4,474,751	\$ 4,751,393
Revenues and Expenses										
<u>Water Rate Revenues</u>										
Residential	1,219,618	1,380,975	1,538,489	1,694,671	1,865,181	2,051,258	2,208,614	2,312,148	2,418,940	2,529,079
Multi-Family	369,592	405,789	438,757	469,470	502,333	537,496	563,479	574,748	586,243	597,968
Commercial	48,565	53,321	57,653	61,689	66,007	70,628	74,042	75,523	77,033	78,574
Government	102,990	113,077	122,264	130,822	139,980	149,778	157,019	160,159	163,362	166,629
Other	21,648	23,769	25,700	27,499	29,424	31,483	33,005	33,665	34,339	35,025
Industrial	17,731	19,467	21,049	22,522	24,099	25,786	27,032	27,573	28,124	28,687
Total	1,780,145	1,996,398	2,203,911	2,406,673	2,627,023	2,866,429	3,063,191	3,183,816	3,308,042	3,435,963
<u>WW Rate Revenues</u>										
Residential	990,835	1,081,881	1,168,321	1,275,436	1,413,341	1,551,636	1,669,663	1,767,805	1,859,392	1,953,936
Non-Residential	34,561	36,289	37,740	39,732	42,514	45,121	46,991	48,201	49,165	50,149
Total	1,025,396	1,118,170	1,206,061	1,315,169	1,455,855	1,596,758	1,716,654	1,816,006	1,908,558	2,004,085
Non-Rate Revenues	2,253,281	313,281	313,281	313,281	313,281	313,281	313,281	313,281	313,281	313,281
Total Revenues	5,058,821	3,427,849	3,723,254	4,035,123	4,396,159	4,776,468	5,093,125	5,313,103	5,529,881	5,753,329
Operating Expenses	4,555,986	2,770,345	2,934,141	3,084,852	3,159,309	3,236,234	3,315,711	3,397,829	3,482,678	3,570,353
Net Revenues for Transfers/COS/Debt Service	502,835	657,504	789,113	950,271	1,236,850	1,540,234	1,777,414	1,915,274	2,047,202	2,182,976
Capital Outlays	60,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000
Net Revenues Available for Debt Service	442,835	617,504	749,113	910,271	1,196,850	1,500,234	1,737,414	1,875,274	2,007,202	2,142,976
Current Debt Service	719,700	719,566	719,428	719,288	719,144	718,996	718,845	718,690	718,531	712,317
Future Debt Service	-	-	32,646	163,231	554,984	881,445	1,012,029	1,012,029	1,012,029	1,142,614
Total Debt Service	719,700	719,566	752,075	882,518	1,274,127	1,600,441	1,730,874	1,730,719	1,730,560	1,854,930
Net Revenues for Contingencies and Transfers	(276,865)	(102,062)	(2,962)	27,753	(77,277)	(100,206)	6,540	144,555	276,642	288,046
<u>Transfers</u>										
Total Contingencies & Transfers	-	-	-	-	-	-	-	-	-	-
Total Cost of Service	5,335,687	3,529,910	3,726,215	4,007,370	4,473,436	4,876,674	5,086,585	5,168,548	5,253,238	5,465,283
Net Revenues	(276,865)	(102,062)	(2,962)	27,753	(77,277)	(100,206)	6,540	144,555	276,642	288,046
Percent of COS	-5.2%	-2.9%	-0.1%	0.7%	-1.7%	-2.1%	0.1%	2.8%	5.3%	5.3%
Ending Water & Sewer Combined Fund Balance	\$ 4,578,409	\$ 4,476,347	\$ 4,473,386	\$ 4,501,139	\$ 4,423,861	\$ 4,323,655	\$ 4,330,195	\$ 4,474,751	\$ 4,751,393	\$ 5,039,439

Notes on Rate Recommendations

The forecast and recommendations presented in this study represent a combination of the best information available from the Town and the project team's expertise. However, this forecast relies in part on assumptions about future events and events beyond the control of the project team (such as account growth rates within the Town). The forecast and recommendations contained in this study may be subject to revision if any of the following events occurs:

- Actual growth in accounts and consumed volumes is less than (or significantly greater than) forecast
- Capital improvement plan funding costs increase significantly due to the rising cost of materials or other factors
- An unforeseen event impacts the Town, such as an extended recession, natural catastrophe, or terrorist attack
- Town budget levels or priorities change significantly from those forecast in this study

It should be noted that none of these events are foreseen by the project team or the Town at this time.

If any of these events occur, the Town may be compelled to consider further adjustments to its water and wastewater rates.

APPENDIX A



Town of Clarkdale Ten Year Rate Analysis and Pro Forma Fiscal Years 2024 - 2033



Utility System

Water
Sewer
Combined

Dashboard

Projections
Bill Comparison
Comparable Utilities

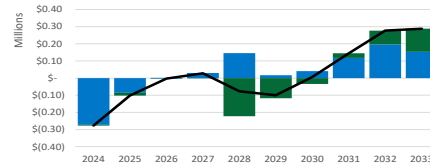
Customer Class

All Classes

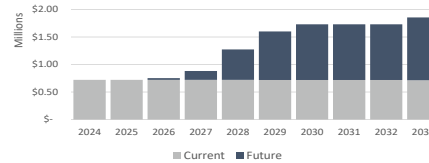
Years

10
5

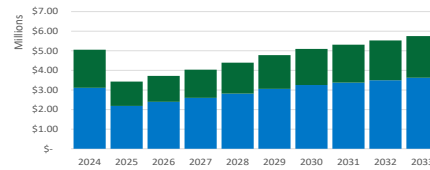
Total Net Revenues Available for Contingency



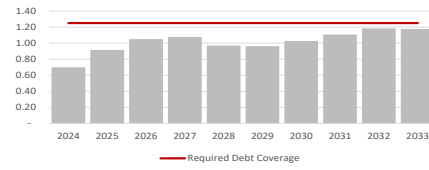
Debt Service



Total Revenues



Debt Coverage



Water Sewer

Combined Projections

Future Debt Term

25

Water Future Bond Issues

	Alternative	Proposed
2024		\$ -
2025		\$ -
2026		\$ 2,000,000
2027		\$ 1,000,000
2028		\$ 5,000,000
2029		\$ 2,000,000
2030		\$ -
2031		\$ -
2032		\$ 2,000,000
2033		\$ -

Sewer Future Bond Issues

	Alternative	Proposed
2024		\$ -
2025		\$ 500,000
2026		\$ -
2027		\$ 5,000,000
2028		\$ -
2029		\$ -
2030		\$ -
2031		\$ -
2032		\$ -
2033		\$ -

Water Rate Adjustments

	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Meter Charge	9.00%	9.00%	7.00%	7.00%	7.00%	7.00%	2.00%	2.00%	2.00%	2.00%
Volume Charge	9.00%	9.00%	7.00%	7.00%	7.00%	7.00%	2.00%	2.00%	2.00%	2.00%

Sewer Rate Adjustments

Base Charge	5.00%	4.00%	4.00%	7.00%	7.00%	5.00%	3.00%	2.00%	2.00%	2.00%
Volume Charge Residential	5.00%	4.00%	4.00%	7.00%	7.00%	5.00%	3.00%	2.00%	2.00%	2.00%
Volume Charge Non-Residential	5.00%	4.00%	4.00%	7.00%	7.00%	5.00%	3.00%	2.00%	2.00%	2.00%

TOWN OF CLARKDALE
WATER/WASTEWATER COST OF SERVICE MODEL

Current	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
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Water Summary

Scen: 2023 11 08 -- Scenario I -- Status Quo

1 Water Monthly Rates and Charges

CITY Water Rate and Charges

W1 Residential

Monthly Minimum Charge

5/8" & 3/4"	\$	28.30	\$	30.85	\$	33.62	\$	35.98	\$	38.50	\$	41.19	\$	44.07	\$	44.95	\$	45.85	\$	46.77	\$	47.71
1"		46.96		51.19		55.79		59.70		63.88		68.35		73.13		74.60		76.09		77.61		79.16
1 1/2"		93.93		102.38		111.60		119.41		127.77		136.71		146.28		149.21		152.19		155.24		158.34
2"		150.52		164.07		178.83		191.35		204.75		219.08		234.41		239.10		243.88		248.76		253.74
3"		301.04		328.13		357.67		382.70		409.49		438.16		468.83		478.20		487.77		497.52		507.47
4"		475.64		518.45		565.11		604.67		646.99		692.28		740.74		755.56		770.67		786.08		801.80
6"		951.29		1,036.91		1,130.23		1,209.34		1,294.00		1,384.58		1,481.50		1,511.13		1,541.35		1,572.18		1,603.62
8"		1,502.79		1,638.04		1,785.46		1,910.45		2,044.18		2,187.27		2,340.38		2,387.19		2,434.93		2,483.63		2,533.30

Volume Rate/1,000 Gal

1,001	5,000	4.96	5.41	5.89	6.31	6.75	7.22	7.72	7.88	8.04	8.20	8.36
5,001	10,000	5.15	5.61	6.12	6.55	7.01	7.50	8.02	8.18	8.34	8.51	8.68
10,001	15,000	7.21	7.86	8.57	9.17	9.81	10.49	11.23	11.45	11.68	11.92	12.15
15,001	20,000	7.46	8.13	8.86	9.48	10.15	10.86	11.62	11.85	12.09	12.33	12.58
20,001	25,000	10.65	11.61	12.65	13.54	14.49	15.50	16.59	16.92	17.26	17.60	17.95
25,001	30,000	10.85	11.83	12.89	13.79	14.76	15.79	16.90	17.24	17.58	17.93	18.29
30,001	Above	11.00	11.99	13.07	13.98	14.96	16.01	17.13	17.47	17.82	18.18	18.54

W2 Multi-Family

Monthly Minimum Charge

5/8" & 3/4"	\$	28.30	\$	30.85	\$	33.62	\$	35.98	\$	38.50	\$	41.19	\$	44.07	\$	44.95	\$	45.85	\$	46.77	\$	47.71
1"		46.96		51.19		55.79		59.70		63.88		68.35		73.13		74.60		76.09		77.61		79.16
1 1/2"		93.93		102.38		111.60		119.41		127.77		136.71		146.28		149.21		152.19		155.24		158.34
2"		150.52		164.07		178.83		191.35		204.75		219.08		234.41		239.10		243.88		248.76		253.74
3"		301.04		328.13		357.67		382.70		409.49		438.16		468.83		478.20		487.77		497.52		507.47
4"		475.64		518.45		565.11		604.67		646.99		692.28		740.74		755.56		770.67		786.08		801.80
6"		951.29		1,036.91		1,130.23		1,209.34		1,294.00		1,384.58		1,481.50		1,511.13		1,541.35		1,572.18		1,603.62
8"		1,502.79		1,638.04		1,785.46		1,910.45		2,044.18		2,187.27		2,340.38		2,387.19		2,434.93		2,483.63		2,533.30

Volume Rate/1,000 Gal

1,001	5,000	4.96	5.41	5.89	6.31	6.75	7.22	7.72	7.88	8.04	8.20	8.36
5,001	10,000	5.15	5.61	6.12	6.55	7.01	7.50	8.02	8.18	8.34	8.51	8.68
10,001	15,000	7.21	7.86	8.57	9.17	9.81	10.49	11.23	11.45	11.68	11.92	12.15
15,001	20,000	7.46	8.13	8.86	9.48	10.15	10.86	11.62	11.85	12.09	12.33	12.58
20,001	25,000	10.65	11.61	12.65	13.54	14.49	15.50	16.59	16.92	17.26	17.60	17.95
25,001	30,000	10.85	11.83	12.89	13.79	14.76	15.79	16.90	17.24	17.58	17.93	18.29
30,001	Above	11.00	11.99	13.07	13.98	14.96	16.01	17.13	17.47	17.82	18.18	18.54

TOWN OF CLARKDALE
WATER/WASTEWATER COST OF SERVICE MODEL

Current 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033

Water Summary

Scen: 2023 11 08 -- Scenario I -- Status Quo

W3 Commercial

Monthly Minimum Charge

5/8" & 3/4"	\$	28.30	\$	30.85	\$	33.62	\$	35.98	\$	38.50	\$	41.19	\$	44.07	\$	44.95	\$	45.85	\$	46.77	\$	47.71
1"		46.96		51.19		55.79		59.70		63.88		68.35		73.13		74.60		76.09		77.61		79.16
1 1/2"		93.93		102.38		111.60		119.41		127.77		136.71		146.28		149.21		152.19		155.24		158.34
2"		150.52		164.07		178.83		191.35		204.75		219.08		234.41		239.10		243.88		248.76		253.74
3"		301.04		328.13		357.67		382.70		409.49		438.16		468.83		478.20		487.77		497.52		507.47
4"		475.64		518.45		565.11		604.67		646.99		692.28		740.74		755.56		770.67		786.08		801.80
6"		951.29		1,036.91		1,130.23		1,209.34		1,294.00		1,384.58		1,481.50		1,511.13		1,541.35		1,572.18		1,603.62
8"		1,502.79		1,638.04		1,785.46		1,910.45		2,044.18		2,187.27		2,340.38		2,387.19		2,434.93		2,483.63		2,533.30

Volume Rate/1,000 Gal

1,001	5,000	4.96	5.41	5.89	6.31	6.75	7.22	7.72	7.88	8.04	8.20	8.36
5,001	10,000	5.15	5.61	6.12	6.55	7.01	7.50	8.02	8.18	8.34	8.51	8.68
10,001	15,000	7.21	7.86	8.57	9.17	9.81	10.49	11.23	11.45	11.68	11.92	12.15
15,001	20,000	7.46	8.13	8.86	9.48	10.15	10.86	11.62	11.85	12.09	12.33	12.58
20,001	25,000	10.65	11.61	12.65	13.54	14.49	15.50	16.59	16.92	17.26	17.60	17.95
25,001	30,000	10.85	11.83	12.89	13.79	14.76	15.79	16.90	17.24	17.58	17.93	18.29
30,001	Above	11.00	11.99	13.07	13.98	14.96	16.01	17.13	17.47	17.82	18.18	18.54

W4 Government

Monthly Minimum Charge

5/8" & 3/4"	\$	28.30	\$	30.85	\$	33.62	\$	35.98	\$	38.50	\$	41.19	\$	44.07	\$	44.95	\$	45.85	\$	46.77	\$	47.71
1"		46.96		51.19		55.79		59.70		63.88		68.35		73.13		74.60		76.09		77.61		79.16
1 1/2"		93.93		102.38		111.60		119.41		127.77		136.71		146.28		149.21		152.19		155.24		158.34
2"		150.52		164.07		178.83		191.35		204.75		219.08		234.41		239.10		243.88		248.76		253.74
3"		301.04		328.13		357.67		382.70		409.49		438.16		468.83		478.20		487.77		497.52		507.47
4"		475.64		518.45		565.11		604.67		646.99		692.28		740.74		755.56		770.67		786.08		801.80
6"		951.29		1,036.91		1,130.23		1,209.34		1,294.00		1,384.58		1,481.50		1,511.13		1,541.35		1,572.18		1,603.62
8"		1,502.79		1,638.04		1,785.46		1,910.45		2,044.18		2,187.27		2,340.38		2,387.19		2,434.93		2,483.63		2,533.30

Volume Rate/1,000 Gal

1,001	5,000	4.96	5.41	5.89	6.31	6.75	7.22	7.72	7.88	8.04	8.20	8.36
5,001	10,000	5.15	5.61	6.12	6.55	7.01	7.50	8.02	8.18	8.34	8.51	8.68
10,001	15,000	7.21	7.86	8.57	9.17	9.81	10.49	11.23	11.45	11.68	11.92	12.15
15,001	20,000	7.46	8.13	8.86	9.48	10.15	10.86	11.62	11.85	12.09	12.33	12.58
20,001	25,000	10.65	11.61	12.65	13.54	14.49	15.50	16.59	16.92	17.26	17.60	17.95
25,001	30,000	10.85	11.83	12.89	13.79	14.76	15.79	16.90	17.24	17.58	17.93	18.29
30,001	Above	11.00	11.99	13.07	13.98	14.96	16.01	17.13	17.47	17.82	18.18	18.54

W5 Other

Monthly Minimum Charge

5/8" & 3/4"	\$	28.30	\$	30.85	\$	33.62	\$	35.98	\$	38.50	\$	41.19	\$	44.07	\$	44.95	\$	45.85	\$	46.77	\$	47.71
1"		46.96		51.19		55.79		59.70		63.88		68.35		73.13		74.60		76.09		77.61		79.16
1 1/2"		93.93		102.38		111.60		119.41		127.77		136.71		146.28		149.21		152.19		155.24		158.34
2"		150.52		164.07		178.83		191.35		204.75		219.08		234.41		239.10		243.88		248.76		253.74
3"		301.04		328.13		357.67		382.70		409.49		438.16		468.83		478.20		487.77		497.52		507.47
4"		475.64		518.45		565.11		604.67		646.99		692.28		740.74		755.56		770.67		786.08		801.80
6"		951.29		1,036.91		1,130.23		1,209.34		1,294.00		1,384.58		1,481.50		1,511.13		1,541.35		1,572.18		1,603.62
8"		1,502.79		1,638.04		1,785.46		1,910.45		2,044.18		2,187.27		2,340.38		2,387.19		2,434.93		2,483.63		2,533.30

Volume Rate/1,000 Gal

1,001	5,000	4.96	5.41	5.89	6.31	6.75	7.22	7.72	7.88	8.04	8.20	8.36
5,001	10,000	5.15	5.61	6.12	6.55	7.01	7.50	8.02	8.18	8.34	8.51	8.68
10,001	15,000	7.21	7.86	8.57	9.17	9.81	10.49	11.23	11.45	11.68	11.92	12.15
15,001	20,000	7.46	8.13	8.86	9.48	10.15	10.86	11.62	11.85	12.09	12.33	12.58
20,001	25,000	10.65	11.61	12.65	13.54	14.49	15.50	16.59	16.92	17.26	17.60	17.95
25,001	30,000	10.85	11.83	12.89	13.79	14.76	15.79	16.90	17.24	17.58	17.93	18.29
30,001	Above	11.00	11.99	13.07	13.98	14.96	16.01	17.13	17.47	17.82	18.18	18.54

TOWN OF CLARKDALE WATER/WASTEWATER COST OF SERVICE MODEL										
Current	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033

Water Summary
Scen: 2023 11 08 -- Scenario I -- Status Quo

W6 Industrial

Monthly Minimum Charge																						
5/8" & 3/4"	\$	28.30	\$	30.85	\$	33.62	\$	35.98	\$	38.50	\$	41.19	\$	44.07	\$	44.95	\$	45.85	\$	46.77	\$	47.71
1"		46.96		51.19		55.79		59.70		63.88		68.35		73.13		74.60		76.09		77.61		79.16
1 1/2"		93.93		102.38		111.60		119.41		127.77		136.71		146.28		149.21		152.19		155.24		158.34
2"		150.52		164.07		178.83		191.35		204.75		219.08		234.41		239.10		243.88		248.76		253.74
3"		301.04		328.13		357.67		382.70		409.49		438.16		468.83		478.20		487.77		497.52		507.47
4"		475.64		518.45		565.11		604.67		646.99		692.28		740.74		755.56		770.67		786.08		801.80
6"		951.29		1,036.91		1,130.23		1,209.34		1,294.00		1,384.58		1,481.50		1,511.13		1,541.35		1,572.18		1,603.62
8"		1,502.79		1,638.04		1,785.46		1,910.45		2,044.18		2,187.27		2,340.38		2,387.19		2,434.93		2,483.63		2,533.30
Volume Rate/1,000 Gal																						
1,001	5,000	4.96	5.41	5.89	6.31	6.75	7.22	7.72	7.88	8.04	8.20	8.36										
5,001	10,000	5.15	5.61	6.12	6.55	7.01	7.50	8.02	8.18	8.34	8.51	8.68										
10,001	15,000	7.21	7.86	8.57	9.17	9.81	10.49	11.23	11.45	11.68	11.92	12.15										
15,001	20,000	7.46	8.13	8.86	9.48	10.15	10.86	11.62	11.85	12.09	12.33	12.58										
20,001	25,000	10.65	11.61	12.65	13.54	14.49	15.50	16.59	16.92	17.26	17.60	17.95										
25,001	30,000	10.85	11.83	12.89	13.79	14.76	15.79	16.90	17.24	17.58	17.93	18.29										
30,001	Above	11.00	11.99	13.07	13.98	14.96	16.01	17.13	17.47	17.82	18.18	18.54										

TOWN OF CLARKDALE WATER/WASTEWATER COST OF SERVICE MODEL											
Current	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	

Water Summary
Scen: 2023 11 08 -- Scenario I -- Status Quo

2 Wastewater Monthly Rates and Charges

Residential																						
<u>Monthly Minimum Charge</u>																						
All Meters	\$	54.00	\$	56.70	\$	58.97	\$	61.33	\$	65.62	\$	70.21	\$	73.72	\$	75.94	\$	77.45	\$	79.00	\$	80.58
Non-Residential																						
<u>Monthly Minimum Charge</u>																						
All Meters		54.00		56.70		58.97		61.33		65.62		70.21		73.72		75.94		77.45		79.00		80.58
<u>Volume Rate/1,000 Gal</u>																						
5,001 Above		2.25		2.36		2.46		2.56		2.73		2.93		3.07		3.16		3.23		3.29		3.36

**TOWN OF CLARKDALE
WATER/WASTEWATER COST OF SERVICE MODEL**

Current 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033

Forecast Summary**Scenario: 2023 11 08 -- Scenario I -- Status Quo****1 WATER and WASTEWATER Utility Revenues and Expenses**

Beginning of TY Fund Balance \$ 4,855,274
TY Transfer/Use -

Revised Beginning Fund Balance \$ 4,855,274 \$ 4,578,409 \$ 4,476,347 \$ 4,473,386 \$ 4,501,139 \$ 4,423,861 \$ 4,323,655 \$ 4,330,195 \$ 4,474,751 \$ 4,751,393

Revenues

Water Rate Revenues	1,780,145	1,996,398	2,203,911	2,406,673	2,627,023	2,866,429	3,063,191	3,183,816	3,308,042	3,435,963
Wastewater Rate Revenues	1,025,396	1,118,170	1,206,061	1,315,169	1,455,855	1,596,758	1,716,654	1,816,006	1,908,558	2,004,085
	2,805,540	3,114,568	3,409,973	3,721,842	4,082,878	4,463,187	4,779,844	4,999,822	5,216,600	5,440,048
Non-Rate Revenues	2,253,281	313,281	313,281	313,281	313,281	313,281	313,281	313,281	313,281	313,281
Total Revenues	5,058,821	3,427,849	3,723,254	4,035,123	4,396,159	4,776,468	5,093,125	5,313,103	5,529,881	5,753,329

Cost of Service**Operating Expenses:**

Personnel	878,890	995,046	1,115,847	1,230,323	1,267,233	1,305,250	1,344,407	1,384,739	1,426,281	1,469,070
Supplies	607,225	588,740	614,327	636,298	659,092	682,739	707,273	732,730	759,146	786,559
Services	3,069,871	1,186,558	1,203,967	1,218,231	1,232,985	1,248,246	1,264,031	1,280,360	1,297,251	1,314,724
Capital	-	-	-	-	-	-	-	-	-	-
Total	4,555,986	2,770,345	2,934,141	3,084,852	3,159,309	3,236,234	3,315,711	3,397,829	3,482,678	3,570,353

Net Revenues for Debt Service, Capital Outlays and Transfers 502,835 657,504 789,113 950,271 1,236,850 1,540,234 1,777,414 1,915,274 2,047,202 2,182,976

Current Debt Service	719,700	719,566	719,428	719,288	719,144	718,996	718,845	718,690	718,531	712,317
Future Debt Service	-	-	32,646	163,231	554,984	881,445	1,012,029	1,012,029	1,012,029	1,142,614
Total Debt Service	719,700	719,566	752,075	882,518	1,274,127	1,600,441	1,730,874	1,730,719	1,730,560	1,854,930

Net Revenues for Capital Outlays, Contingencies and Transfers (216,865) (62,062) 37,038 67,753 (37,277) (60,206) 46,540 184,555 316,642 328,046

Capital Outlays .	60,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000
Transfers	-	-	-	-	-	-	-	-	-	-

Total Cost of Service 5,335,687 3,529,910 3,726,215 4,007,370 4,473,436 4,876,674 5,086,585 5,168,548 5,253,238 5,465,283

Net Revenues	(276,865)	(102,062)	(2,962)	27,753	(77,277)	(100,206)	6,540	144,555	276,642	288,046
Percent of Revenues	-5.5%	-3.0%	-0.1%	0.7%	-1.8%	-2.1%	0.1%	2.7%	5.0%	5.0%

Ending Water & WW Combined Fund Balance \$ 4,578,409 \$ 4,476,347 \$ 4,473,386 \$ 4,501,139 \$ 4,423,861 \$ 4,323,655 \$ 4,330,195 \$ 4,474,751 \$ 4,751,393 \$ 5,039,439

Revenue Adequacy Tests

Total Expenses less Transfers	5,335,687	3,529,910	3,726,215	4,007,370	4,473,436	4,876,674	5,086,585	5,168,548	5,253,238	5,465,283
Expenses per Day	14,618	9,671	10,209	10,979	12,256	13,361	13,936	14,160	14,392	14,973
Working Capital as % of Tot Exp.	86%	127%	120%	112%	99%	89%	85%	87%	90%	92%
Number of Working Capital Days	313	463	438	410	361	324	311	316	330	337
Debt Coverage (excludes Capital Outlays and G/F Transfers)	0.70	0.91	1.05	1.08	0.97	0.96	1.03	1.11	1.18	1.18

**TOWN OF CLARKDALE
WATER/WASTEWATER COST OF SERVICE MODEL**

Current 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033

Forecast Summary**Scenario: 2023 11 08 -- Scenario I -- Status Quo****2 WATER Utility Revenues and Expenses**

Beginning of TY Fund Balance \$ 4,855,274

TY Transfer/Use -

Revised Beginning Fund Balance	\$	4,855,274	\$	4,582,657	\$	4,496,675	\$	4,492,814	\$	4,522,634	\$	4,667,743	\$	4,684,708	\$	4,725,399	\$	4,842,853	\$	5,039,213
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Revenues**Water Rate Revenues**

W.1 Residential		1,219,618		1,380,975		1,538,489		1,694,671		1,865,181		2,051,258		2,208,614		2,312,148		2,418,940		2,529,079
W.2 Multi-Family		369,592		405,789		438,757		469,470		502,333		537,496		563,479		574,748		586,243		597,968
W.3 Commercial		48,565		53,321		57,653		61,689		66,007		70,628		74,042		75,523		77,033		78,574
W.4 Government		102,990		113,077		122,264		130,822		139,980		149,778		157,019		160,159		163,362		166,629
W.5 Other		21,648		23,769		25,700		27,499		29,424		31,483		33,005		33,665		34,339		35,025
Sub-Total		1,780,145		1,996,398		2,203,911		2,406,673		2,627,023		2,866,429		3,063,191		3,183,816		3,308,042		3,435,963

Non-Rate Revenues		1,331,343		191,343		191,343		191,343		191,343		191,343		191,343		191,343		191,343		191,343
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Total Revenues		3,111,488		2,187,741		2,395,254		2,598,016		2,818,366		3,057,772		3,254,534		3,375,159		3,499,385		3,627,306
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Cost of Service**Operating Expenses:**

Personnel		539,373		560,948		664,386		684,317		704,847		725,992		747,772		770,205		793,311		817,111
Supplies		380,875		352,941		368,681		382,412		396,674		411,489		426,877		442,864		459,472		476,727
Services		1,932,675		838,716		845,000		849,901		854,949		860,148		865,504		871,020		876,702		882,554
Capital		-		-		-		-		-		-		-		-		-		-
Total		2,852,923		1,752,606		1,878,066		1,916,630		1,956,470		1,997,629		2,040,153		2,084,089		2,129,485		2,176,392

Net Revenues for Debt Service, Capital Outlays and Transfers		258,565		435,135		517,188		681,386		861,896		1,060,143		1,214,381		1,291,071		1,369,900		1,450,914
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Current Debt Service		501,183		501,117		501,049		500,981		500,911		500,840		500,768		500,694		500,619		494,491
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Future Debt Service		-		-		-		130,584		195,877		522,338		652,922		652,922		652,922		783,506
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Total Debt Service		501,183		501,117		501,049		631,565		696,788		1,023,178		1,153,690		1,153,616		1,153,541		1,277,997
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Net Revenues for Capital Outlays, Contingencies and Transfers		(242,617)		(65,982)		16,139		49,821		165,108		36,965		60,691		137,455		216,359		172,917
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Capital Outlays .		30,000		20,000		20,000		20,000		20,000		20,000		20,000		20,000		20,000		20,000
Transfers		-		-		-		-		-		-		-		-		-		-

Total Cost of Service		3,384,105		2,273,722		2,399,116		2,568,196		2,673,258		3,040,807		3,213,843		3,257,705		3,303,026		3,474,389
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Net Revenues		(272,617)		(85,982)		(3,861)		29,821		145,108		16,965		40,691		117,455		196,359		152,917
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Percent of Revenues		-8.8%		-3.9%		-0.2%		1.1%		5.1%		0.6%		1.3%		3.5%		5.6%		4.2%
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Ending Water Fund Balance		\$ 4,582,657		\$ 4,496,675		\$ 4,492,814		\$ 4,522,634		\$ 4,667,743		\$ 4,684,708		\$ 4,725,399		\$ 4,842,853		\$ 5,039,213		\$ 5,192,130
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Revenue Adequacy Tests

Total Expenses less Transfers		3,384,105		2,273,722		2,399,116		2,568,196		2,673,258		3,040,807		3,213,843		3,257,705		3,303,026		3,474,389
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Expenses per Day		9,272		6,229		6,573		7,036		7,324		8,331		8,805		8,925		9,049		9,519
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Working Capital as % of Tot Exp.		135%		198%		187%		176%		175%		154%		147%		149%		153%		149%
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Number of Working Capital Days		494		722		684		643		637		562		537		543		557		545
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Debt Coverage (excludes Capital Outlays and G/F Transfers)		0.52		0.87		1.03		1.08		1.24		1.04		1.05		1.12		1.19		1.14
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**TOWN OF CLARKDALE
WATER/WASTEWATER COST OF SERVICE MODEL**

Current 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033

Forecast Summary**Scenario: 2023 11 08 -- Scenario I -- Status Quo****3 WASTEWATER Utility Revenues and Expenses**

Beginning of TY Fund Balance	\$	-																		
TY Transfer/Use	\$	-																		
Revised Beginning Fund Balance	\$	-	\$	(4,248)	\$	(20,328)	\$	(19,428)	\$	(21,496)	\$	(243,881)	\$	(361,053)	\$	(395,203)	\$	(368,103)	\$	(287,820)

Revenues**Wastewater Rate Revenues**

WW.1 Residential		990,835	1,081,881	1,168,321	1,275,436	1,413,341	1,551,636	1,669,663	1,767,805	1,859,392	1,953,936
WW.2 Non-Residential		34,561	36,289	37,740	39,732	42,514	45,121	46,991	48,201	49,165	50,149
WW.5 Other1		-	-	-	-	-	-	-	-	-	-
WW.6 Other1		-	-	-	-	-	-	-	-	-	-
WW.5 Other1		-	-	-	-	-	-	-	-	-	-
Total		1,025,396	1,118,170	1,206,061	1,315,169	1,455,855	1,596,758	1,716,654	1,816,006	1,908,558	2,004,085

Non-Rate Revenues

		921,938	121,938	121,938	121,938	121,938	121,938	121,938	121,938	121,938	121,938
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Total Revenues		1,947,334	1,240,108	1,327,999	1,437,107	1,577,793	1,718,696	1,838,592	1,937,944	2,030,496	2,126,023
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Cost of Service**Operating Expenses:**

Personnel		339,517	434,098	451,462	546,005	562,386	579,257	596,635	614,534	632,970	651,959
Supplies		226,350	235,799	245,646	253,886	262,417	271,250	280,396	289,866	299,674	309,831
Services		1,137,197	347,842	358,967	368,330	378,036	388,097	398,528	409,340	420,550	432,171
Capital		-	-	-	-	-	-	-	-	-	-
Total		1,703,064	1,017,739	1,056,075	1,168,222	1,202,839	1,238,604	1,275,558	1,313,740	1,353,193	1,393,961

Net Revenues for Debt Service, Capital Outlays and Transfers

		244,270	222,369	271,925	268,885	374,954	480,091	563,033	624,203	677,302	732,062
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Current Debt Service

		218,518	218,449	218,379	218,307	218,232	218,156	218,077	217,996	217,912	217,826
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Future Debt Service		-	-	32,646	32,646	359,107	359,107	359,107	359,107	359,107	359,107
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Total Debt Service		218,518	218,449	251,025	250,953	577,339	577,263	577,184	577,103	577,019	576,933
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Net Revenues for Capital Outlays, Contingencies and Transfers

		25,752	3,920	20,900	17,932	(202,385)	(97,172)	(14,151)	47,101	100,283	155,129
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Capital Outlays .		30,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000
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Transfers		-	-	-	-	-	-	-	-	-	-
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Total Cost of Service		1,951,582	1,256,188	1,327,100	1,439,175	1,800,178	1,835,867	1,872,742	1,910,843	1,950,213	1,990,894
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Net Revenues		(4,248)	(16,080)	900	(2,068)	(222,385)	(117,172)	(34,151)	27,101	80,283	135,129
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Percent of Revenues		-0.2%	-1.3%	0.1%	-0.1%	-14.1%	-6.8%	-1.9%	1.4%	4.0%	6.4%
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Ending Wastewater Fund Balance		\$ (4,248)	\$ (20,328)	\$ (19,428)	\$ (21,496)	\$ (243,881)	\$ (361,053)	\$ (395,203)	\$ (368,103)	\$ (287,820)	\$ (152,691)
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Revenue Adequacy Tests

Total Expenses less Transfers		1,951,582	1,256,188	1,327,100	1,439,175	1,800,178	1,835,867	1,872,742	1,910,843	1,950,213	1,990,894
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Expenses per Day		5,347	3,442	3,636	3,943	4,932	5,030	5,131	5,235	5,343	5,455
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Working Capital as % of Tot Exp.		0%	-2%	-1%	-1%	-14%	-20%	-21%	-19%	-15%	-8%
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Number of Working Capital Days		(1)	(6)	(5)	(5)	(49)	(72)	(77)	(70)	(54)	(28)
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Debt Coverage (excludes Capital Outlays and G/F Transfers)		1.12	1.02	1.08	1.07	0.65	0.83	0.98	1.08	1.17	1.27
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**TOWN OF CLARKDALE
WATER/WASTEWATER COST OF SERVICE MODEL**

Current 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033

Forecast Summary

Scenario: 2023 11 08 -- Scenario I -- Status Quo

1 Water and Wastewater Rates

Water Rates -- Residential

Monthly Minimum Charge --5/8" \$ 28.30 \$ 30.85 \$ 33.62 \$ 35.98 \$ 38.50 \$ 41.19 \$ 44.07 \$ 44.95 \$ 45.85 \$ 46.77 \$ 47.71

Volume Rate Per 1,000 Gal

1,001	5,000	4.96	5.41	5.89	6.31	6.75	7.22	7.72	7.88	8.04	8.20	8.36
5,001	10,000	5.15	5.61	6.12	6.55	7.01	7.50	8.02	8.18	8.34	8.51	8.68
10,001	15,000	7.21	7.86	8.57	9.17	9.81	10.49	11.23	11.45	11.68	11.92	12.15
15,001	20,000	7.46	8.13	8.86	9.48	10.15	10.86	11.62	11.85	12.09	12.33	12.58
20,001	25,000	10.65	11.61	12.65	13.54	14.49	15.50	16.59	16.92	17.26	17.60	17.95
25,001	30,000	10.85	11.83	12.89	13.79	14.76	15.79	16.90	17.24	17.58	17.93	18.29
30,001	Above	11.00	11.99	13.07	13.98	14.96	16.01	17.13	17.47	17.82	18.18	18.54

Water Rates -- Commercial

Monthly Minimum Charge -- 5/8" \$ 28.30 \$ 30.85 \$ 33.62 \$ 35.98 \$ 38.50 \$ 41.19 \$ 44.07 \$ 44.95 \$ 45.85 \$ 46.77 \$ 47.71

Volume Rate Per 1,000 Gal

1,001	5,000	4.96	5.41	5.89	6.31	6.75	7.22	7.72	7.88	8.04	8.20	8.36
5,001	10,000	5.15	5.61	6.12	6.55	7.01	7.50	8.02	8.18	8.34	8.51	8.68
10,001	15,000	7.21	7.86	8.57	9.17	9.81	10.49	11.23	11.45	11.68	11.92	12.15
15,001	20,000	7.46	8.13	8.86	9.48	10.15	10.86	11.62	11.85	12.09	12.33	12.58
20,001	25,000	10.65	11.61	12.65	13.54	14.49	15.50	16.59	16.92	17.26	17.60	17.95
25,001	30,000	10.85	11.83	12.89	13.79	14.76	15.79	16.90	17.24	17.58	17.93	18.29
30,001	Above	11.00	11.99	13.07	13.98	14.96	16.01	17.13	17.47	17.82	18.18	18.54

Wastewater Rates - Residential

Monthly Charge \$ 54.00 \$ 56.70 \$ 58.97 \$ 61.33 \$ 65.62 \$ 70.21 \$ 73.72 \$ 75.94 \$ 77.45 \$ 79.00 \$ 80.58

Wastewater Rates - Commercial

Monthly Minimum Charge	\$ 54.00 \$ 56.70 \$ 58.97 \$ 61.33 \$ 65.62 \$ 70.21 \$ 73.72 \$ 75.94 \$ 77.45 \$ 79.00 \$ 80.58
Volume Rate/1,000 Gal (Over 5,000 Gallons)	2.25 2.36 2.46 2.56 2.73 2.93 3.07 3.16 3.23 3.29 3.36

2 Residential Standard Monthly Bill -- 5/8" Meter

5,000 Gal	Total	5/5	\$ 102.14 \$ 109.17 \$ 116.16 \$ 122.53 \$ 131.10 \$ 140.28 \$ 148.69 \$ 152.41 \$ 155.45 \$ 158.56 \$ 161.73									
Water & WW	Increase -- \$			7.03	6.99	6.36	8.58	9.18	8.42	3.71	3.05	3.17
	Increase -- %			6.9%	6.4%	5.5%	7.0%	7.0%	6.0%	2.5%	2.0%	2.0%
7,000 Gal	Total	7/5	112.44	120.40	128.40	135.62	145.11	155.27	164.74	168.77	172.14	175.59
Water; 7K WW	Increase -- \$			7.96	8.00	7.22	9.49	10.16	9.46	4.03	3.38	3.44
	Increase -- %			7.1%	6.6%	5.6%	7.0%	7.0%	6.1%	2.4%	2.0%	2.0%
15,000 Gal	Total	15/10	163.94	176.53	189.59	201.09	215.17	230.23	244.94	250.58	255.59	260.70
Water; 15K W	Increase -- \$			12.59	13.05	11.50	14.08	15.06	14.71	5.64	5.01	5.11
	Increase -- %			7.7%	7.4%	6.1%	7.0%	7.0%	6.4%	2.3%	2.0%	2.0%

Commercial Monthly Bill -- 5/8"

25,000 Gal	Total	\$ 299.49 \$ 322.48 \$ 346.31 \$ 367.31 \$ 393.02 \$ 420.53 \$ 447.39 \$ 457.69 \$ 466.85 \$ 476.18 \$ 485.71										
Water & WW	Increase -- \$			22.99	23.83	21.00	25.71	27.51	26.86	10.30	9.15	9.34
	Increase -- %			7.7%	7.4%	6.1%	7.0%	7.0%	6.4%	2.3%	2.0%	2.0%

TOWN OF CLARKDALE WATER/WASTEWATER COST OF SERVICE MODEL										
Current	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033

Forecast Summary

Scenario: 2023 11 08 -- Scenario I -- Status Quo

Fund Balance, Revenues and Expenses																					
Beginning of TY Fund Balance		\$ 4,855,274																			
TY Transfer/Use		-																			
Revised Beginning Fund Balance		\$	4,855,274	\$	4,578,409	\$	4,476,347	\$	4,473,386	\$	4,501,139	\$	4,423,861	\$	4,323,655	\$	4,330,195	\$	4,474,751	\$	4,751,393
Revenues and Expenses																					
Water Rate Revenues		1,780,145	1,996,398	2,203,911	2,406,673	2,627,023	2,866,429	3,063,191	3,183,816	3,308,042	3,435,963										
WW Rate Revenues		1,025,396	1,118,170	1,206,061	1,315,169	1,455,855	1,596,758	1,716,654	1,816,006	1,908,558	2,004,085										
Non-Rate Revenues		2,253,281	313,281	313,281	313,281	313,281	313,281	313,281	313,281	313,281	313,281										
Total Revenues		5,058,821	3,427,849	3,723,254	4,035,123	4,396,159	4,776,468	5,093,125	5,313,103	5,529,881	5,753,329										
Operating Expenses		4,555,986	2,770,345	2,934,141	3,084,852	3,159,309	3,236,234	3,315,711	3,397,829	3,482,678	3,570,353										
Net Revenues for Transfers,Capital Outlays and Debt Ser		502,835	657,504	789,113	950,271	1,236,850	1,540,234	1,777,414	1,915,274	2,047,202	2,182,976										
Capital Outlays .		60,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000										
Net Revenues Available for Debt Service		442,835	617,504	749,113	910,271	1,196,850	1,500,234	1,737,414	1,875,274	2,007,202	2,142,976										
Current Debt Service		719,700	719,566	719,428	719,288	719,144	718,996	718,845	718,690	718,531	712,317										
Future Debt Service		-	-	32,646	163,231	554,984	881,445	1,012,029	1,012,029	1,012,029	1,142,614										
Total Debt Service		719,700	719,566	752,075	882,518	1,274,127	1,600,441	1,730,874	1,730,719	1,730,560	1,854,930										
Net Revenues for Contingencies and Transfers		(276,865)	(102,062)	(2,962)	27,753	(77,277)	(100,206)	6,540	144,555	276,642	288,046										
Transfers																					
Total Contingencies & Transfers		-	-	-	-	-	-	-	-	-	-										
Total Cost of Service		5,335,687	3,529,910	3,726,215	4,007,370	4,473,436	4,876,674	5,086,585	5,168,548	5,253,238	5,465,283										
		\$ 532,537	\$ 600,393	\$ (146,220)	\$ (317,344)	\$ (367,845)	\$ (453,776)	\$ 57,340	\$ 253,120	\$ 465,493											
Net Revenues		(276,865)	(102,062)	(2,962)	27,753	(77,277)	(100,206)	6,540	144,555	276,642	288,046										
Percent of COS		-5.2%	-2.9%	-0.1%	0.7%	-1.7%	-2.1%	0.1%	2.8%	5.3%	5.3%										
Ending Water & Sewer Combined Fund Balance		\$ 4,578,409	\$ 4,476,347	\$ 4,473,386	\$ 4,501,139	\$ 4,423,861	\$ 4,323,655	\$ 4,330,195	\$ 4,474,751	\$ 4,751,393	\$ 5,039,439										
Revenue Adequacy Tests																					
Total Exp (Budgetary Basis)		5,335,687	3,529,910	3,726,215	4,007,370	4,473,436	4,876,674	5,086,585	5,168,548	5,253,238	5,465,283										
Expenses per Day		14,618	9,671	10,209	10,979	12,256	13,361	13,936	14,160	14,392	14,973										
Working Capital as % of Tot Exp.		86%	127%	120%	112%	99%	89%	85%	87%	90%	92%										
Number of Working Capital Days		313	463	438	410	361	324	311	316	330	337										
Debt Coverage (excludes Capital Outlays and G/F Transfe		0.70	0.91	1.05	1.08	0.97	0.96	1.03	1.11	1.18	1.18										
Goal is 1.60 and Minimum is 1.20																					
Water& WW Repair & Repl. Fund Balance		-	-	-	-	-	-	-	-	-	-										

**TOWN OF CLARKDALE
WATER/WASTEWATER COST OF SERVICE MODEL**

Current 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033

Forecast Summary

Scenario: 2023 11 08 -- Scenario I -- Status Quo

5 Total Accounts

Water Accounts

Total Accounts	2,322	2,382	2,442	2,502	2,562	2,622	2,682	2,742	2,802	2,862
New Accounts	-	60	60	60	60	60	60	60	60	60
Avg. Annual Growth Rate		2.58%	2.52%	2.46%	2.40%	2.34%	2.29%	2.24%	2.19%	2.14%

Wastewater Accounts

Total Accounts	1,545	1,605	1,665	1,725	1,785	1,845	1,905	1,965	2,025	2,085
New Accounts	-	60	60	60	60	60	60	60	60	60
Avg. Annual Growth Rate		3.88%	3.74%	3.60%	3.48%	3.36%	3.25%	3.15%	3.05%	2.96%

6 Annual Volume

Water Volume

Residential	114,164,374	117,737,594	121,310,814	124,884,033	128,457,253	132,030,473	135,603,693	139,176,913	142,750,133	146,323,352
Multi-Family	32,207,865	32,207,865	32,207,865	32,207,865	32,207,865	32,207,865	32,207,865	32,207,865	32,207,865	32,207,865
Commercial	4,636,505	4,636,505	4,636,505	4,636,505	4,636,505	4,636,505	4,636,505	4,636,505	4,636,505	4,636,505
Government	8,182,136	8,182,136	8,182,136	8,182,136	8,182,136	8,182,136	8,182,136	8,182,136	8,182,136	8,182,136
Other	2,023,674	2,023,674	2,023,674	2,023,674	2,023,674	2,023,674	2,023,674	2,023,674	2,023,674	2,023,674
Total System	161,742,944	165,316,164	168,889,384	172,462,603	176,035,823	179,609,043	183,182,263	186,755,483	190,328,703	193,901,922

Wastewater Billing Units

Residential	89,568,711	93,141,930	96,715,150	100,288,370	103,861,590	107,434,810	111,008,030	114,581,249	118,154,469	121,727,689
Non-Residential	5,760,506	5,760,506	5,760,506	5,760,506	5,760,506	5,760,506	5,760,506	5,760,506	5,760,506	5,760,506
Other1	-	-	-	-	-	-	-	-	-	-
Other1	-	-	-	-	-	-	-	-	-	-
Other1	-	-	-	-	-	-	-	-	-	-
Total System	95,329,217	98,902,437	102,475,657	106,048,876	109,622,096	113,195,316	116,768,536	120,341,756	123,914,976	127,488,195

TOWN OF CLARKDALE
WATER/WASTEWATER COST OF SERVICE MODEL

Current 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033

Water Summary

Scen: 2023 11 08 -- Scenario I -- Status Quo

1 Water Monthly Rates and Charges

Residential

Monthly Minimum Charge

Base Charge	5/8" & 3/4"	\$	28.30	\$	30.85	\$	33.62	\$	35.98	\$	38.50	\$	41.19	\$	44.07	\$	44.95	\$	45.85	\$	46.77	\$	47.71
	1"		46.96		51.19		55.79		59.70		63.88		68.35		73.13		74.60		76.09		77.61		79.16
	1 1/2"		93.93		102.38		111.60		119.41		127.77		136.71		146.28		149.21		152.19		155.24		158.34
	2"		150.52		164.07		178.83		191.35		204.75		219.08		234.41		239.10		243.88		248.76		253.74
	3"		301.04		328.13		357.67		382.70		409.49		438.16		468.83		478.20		487.77		497.52		507.47
	4"		475.64		518.45		565.11		604.67		646.99		692.28		740.74		755.56		770.67		786.08		801.80
	6"		951.29		1,036.91		1,130.23		1,209.34		1,294.00		1,384.58		1,481.50		1,511.13		1,541.35		1,572.18		1,603.62
	8"		1,502.79		1,638.04		1,785.46		1,910.45		2,044.18		2,187.27		2,340.38		2,387.19		2,434.93		2,483.63		2,533.30

Volume Rate/1,000 Gal

1,001	5,000	4.96	5.41	5.89	6.31	6.75	7.22	7.72	7.88	8.04	8.20	8.36
5,001	10,000	5.15	5.61	6.12	6.55	7.01	7.50	8.02	8.18	8.34	8.51	8.68
10,001	15,000	7.21	7.86	8.57	9.17	9.81	10.49	11.23	11.45	11.68	11.92	12.15
15,001	20,000	7.46	8.13	8.86	9.48	10.15	10.86	11.62	11.85	12.09	12.33	12.58
20,001	25,000	10.65	11.61	12.65	13.54	14.49	15.50	16.59	16.92	17.26	17.60	17.95
25,001	30,000	10.85	11.83	12.89	13.79	14.76	15.79	16.90	17.24	17.58	17.93	18.29
30,001	Above	11.00	11.99	13.07	13.98	14.96	16.01	17.13	17.47	17.82	18.18	18.54

Commercial

Monthly Minimum Charge

5/8" & 3/4"	\$	28.30	\$	30.85	\$	33.62	\$	35.98	\$	38.50	\$	41.19	\$	44.07	\$	44.95	\$	45.85	\$	46.77	\$	47.71
1"		46.96		51.19		55.79		59.70		63.88		68.35		73.13		74.60		76.09		77.61		79.16
2"		150.52		164.07		178.83		191.35		204.75		219.08		234.41		239.10		243.88		248.76		253.74
3"		301.04		328.13		357.67		382.70		409.49		438.16		468.83		478.20		487.77		497.52		507.47
4"		475.64		518.45		565.11		604.67		646.99		692.28		740.74		755.56		770.67		786.08		801.80
6"		951.29		1,036.91		1,130.23		1,209.34		1,294.00		1,384.58		1,481.50		1,511.13		1,541.35		1,572.18		1,603.62
8"		1,502.79		1,638.04		1,785.46		1,910.45		2,044.18		2,187.27		2,340.38		2,387.19		2,434.93		2,483.63		2,533.30

Volume Rate Per 1,000 Gal - Commercial

1,001	5,000	4.96	5.41	5.89	6.31	6.75	7.22	7.72	7.88	8.04	8.20	8.36
5,001	10,000	5.15	5.61	6.12	6.55	7.01	7.50	8.02	8.18	8.34	8.51	8.68
10,001	15,000	7.21	7.86	8.57	9.17	9.81	10.49	11.23	11.45	11.68	11.92	12.15
15,001	20,000	7.46	8.13	8.86	9.48	10.15	10.86	11.62	11.85	12.09	12.33	12.58
20,001	25,000	10.65	11.61	12.65	13.54	14.49	15.50	16.59	16.92	17.26	17.60	17.95
25,001	30,000	10.85	11.83	12.89	13.79	14.76	15.79	16.90	17.24	17.58	17.93	18.29
30,001	Above	11.00	11.99	13.07	13.98	14.96	16.01	17.13	17.47	17.82	18.18	18.54

2.1 Residential Monthly Bill --

5,000 Gallons	Total	\$	48.14	\$	52.47	\$	57.20	\$	61.20	\$	65.48	\$	70.07	\$	74.97	\$	76.47	\$	78.00	\$	79.56	\$	81.15
	Dollar Inc				4.33		4.72		4.00		4.28		4.58		4.90		1.50		1.53		1.56		1.59
	Percent Inc				9.0%		9.0%		7.0%		7.0%		7.0%		7.0%		2.0%		2.0%		2.0%		2.0%
10,000 Gallons	Total		73.89		80.54		87.79		93.93		100.51		107.54		115.07		117.37		119.72		122.12		124.56
	Dollar Inc				6.65		7.25		6.15		6.58		7.04		7.53		2.30		2.35		2.39		2.44
	Percent Inc				9.0%		9.0%		7.0%		7.0%		7.0%		7.0%		2.0%		2.0%		2.0%		2.0%
20,000 Gallons	Total		147.24		160.49		174.94		187.18		200.28		214.30		229.31		233.89		238.57		243.34		248.21
	Dollar Inc				13.25		14.44		12.25		13.10		14.02		15.00		4.59		4.68		4.77		4.87
	Percent Inc				9.0%		9.0%		7.0%		7.0%		7.0%		7.0%		2.0%		2.0%		2.0%		2.0%
30,000 Gallons	Total		254.74		277.67		302.66		323.84		346.51		370.77		396.72		404.66		412.75		421.00		429.42
	Dollar Inc				22.93		24.99		21.19		22.67		24.26		25.95		7.93		8.09		8.25		8.42
	Percent Inc				9.0%		9.0%		7.0%		7.0%		7.0%		7.0%		2.0%		2.0%		2.0%		2.0%

TOWN OF CLARKDALE WATER/WASTEWATER COST OF SERVICE MODEL										
Current	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033

Scen: 2023 11 08 -- Scenario I -- Status Quo

2.2 Commercial Monthly Bill --

10,000 Gallons																						
3/4"	\$	73.89	\$	80.54	\$	87.79	\$	93.93	\$	100.51	\$	107.54	\$	115.07	\$	117.37	\$	119.72	\$	122.12	\$	124.56
1"		92.55		100.88		109.96		117.66		125.89		134.70		144.13		147.02		149.96		152.96		156.01
2"		196.11		213.76		233.00		249.31		266.76		285.43		305.41		311.52		317.75		324.11		330.59
3"		346.63		377.83		411.83		440.66		471.51		504.51		539.83		550.62		561.64		572.87		584.33
4"		521.23		568.14		619.27		662.62		709.01		758.64		811.74		827.98		844.54		861.43		878.65
6"		996.88		1,086.60		1,184.39		1,267.30		1,356.01		1,450.93		1,552.50		1,583.55		1,615.22		1,647.52		1,680.47

[illegible]

3 Total Accounts

Total Accounts	2,322	2,382	2,442	2,502	2,562	2,622	2,682	2,742	2,802	2,862
New Accounts		60	60	60	60	60	60	60	60	60
Avg. Annual Growth Rate		2.58%	2.52%	2.46%	2.40%	2.34%	2.29%	2.24%	2.19%	2.14%

4 Annual Water Consumption

W.1 Residential	114,164,374	117,737,594	121,310,814	124,884,033	128,457,253	132,030,473	135,603,693	139,176,913	142,750,133	146,323,352
W.2 Multi-Family	32,207,865	32,207,865	32,207,865	32,207,865	32,207,865	32,207,865	32,207,865	32,207,865	32,207,865	32,207,865
W.3 Commercial	4,636,505	4,636,505	4,636,505	4,636,505	4,636,505	4,636,505	4,636,505	4,636,505	4,636,505	4,636,505
W.4 Government	8,182,136	8,182,136	8,182,136	8,182,136	8,182,136	8,182,136	8,182,136	8,182,136	8,182,136	8,182,136
W.5 Other	2,023,674	2,023,674	2,023,674	2,023,674	2,023,674	2,023,674	2,023,674	2,023,674	2,023,674	2,023,674
Total System	161,742,944	165,316,164	168,889,384	172,462,603	176,035,823	179,609,043	183,182,263	186,755,483	190,328,703	193,901,922

5 Revenues and Expenses -- CASH BASIS

Water Rate Revenue

W.1 Residential	\$	1,219,618	\$	1,380,975	\$	1,538,489	\$	1,694,671	\$	1,865,181	\$	2,051,258	\$	2,208,614	\$	2,312,148	\$	2,418,940	\$	2,529,079
W.2 Multi-Family		369,592		405,789		438,757		469,470		502,333		537,496		563,479		574,748		586,243		597,968
W.3 Commercial		48,565		53,321		57,653		61,689		66,007		70,628		74,042		75,523		77,033		78,574
W.4 Government		102,990		113,077		122,264		130,822		139,980		149,778		157,019		160,159		163,362		166,629
W.5 Other		<u>21,648</u>		<u>23,769</u>		<u>25,700</u>		<u>27,499</u>		<u>29,424</u>		<u>31,483</u>		<u>33,005</u>		<u>33,665</u>		<u>34,339</u>		<u>35,025</u>
		1,780,145		1,996,398		2,203,911		2,406,673		2,627,023		2,866,429		3,063,191		3,183,816		3,308,042		3,435,963
Non-Asset Revenues		<u>1,331,343</u>		<u>191,343</u>		<u>191,343</u>		<u>191,343</u>		<u>191,343</u>		<u>191,343</u>		<u>191,343</u>		<u>191,343</u>		<u>191,343</u>		<u>191,343</u>
Total Revenues		<u>3,111,488</u>		<u>2,187,741</u>		<u>2,395,254</u>		<u>2,598,016</u>		<u>2,818,366</u>		<u>3,057,772</u>		<u>3,254,534</u>		<u>3,375,159</u>		<u>3,499,385</u>		<u>3,627,306</u>

**TOWN OF CLARKDALE
WATER/WASTEWATER COST OF SERVICE MODEL**

	Current	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033										
Water Summary																					
Scen: 2023 11 08 -- Scenario I -- Status Quo																					
Water Cost of Service																					
Budget Code																					
P Personnel	\$	539,373	\$	560,948	\$	664,386	\$	684,317	\$	704,847	\$	725,992	\$	747,772	\$	770,205	\$	793,311	\$	817,111	
SU Supplies		380,875		352,941		368,681		382,412		396,674		411,489		426,877		442,864		459,472		476,727	
SE Services		1,932,675		838,716		845,000		849,901		854,949		860,148		865,504		871,020		876,702		882,554	
C Capital		-		-		-		-		-		-		-		-		-		-	
Total		2,852,923		1,752,606		1,878,066		1,916,630		1,956,470		1,997,629		2,040,153		2,084,089		2,129,485		2,176,392	
Department Code																					
W Utilities -- Water	\$	2,852,923	\$	1,752,606	\$	1,878,066	\$	1,916,630	\$	1,956,470	\$	1,997,629	\$	2,040,153	\$	2,084,089	\$	2,129,485	\$	2,176,392	
WW Utilities -- Sewer		-		-		-		-		-		-		-		-		-		-	
Total		2,852,923		1,752,606		1,878,066		1,916,630		1,956,470		1,997,629		2,040,153		2,084,089		2,129,485		2,176,392	
Total Operating Expenses												2,852,923	1,752,606	1,878,066	1,916,630	1,956,470	1,997,629	2,040,153	2,084,089	2,129,485	2,176,392
Net Revenues for Transfers,Capital Outlays and Debt Service												258,565	435,135	517,188	681,386	861,896	1,060,143	1,214,381	1,291,071	1,369,900	1,450,914
Capital Outlays												30,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000
Debt Service																					
Debt Service -- Current												501,183	501,117	501,049	500,981	500,911	500,840	500,768	500,694	500,619	494,491
Debt Service -- Future												-	-	-	130,584	195,877	522,338	652,922	652,922	652,922	783,506
Total Debt Service												501,183	501,117	501,049	631,565	696,788	1,023,178	1,153,690	1,153,616	1,153,541	1,277,997
Net Revenues for Contingencies & Transfers												(272,617)	(85,982)	(3,861)	29,821	145,108	16,965	40,691	117,455	196,359	152,917
Transfers																					
Total Contingencies & Transfers												-	-	-	-	-	-	-	-	-	-
Total Cost of Service												3,384,105	2,273,722	2,399,116	2,568,196	2,673,258	3,040,807	3,213,843	3,257,705	3,303,026	3,474,389
Net Revenues												(272,617)	(85,982)	(3,861)	29,821	145,108	16,965	40,691	117,455	196,359	152,917
Percent of COS												-8.8%	-3.9%	-0.2%	1.1%	5.1%	0.6%	1.3%	3.5%	5.6%	4.2%
Debt Coverage												0.52	0.87	1.03	1.08	1.24	1.04	1.05	1.12	1.19	1.14
(excludes Capital Outlays, G/F Transfers)																					

TOWN OF CLARKDALE WATER/WASTEWATER COST OF SERVICE MODEL										
Current	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033

Wastewater Summary

Scen: 2023 11 08 -- Scenario I -- Status Quo

1 Wastewater Monthly Rates and Charges

Residential

Monthly Minimum Charge	\$	54.00	\$	56.70	\$	58.97	\$	61.33	\$	65.62	\$	70.21	\$	73.72	\$	75.94	\$	77.45	\$	79.00	\$	80.58
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Non-Residential

Monthly Minimum Charge

All Meters	\$	54.00	\$	56.70	\$	58.97	\$	61.33	\$	65.62	\$	70.21	\$	73.72	\$	75.94	\$	77.45	\$	79.00	\$	80.58
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Volume Rate Per 1,000 Gal - Commercial

5,001 Above	\$	2.25	\$	2.36	\$	2.46	\$	2.56	\$	2.73	\$	2.93	\$	3.07	\$	3.16	\$	3.23	\$	3.29	\$	3.36
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2.1 Residential Monthly Bill --

Total	\$	54.00	\$	56.70	\$	58.97	\$	61.33	\$	65.62	\$	70.21	\$	73.72	\$	75.94	\$	77.45	\$	79.00	\$	80.58
Dollar Inc				2.70		2.27		2.36		4.29		4.59		3.51		2.21		1.52		1.55		1.58
Percent Inc				5.0%		4.0%		4.0%		7.0%		7.0%		5.0%		3.0%		2.0%		2.0%		2.0%

TOWN OF CLARKDALE WATER/WASTEWATER COST OF SERVICE MODEL											
	Current	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033

Wastewater Summary

Scen: 2023 11 08 -- Scenario I -- Status Quo

2.2 Commercial Monthly Bill --

10,000 Gallons											
All Meters	\$ 65.25	\$ 68.51	\$ 71.25	\$ 74.10	\$ 79.29	\$ 84.84	\$ 89.08	\$ 91.76	\$ 93.59	\$ 95.46	\$ 97.37
20,000 Gallons											
All Meters	\$ 87.75	\$ 92.14	\$ 95.82	\$ 99.66	\$ 106.63	\$ 114.10	\$ 119.80	\$ 123.39	\$ 125.86	\$ 128.38	\$ 130.95
50,000 Gallons											
All Meters	\$ 155.25	\$ 163.01	\$ 169.53	\$ 176.31	\$ 188.66	\$ 201.86	\$ 211.96	\$ 218.31	\$ 222.68	\$ 227.13	\$ 231.68

3 Total Accounts

Total Accounts	1,545	1,605	1,665	1,725	1,785	1,845	1,905	1,965	2,025	2,085
New Accounts	60	60	60	60	60	60	60	60	60	60
Avg. Annual Growth Rate	3.88%	3.74%	3.60%	3.48%	3.36%	3.25%	3.15%	3.05%	2.96%	

4 Annual Wastewater Billing Units

WW.1 Residential	89,568,711	93,141,930	96,715,150	100,288,370	103,861,590	107,434,810	111,008,030	114,581,249	118,154,469	121,727,689
WW.2 Non-Residential	5,760,506	5,760,506	5,760,506	5,760,506	5,760,506	5,760,506	5,760,506	5,760,506	5,760,506	5,760,506
WW.3 Other1	-	-	-	-	-	-	-	-	-	-
WW.4 Other1	-	-	-	-	-	-	-	-	-	-
WW.5 Other1	-	-	-	-	-	-	-	-	-	-
Total System	95,329,217	98,902,437	102,475,657	106,048,876	109,622,096	113,195,316	116,768,536	120,341,756	123,914,976	127,488,195

5 Revenues and Expenses -- CASH BASIS

Wastewater Revenues

Wastewater Rate Revenue

WW.1 Residential	990,835	1,081,881	1,168,321	1,275,436	1,413,341	1,551,636	1,669,663	1,767,805	1,859,392	1,953,936
WW.2 Non-Residential	34,561	36,289	37,740	39,732	42,514	45,121	46,991	48,201	49,165	50,149
WW.5 Other1	-	-	-	-	-	-	-	-	-	-
WW.6 Other1	-	-	-	-	-	-	-	-	-	-
WW.5 Other1	-	-	-	-	-	-	-	-	-	-
	1,025,396	1,118,170	1,206,061	1,315,169	1,455,855	1,596,758	1,716,654	1,816,006	1,908,558	2,004,085
Non-Rate Revenues	921,938	121,938	121,938	121,938	121,938	121,938	121,938	121,938	121,938	121,938
Total Revenues	1,947,334	1,240,108	1,327,999	1,437,107	1,577,793	1,718,696	1,838,592	1,937,944	2,030,496	2,126,023

**TOWN OF CLARKDALE
WATER/WASTEWATER COST OF SERVICE MODEL**

	Current	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033										
Wastewater Summary																					
Scen: 2023 11 08 -- Scenario I -- Status Quo																					
Wastewater Cost of Service																					
Budget Code																					
P Personnel	\$	339,517	\$	434,098	\$	451,462	\$	546,005	\$	562,386	\$	579,257	\$	596,635	\$	614,534	\$	632,970	\$	651,959	
SU Supplies		226,350		235,799		245,646		253,886		262,417		271,250		280,396		289,866		299,674		309,831	
SE Services		1,137,197		347,842		358,967		368,330		378,036		388,097		398,528		409,340		420,550		432,171	
C Capital		-		-		-		-		-		-		-		-		-		-	
Total		1,703,064		1,017,739		1,056,075		1,168,222		1,202,839		1,238,604		1,275,558		1,313,740		1,353,193		1,393,961	
Department Code																					
W Utilities -- Water	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	
WW Utilities -- Sewer		1,703,064		1,017,739		1,056,075		1,168,222		1,202,839		1,238,604		1,275,558		1,313,740		1,353,193		1,393,961	
Total		1,703,064		1,017,739		1,056,075		1,168,222		1,202,839		1,238,604		1,275,558		1,313,740		1,353,193		1,393,961	
Total Operating Expenses												1,703,064	1,017,739	1,056,075	1,168,222	1,202,839	1,238,604	1,275,558	1,313,740	1,353,193	1,393,961
Net Revenues for Transfers,Capital Outlays and Debt Service												244,270	222,369	271,925	268,885	374,954	480,091	563,033	624,203	677,302	732,062
Capital Outlays												30,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000
Debt Service																					
Debt Service -- Current												218,518	218,449	218,379	218,307	218,232	218,156	218,077	217,996	217,912	217,826
Debt Service -- Future												-	-	32,646	32,646	359,107	359,107	359,107	359,107	359,107	359,107
Total Debt Service												218,518	218,449	251,025	250,953	577,339	577,263	577,184	577,103	577,019	576,933
Net Revenues for Contingencies & Transfers												(4,248)	(16,080)	900	(2,068)	(222,385)	(117,172)	(34,151)	27,101	80,283	135,129
Transfers																					
Total Contingencies & Transfers												-	-	-	-	-	-	-	-	-	-
Total Cost of Service												1,951,582	1,256,188	1,327,100	1,439,175	1,800,178	1,835,867	1,872,742	1,910,843	1,950,213	1,990,894
Net Revenues												(4,248)	(16,080)	900	(2,068)	(222,385)	(117,172)	(34,151)	27,101	80,283	135,129
Percent of COS												-0.2%	-1.3%	0.1%	-0.1%	-14.1%	-6.8%	-1.9%	1.4%	4.0%	6.4%
Debt Coverage												1.12	1.02	1.08	1.07	0.65	0.83	0.98	1.08	1.17	1.27
(excludes Debt, Cap Outlays, G/F Transfers)																					



MEMO

June 4, 2019

Town of Clarkdale
Maher Hazine, P.E.
Public Works Director & Town Engineer
890 Main Street
Town of Clarkdale, Arizona 86324

RE: Feasibility Study –Expansion of water distribution system and Sewer Collection system.

Dear Maher,

The purpose of this memo is to present the results of our investigation into the feasibility of overall water and sewer system expansion within Town limits. The intent of this exercise is to review the general expansion possibilities for future Town planning and use. The steps taken in the analysis and summary of the finding are as stated below.

Data Gathering

The first step in the evaluation process was to gather as much existing information on the area of the proposed extension as possible. Assembled data and its source included:

- Obtain all available topographic information from the Town of Clarkdale GIS Department.
- Research and extract data from past surveys conducted by SEC in and near the evaluation area.
- Research and gather easement and property data publicly available through Yavapai County.
- This information was gathered into a single CAD file and gaps in the available data identified.

Water Distribution System Analysis

Once the data was assembled into a usable 3D CAD file, various potential routes for distribution system were reviewed. Refer Exhibit A for proposed water distribution system.

- The pipe network was developed within Town ROW or easements.
- Any line extension within private property will be on future development and to be used as a guideline when coordination with future planning and development.
- As the system is pressurized, no profiles were analyzed.



**SOUTHWESTERN
ENVIRONMENTAL
CONSULTANTS, INC.**

www.sec-landmgt.com
info@sec-landmgt.com

CORPORATE OFFICE:
20 STUTZ BEARCAT DRIVE #6
SEDONA, ARIZONA 86336
(928) 282-7787
Fax: 282-0731

BRANCH OFFICE:
825 COVE PARKWAY
COTTONWOOD, ARIZONA 86326
(928) 634-5889
Fax: 634-2222

- The total estimated 8" and 6" water line lengths to be 51,000 LF 28,000 LF respectively.
- The total estimated cost of the system to be 8.7 million.
- The estimate includes a 25% contingency. The estimate excludes the cost to acquire private land and the cost of the ADOT coordination. See cost analysis in appendix C for estimated quantities and cost break down.

Sewer Collection System

Once the data was assembled into a usable 3D CAD file, various potential routes for distribution system were reviewed. After the preliminary analysis, three major categories were identified.

A- Based on the topographic information, areas where design of gravity sewer was possible

B- Based on topographic information, possibility of gravity sewer was inconclusive. Therefore further analysis was carried out (Yavapai Collage area, between Mescal Gulch and Black hills Drive)

C- Based on the topographic information and preliminary investigation, where a pump system was required to service the area. These areas were identified in the analysis. However no cost estimate was developed.

Referee Appendix B, Sewer distribution system for additional layout information.

Based on the analysis;

- The total estimated 8" and 6" sewer line lengths are 70,800 LF 16,200 LF respectively.
- The Estimated cost for the total gravity collection system to be designed and constructed is 10.2 million.
- The estimate includes a 25% contingency. The estimate excludes the cost to acquire private land and the cost of the ADOT coordination. See cost analysis in appendix C for estimated quantities.

Should you have any questions, or need additional information, please contact me at Kginige@sec-landmgt.com or (928) 634-5889.

Sincerely,

G. Krishan Ginige, P.E, MS (Env/Civil Eng.), CFM
President



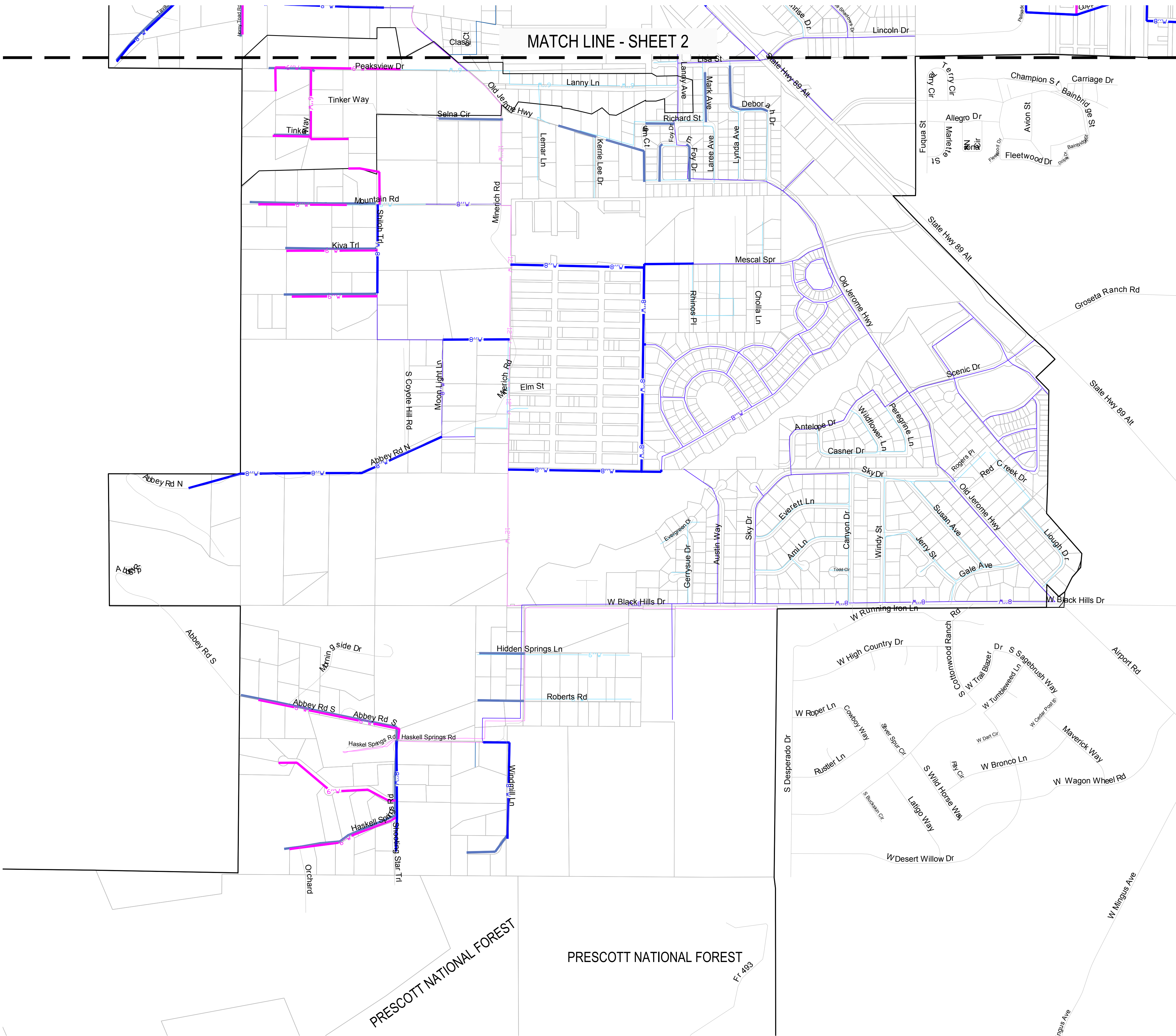
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TOWN OF CLARKDALE, AZ



LEGEND

- 8" W PROPOSED 8" WATER MAIN
- 6" W PROPOSED 6" WATER MAIN
- 12" W EXISTING 12" WATER MAIN
- 8" W EXISTING 8" WATER MAIN
- 6" W EXISTING 6" WATER MAIN

QUANTITIES

8" WATER MAIN - 51,095 LF
6" WATER MAIN - 28,078 LF

NOTE

ALL RIGHT-OF-WAYS HAVE BEEN VERIFIED THROUGH
YAVAPAI COUNTY RECORDER'S ONLINE DATABASE

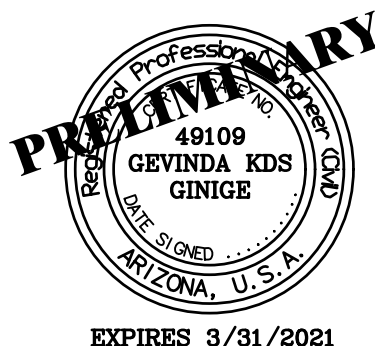
PRELIMINARY. NOT FOR CONSTRUCTION. FOR AGENCY REVIEW ONLY
CLARKDALE SEWER & WATER FEASIBILITY STUDY



825 COVE PARKWAY
COTTONWOOD, AZ 86326
(928) 282-7787

WATER EXPANSION
ALIGNMENTS
PLAN VIEW

DATE 6/4/19	DRAWN SDF	SHEET 1 OF 2
SCALE 1" = 500'	CHECKED KG	PROJECT NO. 18-1105CE



TOWN OF CLARKDALE, AZ



LEGEND

- PROPOSED 8" WATER MAIN
- PROPOSED 6" WATER MAIN
- EXISTING 12" WATER MAIN
- EXISTING 8" WATER MAIN
- EXISTING 6" WATER MAIN

QUANTITIES

8" WATER MAIN - 51,095 LF
6" WATER MAIN - 28,078 LF

NOTE

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(928) 282-7787

WATER EXPANSION ALIGNMENTS
PLAN VIEW

DATE 6/4/19	DRAWN SDF	SHEET 2 OF 2
SCALE 1" = 500'	CHECKED KG	PROJECT NO. 18-1105CE



MATCH LINE - SHEET 1

TOWN OF CLARKDALE - PRELIMINARY WATER COST ESTIMATE

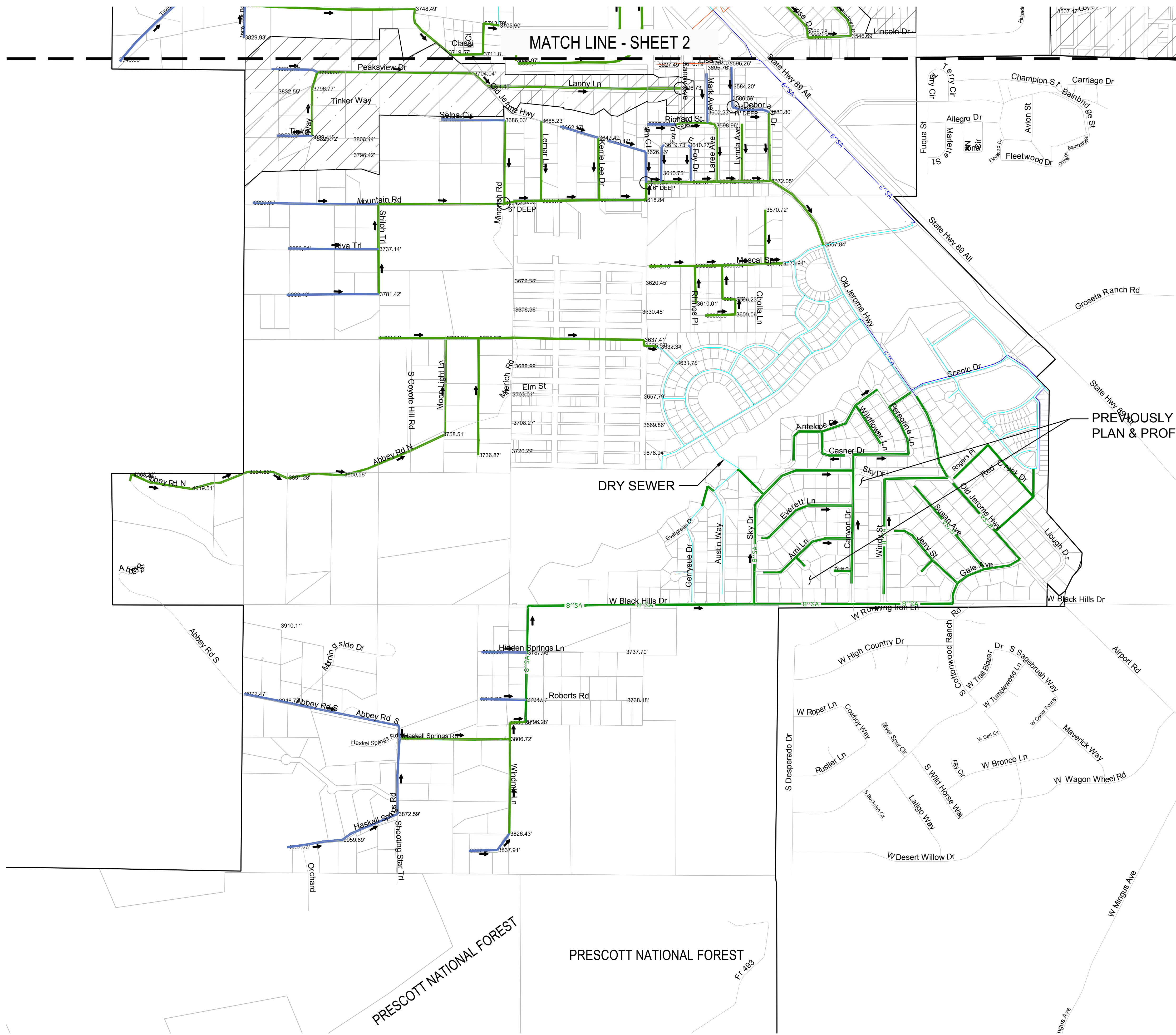
ITEM	DESCRIPTION	QUAN	UNIT	UNIT PRICE	TOTAL
MOBILIZATION					
100	Mobilization	1	LS	\$ 50,000.00	\$ 50,000.00
MOBILIZATION Subtotal :					\$ 50,000.00
ROADS					
110	Survey Markers	NE	EA		
120	Pavement-Roadway - 3"AC\4"ABC	26,391	SY	\$ 26.30	\$ 693,986.38
130	Saw Cut	158,346	LF	\$ 4.00	\$ 633,384.00
140	Traffic Control	1	LS	\$ 100,000.00	\$ 100,000.00
ROADS Subtotal :					\$ 1,427,370.38
WATER					
150	Connect to existing watermain - no saddle figured, no	NE	LS		
160	Backflow preventor @ connection to city main	NE	EA		
170	Pressure Reducing Valve @ connection to city main	NE	EA		
180	8" waterline w/restrained joints	51,095	LF	\$ 36.45	\$ 1,862,412.75
190	6" waterline w/restrained joints	28,078	LF	\$ 28.00	\$ 786,184.00
200	Water valve-8"	50	EA	\$ 1,285.15	\$ 64,257.50
210	Water valve-6"	30	EA	\$ 920.05	\$ 27,601.50
220	Fire Hydrant	155	EA	\$ 3,361.55	\$ 521,040.25
230	Water Meter - meter install only, no meter or box spec	NE	EA		
240	Blow off valve	NE	EA		
250	Service Connection	NE	EA		
260	Concrete encasement @ sewer XING	NE	EA		
270	Air Relief valve	NE	EA		
WATER Subtotal :					\$ 3,261,496.00
MOBILIZATION, ROADS & WATER Subtotal :					\$ 4,738,866.38
MISC					
280	Construction Staking (7.5%)	1	LS	\$ 355,414.98	\$ 355,414.98
290	Testing (3%)	1	LS	\$ 142,165.99	\$ 142,165.99
300	Bond (P&P 1.9%)	1	LS	\$ 90,038.46	\$ 90,038.46
310	As-Built Certification(5%)	1	LS	\$ 236,943.32	\$ 236,943.32
320	Contingency (25%)	1	LS	\$ 1,184,716.60	\$ 1,184,716.60
MISC Subtotal :					\$ 2,009,279.35
Subtotal:					\$6,748,145.73
Tax 6.18%					\$416,698.00
CONSTRUCTION Total:					\$7,164,843.72
DESIGN					
320	Design (15%)	1	LS	\$ 1,012,221.86	\$ 1,012,221.86
330	QA/QC (5%)	1	LS	\$ 337,407.29	\$ 337,407.29
340	Permits (2.5%)	1	LS	\$ 168,703.64	\$ 168,703.64
DESIGN Total :					\$ 1,518,332.79
TOTAL PROJECT COST:					\$8,683,176.51

NE - Not Estimated

Assumptions :

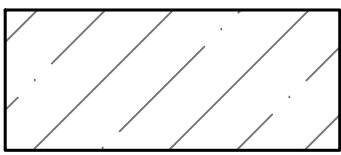
- No ADOT ROW Costs
- Fire Hydrants every 500 feet
- Valves every 1000 feet

TOWN OF CLARKDALE, AZ



LEGEND

- PROPOSED 8" SEWER MAIN
- PROPOSED 6" SEWER MAIN
- EXISTING 15" SEWER MAIN
- EXISTING 12" SEWER MAIN
- EXISTING 10" SEWER MAIN
- EXISTING 8" SEWER MAIN
- EXISTING 6" SEWER MAIN



LIFT STATION REQUIRED

xxxx.xx' EG ELEVATION

PREVIOUSLY DETAILED IN THE BLACK HILLS SEWER PLAN & PROFILE DRAWINGS DATED 5/6/19 (ATTACHED)

QUANTITIES

8" SEWER MAIN - 70,831 LF
6" SEWER MAIN - 16,212 LF

NOTE

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COTTONWOOD, AZ 86326
(928) 282-7787

SEWEREXPANSION
ALIGNMENTS
PLAN VIEW

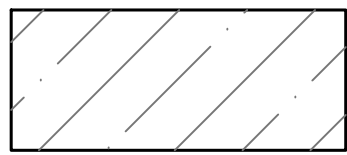
DATE 6/4/19	DRAWN SDF	SHEET 1 OF 2
SCALE 1" = 500'	CHECKED KG	PROJECT NO. 18-1105CE



TOWN OF CLARKDALE, AZ

LEGEND

- PROPOSED 8" SEWER MAIN
- PROPOSED 6" SEWER MAIN
- EXISTING 15" SEWER MAIN
- EXISTING 12" SEWER MAIN
- EXISTING 10" SEWER MAIN
- EXISTING 8" SEWER MAIN
- EXISTING 6" SEWER MAIN



LIFT STATION REQUIRED

xxxx.xx' EG ELEVATION

QUANTITIES

8" SEWER MAIN - 16,212 LF
6" SEWER MAIN - 70,832 LF

NOTE

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CLARKDALE SEWER & WATER FEASIBILITY STUDY



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COTTONWOOD, AZ 86326
(928) 282-7787

SEWER EXPANSION
ALIGNMENTS
PLAN VIEW

DATE 6/4/19	DRAWN SDF	SHEET 2 OF 2
SCALE 1" = 500'	CHECKED KG	PROJECT NO. 18-1105CE



TOWN OF CLARKDALE - PRELIMINARY SEWER COST ESTIMATE

ITEM	DESCRIPTION	QUAN	UNIT	UNIT PRICE	TOTAL
MOBILIZATION					
100	Mobilization	1	LS	\$ 50,000.00	\$ 50,000.00
MOBILIZATION Subtotal :					\$ 50,000.00
ROADS					
110	Survey Markers	NE	EA		
120	Pavement-Roadway - 3"AC\4"ABC	29,015	SY	\$ 26.30	\$ 762,979.18
130	Saw Cut	174,088	LF	\$ 4.00	\$ 696,352.00
140	Traffic Control	1	LS	\$ 100,000.00	\$ 100,000.00
ROADS Subtotal :					\$ 1,559,331.18
SEWER					
150	Connect to Existing manhole	10	EA	\$ 1,265.50	\$ 12,655.00
160	8" Sewer Pipe	70,832	LF	\$ 38.50	\$ 2,727,032.00
170	6" Sewer Pipe	16,212	LF	\$ 28.50	\$ 462,042.00
180	Manhole	239	EA	\$ 3,500.00	\$ 836,500.00
SEWER Subtotal :					\$ 4,038,229.00
MOBILIZATION, ROADS & SEWER Subtotal :					\$ 5,647,560.18
MISC					
190	Construction Staking (5%)	1	LS	\$ 282,378.01	\$ 282,378.01
200	Testing (3%)	1	LS	\$ 169,426.81	\$ 169,426.81
210	Bond (P&P 1.9%)	1	LS	\$ 107,303.64	\$ 107,303.64
220	As-Built Certification(5%)	1	LS	\$ 282,378.01	\$ 282,378.01
230	Contingency (25%)	1	LS	\$ 1,411,890.04	\$ 1,411,890.04
MISC Subtotal :					\$ 2,253,376.51
Subtotal:					\$7,900,936.69
Tax 6.18%					\$487,882.84
CONSTRUCTION Total:					\$8,388,819.53
DESIGN					
240	Design (15%)	1	LS	\$ 1,185,140.50	\$ 1,185,140.50
250	QA/QC (5%)	1	LS	\$ 395,046.83	\$ 395,046.83
260	Permits (2.5%)	1	LS	\$ 197,523.42	\$ 197,523.42
DESIGN Total :					\$ 1,777,710.76
TOTAL PROJECT COST:					\$10,166,530.28

NE - Not Estimated

Assumptions:

- Manholes every 400 feet

APPENDIX B: ARSENIC TREATMENT PLANT

B1 Original Arsenic Treatment Plant Design Memo (2007)

B2 Arsenic Treatment Plant As-Built Plans

B3 Arsenic Treatment Plant O&M Manual

B4 Existing Site Photos

Appendix B1

SHEPHARD WESNITZER, INC.
CIVIL ENGINEERING AND SURVEYING, NATURALLY

MOUNTAIN GATE WATER SYSTEM DESIGN MEMORANDUM

Prepared For:
Empire Residential L.P.
1016 West University Avenue, Suite 202
Flagstaff, Arizona 86001

Prepared By:
SHEPHARD-WESNITZER, INC.
703 S. Main Street
Cottonwood, Arizona 86326
Phone: (928) 639-2712

March 14, 2005

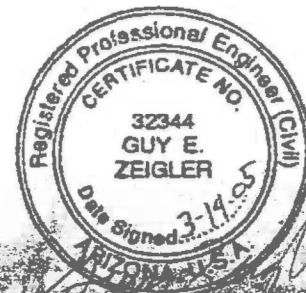


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Appendix “A” – Demand Calculations

- Existing (offsite) System Demand
- Proposed (onsite) System Demand

Appendix “B” – WaterCAD Standard, Steady State (STD) Domestic Analyses

- STD Analysis of Maximum Instantaneous Demand – Input/Output (HGL=3763’; top of tank)

Appendix “C” – WaterCAD Fire Flow Analyses

- Fire Flow with Maximum Instantaneous Demand – Input/Output (HGL=3748’; bottom of tank)

Exhibit A – Water Distribution System Schematic Map



1. INTRODUCTION

1.1 Foreword

Empire Enterprises is proposing a new residential subdivision located in the Town of Clarkdale, Yavapai County, Arizona. The Mountain Gate Subdivision will be a Planned Area Development consisting of 606 residential lots. The project will be developed in three phases with the water system design to be constructed to serve the entire project from its inception. Shephard-Wesnitzer, Inc. Consulting Engineers is providing professional engineering services in preparing the Mountain Gate Subdivision Water System Improvement Plans/Specifications for the project. The objective of this report is to provide the technical background for the proposed water production, storage, and distribution components. An application for approval to construct will be submitted to the Yavapai County Environmental Services Department for review of the water main designs. An application for approval to construct will also be submitted to ADEQ for the well pumping facilities and storage tank.

This report contains general descriptions of proposed water system components. It is recommended that the Improvement Plans be utilized in conjunction with this report for information regarding specific type, size, and location of proposed components. Reference is made to *Mountain Gate Subdivision Construction Plans – Grading, Drainage, and Utilities* and *Cottonwood Water Works Water Tank and Production Facility Improvement Plans* prepared by Shephard-Wesnitzer, Inc.

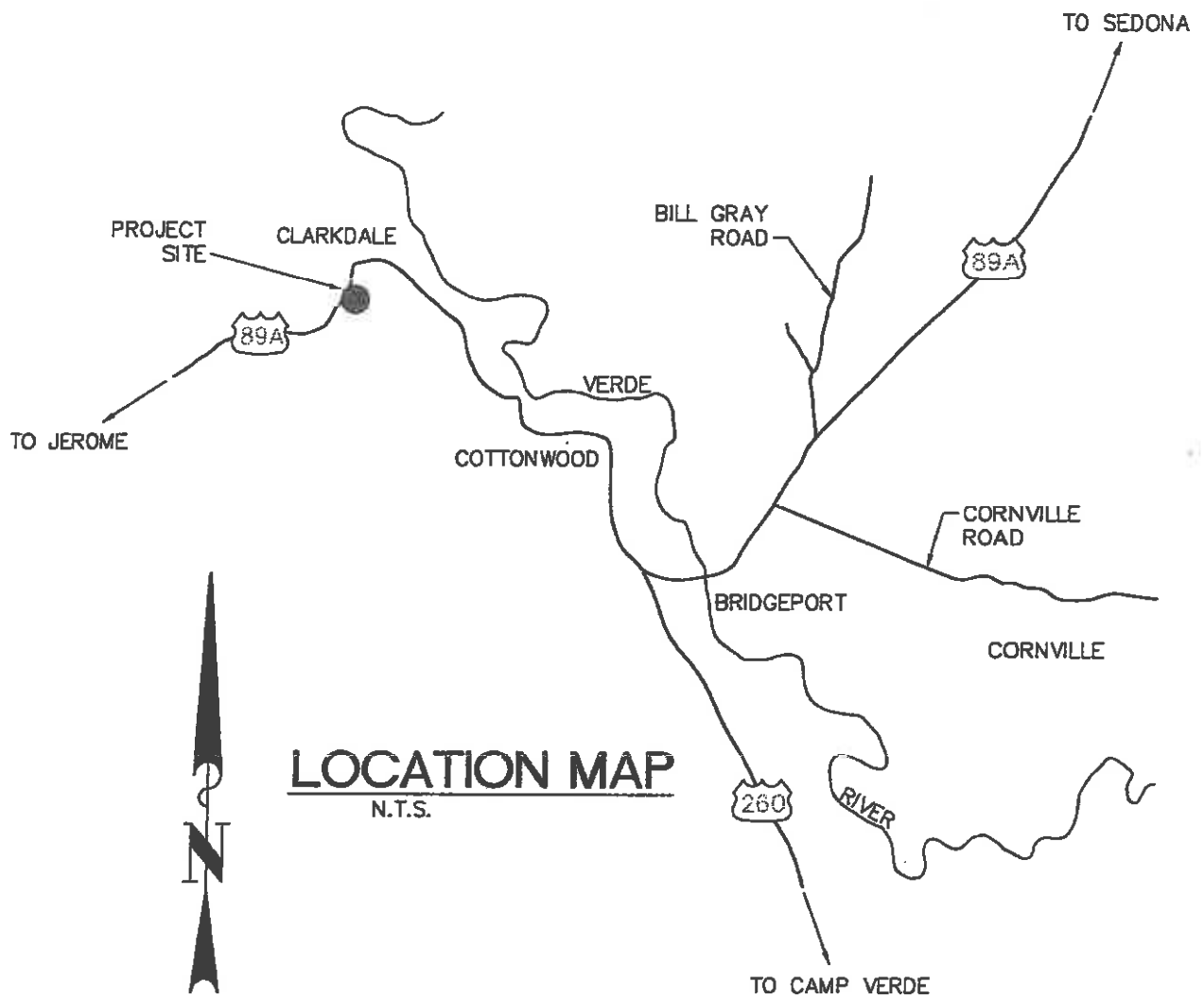
1.2 Existing Conditions

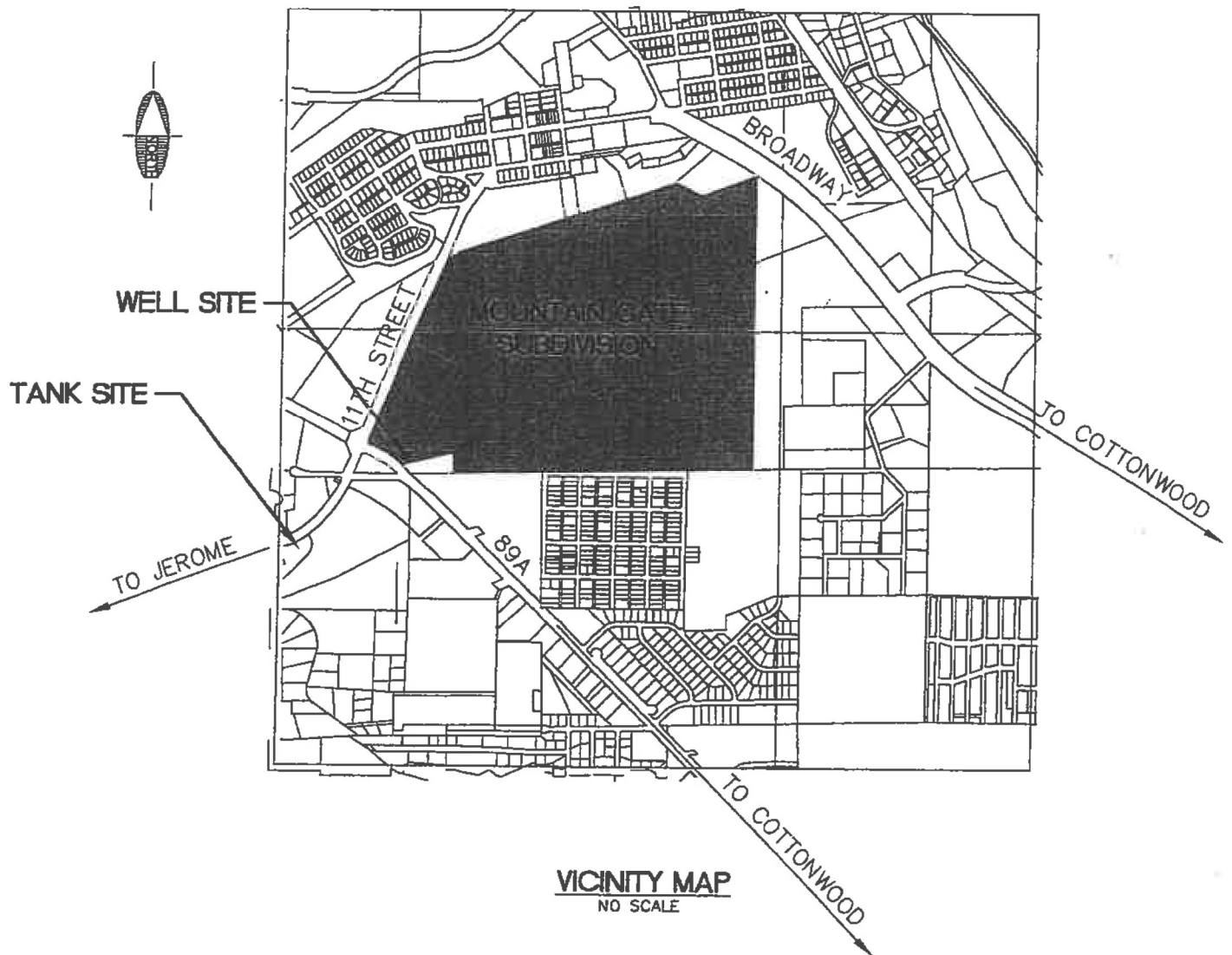
The project site is currently undeveloped except for several graded roads, overhead utility lines and natural gas and sewer utilities. The project can be reached by taking State Route 89A to the intersection with Cement Plant road in the Town of Clarkdale. The project site is located on the northeast corner of this intersection. Specifically, the project is located in Sections 19 and 20, Township 16 North, Range 3 East, Gila & Salt River Base and Meridian, Yavapai County, Arizona. A Vicinity Map is included on Page 3 and Site Map is included on Page 4.

1.3 Proposed Conditions

The water distribution system serving the Mountain Gate Subdivision will act as an extension of an existing water distribution system operated by Cottonwood Water Works. In association with the extension of the piping network to serve Mountain Gate, a new well will be constructed on a dedicated parcel near the southwest corner of the project and a new storage tank will be constructed offsite adjacent to an existing Cottonwood Water Works storage tank that currently serves the existing distribution system.

The goal of the water system extension is to provide all anticipated users with adequate water for normal domestic use and emergency fire protection needs.





2. DISTRIBUTION SYSTEM DESIGN

2.1 Design Criteria

Table 2A provides a summary of criteria used in the design of the Mountain Gate Subdivision water distribution system.

Table 2A
Summary of Design Criteria

CRITERIA DESCRIPTION	VALUE	CRITERIA SOURCE
Average Annual Daily Domestic Consumption	120 gal per capita	n/a
Population Density	2.5 capita/connection	Town of Clarkdale
Min Desirable Residence Pressure	40 psi	Bib Ref No. 2
Unconditional Minimum System Pressure (all flow conditions)	20 psi	Bib Ref No. 2
Project Maximum Instantaneous Demand	534gpm offsite (existing) 560gpm onsite (proposed)	See Demand Calculations in Appendix "A"
Residential Fire Flow Rate/Duration	1000gpm/2 hour.	See Note 1
Storage - Fire	2 hour of criteria fire flow	See Note 1
Storage - Domestic	1 days flow of average day of maximum month	Bib Ref No. 3

Notes:

- 1) Based on a conversation with The Verde Valley Fire District regarding the general flow requirements for adequate fire protection for the project.

2.2 Water Distribution System Design Methodology

The basis of this design focuses upon providing sufficient flow at an adequate pressure for both domestic and fire protection uses. The primary design tool, therefore, results from a pressure analysis. The WaterCAD Version 6.5 computer program, Haestad Methods, was used to model the distribution network.

Minor losses were not accounted for directly in the system model. Instead of using a Hazen Williams roughness coefficient (C) of 130, which is normally used for new ductile iron, a (C) of 120 was used in the calculations to account for line losses and minor losses. A roughness coefficient (C) of 110 was used for the existing water distribution system piping.

Onsite pipe junction elevations for the proposed system were established according to the *Mountain Gate Subdivision Construction Plans – Grading, Drainage, and Utilities* prepared by Shephard-Wesnitzer, Inc. Node elevations are modeled to represent finished grades. See Exhibit A, Water Distribution System Schematic Map, for general distribution system layout and node locations.

The Mountain Gate Subdivision water system operates as an extension of an existing water distribution system and has one boundary node representing an existing storage tank and a proposed storage tank to be located immediately adjacent to it. As stated, this boundary node is represented by a WaterCAD “reservoir” with a water surface elevation ranging from 3748 (base of storage tank) to 3763 (top of storage tank), depending on the analysis. No attempt was made at modeling the proposed well due to inconsistent operation of wells in general and the fact that it will only have a minimal positive impact on system pressures if it is in operation.

An estimate of existing system maximum instantaneous demand was developed based on information provided by Cottonwood Water Works – see Appendix A. This demand (534gpm) was applied at Node J-84 to represent demand from the Town of Clarkdale to the north of the Mountain Gate project. Resulting line losses between the storage tanks and Mountain Gate’s point of connection are therefore taken into account. Proposed system maximum instantaneous demand (560gpm) was distributed evenly across the nodes within the project boundary.

Steady State Standard (STD) analyses were conducted for domestic design - see Appendix “B”. The storage tank was assumed full for modeling domestic demand with a corresponding Hydraulic Grade Line (HGL) of 3763.

The network was also modeled simulating fire protection capabilities using the WaterCAD Fire Flow option - see Appendix “C”. The storage tank was assumed empty (HGL of 3748) for modeling fire flow in addition to system wide domestic demand. All nodes in the system were tested to verify that minimum criteria fire flows (1000gpm) at a 20psi residual and 20psi minimum system pressure. A manual check was then conducted to determine if 40psi residual was available based on the anticipation of sprinkler systems being utilized in the project and their higher pressure requirements. Fire sprinkler demand is typically less than fire flow demand at fire hydrants and from a timing perspective usually happens before demand at fire hydrants. Fire sprinkler demand was therefore not considered in the modeling.

Pressure Reducing Valve (PRV) locations and settings were established to meet the ADEQ desirable pressure range. Also factored into the locations and settings was to provide a minimum pressure differential across each valve of 20psi to allow for consistent operation. The desirable range consists of pressures greater than 40 psi but less than 75 psi for residential services and pressures not exceeding 100 psi in the main line system (Bibliography Reference No. 2).

3. STORAGE TANK AND WELL DESIGN

Storage Tank

The proposed 16' high, 65'4" diameter storage tank has a nominal capacity of 400,000gal and is proposed to be constructed adjacent to an existing storage tank for the system. The tank high-water elevation (3763) is based on matching the max water surface elevation of the existing storage tank. The storage tank volume is designed to provide for required fire flow storage of 120,000gal (1000 gpm x 2 hours) and domestic demand for one average day of the maximum month (Bibliography Reference No. 3) estimated at a factor of 1.2 times the average day demand;

$$1.2 * 120 \text{ gal/day-capita} * 2.5 \text{ capita/connection} * 606 \text{ connections} * 1 \text{ day} = 218,160 \text{ gal}$$

120,000gal+218,160gal=338,160gal which is less than 400,000gal. The 61,840gal not required in association with Mountain Gate will act as additional storage for Mountain Gate and the existing system.

Note that the new Mountain Gate system has been designed with excess capacity to prevent any new demands from being placed on the existing water system. No attempt has been made to evaluate the storage capacity of the existing system with respect to total system demand.

Well

The design of the well and actual pumping capacity is by others. Based on replenishing average day demand over an 8-hour period, the minimum well capacity to serve the Mountain Gate development would be 379gpm (see following calculation).

$$\text{Avg day demand} = 120 \text{ gal/day-capita} * 2.5 \text{ capita/conn} * 606 \text{ conn} * 1 \text{ day} = 181,800 \text{ gal}$$

$$181,800 \text{ gal} / 8 \text{ hour} / (60 \text{ min/hour}) = 379 \text{ gpm}$$

Note that this analysis of required well capacity is performed to meet the ultimate demands of the Mountain Gate system. No analysis has been made to evaluate the production capacity of the existing Cottonwood Water Works system. The well has been determined to have significant capacity beyond the needs of the Mountain Gate development and the developer is working with the water system owner to determine if the well pump can be upsized. This will enable the new water system to be a net exporter of water to the existing system.

Disinfection

Disinfection for the new facilities at Mountain Gate will utilize the pulsator chlorinator, Mec-O-Matic Stingray chlorination feed system with a 50 gallon solution tank or similar product. The system shall be capable of treating the anticipated discharge of up to 600 gpm from the well with a corresponding feed rate of 0-8 gal/day. The feed rate is based on a 12% chlorine solution and a 1ppm injection rate.

Arsenic Removal

The well has been determined to have arsenic levels which meet the current 50 ppb water quality standards. The analyzed quality of 31 ppb will not meet new standards for 2006 and an arsenic control plan is being prepared for the well. The existing well site was originally proposed to also incorporate a storage tank and booster pump station and area is available at the well head for the placement of an arsenic removal and system. The system design will be submitted to ADEQ for review and approval prior to use for domestic purposes.

4. RESULTS

Results of pressure analyses performed on the proposed water distribution system indicate that sufficient volume and pressure can be provided to each connection at Mountain Gate Subdivision during Maximum Instantaneous Demand. See Appendix "B" for Maximum Instantaneous Day input and results. Additionally, the entire development can be adequately protected during a fire emergency situation. See Appendix "C" for the Fire Flow results.

The topographical relief across the project requires the use of pressure reducing valves (PRVs) to serve some of the lower elevations of the project. Two mainline PRVs are situated such that the project is divided into two zones. Table 4A is provided to aid in installation and initial setting of the two pressure reducing valves.

Table 4A
Summary of Pressure Reducing Valve Information

Element No.	Elevation	Size	Upstream Pressure (PSI) @HGL=3763	Downstream Pressure (PSI) PRV Setting @HGL=3705	Downstream Hydraulic Grade Maintained
PRV-1	3601	8" w/2"	65.6	45.0	3705/3694
PRV-2	3577	8" w/2"	75.4	55.4	3705/3694

There are two segments to each PRV, a smaller valve for low/domestic flows and a larger valve for high/fire flows. For installation, the downstream pressure of the low flow PRV should be set to the value listed in Table 4A "Downstream Pressure (PSI) - PRV Setting", and maintained for design operation. The high flow PRV segment should be set 3-5psi less than the low flow PRV and similarly maintained. These settings are provided as a guide. Actual settings will ultimately be dependent on constructed elevations.

Building locations below elevation 3505' will experience domestic pressures in excess of 85psi and will require individual pressure reducing valves on their respective service lines. The lots with projected building locations below 3505' and therefore require an individual pressure reducing valve are 181-183, and 203-210.

4. BIBLIOGRAPHY

1. Haestad Methods, Inc., *WaterCAD, Version 6.5 Users Guide*.
2. Arizona Department of Environmental Quality, *Engineering Bulletin No. 10, Guidelines for the construction of Water Systems*, dated May 1978.
3. State of Arizona, *Arizona Administrative Code Sections R18-5-502 Minimum Design Criteria and R18-5-503 Storage Requirements*, January 30, 2004.

APPENDIX “A”

DEMAND CALCULATIONS

- Existing (offsite) System Demand
- Proposed (onsite) System Demand

Offsite (Existing) Demand - Water Distribution System Calculations

5470000 gal/month (average over 1 year)
182333 gal/day ("average day")
126.6 gal/min ("average day")

Method 1

Method 2

Estimate	120 gal/capita/day
	2.5 capita/connection
	300 gal-day/connection

From Bulletin No. 10 (Chapter 5, Table 3)

231.1 gpm	for first	176 connections
302.4 gpm	based on	0.7 gpm for each additional connection
<u>533.5 gpm</u>		

Use	534 gpm	for existing system demand contributing to line losses.
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This demand to be modeled on node J-84 so line losses associated with this demand are accounted for in modeling the water distribution system extension for Mountain Gate.

Mountain Gate - 04461
Onsite Demand - Water Distribution System Calculations

Domestic Demand

Given 606 connections in Mountain Gate
 maximum instantaneous demand from Bulletin No. 10 (Chapter 5, Table 3)

From Bulletin No. 10 (Chapter 5, Table 3)

231.1 gpm	for first	176 connections
301.0 gpm	based on	0.7 gpm for each additional connection
<u>532.1 gpm</u>		

Irrigation Demand

Estimate 20000 gal/ over 12 hour period
 27.8 gal/min

Total Demand =	560 gal/min
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This demand to be dispersed among the nodes within the project to simulate a uniform distribution of demand throughout the development.

Supply

Based on the Average Day Domestic Demand
 120 gal/capita/day
 2.5 capita/connection
606 connections
 181800 gal per day

Assume 8 hours of well pumping

Required Well Capacity =	379 gpm
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APPENDIX “B”

WATERCAD STANDARD, STEADY STATE (STD) ANALYSIS

- Std Analysis of Maximum Instantaneous Demand – Input/Output
Tank Full (HGL = 3763ft)**

Scenario: HGL=3763(top), Base Demand
Steady State Analysis
Junction Report

Label	Elevation (ft)	Zone	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-3	3,548.00	Z2	8.20	3,704.78	67.83
J-9	3,520.00	Z2	8.20	3,704.77	79.94
J-12	3,544.00	Z2	8.20	3,704.74	69.54
J-13	3,541.00	Z2	8.20	3,704.74	70.84
J-14	3,637.50	Z1	8.20	3,752.51	49.76
J-15	3,644.00	Z1	8.20	3,752.51	46.95
J-16	3,601.00	Z2	8.20	3,705.03	45.01
J-17	3,606.00	Z1	8.20	3,752.44	63.36
J-18	3,592.00	Z2	8.20	3,704.73	48.77
J-19	3,610.00	Z2	8.20	3,704.73	40.98
J-20	3,546.00	Z2	8.20	3,704.75	68.68
J-21	3,547.00	Z2	8.20	3,704.75	68.25
J-22	3,563.00	Z2	8.20	3,704.74	61.32
J-23	3,565.00	Z2	8.20	3,704.74	60.46
J-24	3,526.00	Z2	8.20	3,704.69	77.31
J-25	3,524.00	Z2	8.20	3,704.69	78.18
J-26	3,633.50	Z1	8.20	3,752.47	51.47
J-27	3,595.50	Z2	8.20	3,704.73	47.26
J-28	3,561.00	Z2	8.20	3,704.78	62.21
J-30	3,583.50	Z2	8.20	3,751.30	72.60
J-31	3,572.00	Z2	8.20	3,704.95	57.52
J-33	3,553.50	Z2	8.20	3,704.82	65.47
J-34	3,600.00	Z1	8.20	3,752.32	65.90
J-35	3,592.00	Z2	8.20	3,704.90	48.85
J-37	3,539.00	Z2	8.20	3,704.76	71.72
J-38	3,536.00	Z2	8.20	3,704.72	73.00
J-39	3,519.00	Z2	8.20	3,704.72	80.35
J-40	3,509.00	Z2	8.20	3,704.70	84.67
J-41	3,526.00	Z2	8.20	3,704.70	77.32
J-42	3,590.00	Z1	8.20	3,752.10	70.13
J-43	3,546.00	Z2	8.20	3,704.73	68.68
J-44	3,529.00	Z2	8.20	3,704.73	76.03
J-45	3,586.00	Z2	8.20	3,704.89	51.44
J-46	3,513.00	Z2	8.20	3,704.71	82.94
J-47	3,532.00	Z2	8.20	3,704.71	74.72
J-48	3,569.00	Z2	8.20	3,704.84	58.77
J-49	3,552.50	Z2	8.20	3,704.76	65.87
J-51	3,560.00	Z2	8.20	3,704.84	62.66
J-52	3,570.00	Z2	8.20	3,704.77	58.31
J-53	3,587.00	Z2	8.20	3,704.77	50.95
J-54	3,587.00	Z2	8.20	3,704.78	50.96
J-55	3,608.50	Z1	8.20	3,752.75	62.41
J-56	3,571.00	Z2	8.20	3,704.84	57.91
J-57	3,615.00	Z1	8.20	3,752.41	59.45
J-58	3,593.00	Z1	8.20	3,752.19	68.87
J-59	3,616.00	Z1	8.20	3,753.05	59.29
J-60	3,613.00	Z2	8.20	3,751.30	59.84
J-61	3,612.00	Z1	8.20	3,752.65	60.85
J-62	3,576.00	Z2	8.20	3,704.79	55.72
J-63	3,574.00	Z2	8.20	3,704.84	56.61
J-65	3,568.00	Z2	8.20	3,704.78	59.18
J-66	3,562.00	Z2	8.20	3,704.77	61.77

Title: Mountain Gate Developemnt

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Shephard Wesnitzer Inc

Project Engineer: J. Blinick

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Scenario: HGL=3763(top), Base Demand
Steady State Analysis
Junction Report

Label	Elevation (ft)	Zone	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-67	3,591.00	Z2	8.20	3,704.77	49.22
J-68	3,618.00	Z1	0.00	3,753.66	58.69
J-69	3,557.50	Z2	8.20	3,704.84	63.75
J-70	3,555.00	Z2	8.20	3,704.75	64.79
J-71	3,491.00	Z2	8.20	3,704.74	92.47
J-72	3,523.00	Z2	8.20	3,704.75	78.63
J-73	3,636.00	Z1	8.20	3,752.47	50.39
J-74	3,551.00	Z2	8.20	3,704.77	66.53
J-75	3,626.00	Z2	8.20	3,751.30	54.21
J-76	3,505.00	Z2	8.20	3,704.74	86.42
J-77	3,533.00	Z2	8.20	3,704.74	74.30
J-78	3,590.50	Z2	8.20	3,704.89	49.49
J-79	3,515.00	Z2	8.20	3,704.78	82.11
J-80	3,529.00	Z2	8.20	3,704.70	76.02
J-81	3,554.00	Z2	8.20	3,704.75	65.22
J-82	3,528.00	Z2	8.20	3,704.69	76.45
J-84	3,616.00	Z1	534.00	3,752.52	59.07
J-155	3,577.00	Z1	2.40	3,751.30	75.41
J-167	3,561.00	Z2	8.20	3,704.77	62.20

⁸⁶
~~345.45~~ 3451.25
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28.83

68.83'

Scenario: HGL=3763(top), Base Demand
Steady State Analysis
Pipe Report

Label	Length (ft)	Dia (in)	Material	Hazen- Williams C	Check Valve?	Minor Loss Coefficient	Discharge (gpm)	Headloss Gradient (ft/1000ft)	Pipe Headloss (ft)	Start Node	Stop Node	From Elevation (ft)	To Elevation (ft)
P-6	222.00	8.0	Ductile Iron	120.0	false	0.00	16.40	0.01	0.00	J-27	J-18	3,595.50	3,592.00
P-7	437.00	8.0	Ductile Iron	120.0	false	0.00	-10.35	0.00	0.00	J-52	J-53	3,570.00	3,587.00
P-10	335.00	8.0	Ductile Iron	120.0	false	0.00	1.17	0.00	0.00	J-38	J-39	3,536.00	3,519.00
P-11	186.00	8.0	Ductile Iron	120.0	false	0.00	-8.20	0.00	0.00	J-24	J-25	3,526.00	3,524.00
P-14	606.00	12.0	Ductile Iron	120.0	false	0.00	560.00	1.00	0.61	J-68	J-59	3,618.00	3,616.00
P-15	139.00	12.0	Ductile Iron	120.0	false	0.00	8.20	0.00	0.00	J-14	J-15	3,637.50	3,644.00
P-18	308.00	8.0	Ductile Iron	120.0	false	0.00	120.81	0.42	0.13	J-16	J-35	3,601.00	3,592.00
P-21	243.00	8.0	Ductile Iron	120.0	false	0.00	56.86	0.10	0.03	J-28	J-49	3,561.00	3,552.50
P-22	391.00	8.0	Ductile Iron	120.0	false	0.00	58.67	0.11	0.04	J-45	J-48	3,586.00	3,569.00
P-23	379.00	8.0	Ductile Iron	120.0	false	0.00	-75.18	0.18	0.07	J-45	J-31	3,586.00	3,572.00
P-24	210.00	8.0	Ductile Iron	120.0	false	0.00	76.25	0.18	0.04	J-14	J-26	3,637.50	3,633.50
P-25	548.00	8.0	Ductile Iron	120.0	false	0.00	-92.65	0.26	0.14	J-14	J-61	3,637.50	3,612.00
P-29	801.00	8.0	Ductile Iron	120.0	false	0.00	-7.67	0.00	0.00	J-75	J-30	3,626.00	3,583.50
P-30	630.00	8.0	Ductile Iron	120.0	false	0.00	8.73	0.00	0.00	J-30	J-60	3,583.50	3,613.00
P-32	184.00	8.0	Ductile Iron	120.0	false	0.00	-8.20	0.00	0.00	J-22	J-23	3,563.00	3,565.00
P-33	174.00	8.0	Ductile Iron	120.0	false	0.00	-8.20	0.00	0.00	J-20	J-21	3,546.00	3,547.00
P-34	1,095.00	8.0	Ductile Iron	120.0	false	0.00	8.20	0.00	0.00	J-76	J-77	3,505.00	3,533.00
P-35	256.00	8.0	Ductile Iron	120.0	false	0.00	-73.89	0.17	0.04	J-3	J-33	3,548.00	3,553.50
P-36	165.00	8.0	Ductile Iron	120.0	false	0.00	8.20	0.00	0.00	J-18	J-19	3,592.00	3,610.00
P-37	829.00	8.0	Ductile Iron	120.0	false	0.00	58.11	0.11	0.09	J-69	J-70	3,557.50	3,555.00
P-39	114.00	8.0	Ductile Iron	120.0	false	0.00	8.20	0.00	0.00	J-12	J-13	3,544.00	3,541.00
P-44	680.00	8.0	Ductile Iron	120.0	false	0.00	-31.33	0.03	0.02	J-33	J-48	3,553.50	3,569.00
P-46	403.00	8.0	Ductile Iron	120.0	false	0.00	19.14	0.01	0.01	J-48	J-51	3,569.00	3,560.00
P-47	594.00	8.0	Ductile Iron	120.0	false	0.00	-8.20	0.00	0.00	J-66	J-67	3,562.00	3,591.00
P-51	373.00	8.0	Ductile Iron	120.0	false	0.00	13.06	0.01	0.00	J-43	J-44	3,546.00	3,529.00
P-52	381.00	8.0	Ductile Iron	120.0	false	0.00	-3.59	0.00	0.00	J-46	J-47	3,513.00	3,532.00
P-53	348.00	8.0	Ductile Iron	120.0	false	0.00	3.44	0.00	0.00	J-40	J-41	3,509.00	3,526.00
P-55	515.00	8.0	Ductile Iron	120.0	false	0.00	110.69	0.36	0.19	J-16	J-56	3,601.00	3,571.00
P-58	542.00	8.0	Ductile Iron	120.0	false	0.00	119.22	0.41	0.22	J-57	J-58	3,615.00	3,593.00
P-119	166.00	8.0	Ductile Iron	120.0	false	0.00	-43.15	0.06	0.01	J-54	J-62	3,587.00	3,576.00
P-121	229.00	8.0	Ductile Iron	120.0	false	0.00	39.71	0.05	0.01	J-35	J-78	3,592.00	3,590.50
P-122	223.00	8.0	Ductile Iron	120.0	false	0.00	-8.31	0.00	0.00	J-78	J-45	3,590.50	3,586.00
P-125	308.00	8.0	Ductile Iron	120.0	false	0.00	119.07	0.41	0.13	J-34	J-58	3,600.00	3,593.00
P-126	64.00	8.0	Ductile Iron	120.0	false	0.00	230.10	1.40	0.09	J-58	J-42	3,593.00	3,590.00
P-129	239.00	8.0	Ductile Iron	120.0	false	0.00	37.38	0.05	0.01	J-62	J-65	3,576.00	3,568.00
P-133	447.00	8.0	Ductile Iron	120.0	false	0.00	2.15	0.00	0.00	J-52	J-74	3,570.00	3,551.00
P-136	264.00	8.0	Ductile Iron	120.0	false	0.00	127.27	0.47	0.12	J-17	J-34	3,606.00	3,600.00
P-137	504.00	8.0	Ductile Iron	120.0	false	0.00	-40.29	0.06	0.03	J-72	J-79	3,523.00	3,515.00
P-138	625.00	8.0	Ductile Iron	120.0	false	0.00	-3.28	0.00	0.00	J-79	J-3	3,515.00	3,548.00
P-142	81.00	8.0	Ductile Iron	120.0	false	0.00	8.20	0.00	0.00	J-26	J-73	3,633.50	3,636.00
P-143	221.00	8.0	Ductile Iron	120.0	false	0.00	48.97	0.08	0.02	J-49	J-12	3,552.50	3,544.00
P-145	217.00	8.0	Ductile Iron	120.0	false	0.00	35.19	0.04	0.01	J-38	J-47	3,536.00	3,532.00
P-146	331.00	8.0	Ductile Iron	120.0	false	0.00	23.40	0.02	0.01	J-47	J-41	3,532.00	3,526.00
P-147	232.00	8.0	Ductile Iron	120.0	false	0.00	34.95	0.04	0.01	J-54	J-67	3,587.00	3,591.00
P-148	242.00	8.0	Ductile Iron	120.0	false	0.00	18.55	0.01	0.00	J-67	J-53	3,591.00	3,587.00
P-149	220.00	8.0	Ductile Iron	120.0	false	0.00	-88.73	0.24	0.05	J-62	J-56	3,576.00	3,571.00
P-150	343.00	8.0	Ductile Iron	120.0	false	0.00	13.76	0.01	0.00	J-56	J-63	3,571.00	3,574.00
P-153	347.00	8.0	Ductile Iron	120.0	false	0.00	72.89	0.17	0.06	J-35	J-63	3,592.00	3,574.00
P-154	301.00	8.0	Ductile Iron	120.0	false	0.00	78.46	0.19	0.06	J-63	J-28	3,574.00	3,561.00
P-155	277.00	8.0	Ductile Iron	120.0	false	0.00	18.64	0.01	0.00	J-41	J-80	3,526.00	3,529.00
P-158	291.00	8.0	Ductile Iron	120.0	false	0.00	30.41	0.03	0.01	J-39	J-46	3,519.00	3,513.00
P-159	893.00	8.0	Ductile Iron	120.0	false	0.00	39.82	0.05	0.05	J-78	J-51	3,590.50	3,560.00

Title: Mountain Gate Development

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Project Engineer: J. Binick

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Scenario: HGL=3763(top), Base Demand
Steady State Analysis
Pipe Report

Label	Length (ft)	Dia (in)	Material	Hazen- Williams C	Check Valve?	Minor Loss Coefficient	Discharge (gpm)	Headloss Gradient (ft/1000ft)	Pipe Headloss (ft)	Start Node	Stop Node	From Elevation (ft)	To Elevation (ft)
P-160	212.00	8.0	Ductile Iron	120.0	false	0.00	50.76	0.08	0.02	J-51	J-33	3,560.00	3,553.50
P-161	265.00	8.0	Ductile Iron	120.0	false	0.00	54.21	0.10	0.03	J-3	J-81	3,548.00	3,554.00
P-162	497.00	8.0	Ductile Iron	120.0	false	0.00	-19.82	0.02	0.01	J-81	J-49	3,554.00	3,552.50
P-163	181.00	8.0	Ductile Iron	120.0	false	0.00	67.57	0.14	0.03	J-17	J-57	3,606.00	3,615.00
P-164	482.00	8.0	Ductile Iron	120.0	false	0.00	-59.85	0.11	0.06	J-57	J-26	3,615.00	3,633.50
P-165	422.00	8.0	Ductile Iron	120.0	false	0.00	-8.20	0.00	0.00	J-71	J-76	3,491.00	3,505.00
P-167	2,291.00	12.0	Ductile Iron	110.0	false	0.00	1,094.00	4.08	9.34	R-1	J-68	3,763.00	3,618.00
P-168	1,048.00	12.0	Ductile Iron	110.0	false	0.00	534.00	1.08	1.13	J-68	J-84	3,618.00	3,616.00
P-169	237.00	8.0	Ductile Iron	120.0	false	0.00	24.60	0.02	0.01	J-80	J-25	3,529.00	3,524.00
P-170	426.00	8.0	Ductile Iron	120.0	false	0.00	8.20	0.00	0.00	J-25	J-82	3,524.00	3,528.00
P-171	139.00	8.0	Ductile Iron	120.0	false	0.00	65.83	0.14	0.02	J-81	J-43	3,554.00	3,546.00
P-172	206.00	8.0	Ductile Iron	120.0	false	0.00	44.57	0.07	0.01	J-43	J-38	3,546.00	3,536.00
P-173	258.00	8.0	Ductile Iron	120.0	false	0.00	25.80	0.02	0.01	J-46	J-40	3,513.00	3,509.00
P-174	486.00	8.0	Ductile Iron	120.0	false	0.00	14.16	0.01	0.00	J-40	J-80	3,509.00	3,529.00
P-175	308.00	8.0	Ductile Iron	120.0	false	0.00	32.57	0.04	0.01	J-12	J-44	3,544.00	3,529.00
P-176	232.00	8.0	Ductile Iron	120.0	false	0.00	37.43	0.05	0.01	J-44	J-39	3,529.00	3,519.00
P-177	461.00	8.0	Ductile Iron	120.0	false	0.00	7.49	0.00	0.00	J-72	J-21	3,523.00	3,547.00
P-178	339.00	8.0	Ductile Iron	120.0	false	0.00	24.60	0.02	0.01	J-23	J-27	3,565.00	3,595.50
P-180	317.00	8.0	Ductile Iron	120.0	false	0.00	111.52	0.37	0.12	J-31	J-69	3,572.00	3,557.50
P-181	903.00	8.0	Ductile Iron	120.0	false	0.00	45.22	0.07	0.06	J-69	J-79	3,557.50	3,515.00
P-182	152.00	8.0	Ductile Iron	120.0	false	0.00	-8.91	0.00	0.00	J-21	J-70	3,547.00	3,555.00
P-183	150.00	8.0	Ductile Iron	120.0	false	0.00	41.00	0.06	0.01	J-70	J-23	3,555.00	3,565.00
P-184	492.00	8.0	Ductile Iron	120.0	false	0.00	8.20	0.00	0.00	J-74	J-37	3,551.00	3,539.00
P-185	207.00	8.0	Ductile Iron	120.0	false	0.00	42.57	0.06	0.01	J-65	J-167	3,568.00	3,561.00
P-186	167.00	8.0	Ductile Iron	120.0	false	0.00	14.25	0.01	0.00	J-167	J-74	3,561.00	3,551.00
P-187	559.00	8.0	Ductile Iron	120.0	false	0.00	-20.13	0.02	0.01	J-49	J-167	3,552.50	3,561.00
P-188	284.00	8.0	Ductile Iron	120.0	false	0.00	0.53	0.00	0.00	J-60	J-75	3,613.00	3,626.00
P-189	692.00	8.0	Ductile Iron	120.0	false	0.00	8.20	0.00	0.00	J-3	J-9	3,548.00	3,520.00
P-190	189.00	8.0	Ductile Iron	120.0	false	0.00	-203.04	1.11	0.21	J-17	J-61	3,606.00	3,612.00
P-191	585.00	8.0	Ductile Iron	120.0	false	0.00	-13.40	0.01	0.00	J-65	J-28	3,568.00	3,561.00
P-193	43.00	12.0	Ductile Iron	120.0	false	0.00	239.70	0.21	0.01	PRV-	J-16	3,601.00	3,601.00
P-195	306.00	12.0	Ductile Iron	120.0	false	0.00	551.80	0.98	0.30	J-59	J-55	3,616.00	3,608.50
P-197	351.00	8.0	Ductile Iron	120.0	false	0.00	24.60	0.02	0.01	J-72	J-76	3,523.00	3,505.00
P-198	92.00	8.0	Ductile Iron	120.0	false	0.00	194.90	1.02	0.09	PRV-	J-31	3,577.00	3,572.00
P-199	209.00	12.0	Ductile Iron	120.0	false	0.00	239.70	0.21	0.04	J-55	PRV-	3,608.50	3,601.00
P-200	304.00	12.0	Ductile Iron	120.0	false	0.00	303.90	0.32	0.10	J-55	J-61	3,608.50	3,612.00
P-201	90.00	8.0	Ductile Iron	120.0	false	0.00	-24.60	0.02	0.00	J-30	J-155	3,583.50	3,577.00
P-202	76.00	8.0	Ductile Iron	120.0	false	0.00	194.90	1.02	0.08	J-155	PRV-	3,577.00	3,577.00
P-203	612.00	8.0	Ductile Iron	120.0	false	0.00	221.90	1.30	0.80	J-42	J-155	3,590.00	3,577.00

Scenario: HGL=3763(top), Base Demand
Steady State Analysis
Valve Report

Label	Elevation (ft)	Initial HGL (ft)	Initial Pressure (psi)	Control Status	Discharge (gpm)	Headloss (ft)	From HGL (ft)	To HGL (ft)	From Pressure (psi)	To Pressure (psi)
PRV-1	3,601.00	3,705.00	45.01	Throttling	239.70	47.67	3,752.70	3,705.04	65.64	45.01
PRV-2	3,577.00	3,705.00	55.40	Throttling	194.90	46.18	3,751.23	3,705.05	75.38	55.40

Scenario: HGL=3763(top), Base Demand
Steady State Analysis
Reservoir Report

Label	Elevation (ft)	Zone	Calculated Hydraulic Grade (ft)	Inflow (gpm)	Outflow (gpm)
R-1	3,763.00	Tank	3,763.00	-1,094.00	1,094.00

APPENDIX “C”

WATERCAD FIRE FLOW ANALYSIS

**- Std Analysis of Maximum Day Demand – Input/Output
Tank Full (HGL = 3748ft)**

Scenario: HGL=3748(bt),Base,FF=1000

Fire Flow Analysis

Fire Flow Report

Label	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Total Flow Needed (gpm)	Total Flow Available (gpm)	Required Residual Pressure (psi)	Calc Residual Pressure (psi)	Calc Min Zone Pressure (psi)	Min Zone Jct	Required Min System Pressure (psi)	Calc Minimum System Pressure (psi)	Min System Jct
J-3	1,000.00	1,100.00	1,008.20	1,108.20	20.00	65.07	32.83	J-75	20.00	27.08	J-15
J-9	1,000.00	1,100.00	1,008.20	1,108.20	20.00	69.51	32.83	J-75	20.00	27.08	J-15
J-12	1,000.00	1,100.00	1,008.20	1,108.20	20.00	65.91	33.17	J-75	20.00	27.12	J-15
J-13	1,000.00	1,100.00	1,008.20	1,108.20	20.00	65.95	33.17	J-75	20.00	27.12	J-15
J-14	1,000.00	1,100.00	1,008.20	1,108.20	20.00	27.29	24.48	J-15	20.00	24.48	J-15
J-15	1,000.00	1,100.00	1,008.20	1,108.20	20.00	24.26	27.29	J-14	20.00	27.29	J-14
J-16	1,000.00	1,100.00	1,008.20	1,108.20	20.00	44.92	34.27	J-75	20.00	27.24	J-15
J-17	1,000.00	1,100.00	1,008.20	1,108.20	20.00	41.90	26.20	J-15	20.00	26.20	J-15
J-18	1,000.00	1,100.00	1,008.20	1,108.20	20.00	33.75	25.97	J-19	20.00	25.97	J-19
J-19	1,000.00	1,100.00	1,008.20	1,108.20	20.00	24.14	32.42	J-75	20.00	27.04	J-15
J-20	1,000.00	1,100.00	1,008.20	1,108.20	20.00	59.79	32.43	J-75	20.00	27.04	J-15
J-21	1,000.00	1,100.00	1,008.20	1,108.20	20.00	61.29	32.43	J-75	20.00	27.04	J-15
J-22	1,000.00	1,100.00	1,008.20	1,108.20	20.00	50.62	32.32	J-19	20.00	27.04	J-15
J-23	1,000.00	1,100.00	1,008.20	1,108.20	20.00	51.79	32.32	J-19	20.00	27.04	J-15
J-24	1,000.00	1,100.00	1,008.20	1,108.20	20.00	65.36	33.13	J-75	20.00	27.12	J-15
J-25	1,000.00	1,100.00	1,008.20	1,108.20	20.00	68.28	33.13	J-75	20.00	27.12	J-15
J-26	1,000.00	1,100.00	1,008.20	1,108.20	20.00	28.85	24.98	J-15	20.00	24.98	J-15
J-27	1,000.00	1,100.00	1,008.20	1,108.20	20.00	34.73	28.46	J-19	20.00	27.04	J-15
J-28	1,000.00	1,100.00	1,008.20	1,108.20	20.00	59.75	33.31	J-75	20.00	27.13	J-15
J-30	1,000.00	1,100.00	1,008.20	1,108.20	20.00	41.03	22.64	J-75	20.00	22.64	J-75
J-31	1,000.00	1,100.00	1,008.20	1,108.20	20.00	54.91	32.01	J-75	20.00	26.99	J-15
J-33	1,000.00	1,100.00	1,008.20	1,108.20	20.00	62.62	32.77	J-75	20.00	27.07	J-15
J-34	1,000.00	1,100.00	1,008.20	1,108.20	20.00	43.12	26.16	J-15	20.00	26.16	J-15
J-35	1,000.00	1,100.00	1,008.20	1,108.20	20.00	47.40	33.31	J-75	20.00	27.13	J-15
J-37	1,000.00	1,100.00	1,008.20	1,108.20	20.00	62.34	33.33	J-75	20.00	27.14	J-15
J-38	1,000.00	1,100.00	1,008.20	1,108.20	20.00	68.61	33.12	J-75	20.00	27.11	J-15
J-39	1,000.00	1,100.00	1,008.20	1,108.20	20.00	75.91	33.12	J-75	20.00	27.11	J-15
J-40	1,000.00	1,100.00	1,008.20	1,108.20	20.00	78.48	33.12	J-75	20.00	27.11	J-15
J-41	1,000.00	1,100.00	1,008.20	1,108.20	20.00	71.06	33.12	J-75	20.00	27.11	J-15
J-42	1,000.00	1,100.00	1,008.20	1,108.20	20.00	46.24	26.13	J-15	20.00	26.13	J-15
J-43	1,000.00	1,100.00	1,008.20	1,108.20	20.00	65.11	33.11	J-75	20.00	27.11	J-15
J-44	1,000.00	1,100.00	1,008.20	1,108.20	20.00	72.20	33.14	J-75	20.00	27.12	J-15
J-45	1,000.00	1,100.00	1,008.20	1,108.20	20.00	49.03	32.65	J-75	20.00	27.06	J-15
J-46	1,000.00	1,100.00	1,008.20	1,108.20	20.00	77.63	33.12	J-75	20.00	27.11	J-15
J-47	1,000.00	1,100.00	1,008.20	1,108.20	20.00	69.49	33.12	J-75	20.00	27.11	J-15
J-48	1,000.00	1,100.00	1,008.20	1,108.20	20.00	55.80	32.73	J-75	20.00	27.07	J-15
J-49	1,000.00	1,100.00	1,008.20	1,108.20	20.00	63.24	33.21	J-75	20.00	27.13	J-15
J-51	1,000.00	1,100.00	1,008.20	1,108.20	20.00	59.71	32.77	J-75	20.00	27.07	J-15
J-52	1,000.00	1,100.00	1,008.20	1,108.20	20.00	53.26	33.35	J-75	20.00	27.14	J-15
J-53	1,000.00	1,100.00	1,008.20	1,108.20	20.00	45.92	33.35	J-75	20.00	27.14	J-15
J-54	1,000.00	1,100.00	1,008.20	1,108.20	20.00	47.28	33.37	J-75	20.00	27.14	J-15
J-55	1,000.00	1,100.00	1,008.20	1,108.20	20.00	42.73	27.27	J-15	20.00	27.27	J-15
J-56	1,000.00	1,100.00	1,008.20	1,108.20	20.00	56.00	33.48	J-75	20.00	27.15	J-15
J-57	1,000.00	1,100.00	1,008.20	1,108.20	20.00	37.59	25.97	J-15	20.00	25.97	J-15
J-58	1,000.00	1,100.00	1,008.20	1,108.20	20.00	45.69	26.13	J-15	20.00	26.13	J-15
J-59	1,000.00	1,100.00	1,008.20	1,108.20	20.00	40.47	28.12	J-15	20.00	28.12	J-15
J-60	1,000.00	1,100.00	1,008.20	1,108.20	20.00	25.75	20.77	J-75	20.00	20.77	J-75
J-61	1,000.00	1,100.00	1,008.20	1,108.20	20.00	40.55	26.66	J-15	20.00	26.66	J-15
J-62	1,000.00	1,100.00	1,008.20	1,108.20	20.00	53.09	33.38	J-75	20.00	27.14	J-15
J-63	1,000.00	1,100.00	1,008.20	1,108.20	20.00	54.63	33.37	J-75	20.00	27.14	J-15

Scenario: HGL=3748(bt),Base,FF=1000

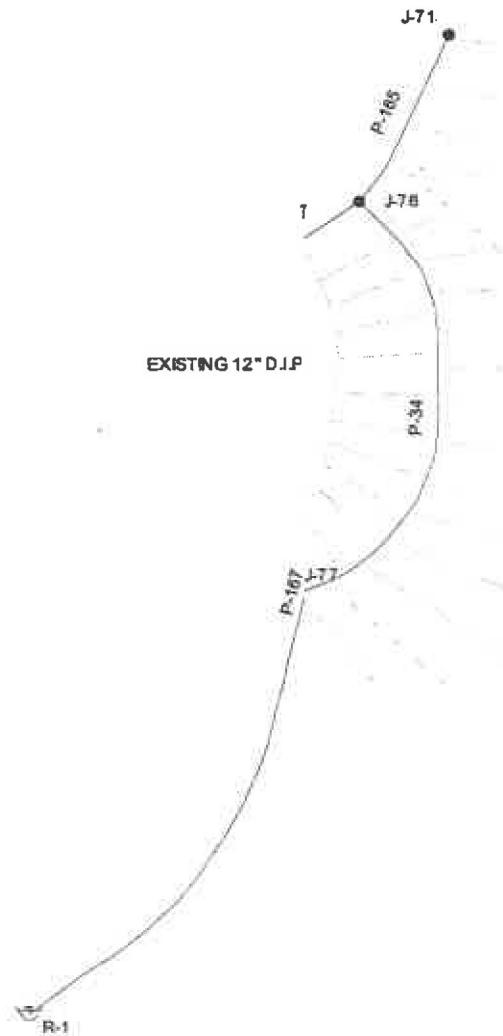
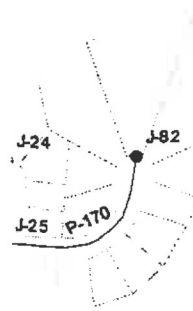
Fire Flow Analysis

Fire Flow Report

Label	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Total Flow Needed (gpm)	Total Flow Available (gpm)	Required Residual Pressure (psi)	Calc Residual Pressure (psi)	Calc Min Zone Pressure (psi)	Min Zone Jct	Required Min System Pressure (psi)	Calc Minimum System Pressure (psi)	Min System Jct
J-65	1,000.00	1,100.00	1,008.20	1,108.20	20.00	56.41	33.34	J-75	20.00	27.14	J-15
J-66	1,000.00	1,100.00	1,008.20	1,108.20	20.00	50.62	33.36	J-75	20.00	27.14	J-15
J-67	1,000.00	1,100.00	1,008.20	1,108.20	20.00	44.66	33.36	J-75	20.00	27.14	J-15
J-68	1,000.00	1,100.00	1,000.00	1,100.00	20.00	41.58	29.83	J-15	20.00	29.83	J-15
J-69	1,000.00	1,100.00	1,008.20	1,108.20	20.00	59.82	32.34	J-75	20.00	27.03	J-15
J-70	1,000.00	1,100.00	1,008.20	1,108.20	20.00	57.87	32.42	J-75	20.00	27.04	J-15
J-71	1,000.00	1,100.00	1,008.20	1,108.20	20.00	77.38	32.46	J-75	20.00	27.04	J-15
J-72	1,000.00	1,100.00	1,008.20	1,108.20	20.00	72.22	32.46	J-75	20.00	27.04	J-15
J-73	1,000.00	1,100.00	1,008.20	1,108.20	20.00	26.87	24.98	J-15	20.00	24.98	J-15
J-74	1,000.00	1,100.00	1,008.20	1,108.20	20.00	62.61	33.33	J-75	20.00	27.14	J-15
J-75	1,000.00	1,099.80	1,008.20	1,108.00	20.00	20.00	26.43	J-60	20.00	26.13	J-15
J-76	1,000.00	1,100.00	1,008.20	1,108.20	20.00	76.00	32.46	J-75	20.00	27.04	J-15
J-77	1,000.00	1,100.00	1,008.20	1,108.20	20.00	51.75	32.46	J-75	20.00	27.04	J-15
J-78	1,000.00	1,100.00	1,008.20	1,108.20	20.00	47.33	32.87	J-75	20.00	27.09	J-15
J-79	1,000.00	1,100.00	1,008.20	1,108.20	20.00	77.78	32.54	J-75	20.00	27.05	J-15
J-80	1,000.00	1,100.00	1,008.20	1,108.20	20.00	68.82	33.12	J-75	20.00	27.11	J-15
J-81	1,000.00	1,100.00	1,008.20	1,108.20	20.00	62.26	33.07	J-75	20.00	27.11	J-15
J-82	1,000.00	1,100.00	1,008.20	1,108.20	20.00	61.83	33.13	J-75	20.00	27.12	J-15
J-84	1,000.00	1,100.00	1,534.00	1,634.00	20.00	38.55	29.83	J-15	20.00	29.83	J-15
J-155	1,000.00	1,100.00	1,002.40	1,102.40	20.00	44.87	44.87	J-155	20.00	23.67	J-75
J-167	1,000.00	1,100.00	1,008.20	1,108.20	20.00	59.16	33.32	J-75	20.00	27.14	J-15

EXHIBIT A

Water Distribution System Schematic Map

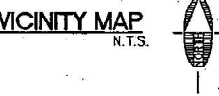
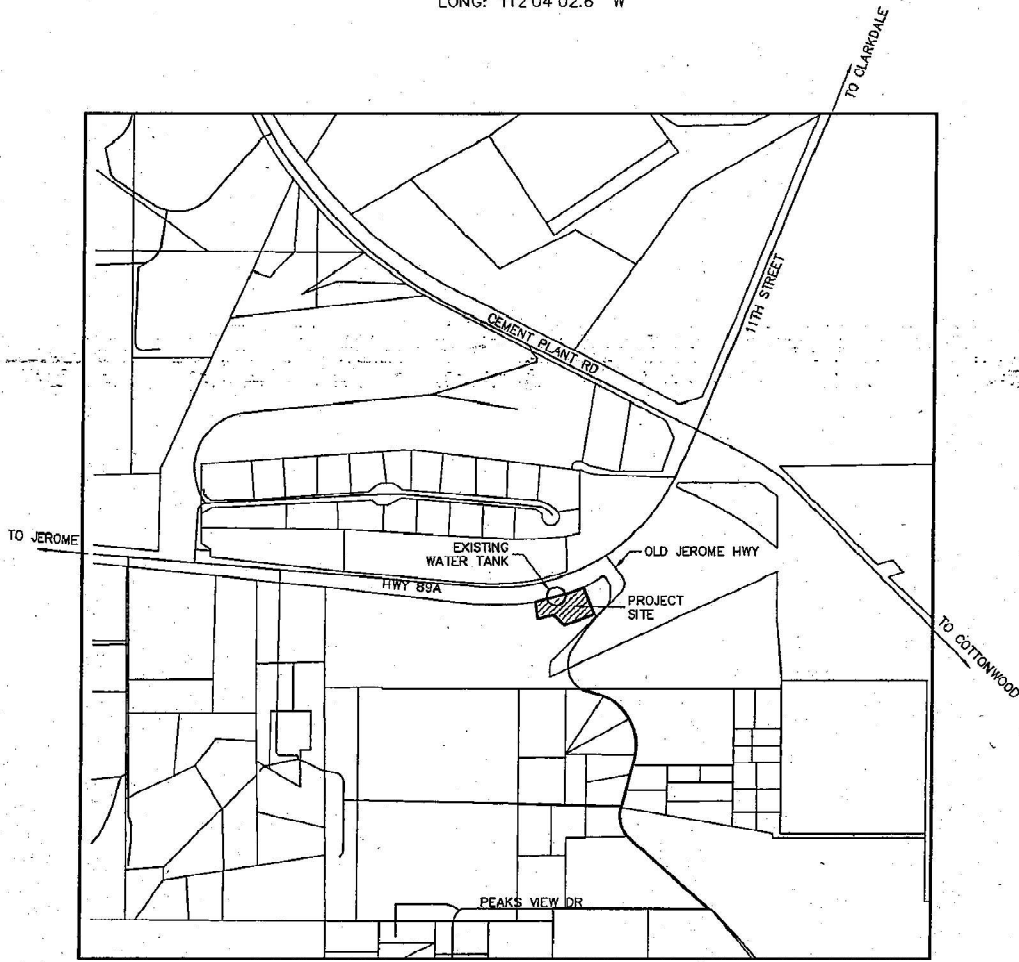


CONSTRUCTION PLANS FOR
ARSENIC REMOVAL SYSTEM
FOR THE TOWN OF CLARKDALE WATER SYSTEM
FOR MOUNTAIN GATE SUBDIVISION

PORTION OF SECTION 30,
TOWNSHIP 16 NORTH, RANGE 3 EAST
GILA AND SALT RIVER BASE AND MERIDIAN,
YAVAPAI COUNTY, ARIZONA

LAT: 34°45'32.6" N
LONG: 112°04'02.6" W

OWNER/DEVELOPER
EMPIRE DEVELOPMENT
1016 W UNIVERSITY AVE, SUITE 202
FLAGSTAFF, AZ 86001
(928) 214-9683



SHEET INDEX	
SHEET NO.	DESCRIPTION
1	ARSENIC REMOVAL SYSTEM COVER SHEET
2	ARSENIC REMOVAL SYSTEM NOTES SHEET
3	ARSENIC REMOVAL SYSTEM SITE PLAN SHEET
4	ARSENIC REMOVAL SYSTEM BUILDING PLAN SHEET
5	ARSENIC REMOVAL SYSTEM DETAILS SHEET

PLOTTED: Mar 06, 2007-11:43am

FILE: P:\2004\04461\DWG\22707-ARSENIC PLANT\DWG\04461-1 COVER SHEET.DWG Taylor 06

CALL TWO WORKING DAYS
BEFORE YOU DIG
1-800-STAKE-IT

PRELIMINARY
NOT FOR CONSTRUCTION,
BIDDING OR RECORDING

NO.	DESCRIPTION	DATE	BY
1	SWI REVIEW, CLIENT MOD.	2/28/07	DP,TA
2	CLIENT MOD.	2/28/07	TA
3	OFFICE QC, STRUCTURAL	3/02/07	TA

SWI
Shephard & Wesnitzer, Inc.

75 Kallaf Place
Sedona, AZ 86336
928.282.1051
928.282.2058 fax
www.swiaz.com

JOB NO:	04461
DATE:	JAN 2006
SCALE:	AS SHOWN
DRAWN:	DJP
DESIGN:	DJM/DJP
CHECKED:	DJM

MOUNTAIN GATE SUBDIVISION	CLARKDALE, ARIZONA	DRAWING NO.
ARSENIC REMOVAL SYSTEM COVER SHEET		C01
SHT NO. 1	OF 5	Pages 58 of 477

03-05-07

FILE: P:\2004\04-46\NWA\22707-ARSENIC PLANT\DWG\04461 2 NOTES SHEET 2.dwg Taylor 08

CONSTRUCTION NOTES

PROJECT DESCRIPTION:

The project consists of the construction of an Arsenic Removal system. The developer of North Gate has already constructed a new well and water storage tank. The Arsenic Removal System will be constructed on the storage tank site.

GENERAL CONDITIONS (100):

The work shall be done in accordance with the following specifications and these plans. In the event of a conflict between the specifications and the plans, the plans will take precedence. In the absence of conflict between the specifications and the plans, the plans supplement and add to the specifications.

Maricopa Association of Governments, "Uniform Standard Specifications for Public Works Construction", 2006 edition (MAG Specifications);

Maricopa Association of Governments, "Uniform Standard Details for Public Works Construction", 2006 edition (MAG Details);

City of Clarkdale:
Town Code, Chapter 12 Subdivision and Chapter 15 Work in Right of Way,
Zoning Code.

Arizona Department of Environmental Quality Regulations:
AAC 18-4 "Safe Drinking Water",
ACC 18-5, Art. 5 "Minimum Design Criteria" (Water System),

Arizona Department of Environmental Quality Engineering Bulletins:
8 "Disinfection of Water Systems",
10 "Guidelines for the Construction of Water Systems",

American Water Works Association (AWWA), "Standards", Sections C and D, most recent edition.

Clarkdale Building Codes:
"International Building Code" (IBC) 2003,
"International Residential Code" (IRC) 2003,
"International Plumbing Code" (IPC) 2003,
"International Mechanical Code" (IMC) 2003,
"National Electric Code" (NEC), 2003;
as adopted and amended by the Town of Clarkdale.

An Arsenic Removal System has been designed by Kinetico. It is documented in the following documents:

Full Proposal 07140-A Prepared for Empire Companies - Mountain Gate Well, dated 7/14/06.
Equipment Submittal for Empire Companies - Mountain Gate Well, Macrolite? FM 360 Arsenic Removal System, undated but received by SWI in January, 2007.

The equipment shall be installed and started up in accordance with the manufacturers' recommendations. (The responsible parties for construction, installation, or startup are not defined in these plans. Refer to the applicable effective contract documents.)

At the time these plans were prepared, Kinetico had not provided a draft installation manual or draft Operation and Maintenance Manual. When those documents are provided some modification of these plans and the Contract Documents may be required.

It shall be the Contractor's responsibility to obtain copies of the above Standards, Specifications and Details, as well as all other standards and specifications which may be necessary to completely and accurately interpret these Plans.

All quantities shown are approximate and are furnished solely for the Contractor's convenience. They do not necessarily correspond to Bid Schedule items. Payment will be based on Bid Schedule items. The Contractor shall not be relieved of responsibility for independently estimating work quantities prior to bidding.

Underground utility locations, as shown on these plans, were determined from field measurements, construction plans, record plans, or utility maps furnished by others. Locations of underground utilities are to be regarded as approximate only. It is the Contractor's responsibility to establish in the field the actual locations of ??????????all underground lines which may in any way affect the work.

Compensation for utility relocations and adjustments shall not include any costs for repair to the utility damaged by the Contractor or his Subcontractor(s). The Contractor is not relieved of the responsibility for determining the location of all utilities affecting the work.

The Contractor shall not be relieved of responsibility for making complete and accurate on-site determinations of the locations of all utilities, structures and field conditions, which may affect the progress of the work.

Where plans call for connecting new structures to existing underground pipes or structures, it shall be the Contractor's responsibility to determine, at the time of construction, exact sizes, types and locations of existing underground improvements and to furnish materials as needed to make the required connections.

All Improvements shall be constructed by contractors licensed by the Arizona State Registrar of Contractors, with a class of license(s) for the specific work being performed.

GENERAL SCOPE OF WORK (104):

Measures to minimize blowing dust shall be employed throughout the contract. These include, but are not limited to, watering, sweeping, use of dust palliatives, adjustment of work generating dust, and placement of surfacing material such as aggregate base. These methods shall be effectively employed at all times. Excessive watering that produces mud will not be considered dust control.

GENERAL CONTROL OF WORK (105):

The City Manager or his authorized representative may suspend the work by written notice when, in his judgment, progress is unsatisfactory, work being done is unauthorized or defective, weather conditions are unsuitable, or there is danger to the public health or safety.

Shop drawings and product data submittals shall be provided by the contractor per MAG Section 105.2. Specifically the following shall be submitted:
1. Arsenic Removal Building and associated components.

Utilities must be located to minimize interference with one another, to provide required horizontal and vertical separations, and to provide maintenance access without violating easement boundaries. Utility work done in public right-of-way and easements must be done by a contractor licensed to do public utility construction.

A utility coordination meeting shall be coordinated by the Contractor prior to the start of any work. All utility issues shall be addressed in accordance with MAG Section 105.6.

The appropriate utility companies shall be notified by the Contractor prior to any construction. "Blue Stake" number is 1-800-STAKE-IT. Contractor shall allow two working days after "Blue Stake Center" is notified, before commencing any excavation work in proximity of buried utilities.

Shepherd - Wesnitzer, Inc. will provide construction staking services for this project as per an existing separate contract with Empire Companies.

Approval of a portion of the work in progress does not guarantee its final acceptance. Testing and evaluation may continue until written final acceptance of a complete workable unit. Acceptance of completed improvements will not be given until defective or unauthorized work is removed, and final clean-up is complete.

The Contractor is responsible for the successful startup and operation of the system, including initial operating adjustments to optimize the entire system. The Contractor will furnish information to the Engineer for use in preparing an Operation and Maintenance manual for the system. The information will include, at a minimum, the manufacturer's literature on operation maintenance and the initial operating settings of the equipment.

The notice from the contractor of presumptive completion of the project shall conform to MAG Specifications Section 105.15. That notice shall include a statement that the project was completed in accordance with the contract documents with all exceptions listed. It shall also include an "as-built" plan indicating the actual location of all utilities, including water mains, sewer mains, underground drainage structures, all sewer and water services, all fittings, valves and manholes.

GENERAL CONTROL OF MATERIALS (106):

The contractor may submit carefully documented and considered written proposals for alternate materials and construction methods per MAG 106.4. Those proposals that are found to be in conformity with good engineering design and can be easily maintained may be given written approval for incorporation in the construction plans. If they are found to be in the public interest.

GENERAL, LEAGAL REGULATIONS AND RESPONSIBILITY TO PUBLIC (107):

This project is part of a larger grading project that must comply with the provisions of AZPDES, Stormwater Permit. A Stormwater Pollution Prevention Plan (SWPPP) has been prepared for the overall development project. Work associated with this project shall conform to that SWPPP and be coordinated with the site operator (contractor) responsible to complete the SWPPP as directed in the SWPPP, file the Notice of Intent, implement the requirements of SWPPP, and file the Notice of Termination. The contractor shall minimize pollutants in storm water discharges using the Best Management Practices (BMP's) described in these plans and the SWPPP.

The Applicant, Developer, will obtain Construction Authorization from ADEQ. (ADEQ requires permits to be issued prior to new construction, extension to, or modification of a water distribution system, water treatment, sewage collection system or sewage treatment system.)

Contractor shall obtain all other required permits.

Engineer shall provide Engineer's Certificate of Completion as required by ADEQ for all water and sewer system construction. Related inspection and testing shall be provided at the contractor's expense.

The Contractor shall be responsible for maintenance of the streets and of partially completed portions of the work until final acceptance of the work. Contractor shall be responsible for maintaining the quality of existing streets leading to the project site. Existing streets found to be damaged by construction traffic shall be repaired to the satisfaction of the City Engineer by the Contractor at no additional cost.

GENERAL, COMMENCEMENT, PROSECUTION AND PROGRESS (108):

The Engineer shall be notified 24 hours prior to beginning different phases of construction so that inspections may be scheduled.

A construction schedule shall be prepared as per MAG Specifications Section 108.4.

Any defects which appear in the work within the 1 year warranty period from the date of acceptance, and which are due to improper workmanship or inferior materials supplied, shall be corrected by or at the expense of the contractor.

EARTHWORK (200):

No analysis of earthwork was completed for this project. Construction shall conform to the grades shown. Excess materials will be incorporated into the site grading.

Rough grading must be completed prior to installation of underground utilities.

Earthwork construction shall conform to the recommendations in the Geotechnical Report which will be provided by the developer. The report was not available at the time these plans were prepared.

STREETS AND RELATED WORK (300):

No specific notes.

RIGHT-OF-WAY AND TRAFFIC CONTROL (400):

No specific notes.

STRUCTURES (500):

The foundations (equipment pad, building floor slab and building footing) were designed using standard values without a geotechnical report. A geotechnical report is being completed at this time. That report shall be reviewed and the foundation design approved by a structural engineer and the geotechnical engineer. Foundation construction shall conform to the recommendations of the geotechnical report, geotechnical engineer's review and structural engineer's review.

A masonry building is shown in the plans. A metal building is acceptable. The contractor shall prepare a submittal to the owner of a building with the interior size shown and the accessories called for here or elsewhere in the plans. The following components shall be provided:

- Building insulation, heating and ventilation shall be adequate to automatically maintain interior temperatures above 50° F during expected winter temperatures and below 20° F above expected summer temperatures.
- Electrical system shall include service to the equipment called for in these plans. Two separate 20 amp circuits shall be provided to convenience outlets located on each wall of the system.
- Fluorescent lighting shall be provided adequate to light all portions of the building. No fixtures shall be placed directly above the FM360 unit or the backwash pump unit.
- The interior ceiling height shall be 16 feet. That is 5 feet above the filter unit hatch and 3 feet above any portion of the Arsenic Removal equipment.
- Alternately the interior ceiling height may be 13.5 feet with a 4' x 4' removable skylight directly above each of the filter units. That is 2.5 feet above the filter unit hatch and 1 foot above any portion of the Arsenic Removal equipment.

The excavation method employed shall be the Contractor's option. Material shall not be stockpiled to a depth of more than 5 feet above finished grade within 25 feet of any excavation or structure. Excavation shall extend a sufficient distance from walls and footings to allow placing and removal of forms, installation of services and inspection by the Engineer. Fill and backfill, to within 24" of finished grade shown on the drawings and around the periphery of the structure, shall be native material, free from broken concrete, vegetation, or other debris with sufficient fines to fill all voids and to insure a uniformly compacted mass of the required density and having a maximum size of 3 inches with 0 to 20% minus #200. All fill and backfill shall be placed in layers of not more than 8" loose and compacted to 95% of maximum density, determined by AASHTO Test Method T-99, prior to placement of the next layer.

WATER AND SEWER (600):

Water mains shall be PVC pressure pipe (AWWA C900) as specified under "Materials". Where plans call for DIP the water line shall be Ductile Iron Pipe conforming to MAG Specifications Section 750.

Water lines less than 4 inches shall be PVC Schedule Pipe (ASTM D 1785) as specified under "Materials".

Water line, underground, testing (pressure & leakage) shall conform to the requirements of MAG Specifications Section 610.15, Testing. Water line disinfection and bacteriological testing shall conform to the requirements of MAG Specifications, Section 611, Disinfecting Water Mains.

Water and Sewer crossing shall be constructed as per MAG Detail 404 and ADEQ R18-5-502.C.

MATERIALS (700):

Ductile iron pipe and fittings shall be bituminous coated on the exterior per MAG Specifications Section 750 and encased in a polyethylene protective wrap for protection against corrosive soils as per MAG 610.6.

PVC pressure pipe (AWWA C900) is intended for use in supply lines and distribution systems carrying potable water under pressure. It shall meet the requirements of AWWA C900 "Polyvinyl Chloride (PVC) Pressure Pipe". Class 150 pipe shall conform to the requirements of DR 15 with the outside diameter (OD) dimensions of cast iron pipe (CI). All pipe shall also meet the requirements of the National Sanitation Foundation Standard No. 14 and 61. The pipe shall carry the appropriate marking. Fittings shall be gray or ductile iron with mechanical joint ends conforming to AWWA C110 and C111.

QUANTITIES			
KEY	ITEM	UNITS	AMOUNT
305, 405	6" TAPPING SLEEVE	EA	3
307	45° BEND	EA	1
308, 408	22.5° BEND	EA	1
330	6" PVC WATER LINE	LF	141
340	FLARED END SECTION	EA	2
341	D50-6" RUBRAP	CY	6
342	12" DIA. CMP	LF	57.5
406	90° BEND	EA	3
430	6" DIP SEWER LINE	LF	20
435	8" DIP WATER LINE	LF	33
450	KINETICO FILTER	L.S.	1
451	KINETICO BACKWASH PUMP	L.S.	1
452	FERRIC CHLORIDE CHEMICAL FEED	L.S.	1
453	HYDROCHLORIC ACID CHEMICAL FEED	L.S.	1
454	AIR COMPRESSOR	L.S.	1
460	RELOCATE CHLORINATION SYSTEM	L.S.	1
470	DESIGN A BUILDING AS SHOWN	L.S.	1
471	5,500 GAL BACKWASH TANK	L.S.	1
472	6" DIA. SAFETY POST	EA	8
473	CONCRETE EQUIPMENT PAD	EA	1
474	CONCRETE FLOOR	EA	1
475	BUILDING FOOTING AND STEM/RETAINING WALL	EA	1
480	4" COLOR DRAIN SYSTEM	L.S.	1
481	8" DIP INLET WATER LINE TO TREATMENT SYSTEM	L.S.	1
482	8" DIP OUTLET WATER LINE TO TREATMENT SYSTEM	L.S.	1
483	6" DIP BACKWASH INLET WATER LINE	L.S.	1
484	4" PVC WATER LINE	L.S.	1
485	6" DIP INLET DISCHARGE WATER LINE	L.S.	1

GENERAL STRUCTURAL NOTES

BUILDING CODE:

1997 EDITION OF THE UNIFORM BUILDING CODE, WITH COCONINO COUNTY AMENDMENTS.

LOADS:

ROOF SNOW LOAD = 40 PSF.
ROOF DEAD LOAD = 20 PSF (FUTURE BUILDING).

FOUNDATIONS:

SOILS REPORT BY WESTERN TECHNOLOGIES, INC., JOB NO. 2524JW451 SPREAD FOOTINGS SHALL BEAR ON FIRM, UNDISTURBED SOIL (CONTROLLED COMPACTED FILL) 2'-8" MINIMUM BELOW FINISHED GRADE. FINISHED GRADE IS DEFINED AS TOP OF SLAB FOR INTERIOR FOOTINGS AND LOWEST ADJACENT GRADE WITHIN 5 FEET FOR PERIMETER FOOTINGS. DESIGN SOIL BEARING VALUE = 2500 PSF. FOUNDATION EXCAVATIONS SHALL BE INSPECTED BY SOILS ENGINEER PRIOR TO PLACEMENT OF CONCRETE.

CONCRETE:

MINIMUM 28 DAY STRENGTH 3,000 PSI EXCEPT AS FOLLOWS:

SLABS ON GRADE----- 3,000 PSI
FOUNDATIONS----- 2,500 PSI

MECHANICALLY VIBRATE ALL CONCRETE WHEN PLACED, EXCEPT SLABS ON GRADE NEED TO BE VIBRATED ONLY AROUND UNDER-FLOOR DUCTS, ETC. MAXIMUM SLUMP 4 1/2" FOR CONCRETE WITHOUT PLASTICIZER. IF PLASTICIZER IS USED, A HIGHER FINAL SLUMP MAY BE ALLOWED UPON STRUCTURAL ENGINEER'S APPROVAL, UNLESS APPROVED OTHERWISE IN WRITING BY THE ARCHITECT. ALL CONCRETE SLABS ON GRADE SHALL BE BOUND BY CONTROL JOINTS (KEYED OR SAW CUT) SUCH THAT THE ENCLOSED AREA DOES NOT EXCEED 400 SQUARE FEET. KEVED CONTROL JOINTS NEED ONLY OCCUR AT EXPOSED EDGES DURING POURING. ALL OTHER JOINTS MAY BE SAW CUT.

NO FLY ASH ADDITIVES SHALL BE USED IN FLATWORK OR ARCHITECTURALLY EXPOSED CONCRETE.

FLY ASH SHALL BE LIMITED TO 18 PERCENT CEMENTITIOUS MATERIALS AND SHALL HAVE A REPLACEMENT FACTOR OF 1.2 RELATIVE TO CEMENT REPLACED.

MASONRY:

HOLLOW CONCRETE MASONRY UNITS SHALL CONFORM TO ASTM C90, GRADE N, TYPE 1, F'm = 1,500 PSI, RUNNING BOND, MORTAR TYPE S, 1,800 PSI, GROUT 2,000 PSI. MECHANICALLY VIBRATE GROUT IN VERTICAL SPACES IMMEDIATELY AFTER POURING AND AGAIN ABOUT 5 MINUTES LATER. PROVIDE CLEANOUTS IF GROUT LIFT EXCEEDS 4'-0" IN BLOCK WALLS. MAXIMUM GROUT LIFT SHALL BE 8'-0". UNLESS NOTED OTHERWISE ON THE PLANS, PLACE CONTROL JOINTS IN MASONRY WALLS SUCH THAT NO STRAIGHT WALL EXCEEDS 24'-0" IN LENGTH. CONTROL JOINTS SHALL NOT OCCUR AT WALL CORNERS, INTERSECTIONS, ENDS, WITHIN 24" OF CONCENTRATED POINTS OF BEARING OR JAMBS, OR OVER OPENINGS UNLESS SPECIFICALLY SHOWN ON THE STRUCTURAL DRAWINGS. ALL MASONRY BELOW FINISHED FLOOR OR GRADE SHALL BE GROUTED SOLID.

VERTICAL REINFORCING:

1/4" IN CENTER OF GROUT AT CENTER OF WALL, CONTINUOUS FULL HEIGHT OF WALL AT ALL CORNERS, INTERSECTIONS, WALL ENDS, BEAM BEARINGS, JAMBS, EACH SIDE OF CONTROL JOINTS AND AT INTERVALS NOT TO EXCEED 48" O.C., UNLESS NOTED OTHERWISE. TIE AT 8'-0" VERTICALLY, WITH SINGLE WIRE LOOP TIE BY A.A. WIRE PRODUCTS COMPANY. LAP SPICES SHALL BE 40 BAR DIAMETERS FOR GRADE 40 BARS AND 48 BAR DIAMETERS FOR GRADE 60 BARS. LAP SPICES SHALL BE 1.3 X LAP LENGTH WHEN ADJACENT SPICES ARE SEPARATED BY 3" OR MORE. DOWEL ALL VERTICAL REINFORCING TO FOUNDATION WITH DOWELS TO MATCH VERTICAL REINFORCING.

HORIZONTAL REINFORCING:

2/4" IN MINIMUM 8" DEEP GROUTED CONTINUOUS BOND BEAM AT ROOF. PLACE THESE BARS CONTINUOUS THRU CONTROL JOINTS PER TYPICAL DETAIL. PROVIDE BENT BARS PER TYPICAL DETAILS, TO MATCH HORIZONTAL BOND BEAM BEARINGS, WALL CORNERS AND WALL INTERSECTIONS TO MAINTAIN BEAM BEAM CONTINUITY. LAP SPICES SHALL BE 40 BAR DIAMETERS FOR GRADE 40 BARS AND 48 BAR DIAMETERS FOR GRADE 60 BARS. STAGGER SPICES A MINIMUM OF 40 BAR DIAMETERS. DO NOT SPICE WITHIN 6'-0" OF CONTROL JOINTS.

REINFORCING:

ASTM A615 (Fy = 60 KSI) DEFORMED BARS FOR ALL BARS #5 AND LARGER (AND FOR ALL CONCRETE WALLS, BEAMS, SLABS AND COLUMN REINFORCING). ALL GRADE 60 REINFORCING TO BE WELDED SHALL BE ASTM A706. ASTM A615 (Fy = 40 KSI) DEFORMED BARS FOR ALL BARS #5 AND SMALLER. WELDED WIRE FABRIC PER ASTM A185, WIRE PER ASTM A82. NO TACK WELDING OF REINFORCING BARS ALLOWED WITHOUT PRIOR REVIEW OF PROCEDURE WITH THE STRUCTURAL ENGINEER. LATEST ACI CODE AND DETAILING MANUAL APPLY. CLEAR CONCRETE COVERAGES AS FOLLOWS:

CAST AGAINST AND PERMANENTLY EXPOSED TO EARTH ----- 3"
EXPOSED TO EARTH OR WEATHER ----- 2"

#6 OR LARGER ----- 2"

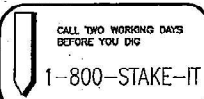
#5 AND SMALLER ----- 1 1/2"

ALL OTHER PER LATEST EDITION OF ACI 318.

LAP SPICES IN CONCRETE:

LAP SPICES, UNLESS NOTED OTHERWISE, SHALL BE CLASS "B" TENSION LAP SPICES PER LATEST EDITION OF ACI 318. STAGGER SPICES A MINIMUM OF ONE LAP LENGTH. LAPS IN WELDED WIRE FABRIC SHALL BE MADE SO THAT THE OVERLAP, MEASURED BETWEEN OUTERMOST CROSS WIRES OF EACH FABRIC SHEET, IS NOT LESS THAN THE SPACING OF CROSS WIRES PLUS 2 INCHES. ALL WELDED WIRE FABRIC SHALL BE CHAIRED TO ENSURE PROPER CLEARANCES.

ALL SPICE LOCATIONS SUBJECT TO APPROVAL BY THE STRUCTURAL ENGINEER. PROVIDE BENT CORNER BARS TO MATCH AND LAP WITH HORIZONTAL BARS AT ALL CORNERS AND INTERSECTIONS PER TYPICAL DETAILS. REINFORCING BAR SPACING GIVEN ARE MAXIMUM ON CENTERS. ALL BARS PER CRS SPECIFICATIONS AND HANDBOOK. DOWEL ALL VERTICAL REINFORCING TO FOUNDATION WITH STANDARD 90 DEGREE HOOKS UNLESS NOTED OTHERWISE. SECURELY TIE ALL BARS IN CORRECT LOCATION BEFORE PLACING CONCRETE.



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Shepherd Wesnitzer, Inc.

75 Kallio Place
Sedona, AZ 86336
928.282.2058 fax
www.swiaz.com

JOB NO:	04461
DATE:	JAN 2006
SCALE:	AS SHOWN
DRAWN:	DJP
DESIGN:	DMM/DJP
CHECKED:	DMM

MOUNTAIN GATE SUBDIVISION

ARSENIC REMOVAL SYSTEM
NOTES

CLARKDALE
ARIZONA

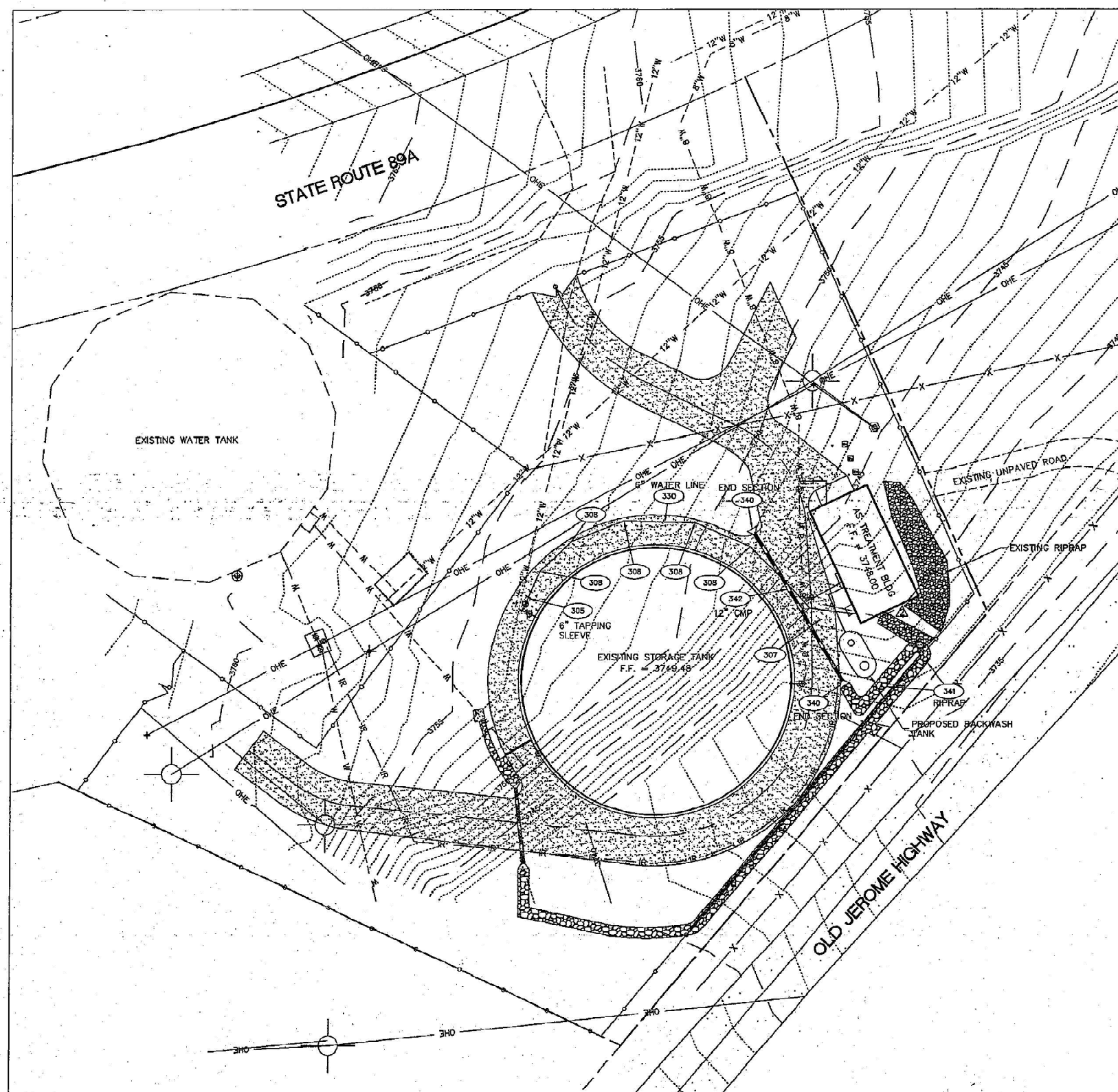
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N01

SHT NO. OF

2

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Government	Percentage
Current government	10
Previous government	20

NOTE: THIS PLAT DOES NOT REPRESENT
THE RESULTS OF A BOUNDARY SURVEY

	EXISTING OVERHEAD ELECTRIC
	EXISTING FENCE
	GUARDRAIL
	UNPAVED ROAD
	INDEX CONTOUR
	INTERMEDIATE CONTOUR
	EXISTING WATER LINE
	EXISTING 12" WATER LINE
	EXISTING LIGHT POLE
	EXISTING PAVED ROAD
	EXISTING FLARE END SECTION
	EXISTING CULVERT
	EXISTING 6" WATER LINE
	EXISTING 8" WATER LINE
	EXISTING IRRIGATION LINE
	EXISTING GAS ELECTRIC BOX

STRUCTURE-BUILDING
FLARE END SECTION
CULVERT
PROPOSED 6" WATER LINE
PROPOSED 8" WATER LINE
PROPOSED BOLLARD

CONTRACTOR TO VERIFY ALL QUANTITIES

- (305) (1 EA) CONSTRUCT A 6" TAPPING SLEEVE ON THE EXISTING 12" LINE PER M.A.G. STD. DTL. 340 INCLUDING VALVE BOX AND COVER WITH CONCRETE COLLAR PER M.A.G. STD. DTL. 391
- (307) (1 EA) INSTALL 45° BEND WITH JOINT RESTRAINTS PER M.A.G. STD. DTL. 303.
- (308) (5 EA) INSTALL 22.5° BEND WITH JOINT RESTRAINTS PER M.A.G. STD. DTL. 303.
- (330) (141' L.F.) INSTALL 8" WATER LINE (PVC) COMPLETE INCLUDING ALL APPURTENANCES PER TRENCH DETAIL
- (340) (2 E.A.) CONSTRUCT FLARED END SECTION.
- (341) (8 C.Y.) D50-8" RIPRAP, 12" THICK OVER CONTECH C200 FILTER FABRIC. EXTEND RIPRAP 2' UP AN AROUND THE END SECTIONS. IF ROCK IS ENCOUNTERED DURING INSTALLATION OF CMP, RIPRAP SHALL NOT BE OMITTED FOR THE 2' AREA AROUND THE END SECTIONS.
- (342) (57.5 L.F.) INSTALL 12" DIA CMP (14 GA. HELICAL 2-2/3"x1/2"). PER M.A.G. STD. DTL. 510. MAINTAIN MINIMUM CLEARANCE FROM TOP OF PAVEMENT TO TOP OF CMP. REGRADE TO DRAIN AT INLETS AND OUTLETS.

SHEET NOTES

1. CONSTRUCTION OF THE TANKS HAS BEEN COMPLETED BUT GRADING DID NOT CONFORM TO THE DESIGN PLANS. FILL HAS BEEN PLACED IN THE AREA OF THE ARSENIC. SOME EXISTING GROUND ELEVATIONS WERE SHOT BUT THE CONTOURS GENERATED WITH THAT DATA WERE INADEQUATE.
2. REQUIRED CLEAN PLACE IS SHOWN AS PER KINETICO RECOMMENDATIONS PIPING SHOWN CROSSING THIS SPACE SHALL HAVE 70" CLEARANCE FROM THE FLOOR SLAB.
3. INSTALL A COMPLETE AND OPERATIONAL KINETICO MACROLITE FM 360 ARSENIC REMOVAL SYSTEM WITH THE REQUIRED FILTERS AND ACCESSORIES.
4. BACKWASH TANK IS PROVIDED TO STORE WATER FROM THE BACKWASH OF THE FILTERS. WATER USED IN THE PROCESS AND FLOOR DRAINS. THE OPERATOR WILL NEED TO SCHEDULE THE ROUTINE PUMPING OF THE TANK BASED UPON FLOWS. IT IS ANTICIPATED THAT AT 50% PLANT CAPACITY THE TANK WILL NEED TO BE EMPTIED DAILY. BEFORE THE SYSTEM IS REQUIRED TO OPERATE AT 100% PLANT CAPACITY A FORCE MAIN WILL BE CONSTRUCTED TO THE CITY OF CLARKDALE SEWER SYSTEM.

CALL TWO WORKING DAYS
BEFORE YOU DIG
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NO.	DESCRIPTION	DATE	BY
1	SWI REVIEW, CLIENT MOD.	2/28/07	DP
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Shephard & Wesnitzer, Inc.

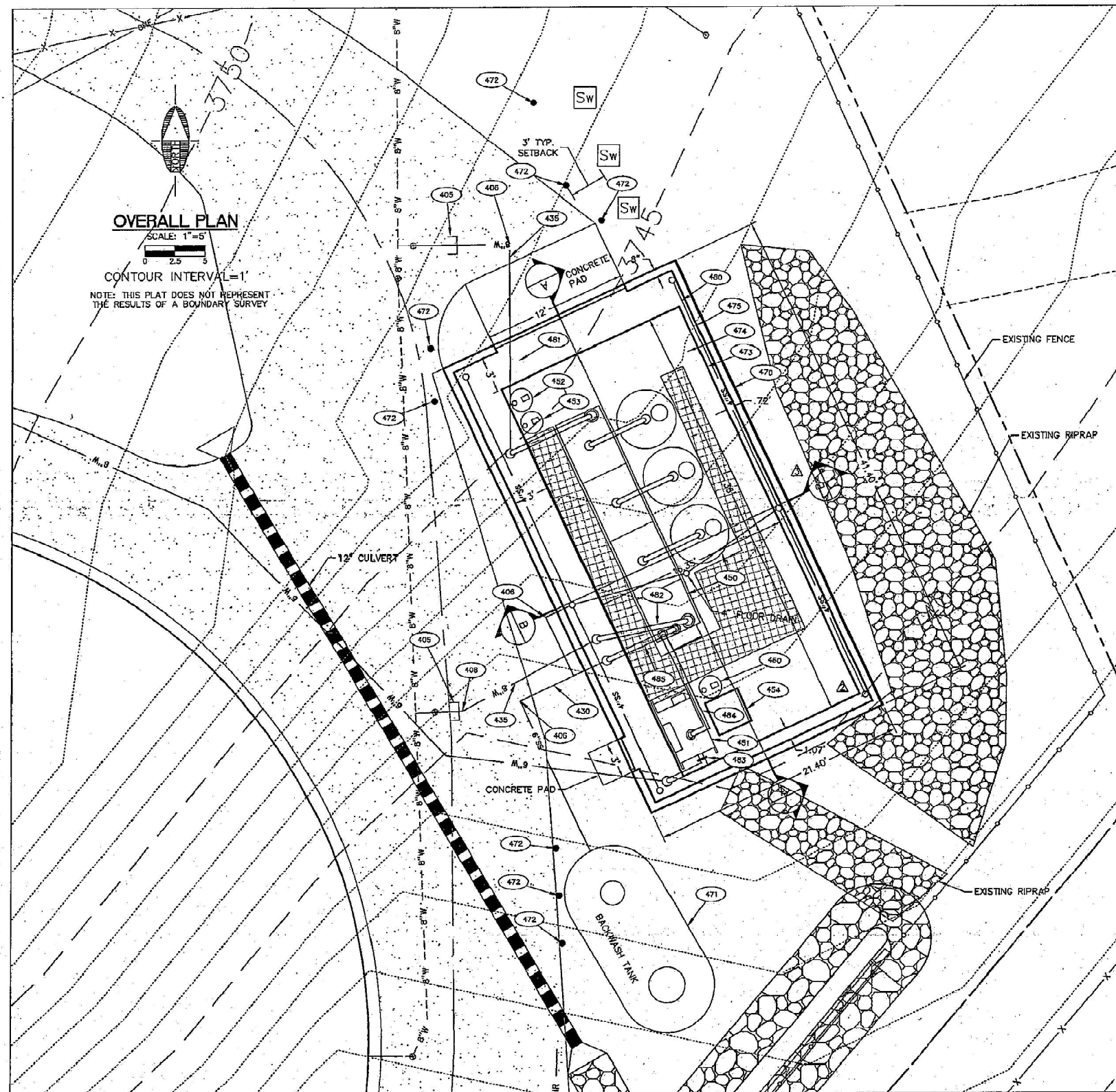
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CLARKDALE
ARIZONA

ARSENIC REMOVAL SYSTEM SITE PLAN

S01

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OVERALL PLAN

SCALE: 1"=5'

CONTOUR INTERVAL=1'

NOTE: THIS PLAN DOES NOT REPRESENT THE RESULTS OF A BOUNDARY SURVEY

LEGEND

- EXISTING FENCE
- CHAINLINK FENCE
- UNPAVED ROAD
- INDEX CONTOUR
- INTERMEDIATE CONTOUR
- EXISTING PAVED ROAD
- EXISTING 6" WATER LINE
- EXISTING 8" WATER LINE
- EXISTING APS ELECTRIC BOX

PROPOSED

- STRUCTURE-BUILDING
- FLARE END SECTION
- CULVERT
- PROPOSED 6" WATER LINE
- PROPOSED 8" WATER LINE
- PROPOSED BOLLARD
- REQUIRED CLEAR SPACE

KEYNOTES

CONTRACTOR TO VERIFY ALL QUANTITIES

- (2 EA) REMOVE BLIND FLANGE AND CONNECT EXISTING PIPE TO NEW PIPE. CONTRACTOR SHALL CONFIRM EXISTING PIPES AND FITTINGS.
- (3 EA) INSTALL 90° BEND WITH THRUST BLOCK PER M.A.G. STD. DTL. 380.
- (1 EA) INSTALL 22.5° BEND WITH THRUST BLOCK PER M.A.G. STD. DTL. 380.
- (20 L.F.) TO BUILDING EDGE, INSTALL 6" BUILDING SEWER LINE (DIP) COMPLETE INCLUDING ALL APPURTENANCES PER TRENCH DETAIL.
- (35 L.F.) TO BUILDING EDGE, INSTALL 8" WATER LINE (8" DIP) COMPLETE INCLUDING ALL APPURTENANCES PER TRENCH DETAIL.
- (1 L.S.) INSTALL THE KINETICO FILTER, PIPING AND PUMP SYSTEM AS PER THE KINETICO INSTALLATION MANUAL.
- (1 L.S.) INSTALL THE KINETICO BACKWASH PUMP AS PER THE KINETICO INSTALLATION MANUAL.
- (1 L.S.) INSTALL THE FERRIC CHLORIDE CHEMICAL FEED AS PER THE KINETICO INSTALLATION MANUAL.
- (1 L.S.) INSTALL THE HYDROCHLORIC ACID CHEMICAL FEED AS PER THE KINETICO INSTALLATION MANUAL.
- (1 L.S.) INSTALL THE AIR COMPRESSOR AS PER THE KINETICO INSTALLATION MANUAL.
- (1 L.S.) RELOCATE THE CHLORINATION SYSTEM FROM THE SIDE OF THE STORAGE TANK INTO THE TREATMENT BUILDING. CONNECT THE CHLORINATION SYSTEM TO DISCHARGE TO THE DISCHARGE LINE FROM THE ARSENIC REMOVAL SYSTEM.
- (1 L.S.) DESIGN A BUILDING AS SHOWN ON THIS PLAN AND SPECIFIED IN THE GENERAL NOTES FOR APPROVAL. COMPLETE CONSTRUCTION OF THE APPROVED BUILDING INCLUDING ALL REQUIRED COMPONENTS.
- (1 L.S.) CONSTRUCT A BACKWASH TANK USING A 5,500 GALLON DESERT SUN FIBERGLASS TANK. THE TANK INSTALLATION SHALL CONFORM TO THE MANUFACTURER'S RECOMMENDATIONS. THE INVERT ELEVATION SHALL BE FIELD DETERMINED TO MATCH THE DISCHARGE LINE FROM THE BUILDING. ANY BAFLE IN THE TANK SHALL BE BREACHED BY 2 HOLES, 6" DIAMETER IN THE BOTTOM. A 20" AND 30" RISER SHALL BE PROVIDED ON THE TANK AND BROUGHT TO GRADE. RISERS SHALL BE PROVIDED WITH A SUITABLE COVER.
- (8 EA) CONSTRUCT SAFETY POSTS, 6" DIAMETER PIPE, AS PER MAG STANDARD DETAIL 180 IN THE LOCATIONS SHOWN.
- (1 EA) CONSTRUCT A CONCRETE EQUIPMENT PAD TO THE DIMENSIONS SHOWN IN THE PLAN THE BUILDING SECTIONS ON SHEET 6. AS PER THE GENERAL NOTES THE DESIGN OF THE EQUIPMENT PAD SHALL BE CONFIRMED BY THE GEOTECHNICAL AND STRUCTURAL ENGINEER BEFORE CONSTRUCTION. THE EQUIPMENT PAD WILL BE FLAT AT THE ELEVATION SPECIFIED IN THE SECTIONS.
- (1 EA) CONSTRUCT A CONCRETE FLOOR TO THE DIMENSIONS SHOWN IN THE PLAN THE BUILDING SECTIONS ON SHEET 6. AS PER THE GENERAL NOTES THE DESIGN OF THE FLOOR SHALL BE CONFIRMED BY THE GEOTECHNICAL AND STRUCTURAL ENGINEER BEFORE CONSTRUCTION. THE FLOOR WILL BE SLOPED TO THE FLOOR DRAINS SHOWN AND HAVE A MAXIMUM ELEVATION AT ALL WALLS SPECIFIED IN THE SECTIONS. THE CONCRETE FLOOR SHALL BE SEPARATED FROM THE EQUIPMENT PAD AND THE STEM WALL BY A 1/2 INCH EXPANSION JOINT FILLED WITH RESILIENT CHALKING.
- (1 EA) CONSTRUCT AN BUILDING FOOTING AND STEM WALL / RETAINING WALL TO THE DIMENSIONS SHOWN IN THE PLAN THE BUILDING SECTIONS ON SHEET 6. AS PER THE GENERAL NOTES THE DESIGN OF THE FOOTING AND STEM WALL / RETAINING WALL SHALL BE CONFIRMED BY THE GEOTECHNICAL AND STRUCTURAL ENGINEER BEFORE CONSTRUCTION.
- (1 L.S.) CONSTRUCT A 4" FLOOR DRAIN SYSTEM INCLUDING 1 - 6" GRATE IN THE EQUIPMENT PAD AND 6 - 6" GRATES IN THE FLOOR AS SHOWN. THE DRAINS SHALL BE 4" DIP OR CAST IRON SEWER PIPE SLOPED IN ACCORDANCE WITH THE CODE. MULTIPLE PIPES ON THE FILTER, PIPING AND PUMP SYSTEM WILL BE PLUMBED TO DISCHARGE TO THE FLOOR DRAINS.
- (1 L.S.) CONSTRUCT A 8" DIP INLET WATER LINE TO THE TREATMENT SYSTEM. PROVIDE THE REQUIRED FITTINGS FOR HORIZONTAL AND VERTICAL DEFLECTIONS ALONG WITH THE APPROPRIATE JOINT RESTRAINT. A STEEL SLEEVE WITH WATER STOP SHALL BE PROVIDED FOR THE FLOOR PENETRATION. THE ANNULAR AREA SHALL BE FILLED WITH RESILIENT CAULKING.
- (1 L.S.) CONSTRUCT A 8" DIP OUTLET WATER LINE FROM THE TREATMENT SYSTEM. PROVIDE THE REQUIRED FITTINGS FOR HORIZONTAL AND VERTICAL DEFLECTIONS ALONG WITH THE APPROPRIATE JOINT RESTRAINT. A STEEL SLEEVE WITH WATER STOP SHALL BE PROVIDED FOR THE FLOOR PENETRATION. THE ANNULAR AREA SHALL BE FILLED WITH RESILIENT CAULKING.
- (1 L.S.) CONSTRUCT A 6" DIP BACKWASH INLET WATER LINE TO THE BACKWASH PUMP SYSTEM. PROVIDE THE REQUIRED FITTINGS FOR HORIZONTAL AND VERTICAL DEFLECTIONS ALONG WITH THE APPROPRIATE JOINT RESTRAINT. PROVIDE A 4" REDUCER FOR THE CONNECTION TO THE BACKWASH PUMP SYSTEM. A STEEL SLEEVE WITH WATER STOP SHALL BE PROVIDED FOR THE FLOOR PENETRATION. THE ANNULAR AREA SHALL BE FILLED WITH RESILIENT CAULKING.
- (1 L.S.) CONSTRUCT A 4" PVC WATER LINE FROM THE BACKWASH PUMP SYSTEM TO THE TREATMENT SYSTEM. PROVIDE THE REQUIRED FITTINGS FOR HORIZONTAL AND VERTICAL DEFLECTIONS ALONG WITH THE APPROPRIATE JOINT RESTRAINT.
- (1 L.S.) CONSTRUCT A 6" DIP INLET DISCHARGE WASTE LINE FROM THE TREATMENT SYSTEM. PROVIDE THE REQUIRED FITTINGS FOR HORIZONTAL AND VERTICAL DEFLECTIONS ALONG WITH THE APPROPRIATE JOINT RESTRAINT. PROVIDE A 4" REDUCER FOR THE CONNECTION. A STEEL SLEEVE WITH WATER STOP SHALL BE PROVIDED FOR THE FLOOR PENETRATION. THE ANNULAR AREA SHALL BE FILLED WITH RESILIENT CAULKING.

SHEET NOTES

- CONSTRUCTION OF THE TANKS HAS BEEN COMPLETED BUT GRADING DID NOT CONFORM TO THE DESIGN PLANS. FILL HAS BEEN PLACED IN THE AREA OF THE ARSENIC. SOME EXISTING GROUND ELEVATIONS WERE SHOT BUT THE CONTOURS GENERATED WITH THAT DATA WERE INADEQUATE.
- REQUIRED CLEAN PLACE IS SHOWN AS PER KINETICO RECOMMENDATIONS. PIPING SHOWN CROSSING THIS SPACE SHALL HAVE 7'0" CLEARANCE FROM THE FLOOR SLAB.
- INSTALL A COMPLETE AND OPERATIONAL KINETICO MACROUTE FM 360 ARSENIC REMOVAL SYSTEM WITH THE REQUIRED FILTERS AND ACCESSORIES.
- BACKWASH TANK IS PROVIDED TO STORE WATER FROM THE BACKWASH OF THE FILTERS. WATER USED IN THE PROCESS AND FLOOR DRAINS. THE OPERATOR WILL NEED TO SCHEDULE THE ROUTINE PUMPING OF THE TANK BASED UPON FLOWS. IT IS ANTICIPATED THAT AT 50% PLANT CAPACITY THE TANK WILL NEED TO BE EMPTIED DAILY. BEFORE THE SYSTEM IS REQUIRED TO OPERATE AT 100% PLANT CAPACITY A FORCE MAIN WILL BE CONSTRUCTED TO THE CITY OF CLARKDALE SEWER SYSTEM.

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SWI
Shephard & Wesnitzer, Inc.

75 Kollor Place
Sedona, AZ 86336
928.282.1061
928.282.2058 fax
www.swiaz.com

JOB NO:	04461
DATE:	JAN 2006
SCALE:	AS SHOWN
DRAWN:	D.P.
DESIGN:	DMM/D.P.
CHECKED:	DMM

MOUNTAIN GATE SUBDIVISION
**ARSENIC REMOVAL SYSTEM
BUILDING FLOOR PLAN**

CLARKDALE
ARIZONA

DRAWING NO.
B01
SHEET NO. OF
4

EMPIRE RESIDENTIAL CONSTRUCTION
FOR
MOUNTAIN GATE WELL

OPERATION & MAINTENANCE MANUAL

MACROLITE FM 360 ARSENIC REMOVAL SYSTEM

PROJECT MANAGER: TOM GOSHE

TECHNICAL SERVICE: ERIN MILLER



J 01345
REV 0
JANUARY 19, 2007

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CHAPTER 1 SYSTEM OVERVIEW

MACROLITE[®] FM 360 ARSENIC REMOVAL SYSTEM

The Kinetico Arsenic Removal System involves a three-step process of oxidation, co-precipitation, and filtration to remove arsenic. The oxidation step will consist of using the existing chlorination system to oxidize all of the arsenic in the As^{+3} form to arsenic in the As^{+5} form.

The co-precipitation step involves injecting ferric chloride into the oxidized raw water stream. The co-precipitation process takes place as the As^{+5} adsorbs onto the ferric hydroxide floc. This co-precipitation process works best at a pH of 7.2 to 7.6. The raw water pH at the Mountain Gate Well is 8.4, which will be adjusted to between 7.2 and 7.6 using either hydrochloric acid or sulfuric acid. No further pH adjustment will be required, 7.2 to 7.6 is an ideal pH range for most distribution systems.

The Kinetico pressure filtration system involves standard downflow filtration and upflow backwash through a granular bed of Macrolite media. The system is configured using one module, consisting of three 60 inch diameter tanks. The tanks are carbon steel construction with large lexan viewing ports, ASME code rated for 150 psi, floor mounted, and piped to a welded stainless steel frame. The filter beds are comprised of 24 inches of Macrolite ceramic media supported by stainless steel distributors. Each filter tank will be equipped with a 200 gpm flow-limiting device to prevent filter overrun and possible damage to the system.

The system has tested the NSF/ETV protocol and has shown to remove arsenic down to below 3 ppb. See ETV Joint Verification Statement in Appendix, Section 6.0. The media is NSF Standard 61 approved, as is the epoxy tank lining. All plumbing is Schedule 80 PVC solvent bonded pipe and fittings, preventing any system corrosion. All hardware in the flow path is either Schedule 80 PVC or stainless steel.

Standard operation has all three tanks on-line, giving a normal "service" flow capacity of 600 gpm, with a brief reduction to 400 gpm during periods of backwash. This design provides 0% redundancy. With the flexibility of the controls provided with this system, it is possible to backwash during off peak demand hours to allow the system to perform at maximum flow rate during time of high demand.

The entire system is controlled by a programmable logic controller (PLC) in a central control panel, which monitors system performance through various sensors. These sensors consist of various flow meters and pressure sensors.

A backwash can be initiated by a pressure drop across the filters, gallons of water processed, or by pushbutton. When a backwash is signaled, the PLC operates the required actuated valves to backwash the exhausted tank.

CHAPTER 2 PROCESS BASIS FOR DESIGN

The specifications listed in this section were provided by the Buyer and were relied upon by Kinetico in the design of this filtration system. Kinetico has used these specifications as the limiting factors from which the system design, performance and overall feasibility have been based. Should actual site criteria and conditions differ at any time from the influent and facility specifications listed below, modification and/or enhancements to the system may be required at the Buyer's additional expense. It is the responsibility of the Buyer to determine whether or not these specifications accurately reflect the parameters of the system's process.

INFLUENT SPECIFICATIONS

Design Inlet Flow Rate	600 gpm
Maximum Static Pressure	100 psi
Minimum Dynamic Pressure (Inlet) ¹	45 psi
pH High/Low	9/5 SU
Temperature, High/Low	100/35°F
Maximum Arsenic Influent	≤60 ppb
Iron	≤0.1 mg/L
Silica as SiO ₂	≤25 mg/L

If the influent *does not* conform to these water quality specifications, the Kinetico system may not be able to produce effluent water within the qualities desired by the client. If so, the Buyer will bear the burden of cost to make changes to the Kinetico system in order to achieve the quality of effluent specified in this proposal.

¹ Minimum dynamic influent pressure and minimum dynamic effluent pressure were calculated using maximum head loss across the filtration system and maximum clearwell water level. If conditions are such that the head loss across the filtration system is less than the maximum, or the water level in the storage tank is less than the maximum, it is possible to operate the filtration system at lower influent and effluent pressures. Although it is possible to operate the system at lower influent and effluent pressures, it shall be noted that Kinetico cannot be held responsible for achieving rated effluent flow rates under these conditions. Minimum outlet pressure is dependent on the level to which the storage tank is filled. The minimum outlet pressure will correspond with the desired water level in the storage tank, which is determined by the Buyer.

EFFLUENT SPECIFICATIONS

Design Outlet Flow Rate	600 gpm
Normal Pressure Drop (Entire System Start / End of Run)	15/30 psi
Minimum Outlet Pressure ¹	5 psi
pH, High/Low	7/8 SU
Temperature, High/Low	100/35°F
Typical Operation Arsenic Effluent	less than 8 ppb
Arsenic Effluent	less than 10 ppb
Iron	≤0.3 mg/L
Silica as SiO ₂	≤25 mg/L

WASTEWATER DATA

Based on 540,000 gpd system operation, approximately 11,000 gallons of wastewater will be produced each day when the system is operated at 600 gpm with the anticipated feed water quality as listed in Section 3.1. This translates into a 98% recovery. It should be noted that the above wastewater data is an estimate only, and a pilot would need to be performed to establish site specific performance.

The Kinetico system utilizes treated water for its backwash cycles, a minimum of 45 psi at 200 gpm is required. This treated water is to be obtained from the finished water storage tank. It is the Buyer's sole responsibility to maintain an adequate volume of treated water in the storage tank for the purpose of backwash. Failure to provide adequate backwash water will result in system failure and/or an interruption of Buyer's water supply.

FACILITY SPECIFICATIONS REQUIRED

Room Temperature, Maximum/Minimum	120/50°F
Floor Space	See Layouts
Voltage, Frequency	120/220 VAC, 60 Hz & 460 VAC/3 pH/60 Hz
Clear Height	19' H
Required Access Opening	12' H x 12' W
Chemical Requirements	Coagulant, FeCl ₃ , H ₂ SO ₄ or HCl
Compressed Air Requirements (supplied)	75 SCFM @ 80 psi
Phone Service	2 lines (1 Data, 1 Voice)

SPECIAL EQUIPMENT REQUIREMENTS

Explosion Proof Requirements	None
Electrical Design Requirements	UL
Piping Requirements	None
Programmable Controller Requirements	None
Seismic Requirements	None
Other Special Codes	All Pressure Tanks ASME

WARRANTY

EQUIPMENT WARRANTY

Subject to the terms hereof, Kinetico Incorporated (hereinafter referred to as "Kinetico") warrants all equipment, with the exception of the Macrolite[®], manufactured by Kinetico to be free from defects in materials and workmanship for a period of twelve (12) months from the date start-up is completed or sixteen (16) months from the date the equipment was originally scheduled to be shipped to Buyer, whichever occurs first. Macrolite is warranted for ten (10) years from date of shipment. Kinetico's liability to the Buyer, with regard to the above

warranties, is limited to the repair or replacement of any parts, materials or media proved upon Kinetico's inspection to be defective. Such parts, materials and media will be provided free of charge during this period. The repair or replacement of parts, materials or media must be performed by Kinetico or its authorized agent to receive warranty coverage.

Kinetico shall not be liable to replace or repair parts, materials or media damaged by chemical action or wear caused by the presence of unspecified materials in the influent or conditions of installation not properly specified by the Buyer. This warranty does not cover damage to equipment, materials or media caused by the Buyer whole or in part by improper handling, installation, storage, maintenance, Acts of God, improper servicing, or attempting to operate the equipment in excess of its rated capacity or recommended use, intentional or otherwise. Damage to the system due to excessive pressure, temperature, or freezing is also not covered by this warranty. Under no circumstances shall Kinetico be liable for expenses involved in the return of equipment, parts, materials or media.

On-site labor charges required for the trouble-shooting, removing and replacing of defective parts, materials or media are included as part of this warranty for a period of twelve (12) months from the date start-up is completed or sixteen (16) months from the date the equipment, materials or media was originally scheduled to be shipped to Buyer, whichever occurs first. After this period, on-site labor charges are billed at Kinetico's standard per diem rate, plus expenses.

PROCESS WARRANTY

Subject to the restrictions indicated below, Kinetico Incorporated warrants the system will meet the design and effluent specifications listed in Kinetico's full proposal for a period of twelve (12) months from the date start-up is completed or sixteen (16) months from the date the equipment was originally scheduled to be shipped to Buyer, whichever occurs first. This warranty is subject to the stipulation that the influent to the Kinetico system conforms to the specifications listed in Section 3.1, and further, that the applicable specifications contained in Section 3.5 are followed. Further, this warranty may only be invoked upon:

The system's failure to meet the effluent arsenic specifications listed in Section 3.2 in five percent or greater of the measurements taken each month by system operators in accordance with the requirements of the state drinking water regulations in effect as of the date of this proposal.

Kinetico must be contacted by the Buyer in writing ("notice") if it appears that the system is not meeting effluent specifications. Buyer will provide Kinetico with at least sixty (60) days from the date of notice to allow Kinetico to correct the problem. Similarly, Kinetico will have the same period of time, from the date of its knowledge of the test results, to return the system to compliance. The warranty may only be invoked if Kinetico fails to return the system to compliance within this time frame.

Should Kinetico fail to meet this warranty, its sole obligation (and Buyer's sole remedy) under this section is to remove the system at its expense and refund the purchase price of the system to the Buyer.

If it is determined that Kinetico or its system is not responsible for the failure to meet the effluent specifications, the Buyer will pay Kinetico for its reasonable costs incurred in investigating and solving the problem.

NO ENVIRONMENTAL WARRANTY

Compliance with environmental regulations regarding Buyer's water system are outside of Kinetico's control and, therefore, are the sole responsibility of the Buyer. Kinetico does not warranty results in terms of achieving or maintaining compliance with any environmental regulations, whether now or hereafter in effect, that may apply to Buyer's public water system. Buyer shall indemnify and hold harmless Kinetico from any and all causes of action relating to Buyer's responsibility.

NO OTHER WARRANTIES

There exists no other expressed warranty beyond those listed above. Any and all implied warranties, including any warranty of merchantability or fitness for a particular purpose, are limited to the duration of this written warranty and are excluded to the extent permitted by law. There are no warranties other than those contained herein. In no event shall Kinetico be liable

for indirect, special or consequential damages in connection with the use of this system, except as specified or referenced in this section.

LIMITATION OF REMEDIES AND LIABILITIES

Buyer's exclusive remedies and Kinetico's total liabilities are expressly limited to Section XIV of the General Terms and Conditions of Sale attached hereto. These limitations will survive the expiration of any warranty.

CHAPTER 3 THEORY OF APPLIED TECHNOLOGY

MACROLITE

REMOVAL MECHANISM

Macrolite media depends on physical straining as the primary removal mechanism. The media's most unique characteristics are its shape and surface condition. The media is special and the surface is quite rough, maximizing its ability to capture small particles.

Conventional granular media differs in size and has angular shapes which tend to either interlock and restrict, or settle in positions which leave large interstitial gaps. Instead, Macrolite is a manufactured product with an intentionally spherical shape. The rounded shape provides a relatively uniform matrix of interstitial passages between the media granules. These uniform passages are key to the media's outstanding flow vs. straining capability relationship. The spatial uniformity provides higher filtering performance than any randomly shaped media could achieve regardless of how carefully graded it may be. It should also be noted that the media's shape also provides repeatability, since the filter bed will settle into a similar relationship each time after backwashing instead of the varied granule to granule relationships which occur with irregular, angular media.

The second physical characteristic which gives Macrolite its performance is the surface texture. The surface of the media is rough and physically captures small and mid-sized particles as they work their way through the passages between the media granules. This capture is a simple physical phenomenon created by collisions within the filter bed caused by the momentum of the particle and the winding flow path through the bed. Through experimentation and experience, the proper bed depth and flow rate was determined in order to provide a sufficient number of these collision opportunities to occur. The effectiveness of the portion of the physical removal is

not haphazard or by chance. It is a determinable dynamic relationship of influent particle size distribution, flow rate, and bed depth. This capture within the bed also increases the filter depth and area, giving it greater capacity and correspondingly longer runs than a filter which traps all the particulate on top of the bed.

PHYSICAL CHARACTERISTICS

- Kinetico's Macrolite media is a manufactured ceramic material with a spherical shape and a textured surface.
- Macrolite starts out as fine granules about 40 micron in size and, through a very complex manufacturing process, is formed into the final media product. It is through this manufacturing process that Macrolite gains its advantages. The raw materials are formed to a certain size and specific gravity then fired in a kiln to its final ceramic state.
- The 70 mesh media used in our systems has a diameter of approximately .215 mm and a specific gravity of 2.5.
- Macrolite is chemically inert and is compatible with all types of acids, caustics, and oxidants. It has an indefinite service life and normally never needs replacement.

CHAPTER 4 TRAINING

Training Agenda

MOUNTAIN GATE WELL

Job Number: J 01345

Date: ____/____/____

- I. System Theory with Terms and Definitions
 - A. Macrolite Filtration
- II. System Design
 - A. Macrolite Filtration
- III. Process Design / Subsystem Integration
 - A. How primary system works from inlet to end product(s)
 - B. How auxiliary systems work from inlet to end product(s)
- IV. Troubleshooting Theory
 - A. Macrolite Filtration
- V. Maintenance
 - A. Macrolite Filtration



TRAINING SIGN-IN SHEET

MOUNTAIN GATE WELL

Job Number: J 01345

Date: ____ / ____ / ____

Kinetico Instructors: _____

No.	Print Name	Signature	Department
1			
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GLOSSARY OF WATER TERMS

Absolute Purity Water — Water with a specific resistance of 18.3 megohm-cm at 25°C.

Absorption — Process by which one substance is taken up by another, either chemically or physically, as when a sponge 'soaks up' a liquid, or one substance dissolves into another.

Acid Feed — Injecting sulfuric or hydrochloric acid into a water stream to make it less alkaline (pH adjustment).

Activated Carbon — Material used to adsorb organic impurities from water. Comes from wood, lignite, pulp-mill char, blood, etc. The source material is initially charred at high temperature to convert it to carbon. The carbon is then 'activated' by oxidation from exposure to high temperature steam. Comes in granular or powdered form.

Adhesion — The attractive force that exists between an electrodeposit and its substrate that can be measured as the force required to separate an electrodeposit and its substrate.

Adsorption — Adhesion of the molecules of a gas, liquid or dissolved substance to a surface because of chemical or electrical attraction. Typically accomplished with granular activated carbon to remove dissolved organics.

Agglomerate — When suspended solids cluster together to form larger clumps or masses, which are easier to remove by filtration or settling.

Alk — See Alkalinity

Alkalinity — Measure of content of carbonates, bicarbonates, hydroxides, and occasionally borates, silicates and phosphates in water, expressed in parts per million of calcium carbonate.

Alum — Aluminum sulfate, commonly added during municipal treatment to cause insoluble colloids to coalesce into larger panicles, which can be removed by settling. Also see "Flocculation."

Alumina - HCl — Acid washed (HCl) activated alumina

Alumina - HOH — Water washed activated alumina

Angstrom — One ten-thousandth of a micron.

Anion — A negatively charged ion.

Anion Exchange Resin — An ion exchange material that removes anions from solution by exchanging them with hydroxyl ions.

Anode — The electrode in electrolysis at which negative ions are discharged, positive ions are formed, or other oxidizing reactions occur.

ANPRM — Advanced Notice for Proposed Rule Making

Aquifer — Underground layer of permeable rock, sand or gravel that supplies water for wells or springs.

ASTM — The American Society of Testing and Materials.

AWWA — American Water Works Association

AWWARF — American Water Works Association Research Foundation

Atmospheric Evaporator — Apparatus used to reduce the volume of water by evaporation. Typically uses a combination of water spray and air flow to evaporate at higher than ambient (but lower than boiling) temperature.

Atomic Absorption Spectrophotometry — A highly sensitive instrumental technique for identifying and measuring trace elements in water. About 68 different elements can be determined by AA analysis, some down to the level of parts per trillion.

Background Contamination — Contamination introduced accidentally in reagents, dilution water, solvents, rinse water, etc., which can be confused with constituents in sample being analyzed.

Backwash — Some types of filters may be cleaned by reversing the flow of water to force contaminants out of plugged pores and passages.

Barrel Plating — Electroplating of small parts in bulk in a rotating container.

Baseline — In some analytical procedures the sample is dissolved in water or combined with other reagents for analysis. A blank, or standard consisting of the same reagents may be analyzed without sample present. This provides a comparative reference point, or baseline, so it's clear what test results can be attributed solely to the sample itself.

Basis Metal — Metal upon which coatings are deposited.

Bed — Column of carbon, sand or ion exchange resins through which the water passes during treatment.

Biochemical Oxygen Demand (BOD) — The amount of oxygen required to oxidize the dissolved organic matter in a water sample by aerobic (bacterial) decay. It's a measure of the oxygen depletion that would result from discharging organic impurities into a waterway.

Biological Impurities — Impurities resulting from living matter (bacteria, virus, algae, protozoa, microfungi and their by-products, including pyrogens.

Biopure Water — Water that is sterile, pyrogen free and has a total solids content of less than 1 ppm.

Blank — A preliminary analysis omitting only the sample to provide an unbiased reference point or baseline for comparison. It's important to minimize extraneous contamination that could be confused with constituents in the sample itself.

Boiler — The vessel used in distillation systems to convert water into steam.

Breakthrough — The point at which ions can be detected downstream of an ion exchange bed, indicating that the resin capacity is depleted.

Bright Dip — A solution used to produce a bright surface on a metal.

Bright Plating — A process that produces an electrodeposit having a high degree of specular reflectance in the as plated condition.

Buffer — A solution that is capable of opposing small changes in chemical composition: particularly in pH.

BV — Bed volumes, i.e. a volume of feedwater equal to the volume of media including void spaces between particles.

C — Disinfectant concentration

CA — Cellulose acetate

CAA — Clean Air Act

Calcium — A metallic element always found combined in water, usually as calcium carbonate (CaCO_3). Soluble in water, it causes hardness and subsequent scaling.

Carbon — See "Adsorption."

Carbonate Hardness — Hardness in water caused by bicarbonates and carbonates of calcium and magnesium.

Cathode — The electrode in electrolysis at which positive ions are discharged, negative ions are formed, or other reducing reactions occur.

Cation — A positively charged ion.

Cation Exchange Resin — Ion exchange resins capable of removing cations by exchanging them for hydrogen ions.

CCPP — Calcium carbonate precipitation potential

CDA — Cellulose diacetate

CDC — Center for Disease Control

Channeling — Failure of a bed caused when water finds furrows or channels through which it can flow without effective contact with the bed.

Chelating Agents — Organic compounds that can react with ions in solution.

Chemical Oxygen Demand (COD) — The amount of oxygen needed to completely oxidize all oxidizable organic and inorganic substances in water.

Chloramine — A chlorine compound formed by reaction with organic amines or ammonia.

Chlorination — Adding chlorine or chlorine compounds to water for disinfection.

Chlorine — An element used to kill micro-organisms in water. At room temperature and atmospheric pressure it is a greenish yellow gas.

Chlorine Demand — Amount of chlorine used up by reacting with oxidizable substances in water before chlorine residual can be measured.

Chlorine Residual — Portion of free or combined chlorine that remains active after specified contact period.

Coagulation — Adding insoluble compounds to water that neutralize the electrical charge on colloids causing them to coalesce to form larger particles that can be removed by settling. Also referred to as flocculation.

COD – Chemical oxygen demand

Coliform Bacteria — A group of bacteria found mainly in man's intestines, and are therefore a useful measure of fecal pollution in water. They are easy to identify and count in the laboratory because of their ability to ferment lactose.

Colloids — Particles so fine they will not settle without prior coagulation. They range from 10 to 1,000 Angstroms. They have a net negative charge, and readily clog membranes and foul resin beds. Examples are bacteria, silica and clay.

Coloring – (1) The production of desired colors on metal surfaces by chemical or electrochemical action. (2) Light buffing of polished metal surfaces for the purpose of producing a high luster.

Concentration Polarization — The phenomenon in ultrafiltration (UF) in which solutes form a dense, polarized layer next to the membrane surface which eventually blocks further flow. UF systems counteract this by continuously flushing the solute away from the membrane surface.

Condensate — Distillate just after it has been transformed from steam into the liquid state.

Condenser — The heat exchanger used in distillation to cool steam in order to convert it from the vapor to the liquid phase.

Conductivity — The reciprocal of resistivity. It is a measure of the ability to conduct an electric current. Since ionized impurities increase the conductivity of water, it is also an accurate measure of ionic purity. To measure it, current is passed between two electrodes a fixed distance apart. Conductivity is normally expressed as micromhos/cm.

Corrosion – (1) Gradual solution or oxidation of a metal. (2) Solution of anode metal by the electrochemical action in the plating cell.

Covering Power – The ability of a plating solution under a specified set of plating conditions to deposit metal on the surfaces of recesses or deep holes. (To be distinguished from throwing power).

Critical Point — The combination of pressure and temperature at which the gas and liquid phases of a substance become indistinguishable.

CT – value time (disinfectant concentration times the contact time)

CU – Color units

CUR – Carbon usage rate

CWA – Clean Water Act

CWSS – Community Water Supply Survey

d_p – Diameter of particle in suspension to be filtered

d₁₀ – Sieve size for which 10 percent by weight of the grains of filter medium are smaller

D – Pipe diameter, ft or m

Dalton — Nominal molecular weight.

DBP – Disinfection by-product

D.E. – Diatomaceous earth

Deionization — Removing dissolved ions from solution by passing it through a bed of ion exchange resins, consisting of polymer beads that exchange hydrogen ions for cations and hydroxyl ions for anions in solution. The ionic impurities remain bound to the resins, and the hydrogen and hydroxyl ions combine with each other to form water.

Demineralization — Sometimes used interchangeably with deionization. Refers to the removal of minerals and mineral salts using ion exchange.

Desalination — The removal of dissolved salts from brine to produce potable water.

Diffusion — Random thermal motion of particles which causes them to flow from a region of higher concentration to one of lower concentration until they're uniformly distributed.

Dilution — Lowering the concentration of a solution by adding more solvent.

Dilution Factor — The ratio of solvent to solute, by volume.

Disinfection — To destroy most (but not necessarily all) of the harmful or objectionable microorganisms by means of chemicals, heat, ultraviolet light, etc. Also referred to as sanitization.

Dissolved Solids — Also referred to as Total Dissolved Solids (TDS), it is the amount of nonvolatile matter dissolved in a water sample, and is usually expressed in parts-per-million by weight.

Distillation — The process of separating water from impurities by heating until it changes into vapor and then cooling the vapor to condense it into purified water.

DOC – Dissolved organic carbon

DOX – Dissolved organic halogen

Drag-Out – The solution that adheres to articles removed from the processing tank.

DWPL – Drinking Water Priority List

EBCT – Empty bed contact time, i.e., the hydraulic residence time in an empty bed of the same volume as the media including voids

EBCT_{sc}/EBCT_{LC} – ratio of the EBCT of a small column to that of a large column

ED – Electrodialysis

EDR – Electrodialysis reversal

Effluent — The output or discharge from a water treatment process.

Electrolysis – Production of chemical changes by the passage of current through an electrolyte.

Electrolyte – (1) A conducting medium in which the flow of current is accompanied by movement of matter. Most often an aqueous solution of acids, bases, or salts, but includes many other media, such as fused salts, ionized gases, some solids, etc.

Electroplating – The electrode position of an adherent metallic coating upon an electrode for the purpose of securing a surface with properties or dimensions different from those of the basis metal.

Endotoxin — A poisonous substance present in bacteria that is released when the cell disintegrates. In water treatment, it most often refers to pyrogens. See "Pyrogens."

Evaporator — Apparatus used in distillation to heat water to create a phase change from the liquid to the vapor state. Also called the boiler.

Exhaustion — When absorbents, such as activated carbon or ion exchange resins, have depleted their capacity by using up all active sites. Ion exchange resins may be regenerated to reverse the process.

Extractables — Undesirable foreign substances that are leached or dissolved by water from the materials of construction used in filters, storage vessels, distribution piping and other wetted surfaces.

FA – Fulvic acid

Fe – Iron dose

[Fe²⁺] – Iron (II) concentration

Feedwater — Water entering a treatment process.

Filtration — Removal of suspended matter by passing it through a porous matrix that prevents particles from getting through, usually by entrapment on or in the filter matrix.

Flocculation — Addition of one or more chemicals to produce a floc, which is an insoluble compound that absorbs colloidal matter and readily settles.

Flow Decay — Measuring the decline in flow rate through a filter to establish a Silt Index for the water being filtered. The Silt Index is a measure of suspended solids and their ability to clog the filter.

Flow Restrictor — A flow-limiting orifice used to control flow rate or pressure drop in a liquid stream.

Fouling — When gelatinous coatings, colloidal masses or dense bacterial growth form a compacted crust on membrane or filter surfaces which blocks further flow.

GAC – Granular activated carbon

Gel — A continuous mass formed when colloids congeal.

Grains per Gallon — Concentration of dissolved ions in water, generally as calcium carbonate. 7,000 grains is equal to a pound. One grain per gallon is equivalent to 17.1 ppm of Dissolved Solids (as calcium carbonate). See "Milliequivalent."

Growththrough — A time-related phenomenon in which successive generations of bacteria grow through a membrane filter with pores small enough to prevent passage of the original parent organism.

GWSS – Ground Water Supply Survey

h – depth of media, ft or m

Hardness — Concentration of calcium and magnesium salts in water. Hardness is a term originally referring to the soap-consuming power of water. As such it is sometimes also taken to include iron and manganese. High hardness can cause boiler or pipe scale and failure of reverse osmosis membranes.

Heat of Vaporization — The amount of heat needed to change a unit volume of water from a liquid to a vapor without a temperature change.

Hollow Fiber — Refers to reverse osmosis and ultrafiltration membranes formed into small diameter (about 0.05' I.D.) tubes. The inner surface is a very thin (RO or UF) membrane skin supported by a thicker porous outer layer which gives the tube its strength. Hollow fibers are used in bundles of 1,000 or more in a single cartridge shell. Water is forced through the center (upstream surface) of each tube and purified permeate is collected from the outer wall (downstream surface).

HPC – Heterotrophic plate count

HPLC — High performance liquid chromatography is an instrumental technique for measuring trace levels of organics. Trace organics can be separated into distinct bands in a flowing stream based on their relative attraction to an adsorptive medium. Each band is then profiled as the solvent flows through a UV detector.

Hydrogen Embrittlement – Embrittlement of a metal or alloy caused by absorption of hydrogen during pickling, cleaning, or plating.

Hydrophilic — Having a strong affinity for water.

Hydrophobic — Non-wetting; water repelling.

Inert — Does not dissolve in water, nor react chemically with other substances.

In-line — An integral part of the flow path. In a fluid stream, something is said to be in-line if the entire fluid stream flows directly through it.

Inorganic — Commonly referred to as mineral, it includes all matter that is not animal or vegetable. Inorganic substances normally dissociate in water to form ions.

IOC – Inorganic chemicals

Ion — An atom or group of atoms with an electrical charge that is positive (cation) or negative (anion) as a result of having lost or gained electrons.

Ion Exchange — Also called deionization. A process in which hardness ions attached to the resin beads are exchanged for undesirable ions in solution. Typically, hydrogen ions are exchanged for any cations and hydroxyl ions for any anions. The hydrogen and hydroxyl ions combine to form pure water.

Langelier Index — A measure of the degree of saturation of calcium carbonate in water, which is based on pH, alkalinity and hardness. If the Langelier Index is positive, calcium carbonate can precipitate out of solution to form scale. See "Saturation Index."

Latent Heat of Fusion — The amount of heat needed to change a unit of substance, such as water, from a solid to a liquid without change in temperature.

Leach — To dissolve by the action of a moving liquid. For example, high purity water leaches trace impurities from glass vessels.

Lipopolysaccharide — Molecule found in the outer cell walls of some bacteria, which trigger the immune response, resulting in fever. Also referred to as pyrogens or as endotoxins, though, strictly speaking, they are not endotoxins.

Log Removal – A shorthand term for log₁₀ removal, used in reference to the Surface Water Treatment Rule and the physical-chemical treatment of water to remove, kill, or inactivate pathogenic organisms such as *Giardia lamblia* and viruses. A 1-log removal equals a 90 percent in density of the target organism; a 2-log removal equals a 99 percent reduction; a 3-log removal equals a 99.9 percent reduction; and so on.

LR – Larson ratio

LSI – Langelier saturation index

Macrorreticular Resin — An ion exchange resin with a reticular porous matrix that makes it effective for removing colloids and bacteria, as well as dissolved ions. It is especially useful for preventing colloidal and organic fouling of mixed-bed resins and premature clogging of final filters.

MCL – Maximum contaminant level

MCLG – Maximum contaminant level goal

MCLs – Maximum contaminant levels

MDL – Method detection limit

Mechanical Plating – The formation of an adherent metallic coating upon a basis metal by impingement of solid particles of the coating metal.

Metal Distribution Ratio – the ratio of the thicknesses of deposit upon two specified areas of a cathode. See Throwing Power.

Megohm-cm — A measure of ionic purity in water. Resistivity (the reciprocal of conductivity) is a measure of resistance to electrical flow. The fewer dissolved ions in water the higher its resistivity. One megohm-cm is equivalent to a million ohms of resistivity measured between two electrodes one centimeter apart. The theoretical maximum ionic purity for water is 18.3 megohm-cm at 25°C.

Membrane — Filtration membranes are thin polymer films that are permeable to water and other fluids. Microporous membrane filters have measurable pore structures, which physically remove panicles or microorganisms larger than pore size. Ultrafiltration membranes, (sometimes called molecular sieves), also remove molecules larger than a specified molecular weight. Reverse osmosis membranes are permeable to water molecules, and very little else, rejecting even dissolved ions in water.

Meq – Milliequivalent, 10^{-3} equivalents

MF – Membrane filter

Mho — Unit of measurement for conductivity; the reciprocal of ohm (resistivity). See "Megohm-cm."

Micro — Prefix meaning one millionth, as in microgram, micrometer.

Microinch – One millionth of an inch, 0.000001 in. = 0.001 mil.

Micrometer — One millionth of a meter. Still widely referred to as a micron in the U.S., although micrometer is now the internationally accepted standard.

Micromho — A measure of conductivity equal to one millionth of a mho.

Micron — See "Micrometer."

Mil – One thousandth of an inch, 0.001 in – 25.4 microns.

Milli — Prefix meaning thousandths, as in milliliter, milligram.

Milliequivalent — To simplify the calculation of ion exchange resin capacity, total dissolved ion concentrations are usually convened into equivalent concentrations of calcium carbonate, the most common source of dissolved ions in water. Resin capacity is nominally given in ppm as CaCO_3 , or in grains per gallon as CaCO_3 (7,000 grains = 1 pound). However, it may also be given as milliequivalents per liter (meq/L). Since calcium carbonate has a molecular weight of 100 and an equivalent weight of 50 (because calcium has a valence of two), ppm as CaCO_3 can be converted to meq/L by dividing by 50. Thus, 1 ppm of CaCO_3 . 0.02 meq/L. Also see Grains Per Gallon.

Mixed-Bed Ion Exchange — Mixing both anion and cation resins in the same deionizer results in higher efficiency, but lower capacity than separate-bed deionizers.

Molecular Weight — The weight of a molecule that may be calculated as the sum of the atomic weights of its constituent atoms. Atomic weight is the weight of an element in relation to some element taken as the standard, usually oxygen (16) or carbon (12).

MR – Macroporous, i.e. a resin with large pores made by incorporating microspheres into a macrosphere (the resin bead)

MTD – Maximally tolerated dose

MTZ – Mass transfer zone

MW – Molecular weight

MWC – Molecular weight cutoff

Nano — A prefix meaning billionths, as in nanogram, nanosecond. One nanogram per liter is equal to one part-per-billion (ppb is used only in U.S.).

NAS – National Academy of Sciences

NCCLS — National Committee for Clinical Laboratory Standards.

NES – National Eutrophication Study

NF – Nanofiltration

NIPDWR – National Interim Primary Drinking Water Regulation

NO₃-N – Nitrate reported as nitrogen, mg/L

NOAEL – No observed adverse effect level

NOM – Natural organic matter

Nominal Pore Size — Based on retention efficiency, a filter should retain 99.9% of all particles larger than its nominal rated pore size.

NOMS – National Organic Monitoring Survey

Noncarbonate Hardness — Hardness in water caused by chlorides, sulfates and nitrates of calcium and magnesium. See 'Hardness'.

NORS – National Organics Reconnaissance Survey

NPDES – National Pollutant Discharge Elimination System

NSP – National Screening Program

NSS – Nitrate-sulfate selective (refers to a special SBA resin that prefers nitrate over sulfate at the ionic strength of natural (fresh) waters)

NTU - The unit used to describe turbidity. Nephelometric refers to the way the instrument, a nephelometer, measures how much light is scattered by suspended particles in the water. The greater the scattering, the higher the turbidity. Therefore, low NTU values indicate high water clarity, while high NTU values indicate low water clarity.

NTP – National Toxicology Program

NVTOC – Nonvolatile total organic carbon

Ohm — The practical unit of electrical resistance in a circuit. where a potential difference of one volt produces a current of one ampere.

Osmosis — The diffusion of a solvent through a semipermeable membrane from a less concentrated solution to a more concentrated solution.

P-A – Presence-absence

PA – Polyamide

PAC – Powdered activated carbon

Particulate — Usually a solid particle large enough to be removed by filtration. Nonfilterable solids are usually referred to as colloids.

PBP – *p*-bromophenol

PCB – Polychlorination biphenols

Peeling – The detachment or partial detachment of an electrodeposited coating from a basis metal or undercoat.

Per Cent Recovery — In reverse osmosis or ultrafiltration, the ratio of pure water output to feedwater input.

Per Cent Rejection — In reverse osmosis or ultrafiltration, the ratio of impurities removed to total impurities in the incoming feedwater. For example, RO membranes typically remove (reject) 90% of the dissolved inorganic contaminants in water.

Permeate — to reverse osmosis, the water that diffuses through the membrane, thereby becoming purified water.

pH — The logarithm of the reciprocal of the hydrogen-ion concentration. A solution with a pH lower than 7 is acidic. If its pH is higher than 7 it is alkaline.

Pico — A prefix meaning one trillionth, as in picogram.

Pit – A small depression or cavity produced in a metal surface during electrodeposition or by corrosion.

POE – Point-of-entry (describes a treatment device located at the point where it can treat all the water entering a house)

Polished Water — High purity water after it has undergone a second treatment step. Ultrapure water usually undergoes two or more treatment steps: more economical pretreatment processes (e.g., reverse osmosis) are used to remove all but a very small fraction of the impurities, and highly efficient polishing processes (e.g., mixed-bed deionization) are used to remove the impurities that remain.

Potable — Suitable for drinking.

POU — Point-of-use (describes a treatment device located at the point of use, e.g., under the sink where it treats water for drinking and cooking only)

PPB — Parts per billion, or micrograms per liter. Abbreviated ppb only in U.S. One part per billion is like seeing a bottle cap on the earth's equator from an orbiting satellite.

PPM — Parts per million. The most common measure of dissolved ionized impurities in water. The same as milligrams per liter. For discussion of ppm as a measure of Total Ionized Solids, see "Milliequivalent"

Precipitate — When a solution reaches saturation, solute will begin to come out of solution, as when water precipitates from the air as rain, or calcium carbonate precipitates out of water to form scale, the chalky white substance deposited on the inside of tea kettles.

Pretreatment — Initial water treatment steps, performed prior to final processing to prolong the life of cartridges and filters and to protect downstream elements from premature failure. See "Polishing."

Product Water — The purified water produced as a result of treatment.

psig — Pounds per square inch of gauge pressure, or pressure above atmospheric pressure.

Purification — Removal of impurities of concern. It has one meaning when applied the preparation of drinking water, another when applied to reagent grade water for the laboratory, and still another when applied to water used to rinse integrated circuit devices.

Pyrogens — In water purification, it usually refers to pyrogens of bacterial origin, which are lipopolysaccharides found in the outer cell walls of certain bacteria. Pyrogens trigger the immune response, causing a fever reaction; hence the name pyrogen (heat producing). Bacterial pyrogens were at one time believed to be toxic substances released when bacterial cells disintegrate, and are therefore still referred to as endotoxins

Q — Raw water flow

Q_a — Airflow rate

R — Reynold's number based on superficial velocity, $d_{eq}V_p/\mu$

R' — Reynold's number for flow through granular bed, $4(V/\epsilon)rp/\mu$

R_i — Reynold's number based on interstitial velocity, $V/S_v\mu(1-\epsilon)$

R_{mf} — Reynold's number based on minimum fluidization velocity, $d_{eq}V_{mf}/\mu$

Recirculation — Continuous recirculation may be necessary to maintain uniformly high purity in larger water systems. Water is continuously recirculated and reprocessed to prevent stagnation and to rinse out residual impurities in the system. Bacteria flourish in stagnant water.

Regenerate — Restore ion exchange capacity of resins by reversing the process. An acid rinse is used to restore cation resin capacity and a sodium hydroxide rinse is used to restore anion resin capacity.

Reject — In reverse osmosis and ultrafiltration, those impurities not able to permeate the membrane are said to be rejected (removed). They are flushed away in the reject (waste) stream.

Resin — Ion exchange resins are usually bead-like spherical materials with an affinity for particular ions. Cation exchange resins, made of styrene and divinylbenzene containing sulfonic acid groups, will exchange hydrogen ions for any cations they encounter. Similarly, anion exchange resins, made of styrene and divinylbenzene containing quaternary ammonium groups, will exchange a hydroxyl ion for any anions.

Resistivity — A measure of resistance to the flow of electricity. In water, it is an accurate measure of ionic purity. See "Megohm-cm."

Reverse Osmosis — The reversal of osmosis to purify water. In osmosis, water diffuses through a semipermeable membrane from a less concentrated solution to a more concentrated solution. The flow of water can be reversed with an opposing pressure that exceeds osmotic pressure. With RO, water is forced out of a concentrated solution, leaving the solute (impurities) behind.

RO — Reverse Osmosis

RSI — Ryznar (saturation) index

RSSCT — Rapid small-scale column test

RWS — Rural Water Survey

S_v – Specific surface, grain surface area per unit grain volume

SAC – Strong-acid cation referring to a cation-exchange resin with sulfonic acid functionality

Sacrificial Protection – The form of corrosion protection wherein one metal corrodes in preference to another, thereby protecting the latter from corrosion.

SAED – Selected area electron diffraction

SAR – Start action request

SARA – Superfund Amendments and Reauthorization Acts

SARP – Strong Acid Regenerable Polisher. An ion exchange (cation) tank, used at the end of a series of ion exchangers to “Polish” product water to a higher quality.

Salinity – The concentration of soluble minerals (mainly salts of the alkali metals or of magnesium) in water.

Salt – Any of numerous compounds that result from replacement of part or all of the acid hydrogen of an acid by a metal or a radical acting like a metal; an ionic or electrovalent crystalline compound.

Salt Rejection – In reverse osmosis, the ratio of salts removed (rejected) to the original salt concentration. See “Per Cent Rejection.”

Saturation Index – The relation of calcium carbonate to the pH, alkalinity and hardness of a water to determine its scale-forming tendency. See “Langelier Index.”

SBA – Strong-base anion referring to an anion-exchange resin with quaternary amine functionality

Scale – The mineral deposits that can coat the insides of boilers or the surfaces of RO membranes. It consists mainly of calcium carbonate, which precipitates out of solution under certain conditions of pH, alkalinity and hardness. See “Saturation Index.”

SCD – Streaming current detector

SDI – Silt density index

SDVB – Styrene divinylbenzene

SDWA – Safe Drinking Water Act (P.L. 93-523 plus amendments)

Sedimentation – A primary step in municipal water treatment. Water is allowed to stand long enough for solids to settle by gravity. Also called settling.

SEM – Scanning electron microscope

Semipermeable – Membranes that do not have measurable pores, but through which smaller molecules can pass.

SFR – Service flow rate, i.e., the exhaustion rate for an ion exchanger or adsorbent usually reported in gpm/ft³ or BV/h

SHMP – Sodium hexametaphosphate

SI – Saturation index

SMCL – Secondary maximum contaminant level

SOC – Synthetic organic chemical

Softener – Water treatment equipment that uses a sodium-based ion exchange resin, principally to remove hardness cations.

Solute – The substance that dissolves to form ions in solution.

Solution – A liquid that contains dissolved solute.

Solvent – A liquid capable of dissolving a solute.

SPC – Standard plate count

Specific Conductance – The reciprocal of specific resistance, usually expressed in micromhos/cm.

Specific Ion Determinations – Electrochemical measurement of trace ion levels in solution.

Specific Resistance – Resistance of a one-centimeter cube of water to the passage of electricity under standard conditions, expressed in ohms/cm. It is a measure of the Total Ionized Solids concentration.

Spore – A reproductive cell or seed of algae, fungi, or protozoa.

SS – Suspended solids

Sterilization — Destruction or removal of all viable organisms.

Suspended Solids — Undissolved solids that can be removed by filtration. Determined by filtering a sample of water and weighing the filter paper.

SWTR – Surface water treatment rule

T- Contact time

Tarnish – (1) Dulling, staining, or discoloration of metals due to superficial corrosion. (2) The film so formed.

TCA – Methyl chloroform

TCAN – Trichloroacetonitrile

TCE – Trichloroethene

TCLP – Toxicity Characteristic Leaching Procedure

TCP – Trichlorophenol

TCSA – Toxic Substances Control Act

TDS — Total Dissolved Solids. The total solids dissolved in a solution, usually measured in mg/ml. (See Total Solids)

TEM – Transmission electron microscope

TFC – Thin film composite

THM – Trihalomethane

THMFP – Trihalomethane formation potential

Throwing Power – The improvement of the coating (usually metal) distribution over the primary current distribution on an electrode (usually cathode) in a given solution, under specified conditions. The term may also be used for anodic processes for which the definition is analogous.

TOC – Total organic carbon

TON – Threshold odor number

Total Bacteria Count — An estimation of the total number of bacteria in a sample based, usually, on Standard Methods procedures for collecting, incubating, and counting colony-forming units (cfu).

Total Ionized Solids — Concentration of dissolved ions in solution, expressed in concentration units of NaCl (sodium Chloride). It determines the operating life of ion exchange resins, and is calculated from measurements of Specific Resistance. Also see "Milliequivalent."

Total Organic Carbon — A measure of the level of organic impurities in water, which determines the operating life of activated carbon beds.

Total Solids — Total solids in water include both dissolved and suspended solids, determined by weighing a sample before and after evaporation to get rid of all water in the sample.

TOX – Total organic halogen

Trace Analysis — Analyzing constituents present in ppm and ppb concentrations. Trace analysis requires extremely pure reagents, made with ultrapure Type I reagent grade water.

Treatment — Water treatment, also referred to as water conditioning, can consist of adding, as well as removing, chemicals to change the properties of water. In water softening, for example, sodium ions are substituted for ions, which cause "hardness," thus reducing the scale-forming tendencies of water. Water purification, on the other hand, always consists of removing undesirable impurities.

TSS — Total Suspended Solids. The total solids suspended in a solution, usually measured in mg/ml. (See Total Solids)

Turbidity — A suspension of fine particles that obscures light rays but requires many days for sedimentation because of small particle size.

Two-Bed — Separate beds or layers of cation and anion exchange resins. Results in lower purity than mixed-bed deionization, but provides higher capacity in terms of throughput.

UC – Uniformity coefficient, d_{60}/d_{10}

UF – Ultrafiltration

Ultrafiltration — Molecular sieves, membranes with pores small enough to remove large molecules. Rated in terms of nominal molecular weight cutoff. A 10,000 Dalton (molecular weight) UF membrane for example, will remove bacterial pyrogens, which are typically in the range of 20,000 Daltons.

Ultrapure Water — Water with a specific resistance higher than 1 megohm-cm. In the laboratory, it usually refers to Type I reagent grade water. Anything in laboratory water that is not H₂O is an impurity. Although chemically pure water is not attainable, ultrapure water systems are now capable of reducing impurities down to the limits of detection.

USEPA — U.S. Environmental Protection Agency

USP — U.S. Pharmacopoeia.

UV - Ultraviolet

UV Oxidation — Ultraviolet radiation is employed in water purification for the photochemical oxidation of organic impurities, resulting in HPLC grade water with organic impurity levels below 0.0005 absorbance units.

Vapor Pressure — The pressure at which equilibrium is established between the liquid and gas phases of a substance.

Viable Organism — Capable of living and reproducing. Thus nothing is sterile as long as it contains even a single viable organism.

Virus — An obligate parasite much smaller than bacteria. Regarded as the simplest living microorganisms. Extremely complex molecules that typically contain a protein coat surrounding an RNA or DNA core of genetic material. They are capable of growing and multiplying only in living cells, and cause various important diseases.

Viscosity — The tendency of a fluid to resist flowing as a result of molecular attraction (cohesion).

VOC – Volatile organic contaminant

WAC – Weak-acid cation (refers to a cation-exchange resin typically with carboxylic acid functionality)

WBA – Weak-base anion (refers to an anion exchange resin with primary, secondary, or tertiary amine functionality)

WHO – World Health Organization

Work (Plating) – The material being plated or otherwise finished.

WQS – Water quality standards

XRD – X-ray diffraction

XRF – X-ray fluorescence

ZBC – Zero point of charge (the pH at which the net charge on the solid particle is zero)

Zeolite — Any of various natural or synthetic hydrated aluminum silicates used as adsorbants in water softening.

UNITS OF MEASURE

amp — Unit of electrical current.

aufs — Unit of measurement when using high performance liquid chromatography techniques. Acronym for absorbance units full scale.

cm — Unit of length. Abbreviation for centimeter. 1 centimeter. 1/100 meter.

cfu — Unit of measurement for bacteria. Abbreviation for colony forming units.

Dalton — Unit of molecule weight.

°C — Unit of temperature abbreviation for degree Centigrade. °C = 5/9 (°F - 32).

°F — Unit of temperature. Abbreviation for degree Fahrenheit. °F = 9/5 (°C) + 32.

gph — Unit of water flow. Abbreviation for U.S. gallons per hour.

gpm — Unit of water flow. Abbreviation for U.S. gallons per minute.

grain — Unit of ion-exchange capacity. Also, unit of weight.

g — Unit of weight. Abbreviation for gram. 1 gram = 0.035 ounces.

Hz — Unit of electrical frequency. Abbreviation for Hertz. 1 Hertz = 1 cycle per second.

kg/cm² — Unit of pressure. Abbreviation for kilogram per square centimeter. 1 kg/cm² = 14.2 pounds per square inch.

kg — Unit of weight. 1 kg = 2.2 pounds.

kPa — Unit of pressure. Abbreviation for kiloPascal. 1 kPa = 0.145 pounds per square inch.

l — Unit of volume. Abbreviation for liter. 1 liter = 0.26 U.S. gallon.

lph — Unit of water flow. Abbreviation for liters per hour. 1 liter per hour = 0.26 gph.

lpm — Unit of water flow. Abbreviation for liters per minute. 1 liter per minute = 0.26 gpm.

megohm-cm — Unit of specific resistance of water. 1 megohm-cm = 1,000,000 ohm-cm.

meter — Unit of length. 1 meter = 39.37 inches.

mho/cm — Unit of specific conductance of water.

μm — Unit of length. Abbreviation for micrometer. 1 micrometer = 1/1,000,000 meter.

μg — Unit of weight. Abbreviation for microgram. 1 microgram = 1/1,000,000 gram.

umho/cm — Unit of specific conductance of water. Abbreviation for micromho/cm. 1 micromho/cm = 1/1,000,000 mho/cm.

micron — Unit of length. 1 micron = 1/1,000,000 meter.

μs/cm — Unit of specific conductance of water. Abbreviation of microSiemen/cm. 1 micro-Siemen/cm = 1 micromho/cm.

mg — Unit of weight. Abbreviation for milligram. 1 milligram = 1/1,000 liter.

ml — Unit of volume. Abbreviation for milliliter. 1 milliliter = 1/1,000 liter.

mm — Unit of length. Abbreviation for millimeter. 1 millimeter = 1/1,000 meter.

ng — Unit of weight. Abbreviation for nanogram. 1 nanogram = 1/1,000,000,000 gram.

NPT — Abbreviation for National Pipe Thread.

NTU — Unit of turbidity. Abbreviation for Nephelometric Turbidity Unit.

ohm-cm — Unit of specific resistance of water.

ppb — Unit of concentration. Abbreviation for parts per billion. 1 part per billion. 1 microgram per liter.

ppm — Unit of concentration. Abbreviation for parts per million. 1 part per million = 1 milligram per liter.

ppm-days — Unit of total chemical exposure. Abbreviation for the multiplicative product of parts per million concentration multiplied by the number of days exposure to that concentration. 2 ppm-days = 2 ppm for 1 day or 1 ppm for 2 days.

psi — Unit of pressure. Abbreviation for pounds per square inch.

s/cm — Unit of specific conductance of water. Abbreviation for Siemens per centimeter. 1 Siemen/cm = 1 mho/cm.

TDS — Abbreviation for total dissolved solids.

TIS — Abbreviation for total ionized solids.

VAC — Abbreviation for volts, alternating current.

CHAPTER 5 SEQUENCE OF OPERATIONS

Instrumentation Numbering Convention

Each Subassembly is labeled on the P&ID with a letter, A, B, etc. A subassembly can contain valves, instruments, and/or pumps, tanks, etc. Each one of these items is labeled alphanumerically. For example, a pressure indicator is labeled PI_ and a control valve is labeled CV_. The first pressure indicator located on a subassembly would be labeled PI1, the second, PI2, etc. (For a complete listing designations, see the P&ID legend sheet, Dwg # 3-P&ID-01). The numerical portion of the designator begins with 1 for each subassembly. In the electrical drawings, here in the Sequence of Operations, and in the program, the designator should be followed by a letter, to indicate on which subassembly the component belongs. For instance, the first pressure indicator on Subassembly A would be labeled PI1-A and the first pressure indicator on Subassembly C would be PI1-C.

SUBASSEMBLY A - CHEMICAL FEED SYSTEM

The assembly consists of two chemical injection points for Ferric Chloride (PCT1A/B-A) and for Hydrochloric Acid (PCT2A/B-A).

ELECTRICAL COMPONENT NAMES

PCT1A	Ferric Chloride Feed Pump
PCT2A	Hydrochloric Acid Feed Pump

OPERATIONAL SEQUENCE

PCT1A will pump FeCl_3 into the raw water pipe. The speed of the pump will range from 0-100% and will vary proportionally to the flow rate registered on FIT2-B, which will be scaled from 0-600 gpm. The concentration of iron in the raw water will be adjusted by manually setting

the stroke adjustment on the pump. PCT2A will pump HCl into the raw water pipe. It is a variable speed pump, which is controlled based on the pH of the water on the inlet of the system using the pH transmitter, AIT7-B. It will be enabled only when the raw water flow meter is registering a flow signal. If $AIT7-B > [system\ pH\ setpoint]$, PCT2-A will pump Acid. The farther away from $[system\ pH\ setpoint]$ it gets, the faster PCT2-A will pump. The closer to $[system\ pH\ setpoint]$ it gets, the slower PCT2-A will pump. If $AIT7-B < [pH\ setpoint]$, PCT2-A will not run.

SUBASSEMBLY B - TRIPLEX FILTRATION SYSTEM

Items in *Italics* are setpoints. The setpoints are changed using the operator interface unit located on the main control panel.

There are three filtration tanks located at the skid. All three tanks filter water in parallel at the same time. The tanks filtering water are online. During a backwash, only two tanks are online. A tank not filtering water is turned off or in Backwash. The Backwashing tank is cleaning. Only one tank backwashes at a time.

The system backwashes based upon runtime, high differential pressure, offline time, or manually initiated by the operator. When any one of these setpoints is reached, or when the operator pushes the backwash pushbutton, a backwash is initiated for that tank. Typically, the manually initiated backwash is based upon sampling and testing. Samples should be taken (at a given frequency) of the effluent water. When the arsenic concentration in the effluent water reaches a control point, a backwash should be manually initiated. The valve sequencing for a backwash is listed in the operational sequence.

The online tank starts a backwash by:

- The BACKWASH FILTER pushbutton

OR

- Automatic PLC start

The BACKWASH FILTER pushbutton is on the operator interface panel (OIP) located on the front of the main control panel.

ELECTRICAL COMPONENT NAMES

PT1-B	Inlet Pressure Transmitter
PT2-B	Tank 1 Outlet Pressure Transmitter
PT3-B	Tank 2 Outlet Pressure Transmitter
PT4-B	Tank 3 Outlet Pressure Transmitter
AIT7-B	Inlet pH Transmitter
AIT1-B	Backwash Turbidimeter
CV1-B	Tank 1-A Top Service Valve
CV2-B	Tank 1-A Top Waste Valve
CV3-B	Tank 1-A Bottom Service Valve
CV4-B	Tank 1-A Bottom Waste Valve
CV5-B	Tank 2-A Top Service Valve
CV6-B	Tank 2-A Top Waste Valve
CV7-B	Tank 2-A Bottom Service Valve
CV8-B	Tank 2-A Bottom Waste Valve
CV9-B	Tank 3-A Top Service Valve
CV10-B	Tank 3-A Top Waste Valve
CV11-B	Tank 3-A Bottom Service Valve
CV12-B	Tank 3-A Bottom Waste Valve
CV13-B	Tank Drain Valve
PCV14-B	Backwash Inlet Valve
CV15-B	Filter to Waste (Rinse) Valve
FIT1-B	Backwash Flow Transmitter
FIT2-B	Filter Effluent Flow Transmitter

OPERATIONAL SEQUENCE

NORMAL SERVICE FLOW

Configuration #	Description	Valves Energized	Valves De-energized	Required Conditions
1	All Three Tanks Online	CV1, CV3, CV5, CV7, CV9, CV11	CV2, CV4, CV6, CV8, CV10, CV12, CV13, PCV14, CV15, CV16, CV17, CV18	

BACKWASH SEQUENCE (TANK 1-B)

Step No.	Description	Valves Energized	Valves De-energized	Required Conditions
1	Isolate Tank 1-B	CV5, CV7, CV9, CV11	CV1, CV2, CV3, CV4, CV6, CV8, CV10, CV12, CV13, CV14, CV15, CV16, CV17, CV18	
2	Valve Delay	CV5, CV7, CV9, CV11	CV1, CV2, CV3, CV4, CV6, CV8, CV10, CV12, CV13, CV14, CV15, CV16, CV17, CV18	"
3	Open Top Waste Valve, T1-B	CV2, CV5, CV7, CV9, CV11	CV1, CV3, CV4, CV6, CV8, CV10, CV12, CV13, CV14, CV15, CV16, CV17, CV18	"
4	Valve Delay	CV2, CV5, CV7, CV9, CV11	CV1, CV3, CV4, CV6, CV8, CV10, CV12, CV13, CV14, CV15, CV16, CV17, CV18	"
5	Open Bottom Waste Valve, T1-B	CV2, CV4, CV5, CV7, CV9, CV11	CV1, CV3, CV6, CV8, CV10, CV12, CV13, CV14, CV15, CV16, CV17, CV18	"
6	Valve Delay	CV2, CV4, CV5, CV7, CV9, CV11	CV1, CV3, CV6, CV8, CV10, CV12, CV13, CV14, CV15, CV16, CV17, CV18	"
7	Open Tank Drain Valve	CV2, CV4, CV5, CV7, CV9, CV11, CV13	CV1, CV3, CV6, CV8, CV10, CV12, CV14, CV15, CV16, CV17, CV18	"
8	Tank Drain Timer	CV2, CV4, CV5, CV7, CV9, CV11, CV13	CV1, CV3, CV6, CV8, CV10, CV12, CV14, CV15, CV16, CV17, CV18	"
9	Tank Drain Complete	CV2, CV4, CV5, CV7, CV9, CV11	CV1, CV3, CV6, CV8, CV10, CV12, CV13, CV14, CV15, CV16, CV17, CV18	"
10	Valve Delay	CV2, CV4, CV5, CV7, CV9, CV11	CV1, CV3, CV6, CV8, CV10, CV12, CV13, CV14, CV15, CV16, CV17, CV18	"
11	Air Sparge Tank T1-B	CV2, CV5, CV7, CV9, CV11, CV16	CV1, CV3, CV4, CV6, CV8, CV10, CV12, CV13, CV14, CV15, CV17, CV18	"
12	Air Sparge Timer	CV2, CV5, CV7, CV9, CV11, CV16	CV1, CV3, CV4, CV6, CV8, CV10, CV12, CV13, CV14, CV15, CV17, CV18	"
13	Settle Timer T1-B	CV2, CV5, CV7, CV9, CV11	CV1, CV3, CV4, CV6, CV8, CV10, CV12, CV13, CV14, CV15, CV16, CV17, CV18	"

Step No.	Description	Valves Energized	Valves De-energized	Required Conditions
14	Prepare for Backwash, Bottom Waste Valve	CV2, CV4, CV5, CV7, CV9, CV11	CV1, CV3, CV6, CV8, CV10, CV12, CV13, CV14, CV15, CV16, CV17, CV18	"
15	Open Backwash Inlet Valve	CV2, CV4, CV5, CV7, CV9, CV11, CV14	CV1, CV3, CV6, CV8, CV10, CV12, CV13, CV15, CV16, CV17, CV18	"
16	Backwash Minimum Timer	CV2, CV4, CV5, CV7, CV9, CV11, CV14	CV1, CV3, CV6, CV8, CV10, CV12, CV13, CV15, CV16, CV17, CV18	"
17a	If AIT1-B < [backwash turbidity setpoint], then Backwash Complete	CV2, CV4, CV5, CV7, CV9, CV11	CV1, CV3, CV6, CV8, CV10, CV12, CV13, CV14, CV15, CV16, CV17, CV18	"
17b	Go to step 19			"
18	If AIT1-B > [backwash turbidity setpoint] and TIMER > [maximum backwash time], Backwash Alarm	CV2, CV4, CV5, CV7, CV9, CV11	CV1, CV3, CV6, CV8, CV10, CV12, CV13, CV14, CV15, CV16, CV17, CV18	"
19	Valve Delay	CV2, CV4, CV5, CV7, CV9, CV11	CV1, CV3, CV6, CV8, CV10, CV12, CV13, CV14, CV15, CV16, CV17, CV18	"
20	Open Filter to Waste (Rinse) Valve	CV4, CV5, CV7, CV9, CV11, CV15	CV1, CV2, CV3, CV6, CV8, CV10, CV12, CV13, CV14, CV16, CV17, CV18	"
21	Valve Delay	CV4, CV5, CV7, CV9, CV11, CV15	CV1, CV2, CV3, CV6, CV8, CV10, CV12, CV13, CV14, CV16, CV17, CV18	"
22	Begin Filter to Waste (Top Valve) Tank 1-B	CV1, CV4, CV5, CV7, CV9, CV11, CV15	CV2, CV3, CV6, CV8, CV10, CV12, CV13, CV14, CV16, CV17, CV18	"
23	Filter to Waste Timer [minutes]	CV1, CV4, CV5, CV7, CV9, CV11, CV15	CV2, CV3, CV6, CV8, CV10, CV12, CV13, CV14, CV16, CV17, CV18	"
24	Bring Tank 1-B Online	CV1, CV3, CV5, CV7, CV9, CV11, CV15	CV2, CV4, CV6, CV8, CV10, CV12, CV13, CV14, CV16, CV17, CV18	"
25	Valve Delay	CV1, CV3, CV5, CV7, CV9, CV11, CV15	CV2, CV4, CV6, CV8, CV10, CV12, CV13, CV14, CV16, CV17, CV18	"
26	Close Filter-To-Waste Valve	CV1, CV3, CV5, CV7, CV9, CV11	CV2, CV4, CV6, CV8, CV10, CV12, CV13, CV14, CV15, CV16, CV17, CV18	"

BACKWASH SEQUENCE (TANK 2-B)

Step No.	Description	Valves Energized	Valves De-energized	Required Conditions
1	Isolate Tank 2-B	CV1, CV3, CV9, CV11	CV2, CV4, CV5, CV6, CV7, CV8, CV10, CV12, CV13, CV14, CV15, CV16, CV17, CV18	
2	Valve Delay	CV1, CV3, CV9, CV11	CV2, CV4, CV5, CV6, CV7, CV8, CV10, CV12, CV13, CV14, CV15, CV16, CV17, CV18	"
3	Open Top Waste Valve, T2-B	CV1, CV3, CV6, CV9, CV11	CV2, CV4, CV5, CV7, CV8, CV10, CV12, CV13, CV14, CV15, CV16, CV17, CV18	"
4	Valve Delay	CV1, CV3, CV6, CV9, CV11	CV2, CV4, CV5, CV7, CV8, CV10, CV12, CV13, CV14, CV15, CV16, CV17, CV18	"
5	Open Bottom Waste Valve, T2-B	CV1, CV3, CV6, CV8, CV9, CV11	CV2, CV4, CV5, CV7, CV10, CV12, CV13, CV14, CV15, CV16, CV17, CV18	"
6	Valve Delay	CV1, CV3, CV6, CV8, CV9, CV11	CV2, CV4, CV5, CV7, CV10, CV12, CV13, CV14, CV15, CV16, CV17, CV18	
7	Open Tank Drain Valve	CV1, CV3, CV6, CV8, CV9, CV11, CV13	CV2, CV4, CV5, CV7, CV10, CV12, CV14, CV15, CV16, CV17, CV18	"
8	Tank Drain Timer	CV1, CV3, CV6, CV8, CV9, CV11, CV13	CV2, CV4, CV5, CV7, CV10, CV12, CV14, CV15, CV16, CV17, CV18	"
9	Tank Drain Complete	CV1, CV3, CV6, CV8, CV9, CV11	CV2, CV4, CV5, CV7, CV10, CV12, CV13, CV14, CV15, CV16, CV17, CV18	"
10	Valve Delay	CV1, CV3, CV6, CV8, CV9, CV11	CV2, CV4, CV5, CV7, CV10, CV12, CV13, CV14, CV15, CV16, CV17, CV18	"
11	Air Sparge Tank T2-B	CV1, CV3, CV6, CV9, CV11, CV17	CV2, CV4, CV5, CV7, CV8, CV10, CV12, CV13, CV14, CV15, CV16, CV18	"
12	Air Sparge Timer	CV1, CV3, CV6, CV9, CV11, CV17	CV2, CV4, CV5, CV7, CV8, CV10, CV12, CV13, CV14, CV15, CV16, CV18	"
13	Settle Timer T2-B	CV1, CV3, CV6, CV9, CV11	CV2, CV4, CV5, CV7, CV8, CV10, CV12, CV13, CV14, CV15, CV16, CV17, CV18	"
14	Prepare for Backwash, Bottom Waste Valve	CV1, CV3, CV6, CV8, CV9, CV11	CV2, CV4, CV5, CV7, CV10, CV12, CV13, CV14, CV15, CV16, CV17, CV18	"
15	Open Backwash Inlet Valve	CV1, CV3, CV6, CV8, CV9, CV11, CV14	CV2, CV4, CV5, CV7, CV10, CV12, CV13, CV15, CV16, CV17, CV18	"
16	Backwash Minimum Timer	CV1, CV3, CV6, CV8, CV9, CV11, CV14	CV2, CV4, CV5, CV7, CV10, CV12, CV13, CV15, CV16, CV17, CV18	"
17a	If AIT1-B < [backwash turbidity setpoint], then Backwash Complete	CV1, CV3, CV6, CV8, CV9, CV11	CV2, CV4, CV5, CV7, CV10, CV12, CV13, CV14, CV15, CV16, CV17, CV18	"

Step No.	Description	Valves Energized	Valves De-energized	Required Conditions
17b	Go to step 19			"
18	If AIT1-B > [backwash turbidity setpoint] and TIMER > [maximum backwash time], Backwash Alarm	CV1, CV3, CV6, CV8, CV9, CV11	CV2, CV4, CV5, CV7, CV10, CV12, CV13, CV14, CV15, CV16, CV17, CV18	"
19	Valve Delay	CV1, CV3, CV6, CV8, CV9, CV11	CV2, CV4, CV5, CV7, CV10, CV12, CV13, CV14, CV15, CV16, CV17, CV18	"
20	Open Filter to Waste (Rinse) Valve	CV1, CV3, CV8, CV9, CV11, CV15	CV2, CV4, CV5, CV6, CV7, CV10, CV12, CV13, CV14, CV16, CV17, CV18	"
21	Valve Delay	CV1, CV3, CV8, CV9, CV11, CV15	CV2, CV4, CV5, CV6, CV7, CV10, CV12, CV13, CV14, CV16, CV17, CV18	"
22	Begin Filter to Waste (Top Valve) Tank 2-B	CV1, CV3, CV5, CV8, CV9, CV11, CV15	CV2, CV4, CV6, CV7, CV10, CV12, CV13, CV14, CV16, CV17, CV18	"
23	Filter to Waste Timer [minutes]	CV1, CV3, CV5, CV8, CV9, CV11, CV15	CV2, CV4, CV6, CV7, CV10, CV12, CV13, CV14, CV16, CV17, CV18	"
24	Bring Tank 2-B Online	CV1, CV3, CV5, CV7, CV9, CV11, CV15	CV2, CV4, CV6, CV8, CV10, CV12, CV13, CV14, CV16, CV17, CV18	"
25	Valve Delay	CV1, CV3, CV5, CV7, CV9, CV11, CV15	CV2, CV4, CV6, CV8, CV10, CV12, CV13, CV14, CV16, CV17, CV18	"
26	Close Filter-To-Waste Valve	CV1, CV3, CV5, CV7, CV9, CV11	CV2, CV4, CV6, CV8, CV10, CV12, CV13, CV14, CV15, CV16, CV17, CV18	"

BACKWASH SEQUENCE (TANK 3-B)

Step No.	Description	Valves Energized	Valves De-energized	Required Conditions
1	Isolate Tank 3-B	CV1, CV3, CV5, CV7	CV2, CV4, CV6, CV8, CV9, CV10, CV11, CV12, CV13, CV14, CV15, CV16, CV17, CV18	
2	Valve Delay	CV1, CV3, CV5, CV7	CV2, CV4, CV6, CV8, CV9, CV10, CV11, CV12, CV13, CV14, CV15, CV16, CV17, CV18	"
3	Open Top Waste Valve, T3-B	CV1, CV3, CV5, CV7, CV10	CV2, CV4, CV6, CV8, CV9, CV11, CV12, CV13, CV14, CV15, CV16, CV17, CV18	"
4	Valve Delay	CV1, CV3, CV5, CV7, CV10	CV2, CV4, CV6, CV8, CV9, CV11, CV12, CV13, CV14, CV15, CV16, CV17, CV18	"
5	Open Bottom Waste Valve, T3-B	CV1, CV3, CV5, CV7, CV10, CV12	CV2, CV4, CV6, CV8, CV9, CV11, CV13, CV14, CV15, CV16, CV17, CV18	"

Step No.	Description	Valves Energized	Valves De-energized	Required Conditions
6	Valve Delay	CV1, CV3, CV5, CV7, CV10, CV12	CV2, CV4, CV6, CV8, CV9, CV11, CV13, CV14, CV15, CV16, CV17, CV18	
7	Open Tank Drain Valve	CV1, CV3, CV5, CV7, CV10, CV12, CV13	CV2, CV4, CV6, CV8, CV9, CV11, CV14, CV15, CV16, CV17, CV18	"
8	Tank Drain Timer	CV1, CV3, CV6, CV8, CV9, CV11, CV13	CV2, CV4, CV5, CV7, CV10, CV12, CV14, CV15, CV16, CV17, CV18	"
9	Tank Drain Complete	CV1, CV3, CV5, CV7, CV10, CV12	CV2, CV4, CV6, CV8, CV9, CV11, CV13, CV14, CV15, CV16, CV17, CV18	"
10	Valve Delay	CV1, CV3, CV5, CV7, CV10, CV12	CV2, CV4, CV6, CV8, CV9, CV11, CV13, CV14, CV15, CV16, CV17, CV18	"
11	Air Sparge Tank T3-B	CV1, CV3, CV5, CV7, CV10, CV18	CV2, CV4, CV6, CV8, CV9, CV11, CV12, CV13, CV14, CV15, CV16, CV17	"
12	Air Sparge Timer	CV1, CV3, CV5, CV7, CV10, CV18	CV2, CV4, CV6, CV8, CV9, CV11, CV12, CV13, CV14, CV15, CV16, CV17	"
13	Settle Timer T3-B	CV1, CV3, CV5, CV7, CV10	CV2, CV4, CV6, CV8, CV9, CV11, CV12, CV13, CV14, CV15, CV16, CV17, CV18	"
14	Prepare for Backwash, Bottom Waste Valve	CV1, CV3, CV5, CV7, CV10, CV12	CV2, CV4, CV6, CV8, CV9, CV11, CV13, CV14, CV15, CV16, CV17, CV18	"
15	Open Backwash Inlet Valve	CV1, CV3, CV5, CV7, CV10, CV12, CV14	CV2, CV4, CV6, CV8, CV9, CV11, CV13, CV15, CV16, CV17, CV18	"
16	Backwash Minimum Timer	CV1, CV3, CV5, CV7, CV10, CV12, CV14	CV2, CV4, CV6, CV8, CV9, CV11, CV13, CV15, CV16, CV17, CV18	"
17a	If AIT1-B < [backwash turbidity setpoint], then Backwash Complete	CV1, CV3, CV5, CV7, CV10, CV12	CV2, CV4, CV6, CV8, CV9, CV11, CV13, CV14, CV15, CV16, CV17, CV18	"
17b	Go to step 19			"
18	If AIT1-B > [backwash turbidity setpoint] and TIMER > [maximum backwash time], Backwash Alarm	CV1, CV3, CV5, CV7, CV10, CV12	CV2, CV4, CV6, CV8, CV9, CV11, CV13, CV14, CV15, CV16, CV17, CV18	"
19	Valve Delay	CV1, CV3, CV5, CV7, CV10, CV12	CV2, CV4, CV6, CV8, CV9, CV11, CV13, CV14, CV15, CV16, CV17, CV18	"
20	Open Filter to Waste (Rinse) Valve	CV1, CV3, CV5, CV7, CV12, CV15	CV2, CV4, CV6, CV8, CV9, CV10, CV11, CV13, CV14, CV16, CV17, CV18	"
21	Valve Delay	CV1, CV3, CV5, CV7, CV12, CV15	CV2, CV4, CV6, CV8, CV9, CV10, CV11, CV13, CV14, CV16, CV17, CV18	"

Step No.	Description	Valves Energized	Valves De-energized	Required Conditions
22	Begin Filter to Waste (Top Valve) Tank 3-B	CV1, CV3, CV5, CV7, CV9, CV12, CV15	CV2, CV4, CV6, CV8, CV10, CV11, CV13, CV14, CV16, CV17, CV18	"
23	Filter to Waste Timer [minutes]	CV1, CV3, CV5, CV7, CV9, CV12, CV15	CV2, CV4, CV6, CV8, CV10, CV11, CV13, CV14, CV16, CV17, CV18	"
24	Bring Tank 3-B Online	CV1, CV3, CV5, CV7, CV9, CV11, CV15	CV2, CV4, CV6, CV8, CV10, CV12, CV13, CV14, CV16, CV17, CV18	"
25	Valve Delay	CV1, CV3, CV5, CV7, CV9, CV11, CV15	CV2, CV4, CV6, CV8, CV10, CV12, CV13, CV14, CV16, CV17, CV18	"
26	Close Filter-To-Waste Valve	CV1, CV3, CV5, CV7, CV9, CV11	CV2, CV4, CV6, CV8, CV10, CV12, CV13, CV14, CV15, CV16, CV17, CV18	"

FILTRATION SYSTEM SETPOINTS

To Backwash: *high differential pressure*
service time
standby time

Backwash Setpoints: *tank drain time*
air scour time
minimum backwash time
maximum backwash time
settle time
backwash turbidity

Other Setpoints: *filter-to-waste time*
low backwash flow

FILTRATION SYSTEM ALARMS

Low Backwash FlowDuring a backwash, if the flow rate registered on FIT1-B is below the [*low backwash flow setpoint*] for 60 seconds, this alarm triggers. This alarm sounds the siren and lights the beacon. The backwash will be paused. After 5 minutes, the backwash will resume. This alarm must be reset by the operator.

Incomplete Backwash Tank #(x)....If the Backwash Flow Alarm occurs a second time, this alarm triggers. The backwash will be terminated, and the filter will

be disabled. This alarm sounds the siren and lights the beacon. It must be reset by the operator.

Backwash Fail Tank #(x).....If the *[maximum backwash time]* expires before AIT1-B <*[backwash turbidity]*, this alarm triggers. The backwash will be terminated, and the tank will perform a filter-to-waste and go back online. This alarm sounds the siren and lights the beacon. It must be reset by the operator.

SUBASSEMBLY C - BACKWASH PUMP SKID, P-1A/B-C

These two pumps pressurize filtered water from the storage tank and feed it to the filter system, Subassembly B, to backwash the filters. The pumps are started and stopped, based on the sequences described here, by the PLC in the Main Control Panel (MCP).

There is a pump select switch 1A/1B located on the Motor Control Enclosure. There is also an HAND/OFF/AUTO select button located on the Motor Control Enclosure that functions as follows:

- | | |
|------|---|
| HAND | In HAND, the pump will be energized regardless of any other condition |
| OFF | Pump does not run. |
| AUTO | In AUTO, the pump will be energized when the 30 seconds after PCV14-B opens during the backwash sequence. It continues until the backwash is complete. It will also be disabled 30 seconds prior to PCV14-B closing. When P-1A or P-1B is supposed to be running, if there is no flow registered at FIT1-B for 60 seconds, it will be disabled. It will be re-enabled after the no flow alarm has been reset. |

BACKWASH PUMP SKID ALARMS

- | | |
|---------|---|
| P1 Fail | This alarm is energized if P1 fails to run when it is supposed to be running. This alarm must be reset with the ALARM ACKNOWLEDGE pushbutton. |
|---------|---|

SUBASSEMBLY D – AIR COMPRESSOR

The air compressor is supplied to provide compressed air for the pneumatically actuated valves and for the air scour portion of the backwash sequence.

ALARM LIST

Alarm Description
ALL FILTERS BACKWASH FAIL
FILTER 1 BACKWASH TURBIDITY FAIL
FILTER 2 BACKWASH TURBIDITY FAIL
FILTER 3 BACKWASH TURBIDITY FAIL
FILTER 1 BACKWASH INCOMPLETE-NO FLOW
FILTER 2 BACKWASH INCOMPLETE-NO FLOW
FILTER 3 BACKWASH NO FLOW
STORAGE TANK HIGH LEVEL
STORAGE TANK LOW LEVEL
LOW BACKWASH FLOW WARNING
BACKWASH PUMP #1 FAIL
BACKWASH PUMP #2 FAIL

INPUT/OUTPUT LIST

			1747-L552B/C	
			RACK #	0
			SLOT #	0
			1746-NI8	
			RACK #	0
			SLOT #	1
I:01.	4-20 mA INPUTS			
00	PT1	SYSTEM INLET PRESSURE		
01	PT2	FILTER 1 OUTLET PRESSURE		
02	PT3	FILTER 2 OUTLET PRESSURE		

03	(PT4)	(FILTER 3 OUTLET PRESSURE)	
04	AIT1	FILTER BACKWASH TURBIDITY	
05	FIT1	FILTER BACKWASH FLOW	
06	FIT2	COMBINED FILTER EFFLUENT FLOW	
07	ST LVL	STORAGE TANK LEVEL (BY OTHERS)	

O:02. 4-20 mA OUTPUTS

00	PCV14	BACKWASH INLET VALVE POSITION
01	CHEM 1	CHEMICAL FEED PUMP #1 SPEED
02	CHEM 2	CHEMICAL FEED PUMP #2 SPEED
03		
04		
05		
06		
07		

1746-NQ8I

RACK #	0
SLOT #	2

I:03/ 24 VDC INPUTS

00	SW1	SYSTEM SWITCH IN AUTO
01	BWP1 AUX	BACKWASH PUMP #1 AUXILIARY CONTACT
02	BWP2 AUX	BACKWASH PUMP #2 AUXILIARY CONTACT
03		
04		
05		
06		
07		
08		
09		
10		
11		
12		
13		
14		
15		

1746-IB16

RACK #	0
SLOT #	3

EMPTY SLOT

RACK #	0
SLOT #	4

O:05/ 24VDC OUTPUTS

00		
01	CV1	TANK 1 TOP SERVICE VALVE
02	CV2	TANK 1 TOP WASTE VALVE
03	CV3	TANK 1 BOTTOM SERVICE VALVE
04	CV4	TANK 1 BOTTOM WASTE VALVE
05	CV5	TANK 2 TOP SERVICE VALVE
06	CV6	TANK 2 TOP WASTE VALVE
07	CV7	TANK 2 BOTTOM SERVICE VALVE
08	CV8	TANK 2 BOTTOM WASTE VALVE
09	(CV9)	(TANK 3 TOP SERVICE VALVE)
10	(CV10)	(TANK 3 TOP WASTE VALVE)

1746-OW16

RACK #	0
SLOT #	5

11	(CV11)	(TANK 3 BOTTOM SERVICE VALVE)
12	(CV12)	(TANK 3 BOTTOM WASTE VALVE)
13	CV13	TANK DRAIN VALVE
14		
15	CV15	FILTER TO WASTE VALVE

O:06/ 24VDC OUTPUTS

00	CV16	TANK 1 AIR SPARGE VALVE
01	CV17	TANK 2 AIR SPARGE VALVE
02	(CV18)	(TANK 3 AIR SPARGE VALVE)
03	FP-RUN	FEED PUMP RUN
04	BW1-RUN	BACKWASH PUMP #1 RUN
05		
06	CHEM1-EN	CHEMICAL PUMP #1 ENABLE
07	CHEM2-EN	CHEMICAL PUMP #2 ENABLE
08		
09		
10		
11		
12		
13		
14	HORN	ALARM HORN
15	BEACON	ALARM BEACON

1746-OW16

RACK #	0
SLOT #	6

I:07. 4-20 mA INPUTS

00		
01		
02		
03		EMPTY SLOT
04		
05		
06		
07		

1746-NI8

RACK #	0
SLOT #	7

O:08/ 24VDC OUTPUTS

00		
01		
02		
03		
04		
05		
06		EMPTY SLOT
07		
08		
09		
10		
11		
12		
13		
14		
15		

1746-OW16

RACK #	0
SLOT #	8

I:09. 4-20 mA INPUTS

00	AIT7	pH TRANSMITTER
01		
02		
03		
04		
05		
06		
07		

1746-NI8

RACK #	0
SLOT #	9

CALIBRATION SHEET

Description	Tag	Design Min.	Design Max.	Units	Output Min.	Output Max.	Output Type	Calibration Result	Cal. By
SYSTEM INLET PRESSURE	PT1	0	145	PSI	4	20	mA		
FILTER 1 OUTLET PRESSURE	PT2	0	145	PSI	4	20	mA		
FILTER 2 OUTLET PRESSURE	PT3	0	145	PSI	4	20	mA		
FILTER 3 OUTLET PRESSURE	PT4	0	145	PSI	4	20	mA		
FILTER BACKWASH TURBIDITY	AIT1	0	100.0	NTU	4	20	mA		
FILTER BACKWASH FLOW	FIT1	0	1243	GPM	4	20	mA		
FILTER EFFLUENT FLOW	FIT2	0	4973	GPM	4	20	mA		
STORAGE TANK LEVEL (BY OTHERS)	ST LVL	0	25	FT	4	20	mA		
INLET pH	AIT7	0	14	SU	4	20	mA		

SETPOINT LIST

Description	Units	Factory Setting	Field Setting
FILTER-TO-WASTE TIME	MIN	3	
BACKWASH DRAIN TIME	MIN	4	
AIR SPARGE TIME	MIN	2	
SETTLE TIME	MIN	2	
MINIMUM BACKWASH TIME	MIN	5	
MAXIMUM BACKWASH TIME	MIN	15	
BACKWASH TURBIDITY OK SETPOINT	NTU	20.0	
LOW BACKWASH FLOW SETPOINT	GPM	120	
DIFFERENTIAL PRESSURE BACKWASH TRIGGER	PSI	25	
DIFFERENTIAL PRESSURE TRIGGER TIME DELAY	SEC	60	
SERVICE TIME BACKWASH TRIGGER	HRS	24	
STANDBY TIME BACKWASH TRIGGER	HRS	96	
CV14 FLOW SETPOINT	GPM	160	
CV14 FLOW DEADBAND	GPM	5	
CV14 PID GAIN (PROPORTIONAL)	-	50.0	
CV14 PID RESET (INTEGRAL)	-	5.0	
STORAGE TANK HIGH LEVEL ALARM	FT	-	
STORAGE TANK SYSTEM ON LEVEL	FT	-	
STORAGE TANK SYSTEM OFF LEVEL	FT	-	
STORAGE TANK LOW LEVEL ALARM	FT	-	
FeCl ₃ TRIM SETPOINT		1	
FeCl ₃ MANUAL SPEED SETPOINT	%	50	
pH SETPOINT	SU	7.4	
pH DEADBAND	SU	0.5	
pH PID GAIN		125	
pH PID RESET		5	
HCl PUMP MANUAL SETPOINT	%	55	

CHAPTER 6 **GENERAL OPERATION AND MAINTENANCE**

ROUTINE MAINTENANCE - GENERAL

DAILY

- Fill out the state EPA log sheet recording such data as pressures throughout the system, output quality, input quality and backwash frequency.
- Make up chemical or check chemical drums for fullness.
- Visually check that all manual valves are set to their proper open or closed position in order for the system to operate correctly. You may wish to mark or lock certain valves into their proper position in order to prevent unauthorized tampering.
- Visually check system for any unusual conditions such as extremely high or low tank levels, small leaks from components or any overheating components.

WEEKLY

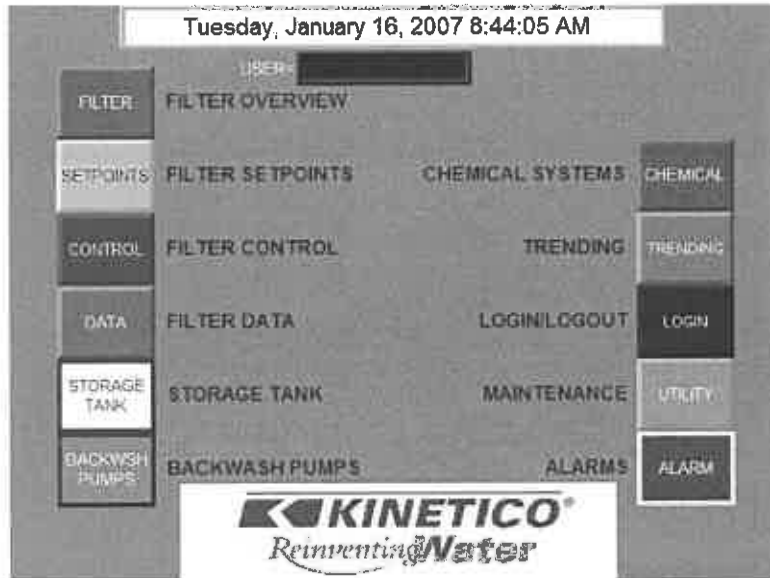
- Review log sheet data in order to find any trends which might show a failure in the system to operate correctly (i.e. water quality dropping off slowly possibly denotes poor regenerations, or outlet pressure slowly dropping can indicate possible filtration bed problems or filter clogging.)

SEMI-ANNUALLY

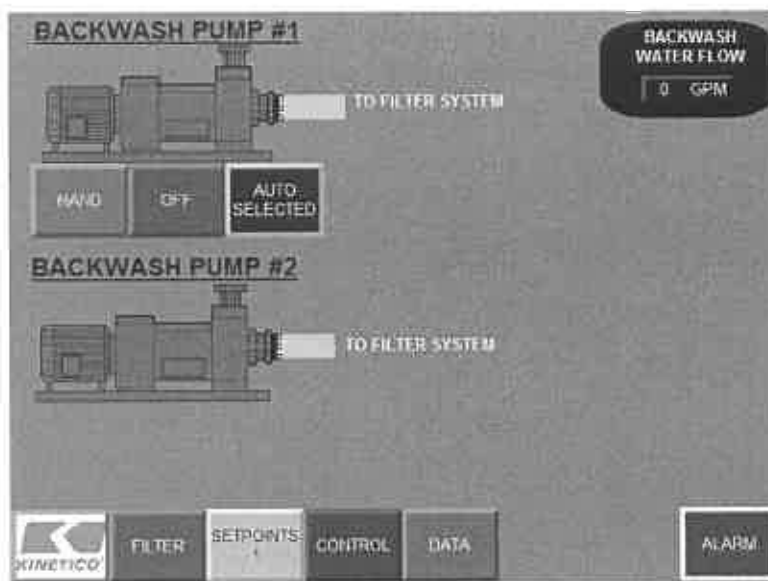
- Check suggested maintenance intervals for individual components in order to keep items properly lubricated and serviced. Items will need detailed inspection and service every six months, depending on the environment in which they are operating and the solutions which the system is pumping.
- Replace any worn components before failure in order to prevent any hazardous situations and unnecessary downtime.

OPERATOR INTERFACE SCREENS (OIP)

MAIN SCREEN



BACKWASH PUMP SCREEN



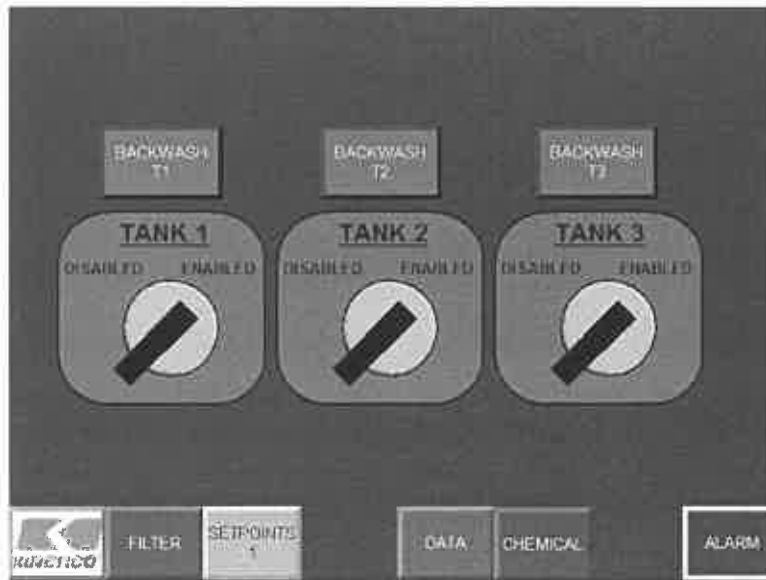
CHEMICAL PUMP SCREEN

The Chemical Pump Screen displays controls for HCl and FeCl₃ pumps. At the top, it shows 'FILTERED WATER FLOW' at 0 GPM and 'INLET pH' at 7.7 SU. Below this, there are two main sections: 'HCl PUMPS' and 'FeCl₃ PUMPS'. Each section has a 'HAND' button, a 'SELECTED' button, and an 'AUTO' button. The 'HCl PUMPS' section shows a flow rate of 0.0 GPM and a setpoint of 7.4. The 'FeCl₃ PUMPS' section shows a flow rate of 0.80 GPM and a setpoint of 50.0. At the bottom, there are buttons for 'FILTER', 'SETPOINTS', 'CONTROL', 'DATA', and 'ALARM'.

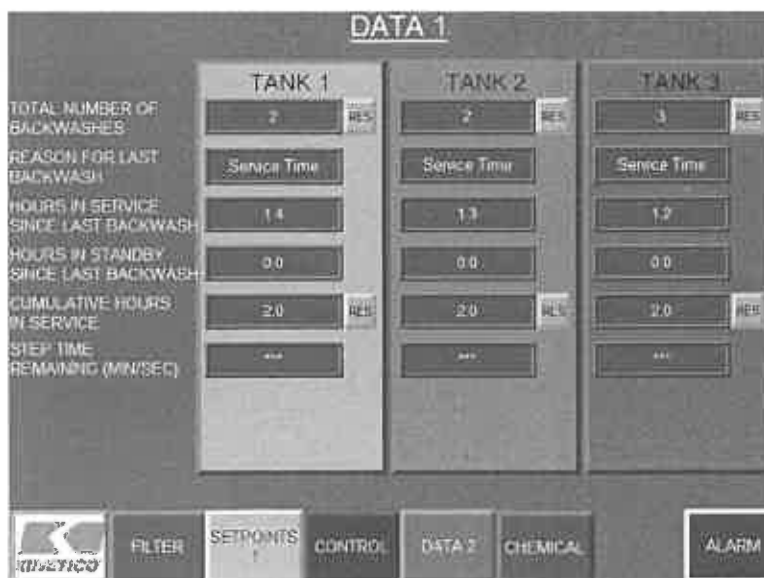
CONFIGURATION SCREEN

The Configuration Settings screen displays various system parameters and their values. At the top, it says 'CONFIGURATION SETTINGS' and 'DO NOT CHANGE THESE SETTINGS WITHOUT FULLY UNDERSTANDING THE IMPLICATIONS'. The screen is divided into several sections with checkboxes and numerical input fields. The parameters include: BACKWASH PUMP? (NT-100), RAW WATER PUMP? (NT-101), FILTERED WATER PUMP? (NT-102), CHEMICAL SYSTEM? (NT-103), VALVE DELAY IN SECS (NT-104), NO. TANK OR LARGER? (NT-105), TURBIDITY OPTION? (NT-106), pH ADJUST OPTION? (NT-107), H-T MODE? (NT-108), HIGH DEMAND MODE? (NT-109), NT-50 FT1 BW FLOW MIN SCALE VALUE (0), NT-51 FT1 BW FLOW MAX SCALE VALUE (1243), NT-52 FT2 FILTERED FLOW MIN SCALE VALUE (0), NT-53 FT2 FILTERED FLOW MAX SCALE VALUE (4973), PM-57 STORAGE TANK MIN SCALE VALUE (0.0), PM-58 STORAGE TANK MAX SCALE VALUE (25.0), NT-56 BW SYSTEM FLOW FOR CHEM PUMP SCALING (0), NT-57 MAX SYSTEM FLOW FOR CHEM PUMP SCALING (645), NT-58 FTW FLOWRATE FOR CHEM PUMP SCALING (200), NT-6 NUMBER OF FILTERS IN SYSTEM (3), NT-1 VALVE MOVEMENT DELAY (MIN IN SECS) (10), and NT-2 FILTER TANK SIZE (4000.04 IN. LBS) (60). At the bottom right, there is a 'UTILITY' button.

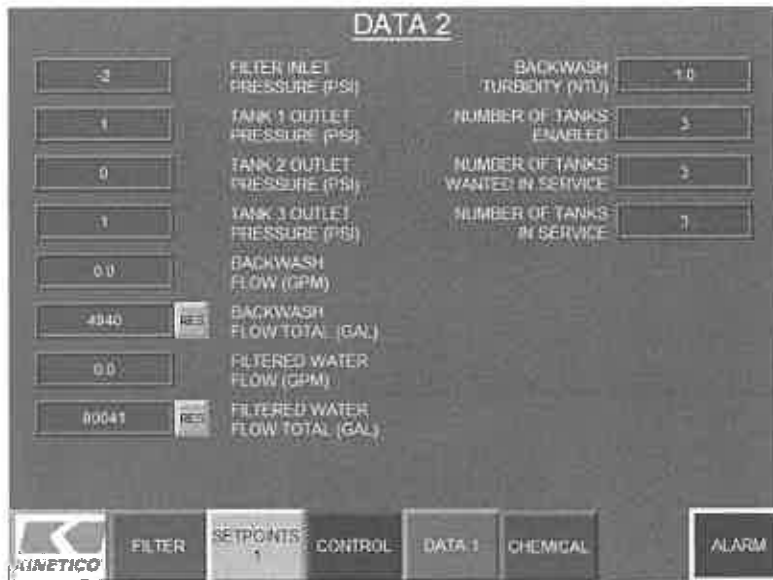
CONTROL SCREEN



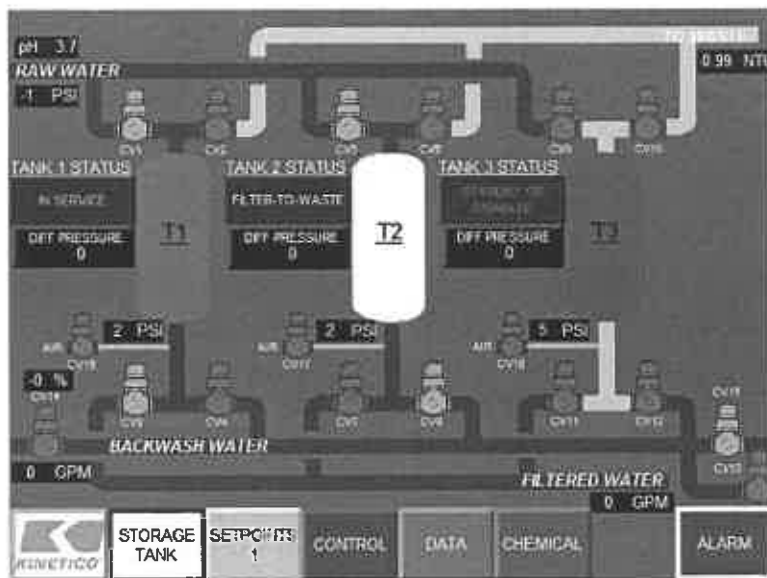
DATA 1 SCREEN



DATA 2 SCREEN



FILTER SCREEN



FILTER SETPOINT SCREEN

3	FILTER TO WASTE TIME (MIN.)	MAXIMUM BACKWASH TIME (MIN.)	15
		BACKWASH TURBIDITY OK SETPOINT (NTU)	20.0
4	BACKWASH DRAIN TIME (MIN.)	LOW BACKWASH FLOW SETPOINT (GPM)	120
2	AIR SPARGE TIME (MIN.)	DIFFERENTIAL PRESSURE BACKWASH TRIGGER (PSI)	25
2	SETTLE TIME (MIN.)	DIFFERENTIAL PRESSURE TRIGGER TIME DELAY (SEC.)	60
5	MINIMUM BACKWASH TIME (MIN.)	TANK SERVICE TIME BACKWASH TRIGGER (HRS)	24.0
		TANK STANDBY TIME BACKWASH TRIGGER (HRS)	96.0

KINETICO FILTER SETPOINTS 2 CONTROL DATA CHEMICAL ALARM

INPUT/OUTPUT SCREEN

INPUTS AND OUTPUTS			
SLOT 1 INPUTS	SLOT 3 INPUTS	SLOT 5 OUTPUTS	SLOT 6 OUTPUTS
I01.00 3819	I03.00 ☐	O05.00 ☐	O06.00 ☐
I01.01 4087	I03.01 ☐	O05.01 ☐	O06.01 ☐
I01.02 4064	I03.02 ☐	O05.02 ☐	O06.02 ☐
I01.03 4108	I03.03 ☐	O05.03 ☐	O06.03 ☐
I01.04 4158	I03.04 ☐	O05.04 ☐	O06.04 ☐
I01.05 4003	I03.05 ☐	O05.05 ☐	O06.05 ☐
I01.06 4002	I03.06 ☐	O05.06 ☐	O06.06 ☐
I01.07 0	I03.07 ☐	O05.07 ☐	O06.07 ☐
I01.08 4000	I03.08 ☐	O05.08 ☐	O06.08 ☐
I01.09 4000	I03.09 ☐	O05.09 ☐	O06.09 ☐
SLOT 2 OUTPUTS	SLOT 3 OUTPUTS	SLOT 5 INPUTS	SLOT 6 INPUTS
O02.00 3995	O03.00 ☐	I05.00 ☐	I06.00 ☐
O02.01 3995	O03.01 ☐	I05.01 ☐	I06.01 ☐
O02.02 3995	O03.02 ☐	I05.02 ☐	I06.02 ☐
O02.03 3995	O03.03 ☐	I05.03 ☐	I06.03 ☐
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O02.06 0	O03.06 ☐	I05.06 ☐	I06.06 ☐
O02.07 0	O03.07 ☐	I05.07 ☐	I06.07 ☐
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O02.19 0	O03.19 ☐	I05.19 ☐	I06.19 ☐
O02.20 0	O03.20 ☐	I05.20 ☐	I06.20 ☐
O02.21 0	O03.21 ☐	I05.21 ☐	I06.21 ☐
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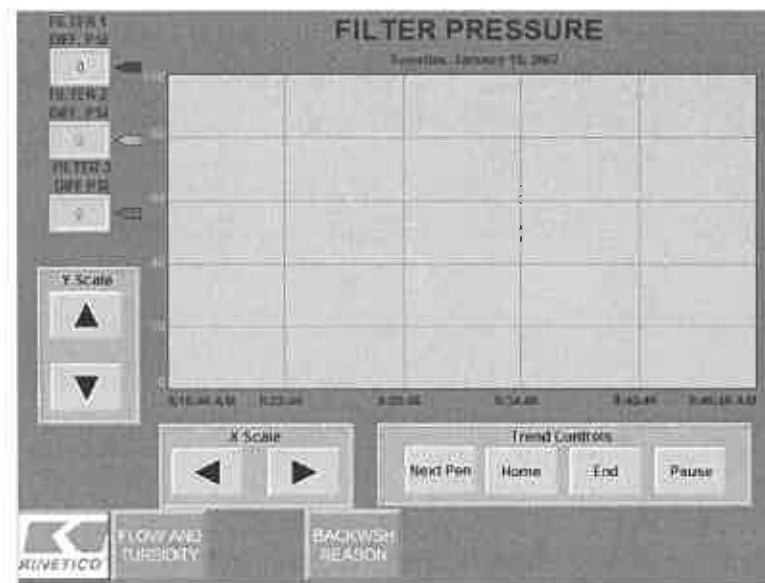
STORAGE TANK SCREEN



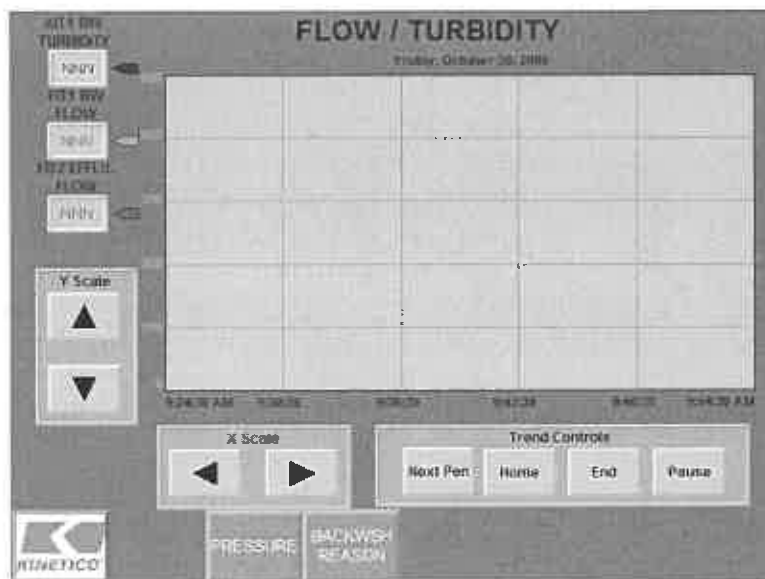
TREND BACKWASH REASON SCREEN



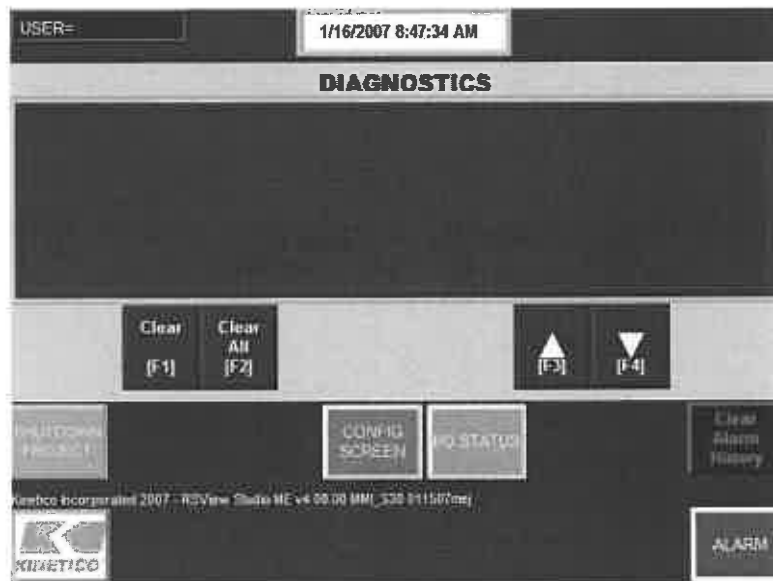
FILTER PRESSURE SCREEN



TREND FLOW/TURBIDITY SCREEN



UTILITY SCREEN



VALVE SETPOINT SCREEN



ROUTINE MAINTENANCE - PUMPS

DAILY

- Observe pump operation. Note any different or excessive noise or vibration, which is unusual from normal operation. Check that valving is properly set on the system to help prevent dead heading (running pump with no flow). Overheating on pump casing is an indication of no flow or too low a flow through the pump.
- Make sure all switches and disconnects are set to the proper setting in order for the system to operate correctly. Disconnects should be locked off for maintenance.
- Check lubricant level on pumps requiring oil lubricating units.

WEEKLY

- On dual pump units you may wish to switch to the second pump weekly in order to keep both pumps operating correctly.

OTHER

- Check manufacturer's specific maintenance schedule for your pump in order to properly maintain the pump.

ROUTINE MAINTENANCE - VALVES

Most automated and manual valves require very little routine maintenance apart from the daily visual inspection. Over prolonged running, some valves may require replacement of various O-ring seals and gaskets as seen fit.

ROUTINE MAINTENANCE - SENSORS

DAILY

- Observe the meter readings of each sensor to determine if the reading is in a range which you would expect.
- Visually observe any leaks around sensors.

WEEKLY

- In excessively dirty waters, weekly cleaning of sensors may be required.
- Verify sensor and meter are reading correctly by checking with a second hand held meter.

OTHER

- Clean and replace sensors as required.

PH TRANSMITTERS AND SENSORS

SHORT TERM SHUT DOWN

If the tank or pipe in which the pH electrode is mounted will be dry for a period of 2 or 3 days, the electrode should be stored in tap water. Deionized water (DI) can be used to rinse the electrode during cleaning and calibration but not for storing. For longer shutdowns, consult a Kinetico service technician.

CONDITIONS TO MONITOR

- Crosscheck the pH of solution with a separate hand-held pH meter at least 2 or 3 times per week. If the pH measured with the hand-held meter is more than 0.5 pH units off, then the pH electrode should be cleaned and calibrated.
- Monitor the level of fluid in tanks/pipes so that electrode is not allowed to operate dry.

ROUTINE MAINTENANCE

As Required

- Clean pH electrode according to the manufacturer's literature prior to calibration. The pH electrode can be gently scrubbed with a soft cloth or soft-bristled brush to remove built-up residue.
- Calibrate pH electrode according to the manufacturer's literature. The frequency of calibration will depend on the degree of contamination of the solution being monitored. The electrode should be cleaned/calibrated weekly until the actual cleaning frequency is determined by experience.

LOG SHEET FOR MOUNTAIN GATE WELL

[illegible]

CHAPTER 7 BILL OF MATERIALS

Level	Component	Description	Qty.	UM
1	J01345CWS	COMMUNITY WATER SYSTEM	1	EA
0.2	J01345A	CHEMICAL ADDITION	1	EA
..3	J01345AM	MISCELLANEOUS	1	EA
...4	74589	PUMP, METERING, 0.0-1.75 GP	1	EA
...4	74257	PUMP, METERING, 0.0-3.15 GP	1	EA
...4	73530	VALVE, INJECTOR, 0050 x 06	2	EA
...4	73920	VALVE, BALL, 0050, 2-WAY, P	2	EA
...4	74354	TANK, 00055G, HDPE, W/P	2	EA
...4	1099	TUBING, 1/2 PE WHT/FT	200	FT
...4	54556	LIGHT, LOW CHEMICAL I	2	EA
...4	67646	VALVE, 5 FUNCTION, FOR M	2	EA
0.2	J01345B	FILTER SKID, FM360	1	EA
..3	J01345BTMM	MACROLITE TANK FILLS	1	EA
...4	12401	MEDIA, M2 SUPERIOR	120	CF
...4	61355	FLANGE, BLIND, 0400, PV	3	EA
...4	57244	NIPPLE, 0100 x 0300, PV8	24	EA
...4	69185	SCREW, HEXHEAD, CAP, 5/8-1	24	EA
...4	57638	WASHER, FLAT, 5/8", SS	48	EA
...4	60774	WASHER, SPLIT LOCK, 5/	24	EA
...4	57637	NUT, HEX, 5/8, NC, 18-8SS	24	EA
...4	74339	PLUG, 0200, MTH, SS6	3	EA
..3	S30304P	FM, TRIPLEX, 60" STEEL, I	1	EA
...4	S30PLUMB60TRIPLEX	PHAN, COMMON 60" TRIPLE	1	EA
....5	S30FRAMET60	FRAME FOR 60" TRIPLE	1	EA
....6	60975	ROD, THD, 3/8-16, CS, P	1	FT
....6	64848	TUBE, SQ, STEEL, 2" x 2"	298	FT
....6	67389	TUBE, SQ, STEEL, 1-1/4	62	FT
....6	68483	FLAT STOCK, STEEL, 2.	3	FT
....6	69734	WASHER, 3/8", ZINC PL	2	EA
....6	69736	NUT, HEX, HEAVY, 3/8, ZINC	4	EA
....6	69804	CHANNEL 'U', 1-5/8 x 1-	99	FT
....6	71495	WASHER, FLAT, 3/8", ZINC	2	EA
....6	71496	WASHER, SPLIT LOCK, 3	2	EA
....6	73117	ANGLE, STEEL, 1.50 x 1.	40	FT
....6	74525	FLAT STOCK, STEEL, 2.	6	FT
....6	74483	FRAME, STD, SS, TURBID	1	EA

Level	Component	Description	Qty.	UM
....7	67389	TUBE, SQ, STEEL, 1-1/4	46	FT
....7	74525	FLAT STOCK, STEEL, 2.	2	FT
....5	65969	VALVE, DIA, 0200, SOC, PV	1	EA
....5	58168	GAUGE, 0-0160 PSI, LWR	6	EA
....5	51997	VALVE, BALL, 0025, 2-WAY	9	EA
....5	53327	VALVE, BALL, 0025, 2-WAY	4	EA
....5	72799	VALVE, DIA, CHECK, 0050	4	EA
....5	74021	VALVE, AIR-SPRG, 0200, 2	1	EA
....5	70937	TRANSM, PRESS, SENSOR	4	EA
....5	74183	CONN, FEMALE RIGHT A	4	EA
....5	59367	#5281, VALVE, SOL, 050, N	3	EA
....5	59461	VALVE, BALL, 0050, 2-WAY	3	EA
....5	71067	VALVE, SOL, MANIFOLD AS	2	EA
....5	71065	ELBOW, MALE, .125 x 002	4	EA
....5	71039	CONN, MALE, 0012 x 0025	4	EA
....5	71063	ADAPTER, 0025, TUBE x 3	4	EA
....5	71068	ELBOW, UNION, 90, 375.	2	EA
....5	71069	TEE, UNION, 0037, OD T	2	EA
....5	64427	VALVE, AIR-SPRG, 0400, B	13	EA
....5	68485	FLOW CONTROL, 200.0 GPM	3	EA
....5	62214	VALVE, BUTTERFLY, 0800, LVR	2	EA
....5	64455	VALVE, 'Y', CHECK, 0400	1	EA
....5	72820	KIT, FILTER/REG, AIR, 14	1	EA
....5	S19CHEMAIRT	PHAN, TRIPLE SKID AI	1	EA
....6	63063	UNION, 0100, SOC, GRN	1	EA
....6	63003	BUSHING, R, 0100 x 0050	6	EA
....6	63008	COUPLING, 0050, TRANS	6	EA
....6	63002	TEE, 0100 SOC, CHEMAI	3	EA
....6	63991	COUPLING, 0100, SOC x SOC	2	EA
....6	73475	VALVE, BALL, 0100, 2-WAY	1	EA
....6	63007	PIPE, 0100, PLAIN END	10	FT
....6	64384	PIPE, 0050, PLAIN END	5	FT
....6	63004	ELBOW, 90, 0100 SOC, A	3	EA
....6	73880	CONN, END, 0100, BRASS	1	EA
....6	73780	NIPPLE, 0050 x 0600, SS	3	EA
....6	64413	NIPPLE, 0050 x CLOSE, S	6	EA
....6	62596	BUSHING, R, 0050 x 0025	1	EA
....6	61512	NIPPLE, 0025 x CLOSE, S	9	EA
....5	S17344FTGS	PHAN, FITTINGS, STD S	1	EA
....6	62314	ELBOW, 90, 0800, SOC x SOC	2	EA

Level	Component	Description	Qty.	UM
....6	72637	TEE, RED, 0800 x 0800 x 0	4	EA
....6	62213	FLANGE, 0800, SOC, PV8	6	EA
....6	73522	FLANGE, 0400, SPG, PV8	15	EA
....6	67675	COUPLING, 0800, SOC x SOC	2	EA
....6	62432	BUSHING, R, 0800 x 0600	2	EA
....6	57572	BUSHING, R, 0600 x 0400	2	EA
....6	0800BFVBOLTS	PHAN, VALVE, BUTTERFLY, 080	2	EA
....7	61446	WASHER, SPLIT LOCK, 3	8	EA
....7	61445	WASHER, FLAT, 3/4", SS	16	EA
....7	62385	SCREW, HEXHEAD, CAP, 3/4x	8	EA
....7	61448	NUT, HEX, 3/4, NC, 18-8S	8	EA
....6	73010	CLAMP, PIPE, 0050, RIG	6	PR
....6	73015	CLAMP, PIPE, 0200, RIG	2	PR
....6	73019	CLAMP, PIPE, 0400, RIG	33	PR
....6	73369	CLAMP, PIPE, 0800, RIG	13	PR
....6	62396	PIPE, 0800, PV8, PLAIN	30	FT
....6	73012	CLAMP, PIPE, 0100, RIG	2	PR
....6	73489	PHAN, KIT, BOLT/GASKE	2	EA
....7	62467	SCREW, HEXHEAD, CAP, 3/4 x	8	EA
....7	61445	WASHER, FLAT, 3/4", SS	16	EA
....7	61448	NUT, HEX, 3/4, NC, 18-8S	8	EA
....7	62430	GASKET, FLG, EP, 0800	1	EA
....7	61446	WASHER, SPLIT LOCK, 3	8	EA
....5	74535	TURBIDIMETER, W/sc100	1	EA
....5	62585	VALVE, DIA, 0050, SOC, PV	1	EA
....5	74492	ORIFICE PLATE, 0400	1	EA
....5	74132	VALVE, CONTROL, 0400, PP/EP	1	EA
....5	70078	DUAL SPEED CONTROLLER	14	EA
....4	S30ELECINT	ELECTRICAL PANEL, INT	1	EA
....5	64420	RACK, 10 SLOT, SLC 500	1	EA
....5	65221	POWER SUPPLY, SLC-500	1	EA
....5	71048	SLC 500, ANALOG INPUT	2	EA
....5	62567	MODULE, SLC-500, INPUT	1	EA
....5	62568	MODULE, SLC-500, OUTPUT	2	EA
....5	65316	MODULE, BLANK, A-B	4	EA
....5	73618	ALARM, BEACON, STROBE	1	EA
....5	58279	FUSE, CC, 015.00 A, 600	1	EA
....5	63691	SWITCH, FUSE, 25 A, 600	1	EA
....5	67393	ENCLOSURE, N-4X, 40 x 3	1	EA
....5	67394	PANEL, BACK, 40 x 32, ST	1	EA

Level	Component	Description	Qty.	UM
....5	71824	POWER SUPPLY, 24 VDC, 5 A	1	EA
....5	66549	TERMINAL, FUSE, WEIDMULLER	30	EA
....5	65271	FUSE, GLASS, 002.000 A	15	EA
....5	66521	FUSE, GLASS, 005.000 A	15	EA
....5	9032	TERMINAL END-CROW WE	4	EA
....5	69236	OUTLET, SIMPLEX, 120 V	1	EA
....5	73792	SWITCH, ETHERNET, W/I	1	EA
....5	59022	PHAN, SWITCH, C/H, E22	1	EA
....6	57729	SWITCH, BLOCK, CONT, 1	1	EA
....6	59024	SWITCH, 2MAINT, LVR, C	1	EA
....5	72969	RELAY, PLC W/BASE, 24	7	EA
....5	73860	OPERATOR, INTERFACE	1	EA
....5	72624	CPU, SLC, 5/05, A-B	1	EA
....5	73882	CABLE, CAT 5e, RJ45, B	1	EA
....5	74481	UPS, 500 VA, SOLA, DIN	1	EA
....5	74493	PLC, 8 CHANNEL, ANALOG	1	EA
....5	74143	HORN, ALARM, 24 VDC, PI	1	EA
....5	74219	FLASH MEMORY, COMPAC	1	EA
....5	74476	HANDLE, CONTROL PANE	1	EA
....5	73428	RELAY, PLC W/BASE, 12	1	EA
...4	S30FIELDT60	TANK FILLS/FITTINGS	1	EA
....5	64143	GRAVEL, GARNET, #30-4	7500	LB
....5	72198	TANK, MEDIA, 60 x 96, ST	3	EA
....5	72206	HEADER & LAT, 60" TK	3	EA
....5	72881	VALVE, AIR & VACUUM, 01	3	EA
....5	72484	VALVE, PRES. RELIEF, 005	3	EA
....5	57777	TEE, 0100, FTH, SS4, 15	3	EA
....5	57688	ELBOW, 90, 0100, FTH, S	3	EA
....5	64650	BUSHING, R, 0100 x 0050	3	EA
....5	57640	NIPPLE, 0100 x CLOSE, S	6	EA
....5	65927	NIPPLE, 0100 x 0400, TH	3	EA
....5	57516	FLANGE, 0400, SOC, PV8	12	EA
....5	61610	ELBOW, 45, 0400, SOC x SOC	6	EA
....5	57132	ELBOW, 90, 0400, SOC x SOC	9	EA
....5	66225	KIT, BOLT/GASKET PAC	15	EA
....6	57637	NUT, HEX, 5/8, NC, 18-8S	8	EA
....6	57638	WASHER, FLAT, 5/8", SS	16	EA
....6	60774	WASHER, SPLIT LOCK, 5	8	EA
....6	57577	GASKET, FLG, EP, 0400	1	EA
....6	60734	SCREW, HEXHEAD, CAP, 5/8-	8	EA

Level	Component	Description	Qty.	UM
....5	57773	PIPE, 0400, PV8	45	FT
....5	57352	NIPPLE, 0100 x CLOSE, P	3	EA
....5	57012	ELBOW, 90, 0150, SOC x SOC	6	EA
....5	57001	TEE, 0150, SOC x SOC x SOC	3	EA
....5	52923	UNION, 0150, SOC x SOC	3	EA
....5	59144	PIPE, 0150, PV8	30	FT
....5	57021	BUSHING, R, 0150 x 0075	3	EA
....5	57039	UNION, 0075, SOC x SOC	3	EA
....5	57985	ADAPTER, MALE, 0075, S	3	EA
....5	59081	PIPE, 0075, PV8	6	FT
....5	74138	VALVE, AIR RELEASE, 005	3	EA
....5	64413	NIPPLE, 0050 x CLOSE, S	3	EA
....5	2501	SCREEN, L-1 PRE-FILTER	6	EA
....5	57025	BUSHING, R, 0150 x 0100	3	EA
..3	65983	SADDLE, 0800, BURKERT I	1	EA
..3	72841	TRANSM, PH, 4-20mA, SENS	1	EA
..3	74596	TRANSM, FLOW, 13-1243 GP	1	EA
..3	74597	TRANSM, FLOW, 50-4973 GP	1	EA
..3	74598	TRANSM, FLOW CONVERTER	2	EA
..3	74599	CABLE, INSTRUMENTATION	10	FT
..3	74599	CABLE, INSTRUMENTATION	10	FT
..3	74600	CABLE, INSTRUMENTATION	10	FT
..3	74600	CABLE, INSTRUMENTATION	10	FT
0.2	J01345C	BACKWASH PUMP SKID	1	EA
..3	J01345CS	DUAL PUMP SKID	1	EA
....4	71414SS	FRAME, STD, SS, DUAL PU	1	EA
....5	69803	C-CHANNEL, STEEL, 4.0	22	FT
....5	67389	TUBE, SQ, STEEL, 1-1/4	17	FT
....5	69804	CHANNEL 'U', 1-5/8 x 1-	23	FT
....5	72964	ANGLE, STEEL, 2.00 x 2.	16	FT
....5	72966	FLAT PLATE, STEEL, 8 x	1	EA
....5	64848	TUBE, SQ, STEEL, 2" x 2"	5	FT
....5	73910	FLAT PLATE, STEEL, 14	1	EA
....5	73903	PAD, FRAME FLOOR MTG	4	EA
....6	74502	FLAT STOCK, STEEL, 4.	1	EA
....5	67817	FLAT STOCK, STEEL, 4.	3	FT
....5	73911	FLAT PLATE, STEEL, 27	1	EA
....5	69805	FLAT STOCK, STEEL, 3.	1	FT
....5	73009	ANGLE, STEEL, 1.625 x 2	2	EA
...4	S08289	PHAN, DUAL PUMP BOX, 1	1	EA

Level	Component	Description	Qty.	UM
....5	70932	MCE, DUAL, 30 A, STD	1	EA
....5	70751	OVERLOAD, S&S, 12.0-3	2	EA
....5	58818	FUSE, J, 025.00 A, 600 V	6	EA
...4	73944	VALVE, BALL, 0250, 2-WAY, P	2	EA
...4	73940	VALVE, BALL, 0200, 2-WAY, P	2	EA
...4	70905	VALVE, 'Y', CHECK, 0300, P	3	EA
...4	58168	GAUGE, 0-0160 PSI, LWR	1	EA
...4	51997	VALVE, BALL, 0025, 2-WAY, M	1	EA
...4	66594	VALVE, BUTTERFLY, 0300, LVR	1	EA
...4	70969	PUMP, SSH, 10 HP, 230-46	2	EA
0.2	J01345D	AIR COMPRESSOR	1	EA
..3	J01345DM	MISCELLANEOUS	1	EA
...4	73671	AIR COMPRESSOR, 10HP	1	EA

CHAPTER 8 PARTS ORDERING AND RETURNS

PARTS ORDERING

To expedite the processing of the large volume of parts and service orders, we ask that you review our ordering guidelines below. By following these guidelines, which are subject to change at Kinetico's discretion, we will be better equipped to ship your order as efficiently as possible.

- All orders called in by phone should be followed by a faxed copy of a Purchase Order before processing. Order Desk fax number is 440-564-4361.
- All faxed purchase orders need to have the PO number on it, along with terms and conditions of sale, shipping instructions, and a signature.
- Purchase requisitions cannot be accepted unless they have a PO number and terms and conditions of sale, dollar amount, and a signature.
- Besides purchase orders, Kinetico accepts Visa, MasterCard, Discover, and American Express cards for parts and service orders.
- All orders will have a minimum purchase amount value of \$50.00.
- Any orders received by 2:00 p.m. EST, and if the parts are in stock, we will be able to ship the same day. (Non-stock items may take longer depending on delivery times and urgency of request).
- Expedited orders will be charged an expediting fee of 10% of the value of the purchase order.
- All overseas shipments are to be shipped "Collect".
- Kinetico's Net terms of sale are 30 days and FOB point is Newbury, Ohio.
- All purchase orders are subject to Kinetico's Terms and Conditions of Sale.

For your convenience, please note the contacts and numbers of the Kinetico Parts and Service Sales Department:

Phone Number: 440-564-5397 Erin Miller – Ext. 435

Fax Number: 440-564-4361

e-mail: esdparts@kinetico.com

Order Desk Hours – 7:00 a.m. to 5:00 p.m. EST

Fax in orders – Open 24 hours per day

RETURNS POLICY

- Customer places a call to Kinetico with all applicable information concerning a possible defective part.
- Customer issues a purchase order for a new replacement part.
- Kinetico will fax the customer a Return Authorization form if one is needed.
- Customer completes the form entirely and returns the form with the defective, thoroughly flushed out (if applicable) part. No credit will be issued if the part has not been cleaned prior to returning it to Kinetico. **NO EXCEPTIONS.**
- Once we have returned the part to the vendor, any credit that is issued to us will be forwarded to you in the same amount on a credit invoice.

The following page is our Return Authorization form. Fill out the form completely and return it with the part(s) that you are returning. You must fill out the reason for returning the parts and the system information in order for us to accurately report data back to our vendor.



Return Authorization Form

Authorization No. _____ Date ____/____/____ Job No. _____

Company Name _____ Contact Name: _____

Address _____
Street City State Zip

Kinetico Part Number	Quantity	Description

Authorized by _____ Date ____/____/____

*****PARTS MUST BE RETURNED WITHIN 30 DAYS*****

Return To: Kinetico Inc.
10975 Kinsman Road Phone: (440) 564-5397
Newbury, OH 44065 Fax: (440)564-4361
Attention: Erin Miller esdparts@kinetico.com

1. Warranty parts will be repaired or replaced.
2. Credit will be issued only if a new part is purchased.
3. Shipping and handling to be paid by customer.

CUSTOMER TO COMPLETE INFORMATION BELOW

Reason for return(s). Be specific. _____

FOR OFFICE USE ONLY (ROUTER)

- ☐ Parts Received _____
- ☐ Purchasing Department _____
- ☐ Accounting – Credit Issued ____/____/____ Part Charged to Customer ____/____/____
- ☐ Part Returned to Customer Repaired ____/____/____ or Replaced ____/____/____
- ☐ Special in-house Instructions _____

RECOMMENDED SPARE PARTS

The following pages are a quote for the parts we recommend you keep on hand for emergency repairs.

**KINETICO®**

Kinetico Incorporated
 Teered Systems
 15 Kinsman Rd.
 P.O. Box 193
 Newbury, Ohio 44065 USA
 (440)564-5397 FAX(440)338-8694

QUOTE

DATE	01/12/07
PAGE NO.	1
OUR QUOTE #	35879
CUSTOMER NO.	300610
BRANCH/PLANT	CWS

SOLD TO	EMPIRE RESIDENTIAL CONSTRUCTION, LP 3001 NORTH MAIN STREET #1B RE: MOUNTAIN GATE SEDONA AZ 86341
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SHIP TO	EMPIRE RESIDENTIAL CONSTRUCTION, LP 3001 NORTH MAIN STREET #1B SEDONA AZ 86341
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QUOTE DATE			SHIPPING INSTRUCTIONS			
CUSTOMER P.O. NO.		SHIPPING TERMS		BEST WAY		
01/12/07		RECOMMENDED SPARE PARTS		J01345		
		FOB Newbury, OH				
ITEM NO.	DESCRIPTION	UM	QUANTITY	UNIT PRICE	EXTENDED PRICE	
74589	PUMP, MTRG, 0.0-1.75GPH, 150PSI PULSATRON, PVC/PVC/TFE	EA S	1	1,344.0000	1,344.00	
74257	PUMP, MTRG, 0.0-3.15GPH, 150PSI PULSATRON, PVC/PVC/TFE	EA S	1	1,374.0000	1,374.00	
73530	VLV, INJECTOR, 0050x0600, MNPTxL CPVC, HAST' C', PFS, WESTFALL	EA S	2	234.0000	468.00	
67646	VLV, 5 FUNCTION, FOR MTRG PUMP, PULSAFEEDER	EA S	1	75.0000	75.00	
58168	PRESSURE GAUGE TO READ DUAL SCALE: PSI/BAR. GAUGE, 0-0160PSI, LWR MT, 2.5", S 6, L-F LOGO GAUGE, DUAL SCALE	EA S	2	23.2500	46.50	
51997	VLV, BALL, 0025, 2WAY, MTHxHOSE, PV8, ASAHI	EA S	2	15.7500	31.50	
70937	TRANSM, PRESS, SENSOR, 0-145PSI, SS6, VT, 025MTH, EFECTOR PA3	EA S	1	412.5000	412.50	
58279	FUSE, CC, 015.00A, 600V, TMDLY	EA S	3	10.4300	31.29	
65271	FUSE, GLASS, 002.000A, 250V, TMDL	EA S	15	1.7300	25.95	
66521	FUSE, GLASS, 005.000A, 250V, TMDL	EA S	15	1.8000	27.00	
58818	FUSE, J, 025.00A, 600V, TMDLY	EA S	3	11.1000	33.30	
			Sales Tax		Total Amount	

PRICE FIRM FOR 45 DAYS FROM DATE OF THIS QUOTE.

Terms and Conditions for Parts & Services Sales are attached to this quote.
 Acceptance of this quote as an order, is acceptance of the terms and conditions attached.



Kinetic Incorporated
Leered Systems
15 Kinsman Rd.
P.O. Box 193
Newbury, Ohio 44065 USA
(440)564-5397 FAX(440)338-8694

QUOTE

DATE	01/12/07
PAGE NO.	2
OUR QUOTE #	35879
CUSTOMER NO.	300610
BRANCH/PLANT	CWS

SOLD TO
EMPIRE RESIDENTIAL CONSTRUCTION, LP
3001 NORTH MAIN STREET #1B
RE: MOUNTAIN GATE
SEDONA AZ 86341

SHIP TO
EMPIRE RESIDENTIAL CONSTRUCTION, LP
3001 NORTH MAIN STREET #1B
SEDONA AZ 86341

[illegible]

PRICE FIRM FOR 45 DAYS FROM DATE OF THIS QUOTE.

Terms and Conditions for Parts & Services Sales are attached to this quote.
Acceptance of this quote as an order, is acceptance of the terms and conditions attached.

TERMS AND CONDITIONS OF PRODUCT & SERVICE SALES

ORDER ACCEPTANCE: Kinetico Incorporated ("Kinetico") reserves the right to accept or reject all orders. Customer, by offering to purchase products and/or services, agrees that its offer and Kinetico's acceptance are expressly limited to these Terms and Conditions. Possession of a price sheet shall not be construed as an offer to sell the products listed. The minimum amount of any one product order shall be fifty dollars (\$50.00). The minimum amount of any one service order shall be five hundred dollars (\$500.00). Customer cancellations and/or change orders are subject to Kinetico's acceptance. In the event of cancellation, customer agrees to pay Kinetico's actual costs incurred to date, plus a reasonable profit on the same.

QUOTES: Any written quote for products and/or services will be honored for forty-five (45) days from the date written on the quote.

PRICES: Products and services are sold at prices in effect at the time of shipment, **F.O.B. Newbury, Ohio**. These prices generally coincide with Kinetico's most recent dated price sheet in existence at the time of the order. Kinetico reserves the right to change prices without notice.

DELIVERY: Stocked products manufactured by Kinetico are generally shipped within 2 to 3 working days after receipt and acceptance of the order; stocked products from other vendors within 2 to 4 working days. SPECIAL ORDERS (large orders or items not stocked) shall require additional lead time. Customer add-ons to accepted orders may delay delivery. Orders shall not be processed for delinquent accounts until all past due accounts are paid, unless other arrangements have been made with Kinetico's Accounting Department. Kinetico shall not be responsible or liable for delays in delivery outside of its control. Service will be scheduled within 2 weeks of issuance of customer purchase order, unless prior arrangements are made between Kinetico and the Customer.

SHIPPING: All products are shipped **F.O.B. Newbury, Ohio**. Title and risk of loss or damage to products passes to Customer upon Kinetico's delivery to the common carrier. Check shipments for damage before acceptance or note on the freight bill "subject to inspection for concealed damage." Customer is responsible for filing claims with freight carriers. Products are generally shipped via U.P.S. or truck, freight prepaid and invoiced to Customer. Orders from delinquent accounts, if accepted, shall be shipped C.O.D. or C.I.A. freight collect.

PAYMENT: Payment for orders shipped on open account shall be made within thirty days from the date of Kinetico's invoice. Payment for orders shipped on other than an open account shall be in accordance with the terms assigned by Kinetico. Delinquent accounts are subject to a 1½% per month service charge on the unpaid balance. Open accounts require a complete credit analysis prior to approval, based upon Kinetico's investigation and shall be notified if credit is or is not approved. All products sold on open account are subject to Kinetico's security interest in them in the amount owed Kinetico. Kinetico shall have available all rights at law or in equity to a secured seller and, in the event of Customer's delinquency, may enter its premises to remove product(s). Additionally, if delinquent, Customer shall be liable for all collection costs incurred by Kinetico, including reasonable attorney's fees.

ERRORS & RETURNED GOODS: Kinetico shall correct its shipping errors at no charge, provided Customer provides notification within ten (10) days from receipt of shipment. New, current production products may be returned for credit if accompanied by the original invoice (or a photocopy) and a Return Authorization (R.A.) number. Call for a R.A. number. Kinetico reserves the right to invoice customer a 20% restocking charge for returned or refused goods.

WARRANTY: Product(s) manufactured by Kinetico shall be warranted from defects in materials or workmanship for a period of thirty (30) days from Customer's receipt. Kinetico shall, at its option, require the return of such product(s) and shall either repair or replace product(s) at no charge. Product(s) manufactured by Kinetico's vendors are sold with no warranty and WITH ALL FAULTS, but Kinetico shall use its best efforts to obtain from the vendor, in accordance with vendor's customary practice or warranty, the repair or replacement of such product(s) as may prove defective in materials or workmanship. KINETICO EXPRESSLY DISCLAIMS ALL OTHER EXPRESS WARRANTIES AND ALL IMPLIED WARRANTIES, INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL KINETICO BE RESPONSIBLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES CLAIMED BY REASON OF THE SALE OR USE OF PRODUCT(S). ANY LIABILITY OF KINETICO IS HEREBY EXPRESSLY LIMITED IN THE AGGREGATE TO THE PURCHASE PRICE OF THE PRODUCT AND/OR SERVICE IN QUESTION. THESE LIMITATIONS WILL SURVIVE THE EXPIRATION OF THE WARRANTY PERIOD.

MISCELLANEOUS: This is the entire agreement between Kinetico and Customer. These Terms and Conditions shall be interpreted, construed and governed under the laws of the State of Ohio and is not subject to the U.N. Convention on Contracts for the International Sale of Goods. Any modification to these Terms and Conditions shall be in writing and executed by Kinetico and Customer. These Terms and Conditions will be binding upon Kinetico and Customer and their legal successors, representatives and assigns. All obligations created by these Terms and Conditions are deemed to have been performed in Geauga County, Ohio and Customer agrees that it will be the exclusive forum for the resolution of any and all controversies or claims arising out of or relating to these Terms and Conditions or any contract of sale associated therewith. By execution of any purchase order, Customer submits to the jurisdiction of the courts of the State of Ohio.

CHAPTER 9 TROUBLESHOOTING

PUMPS

Symptom	Possible Cause	Correction
1. Pump will not run.	A. Tripped overloads. B. Incorrect switch settings on control panel. C. Alarm conditions. D. Blown fuses. E. Service disconnect is in the "OFF" position. F. Plant voltage and pump voltage requirement incompatible. G. Loose or disconnected wiring. H. Pump output "OFF" on PLC output.	A. Check pump free to rotate and no fuses blown; reset. B. Place switches in correct position. C. Correct condition(s), i.e., low feed tank level. Reset alarm. D. Check pump free to rotate, loose wiring terminal connections, correct fuse size; replace. E. Turn on. F. Check pump wiring diagram for voltage supplied. G. Reconnect and/or tighten connections. H. Check computer logic.
2. Pump runs but pressure output is low.	A. Improper pump rotation. B. Inlet valve(s) are closed. C. Pump inlet strainers are clogged. D. Single phase power to three-phase pump.	A. Switch any two wires to pump motor. B. Determine why. If OK, open valve(s). C. Locate source of debris and correct. Remove, inspect, clean, reinstall. D. Check plant electrical service, check fuses.

PUMPS (CONTINUED)

Symptom	Possible Cause	Correction
2. Pump runs but pressure output is low (continued).	E. Pump impeller is damaged or fouled. F. Pump electrical motor RPM low/amp draw high. G. Non-flooded suction. H. Improper setting of pressure relief or pressure regulator valve. I. Pump casing air bound.	E. Inspect pump inlet strainer. Clean, repair or replace impeller. F. See 1.A, 1.D, 1.F, and 2.D above. G. Tank level low; low level pump shutdown failure. Check that pump has not lost its prime. H. Reset to correct pressure. I. Inspect for suction air leaks; vent air from casing.
3. Pump has water spraying out of shaft area or is wet.	A. Pump seal failure. B. Nearby pump leaking.	A. Check pump inlet strainer; replace seal. B. Locate and correct.
4. Pump casing overheats.	A. Pump inlet and/or outlet valve(s) closed. Never run a pump against a deadhead, i.e., no flow. B. Non-flooded suction.	A. Determine why. If OK, open valve(s). B. See 2.G above.
5. Pump is abnormally noisy.	A. Foreign material is stuck in housing. B. Cavitation. C. Bent blades on cooling fan.	A. Check housing for foreign material. B. Check feed piping for restrictions. C. Check the cooling fan in the rear of the pump.

AUTOMATED VALVES

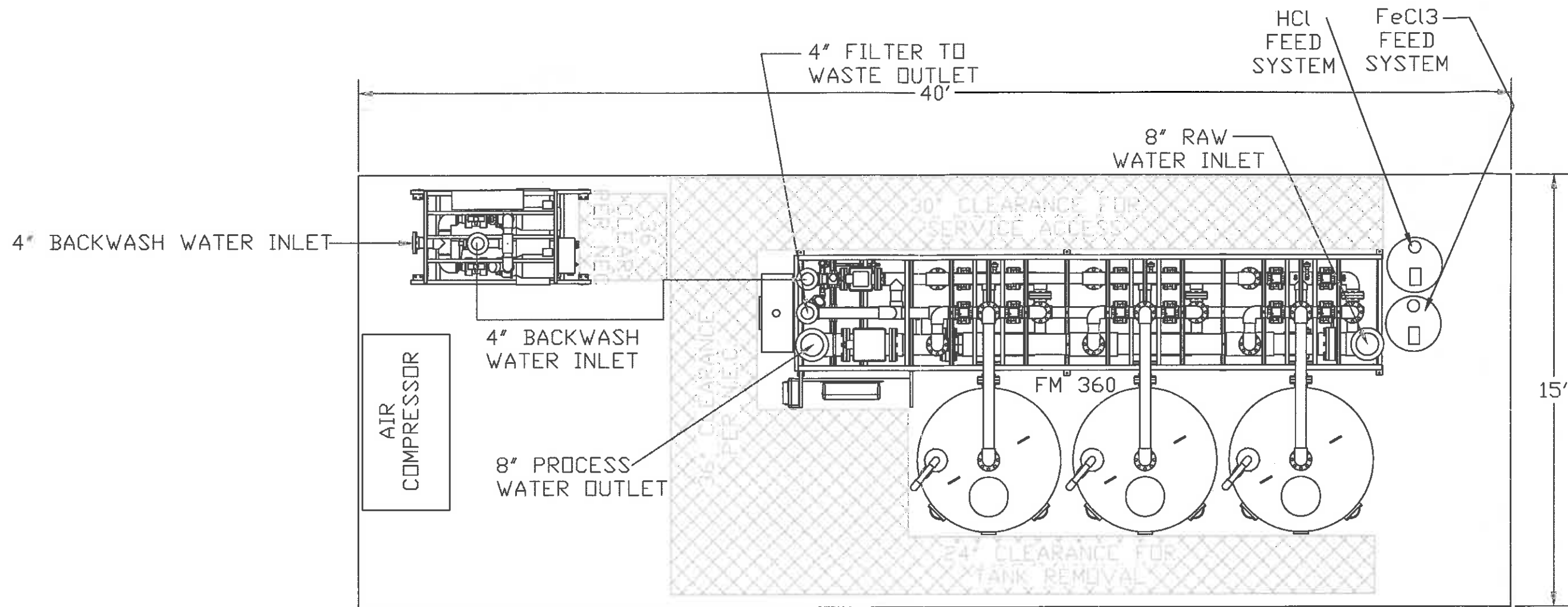
Symptom	Possible Cause	Correction
1. Valve will not operate (i.e., will not open or close when required).	A. Dirt or trapped particle stuck in valve. B. Inlet pressure to valve is too high. C. No back pressure for diaphragm valves. D. Too much back pressure E. Improper voltage or no power to valve. F. Loose or disconnected wire. G. Burned out actuator. H. Low air pressure for air valves. I. Alarm condition prevents valve movement.	A. Clean and replace any broken parts. B. Check valve specification and/or possibly reduce inlet pressure. C. Check valve requirements specification. Possibly add downstream flow control. D. Check valve requirements specification. Remove downstream restrictions. E. Check voltage and signal at valve. F. Check terminals. Reconnect or tighten as necessary. G. Replace and reconnect. H. Check all valve requirements. Increase air pressure. I. Check control panel.
2. Valve actuator overheats (some solenoid valves, when used in 100% duty cycle, are normally hot).	A. Valve limit switches incorrectly set so valve is torquing in a locked rotor condition. B. Valve has improper voltage on it.	A. Set limit switch to proper setting. B. Check wiring voltage.
3. Valve only partially opens or closes.	A. Valve limit switches incorrect. B. Diaphragm valve. C. Foreign material in valve orifice.	A. Set limit switch to proper setting if they are motorized ball valves. B. Clean the diaphragm bonnet for obstructions. C. Clean the valve orifice of all foreign materials.

PLC

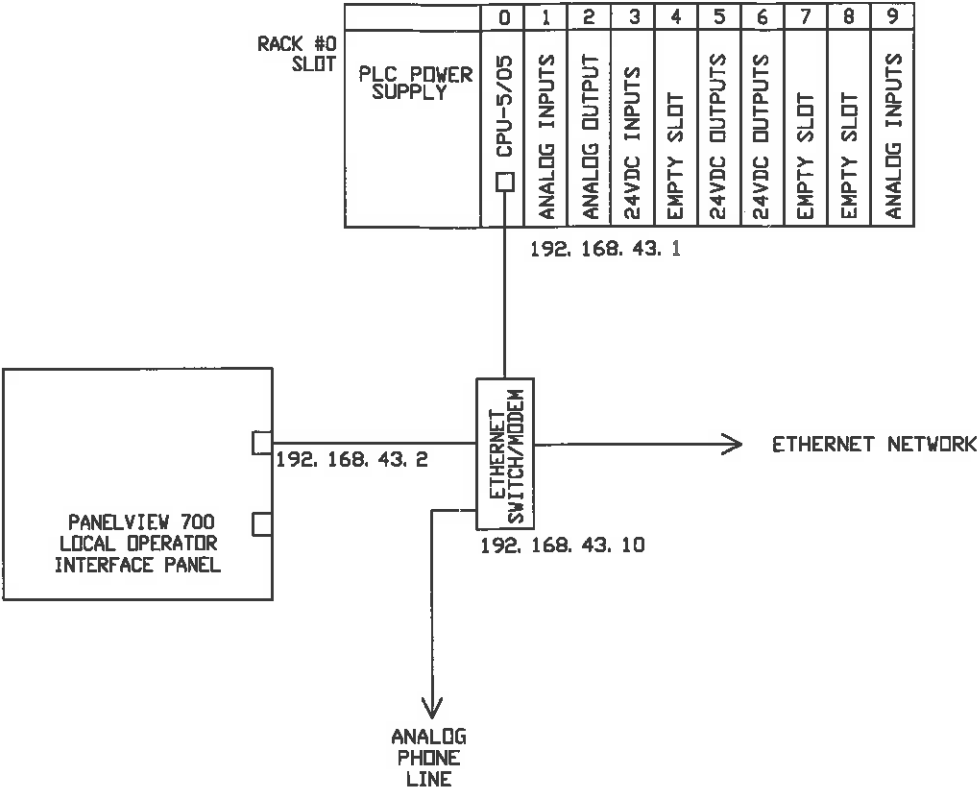
Symptom	Possible Cause	Correction
1. Outputs will not turn on,	A. PLC not in run mode. B. Loose or disconnected wiring. C. PLC output card is not fully seated on rack. D. Panel voltage incorrect. E. Blown fuse or circuit breaker. F. Output card is not wired correctly and that all proper commons are tied to the proper voltage. G. Commons not all connected to proper voltage. H. System "AUTO" switch is not in "AUTO" position.	A. Determine cause, return to run mode. B. Check terminals, reconnect and/or tighten wiring. C. Seat correctly on rack. D. Determine cause(s), i.e., correct transformers with correct primary and secondary connections. E. Replace or fix. F. Check wiring diagrams / schematics / PLC program and wire correctly. G. Check wiring diagram / schematic / PLC program and wire correctly. H. Determine why and return to "AUTO" position.

CHAPTER 10 DRAWINGS

The drawings in this section are your as-installed drawings. The drawings included with the Installation Manual may have been revised during installation. When these revisions have been made, a copy of the revised drawings will be sent to you for placement in this section of your manual.



NOTES										LEGEND										SYSTEM / DRAINAGE PIPING SCHEDULE										THIS DRAWING AND ITS CONTENTS ARE THE PROPERTY OF KINETIC INCORPORATED. THEY HAVE BEEN LOANED TO YOU FOR A LIMITED TIME AND PURPOSE, AND MAY NOT BE COPIED OR REPRODUCED WITHOUT THE WRITTEN PERMISSION OF KINETIC INCORPORATED. THE PROJECT, DESIGN, RECORD AND DATA CONTAINED HEREIN, ARE CONSIDERED TO BE THE PROPERTY OF KINETIC INCORPORATED AND MAY NOT BE REPRODUCED OR USED FOR ANY OTHER PROJECT OR PURPOSE WITHOUT THE WRITTEN PERMISSION OF KINETIC INCORPORATED.										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CONSTRUCTION NOTES:

1. CONTRACTOR MUST AFFIX LABEL WHICH CLEARLY STATES LOCATION OF POWER DISCONNECT FOR THIS PANEL. PER NEC 110.22
2. FIELD WIRING MUST COMPLY WITH NFPA 79 SECTION 16. WIRING METHODS AND PRACTICES.
3. FIELD WIRES SHOULD BE LABELED USING THE SAME NUMBERING SCHEME CONTAINED IN THESE DRAWINGS.
4. FIELD WIRING ENTERING AND / OR TERMINATED IN ENCLOSURES MUST BE RUN IN A NEAT AND ORDERLY MANNER SUCH THAT CLASS 2 CIRCUITS (24VDC) AND CLASS 1 CIRCUITS ARE INSTALLED PER NEC 725.54.
5. ANALOG (4-20mA), 24VDC DIGITAL, 120VAC AND 3 PHASE WIRING SHOULD ALL BE RUN IN SEPARATE CONDUITS.
6. 15 AMP BRANCH PROTECTION AND/OR DISCONNECTING MEANS FOR THIS CONTROL PANEL ARE TO BE PROVIDED BY THE INSTALLER.

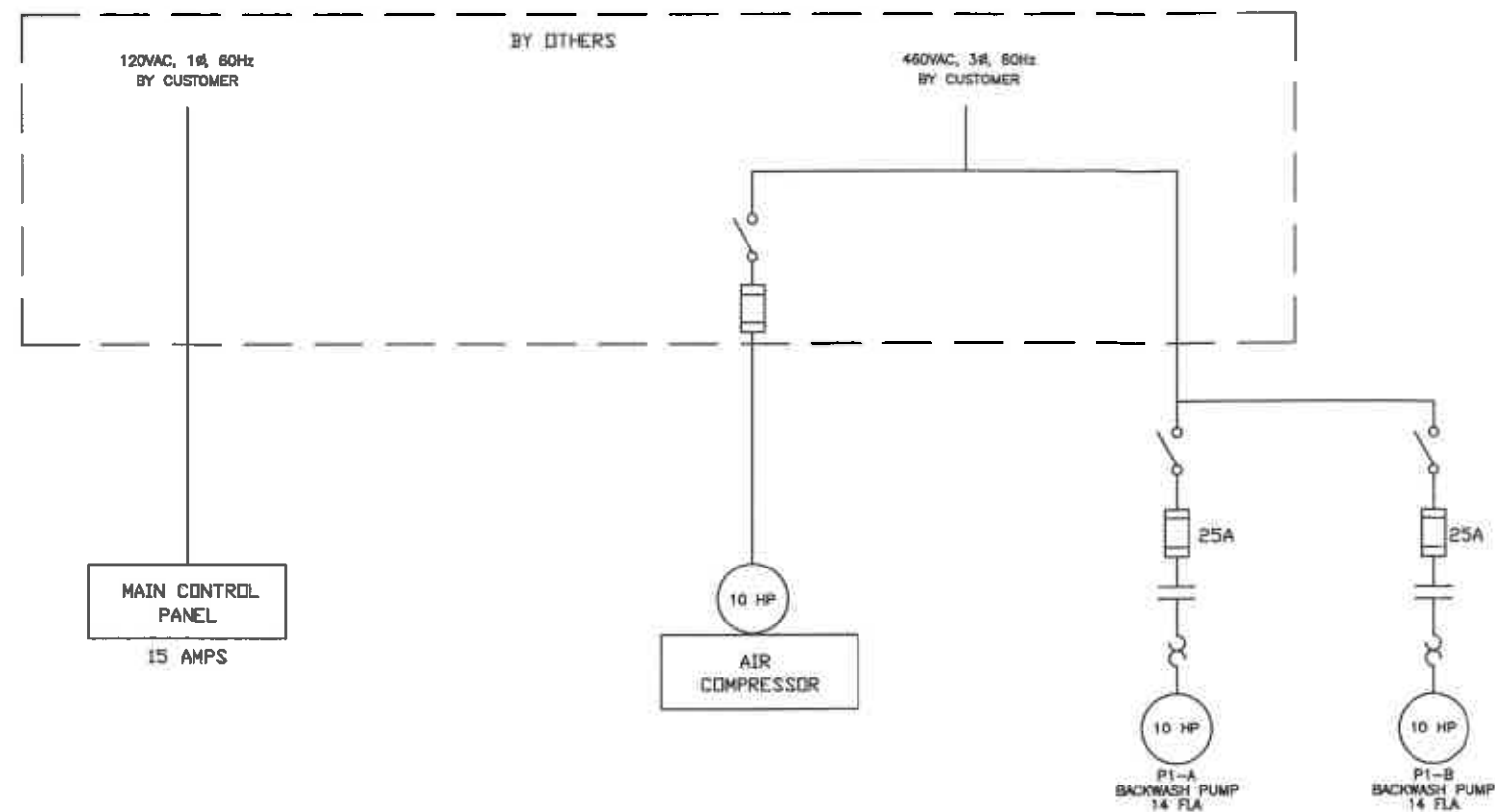
THIS DRAWING AND ITS CONTENTS ARE THE PROPERTY OF KINETICO INCORPORATED. THEY HAVE BEEN LOANED TO YOU FOR A LIMITED TIME AND PURPOSE, AND MAY NOT BE COPIED OR REPRODUCED WITHOUT THE WRITTEN PERMISSION OF AN AUTHORIZED EMPLOYEE OF KINETICO INCORPORATED. ADDITIONALLY, THE PROCESS, METHOD, DESIGN AND DATA CONTAINED HEREIN ARE CONSIDERED TO BE THE PROPERTY OF KINETICO INCORPORATED AND MAY NOT BE DISCLOSED TO ANY OTHER PERSON OR COMPANY NOR USED TO KINETICO'S DISADVANTAGE.

REV	BY	DATE	DESCRIPTION	Elec.	Date	Mech.	Date	Proc.	Date	Proj.	Date
1	JLH	1-18-07	AS MANUFACTURED								
0	JLH	12-6-06	ORIGINAL								



KINETICO
INCORPORATED
10845 Kinsman Road
Newbury, Ohio 44065

CLIENT	EMPIRE COMPANIES - MOUNTAIN GATE WELL CLARKDALE, ARIZONA		
PROJECT	FM 30 FILTRATION SYSTEM J01345		
DRAWING TITLE	PLC TOPOLOGY		
SCALE	NONE	SIZE	B
DRAWING NUMBER	4-1345-01		SUB



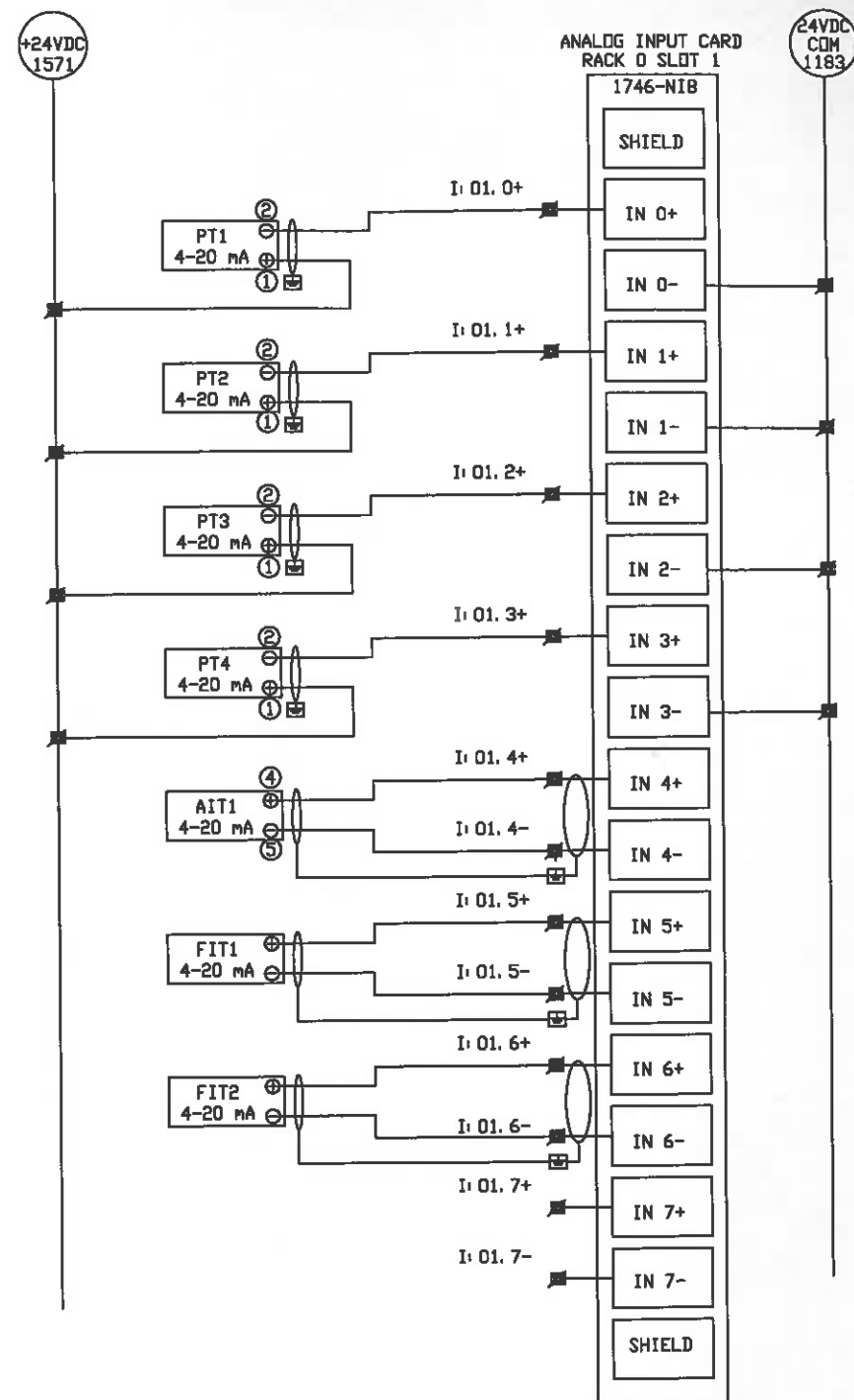
- LEGEND:
- DEVICE LOCATED IN MOTOR CONTROL CENTER/ENCLOSURE (MCC/MCE).
 - ◊ MOTOR CONTROL CENTER/ENCLOSURE TERMINAL BLOCK
 - MAIN CONTROL PANEL TERMINAL BLOCK
 - △ DEVICE LOCATED IN FIELD
 - ▲ FIELD TERMINAL BLOCK
 - ▣ GRN/YEL GND TERMINAL
 - FACTORY INSTALLED WIRING
 - FIELD INSTALLED WIRING
 - SUBASSEMBLY GROUPING

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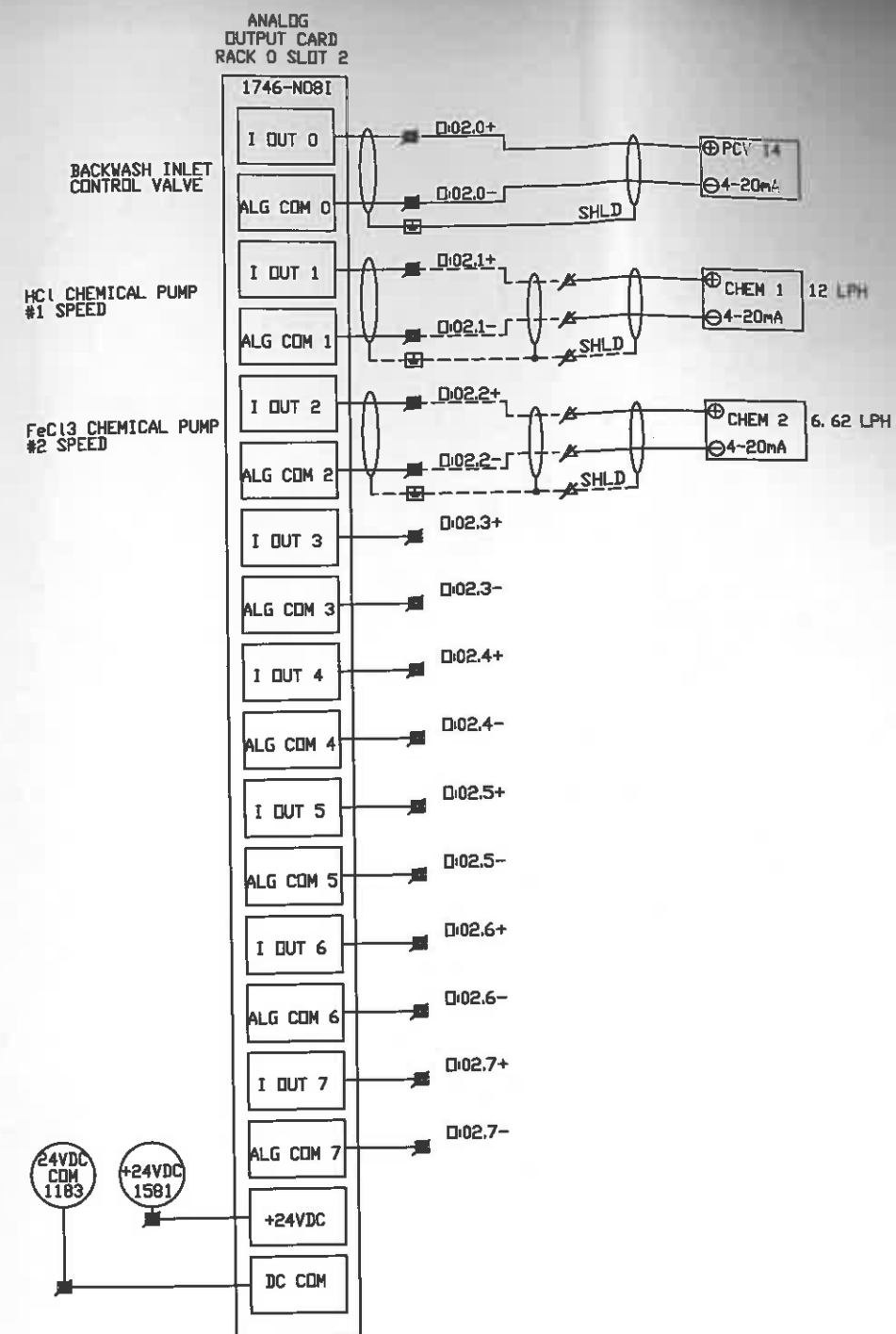
REV	BY	DATE	DESCRIPTION	Elec.	Date	Mech.	Date	Proc.	Date	Proj.	Date
1	JLH	1-18-07	AS MANUFACTURED								
0	JLH	1-3-07	ORIGINAL								

KINETICO
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10845 Kinsman Road
Newbury, Ohio 44065

CLIENT	EMPIRE COMPANIES - MOUNTAIN GATE WELL CLARKDALE, ARIZONA		
PROJECT	MACROLITE FM360 ARSENIC REMOVAL SYSTEM J01345		
DRAWING TITLE	ONE - LINE		
SCALE	NONE	SIZE	B
DRAWING NUMBER	4-1345-02		SUB



FILTER SYSTEM
INLET PRESSURE
 FILTER #1
OUTLET PRESSURE
 FILTER #2
OUTLET PRESSURE
 FILTER #3
OUTLET PRESSURE
 FILTER BACKWASH
TURBIDITY
 FILTER BACKWASH
FLOW
 FILTER EFFLUENT
FLOW
 STORAGE TANK LEVEL
(BY OTHERS)



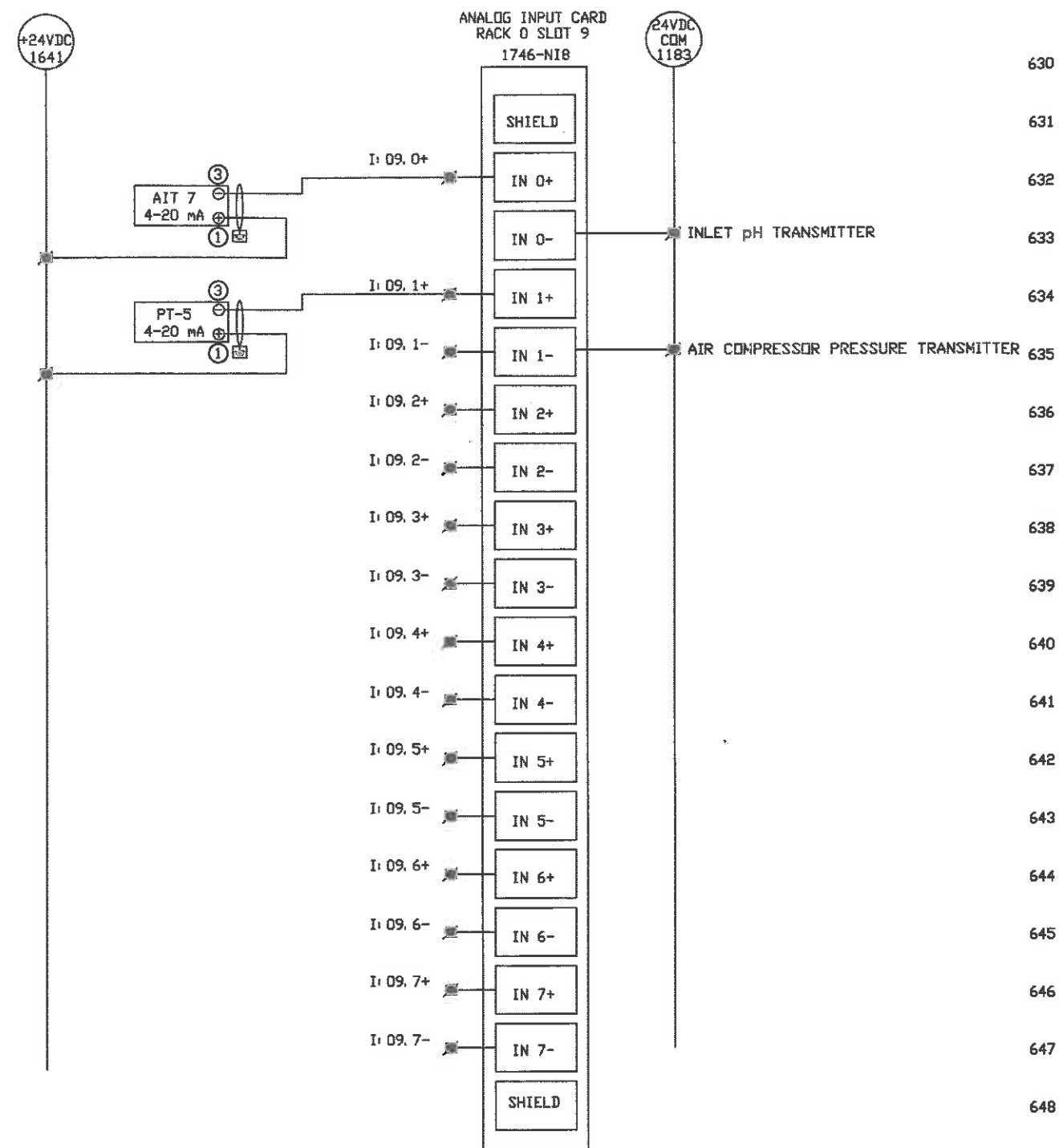
LEGEND:
 ○ DEVICE LOCATED IN MOTOR CONTROL CENTER/ENCLOSURE (MCC/MCE).
 □ MOTOR CONTROL CENTER/ENCLOSURE TERMINAL BLOCK
 ▭ MAIN CONTROL PANEL TERMINAL BLOCK
 △ DEVICE LOCATED IN FIELD
 ▲ FIELD TERMINAL BLOCK
 ▽ GRN/YEL GND TERMINAL
 ————— FACTORY INSTALLED WIRING
 - - - - - FIELD INSTALLED WIRING
 - - - - - SUBASSEMBLY GROUPING

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REV	BY	DATE	DESCRIPTION	Elec.	Date	Mech.	Date	Proc	Date	Proj.	Date
2	JLH	2-20-07	AS INSTALLED								
1	JLH	1-18-07	AS MANUFACTURED								
0	JLH	12-6-06	ORIGINAL								

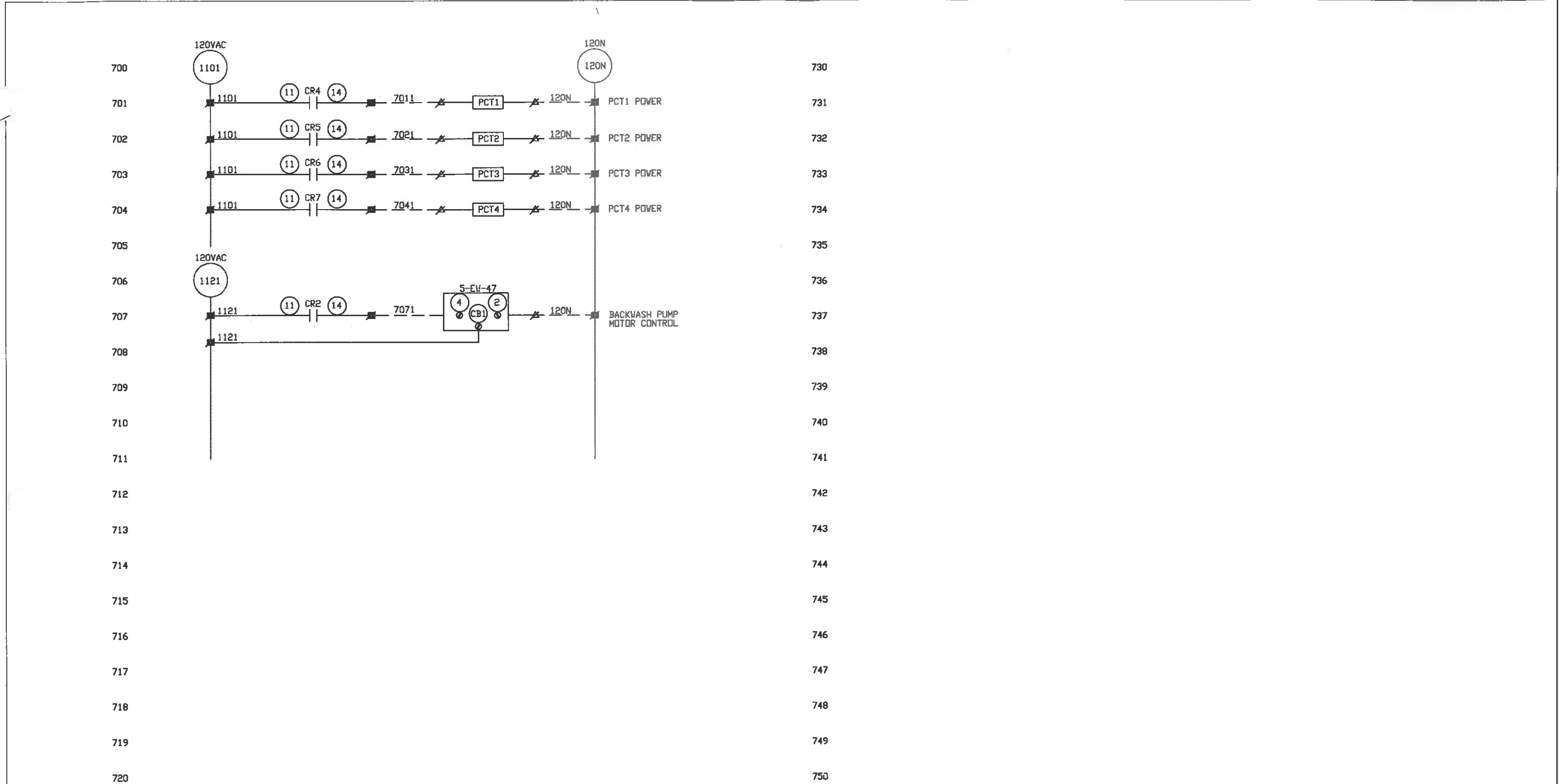
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 10845 Kinsman Road
 Newbury, Ohio 44065

CLIENT	EMPIRE COMPANIES - MOUNTAIN GATE WELL CLARKDALE, ARIZONA		
PROJECT	FM30 FILTRATION SYSTEM J01345		
DRAWING TITLE	PLC SCHEMATIC		
SCALE	NONE	SIZE	B
DRAWING NUMBER	5-1345-02		
SUB			



LEGEND:
 ○ DEVICE LOCATED IN MOTOR CONTROL CENTER/ENCLOSURE (MCC/MCE).
 □ MOTOR CONTROL CENTER/ENCLOSURE TERMINAL BLOCK
 ■ MAIN CONTROL PANEL TERMINAL BLOCK
 △ DEVICE LOCATED IN FIELD
 ▲ FIELD TERMINAL BLOCK
 ▢ GRN/YEL GND TERMINAL
 — FACTORY INSTALLED WIRING
 - - - FIELD INSTALLED WIRING
 - - - SUBASSEMBLY GROUPING

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										PROJECT FM30 FILTRATION SYSTEM J01345										DRAWING TITLE PLC SCHEMATIC
										SCALE NONE										SIZE B
										DRAWING NUMBER 5-1345-06										SUB
REV BY DATE DESCRIPTION										Elec. Date Mech. Date Proc. Date Proj. Date										
2 JLH 6-20-07 AS INSTALLED																				
1 JLH 1-18-07 AS MANUFACTURED																				
0 JLH 12-6-06 ORIGINAL																				



- LEGEND:
- DEVICE LOCATED IN MOTOR CONTROL CENTER/ENCLOSURE (MCC/MCE).
 - ⊗ MOTOR CONTROL CENTER/ENCLOSURE TERMINAL BLOCK
 - MAIN CONTROL PANEL TERMINAL BLOCK
 - △ DEVICE LOCATED IN FIELD
 - ▲ FIELD TERMINAL BLOCK
 - ⊞ GRN/YEL GND TERMINAL
 - FACTORY INSTALLED WIRING
 - - - FIELD INSTALLED WIRING
 - · - SUBASSEMBLY GROUPING

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EMPTY SLOT

RACK 0
SLOT 8

530

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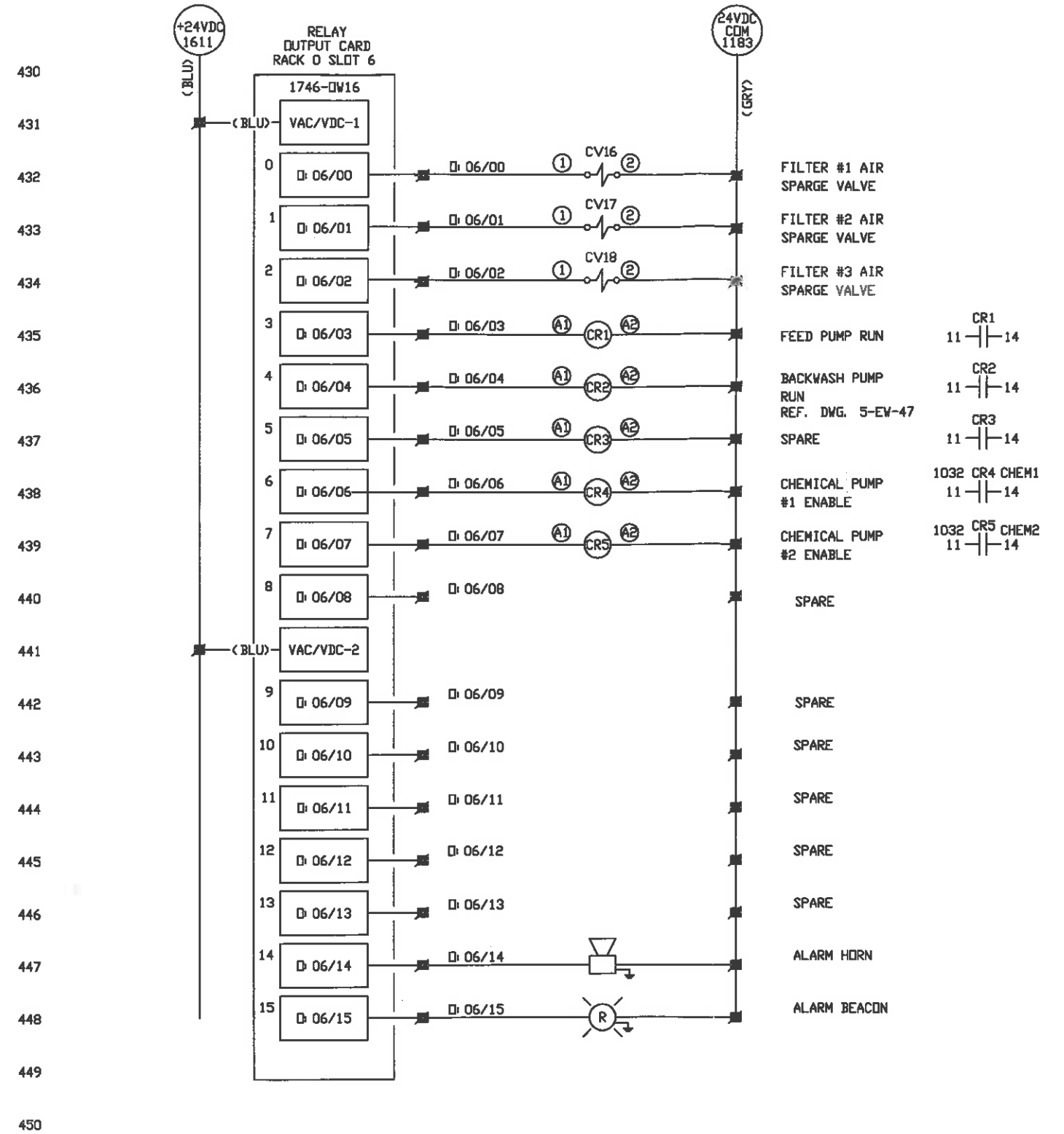
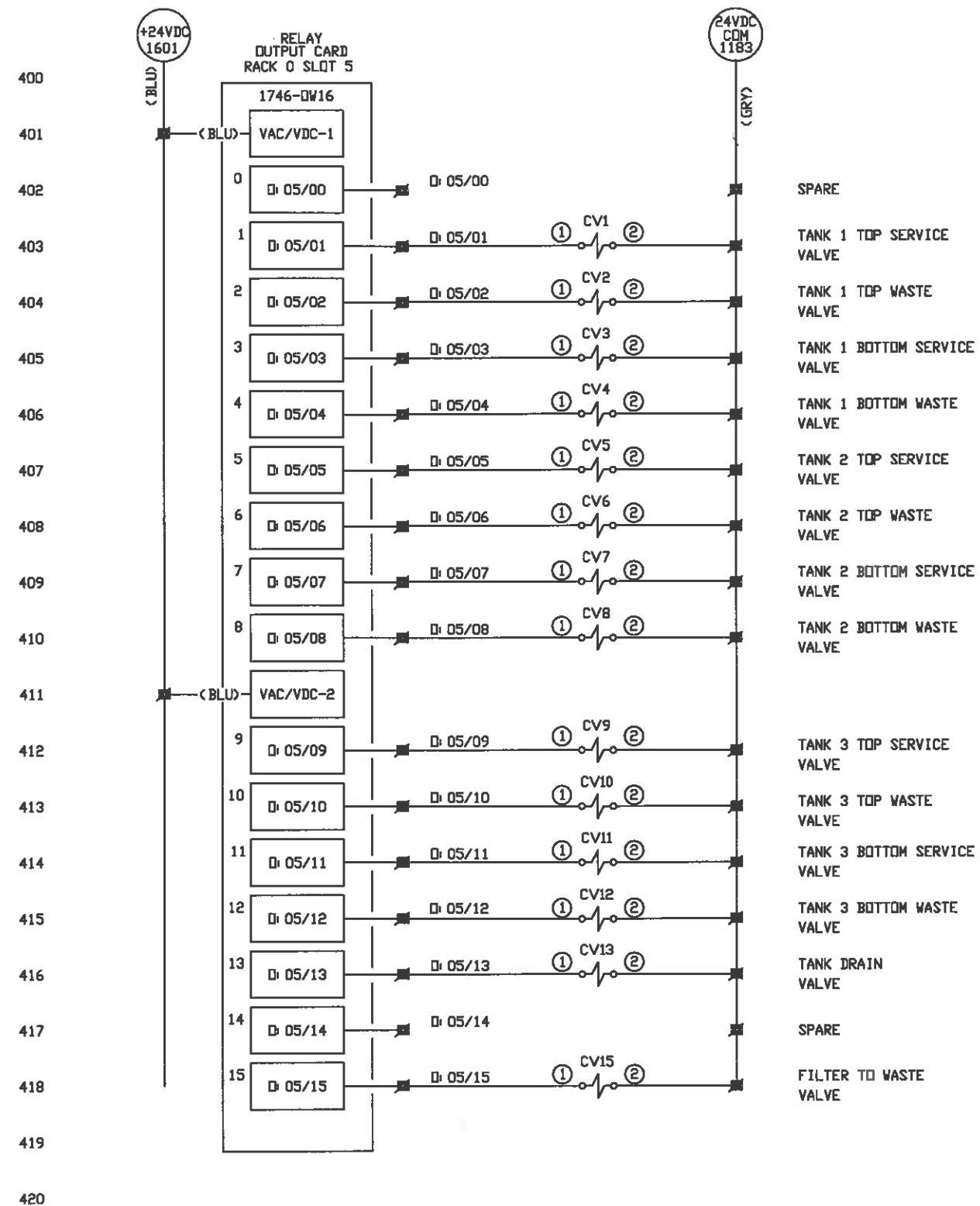


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CLIENT EMPIRE COMPANIES - MOUNTAIN GATE WELL CLARKDALE, ARIZONA			
PROJECT FM30 FILTRATION SYSTEM J01345			
DRAWING TITLE PLC SCHEMATIC			
SCALE NONE	SIZE B	DRAWING NUMBER 5-1345-05	SUB

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0	JLH	12-6-06	ORIGINAL														
REV	BY	DATE	DESCRIPTION	Elec.	Date	Mech.	Date	Proc	Date	Proj.	Date						



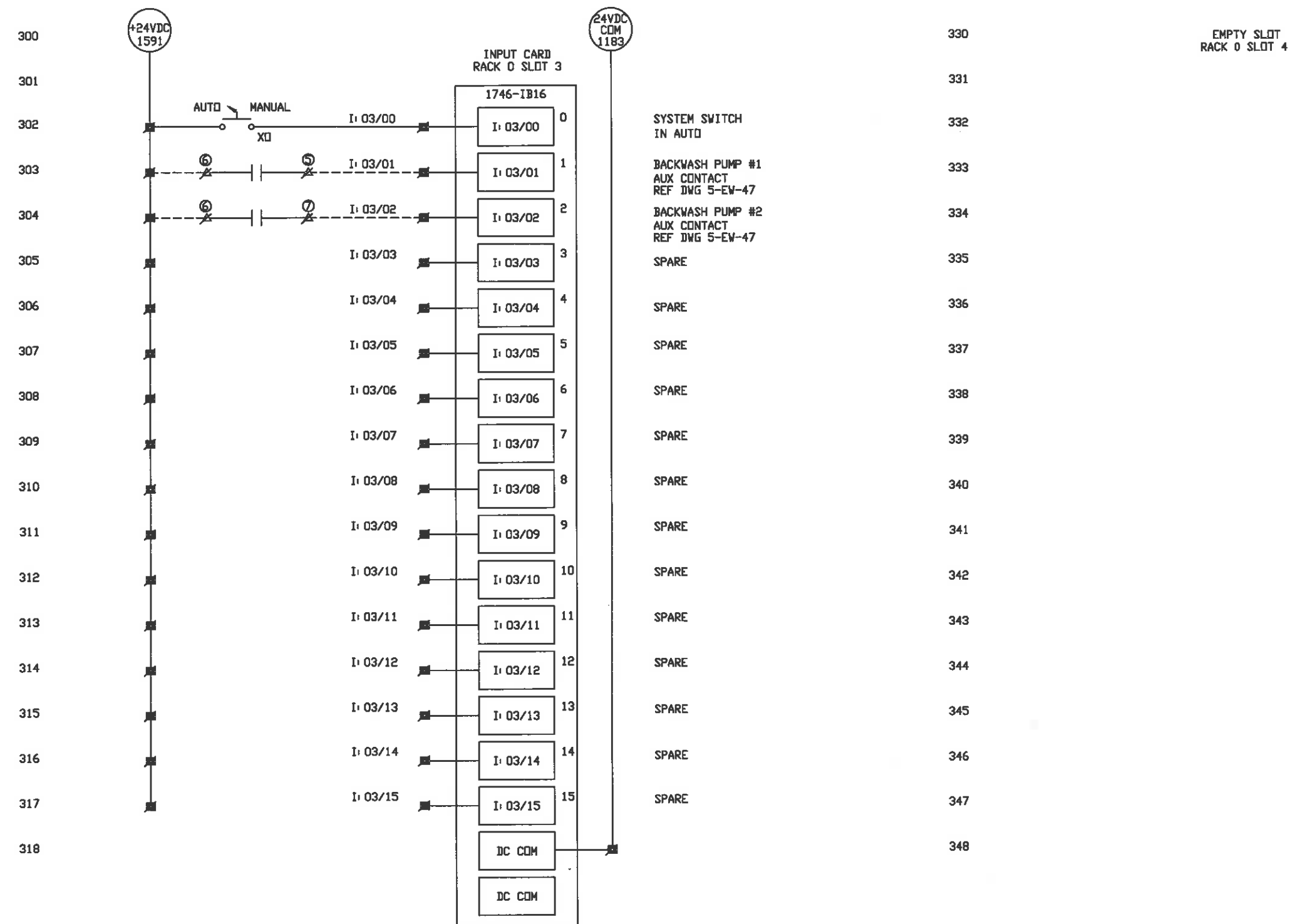
LEGEND: ○ DEVICE LOCATED IN MOTOR CONTROL CENTER/ENCLOSURE (MCC/MCE).
 □ MOTOR CONTROL CENTER/ENCLOSURE TERMINAL BLOCK
 ■ MAIN CONTROL PANEL TERMINAL BLOCK
 △ DEVICE LOCATED IN FIELD
 ▽ FIELD TERMINAL BLOCK
 ■ GRN/YEL GND TERMINAL
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 - - - SUBASSEMBLY GROUPING

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REV	BY	DATE	DESCRIPTION	Elec.	Date	Mech.	Date	Proc.	Date	Proj.	Date
2	JLH	2-20-07	AS INSTALLED								
1	JLH	1-18-07	AS MANUFACTURED								
0	JLH	12-6-06	ORIGINAL								

KINETICO
 KINETICO INCORPORATED
 10845 Kinsman Road
 Newbury, Ohio 44065

CLIENT	EMPIRE COMPANIES-MOUNTAIN GATE WELL CLARKDALE, ARIZONA		
PROJECT	FM30 FILTRATION SYSTEM J01345		
DRAWING TITLE	PLC SCHEMATIC		
SCALE	NONE	SIZE	B
DRAWING NUMBER	5-1345-04		
SUB			



LEGEND:

- DEVICE LOCATED IN MOTOR CONTROL CENTER/ENCLOSURE (MCC/MCE).
- ◊ MOTOR CONTROL CENTER/ENCLOSURE TERMINAL BLOCK
- MAIN CONTROL PANEL TERMINAL BLOCK
- △ DEVICE LOCATED IN FIELD
- ▲ FIELD TERMINAL BLOCK
- GRN/YEL GND TERMINAL
- FACTORY INSTALLED WIRING
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REV	BY	DATE	DESCRIPTION	Elec.	Date	Mech.	Date	Proc.	Date	Proj.	Date
1	JLH	1-18-07	AS MANUFACTURED								
0	JLH	12-6-06	ORIGINAL								



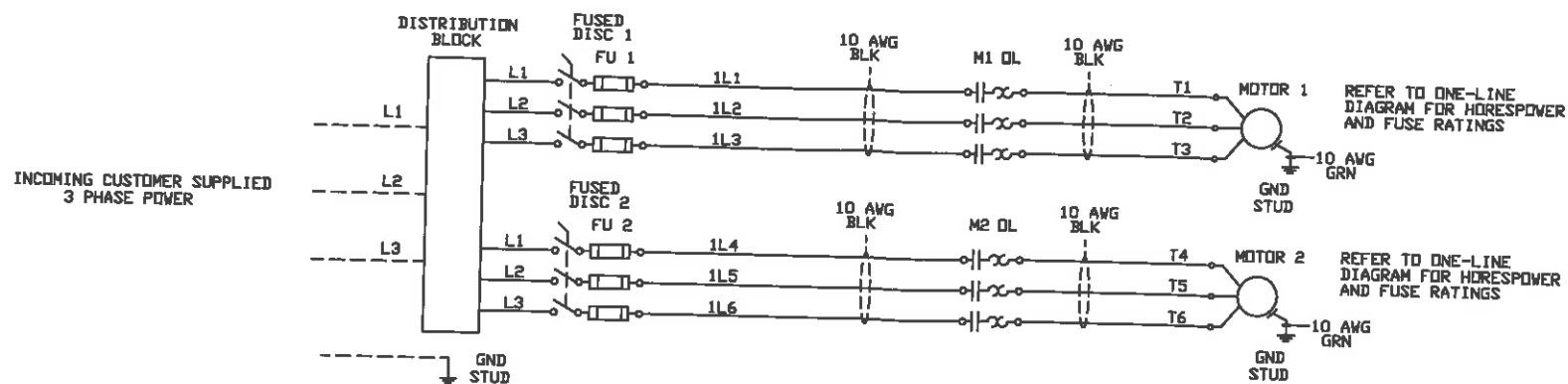
CLIENT	EMPIRE COMPANIES-MOUNTAIN GATE WELL CLARKDALE, ARIZONA		
PROJECT	FM30 FILTRATION SYSTEM J01345		
DRAWING TITLE	PLC SCHEMATIC		
SCALE	SIZE	DRAWING NUMBER	SUB
NONE	B	5-1345-03	

KINETICO INCORPORATED 10845 Kinsman Road Newbury, Ohio 44065		DATE	REV	DESCRIPTION	TOLERANCES									
PROJECT: FMSO FILTRATION SYSTEM		1-18-07	1	AS MANUFACTURED	FRACTIONAL PARTS: .005" & .010"									
SUBJECT: MAIN CONTROL ENCLOSURE		12-6-06	0	ORIGINAL	FRACTIONAL PARTS: .005" & .010"									
DRAWING TITLE: MAIN CONTROL ENCLOSURE					FRACTIONAL PARTS: .005" & .010"									
SCALE: 1-1/2"=1'					FRACTIONAL PARTS: .005" & .010"									
JOB NO: J01345					FRACTIONAL PARTS: .005" & .010"									
CLIENT: EMPIRE COMPANIES - MOUNTAIN GATE WELL					FRACTIONAL PARTS: .005" & .010"									
LOCATION: CLARKDALE, ARIZONA					FRACTIONAL PARTS: .005" & .010"									

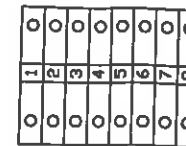
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LEGEND: ○ DEVICE LOCATED IN MOTOR CONTROL CENTER/ENCLOSURE (MCC/MCE).
 ■ MOTOR CONTROL CENTER/ENCLOSURE TERMINAL BLOCK
 ■ MAIN CONTROL PANEL TERMINAL BLOCK
 ▲ DEVICE LOCATED IN FIELD
 ▲ FIELD TERMINAL BLOCK
 ■ GRN/YEL GND TERMINAL
 _____ FACTORY INSTALLED WIRING
 - - - - - FIELD INSTALLED WIRING
 - - - - - SUBASSEMBLY GROUPING

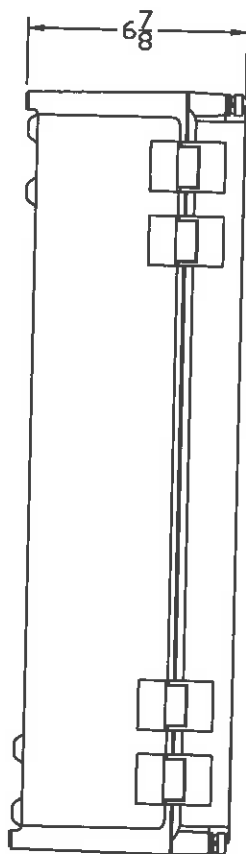
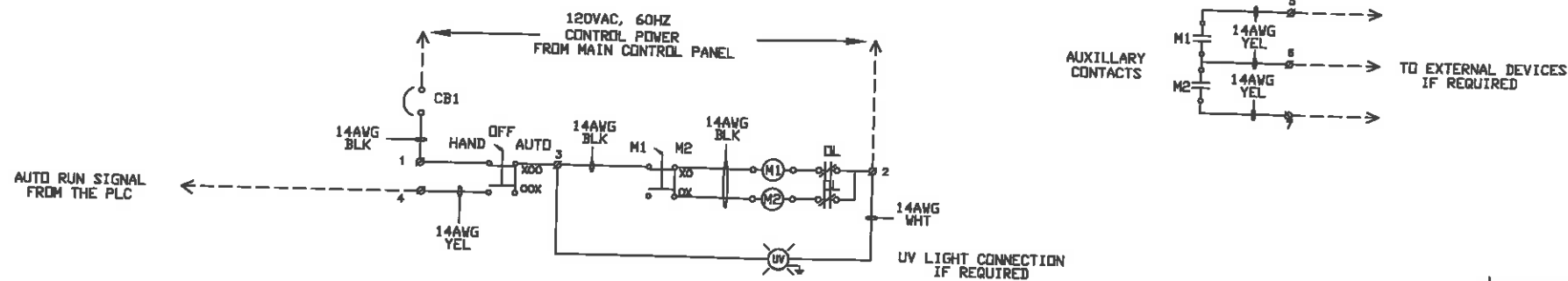
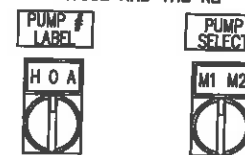
TYPICAL 30 AMP DUAL MOTOR
CONTROL ENCLOSURE SCHEMATIC



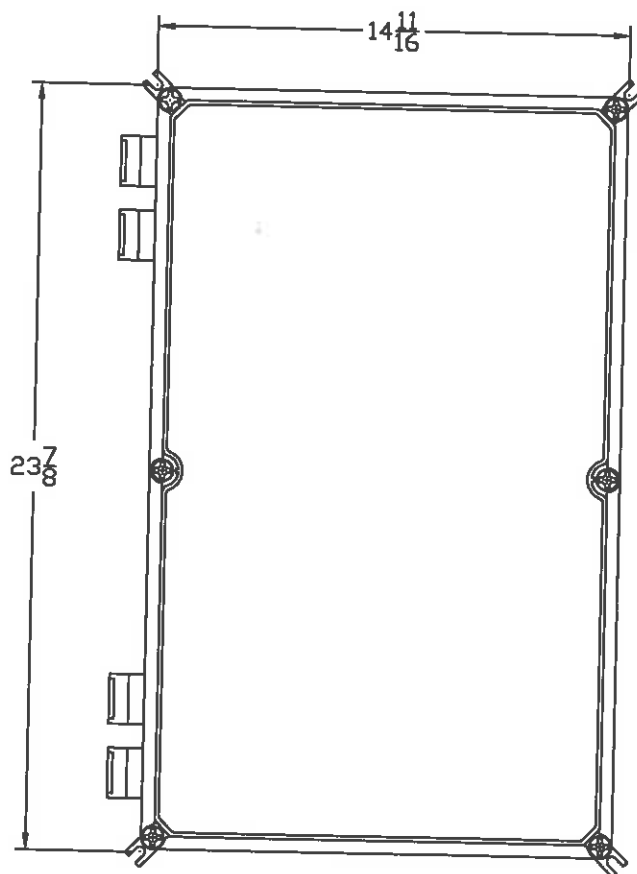
TERMINAL LAYOUT



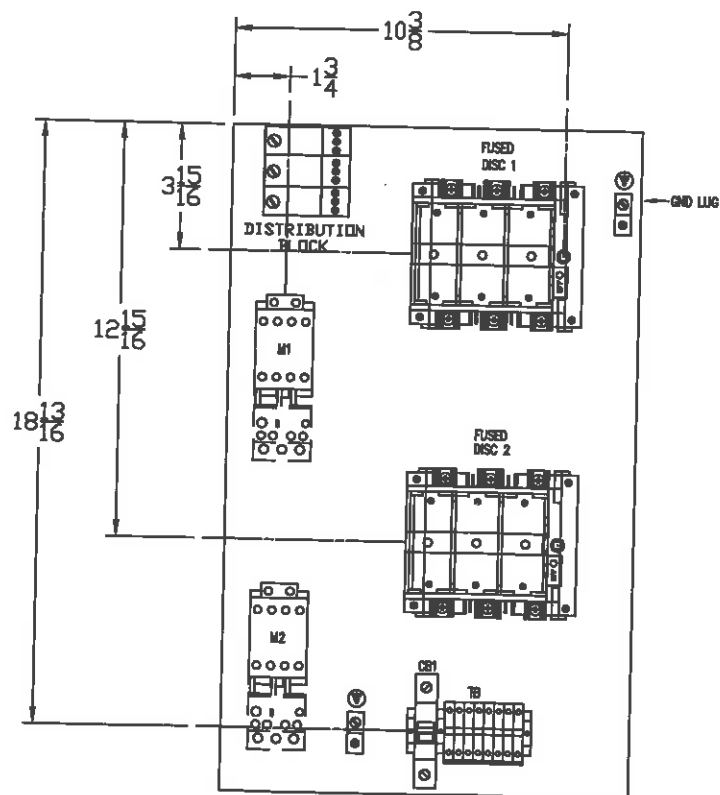
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DEVICE AND TAG NO



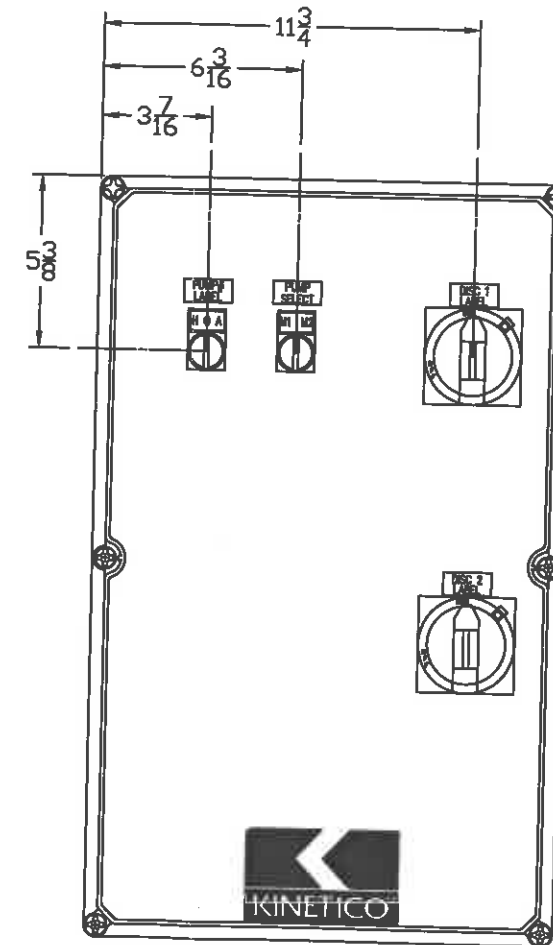
ENCLOSURE - SIDE VIEW
(W1) A11-2414W1H



ENCLOSURE - MOUNTING FEET
(W1) A11-2414W1H



PANEL LAYOUT



ENCLOSURE LAYOUT
(W1) A11-2414V1H

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CLIENT				KINETICO ENGINEERED SYSTEMS			
PROJECT							
KINETICO PART #70932							
DRAWING TITLE							
30 AMP DUAL MOTOR CONTROL ENC.							
SCALE		SIZE		DRAWING NUMBER		SUB	
NONE		R		S-EV-047			

Appendix B4

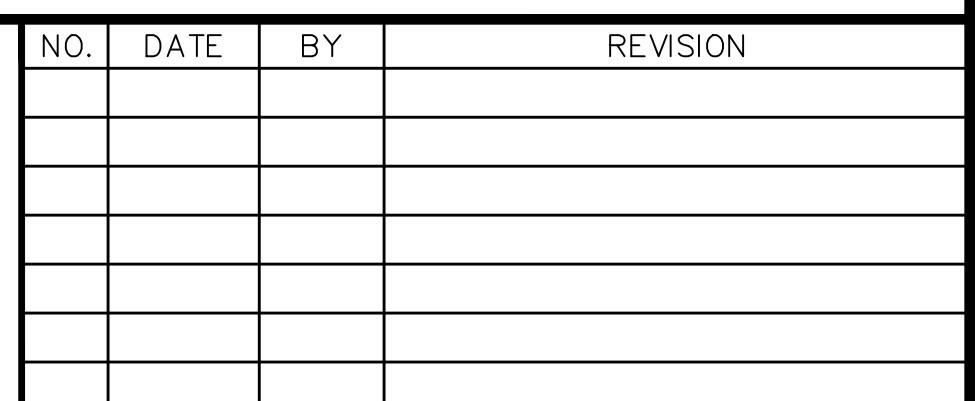






APPENDIX C: SANITARY SEWER COLLECTION SYSTEM

C1 Existing Sewer System Map





Staff Report

Item Number: 6.B.

<u>Agenda Item:</u>	Grant Agreement Between the Town of Clarkdale and the Clarkdale Foundation to Purchase Equipment for Selna-Mongini Park Discuss, consider, and act upon a request by staff to approve the grant agreement between the Town of Clarkdale (the Town) and the Clarkdale Foundation (CF), for CF to act as a fiscal agent via its 501c3 status, to receive a potential grant award from Arizona Public Service (APS) Foundation, and to purchase equipment for the Town's new Selna-Mongini Park.
<u>Staff Contact:</u>	D.K. Green, Grants Manager
<u>Meeting Date:</u>	April 8, 2025
<u>Strategic Goal:</u>	This agenda item supports the following Clarkdale Strategic Goal Area: • Goal Area 1 - Enhance the quality of life for residents, businesses and visitors to Clarkdale. • Goal Area 2 - Enhance the quality and availability of parks, recreation and cultural opportunities.
<u>Background:</u>	The APS Foundation supports capital campaign projects within Arizona that enhance Arizona communities. An application for a \$100,000 grant award was submitted on behalf of the Clarkdale Foundation (CF) to the APS Foundation. Should the grant be awarded, CF would purchase \$100,000 worth of equipment for the Town's new Selna-Mongini Park. The Town is not directly involved in the application and/or award process. If awarded the grant, the Clarkdale Foundation shall receive the funds directly from APS, retain full discretion over the funds, and act completely independently of the Town.
<u>Budget Impact:</u>	Per the grant agreement between CF and the Town, an administrative charge of 2.5% (\$2,500) will be applied for administering this grant award. This fee will be paid by the Town to CF from the Capital Project budget.
<u>Recommendation:</u>	Staff recommends that the Council approve the grant agreement between the Town of Clarkdale (the Town) and the Clarkdale Foundation (CF), for CF to act as a fiscal agent via its 501c3 status, to receive a potential grant award from Arizona Public Service (APS) Foundation, and to purchase equipment for the Town's new Selna-Mongini Park and authorize the Town Manager to sign all

required documents related to this grant.

ORGANIZATION BACKGROUND: (100 words – APS Portal says 200 words)

Established in 1912, Clarkdale is a rural community located in the Verde Valley. Originally a company town for the United Verde Copper, Clarkdale is now a vibrant town known for its rich history, scenic beauty, and strong sense of small-town community. With a population of approximately 4,500 residents, Clarkdale maintains its historic charm while offering modern amenities and services.

The Town is committed to enhancing the quality of life for residents through providing essential services, recreational opportunities, and community engagement opportunities. Clarkdale strives to preserve its history while fostering a vibrant community for all who live, work, and visit.

PROJECT ALIGNMENT: (100 words)

An APS Community Impact Grant would support the Town of Clarkdale by funding an interactive music feature and outdoor fitness center, providing accessible educational and recreational opportunities for all, including residents of the low-income Patio Park neighborhood and the Yavapai-Apache Nation. This project addresses the community's need for equitable Science, Technology, Engineering, and Math education while promoting health and wellness. Aligned with APS's mission, the initiative bridges equity gaps, inspires youth, and fosters long-term quality of life improvements. By investing in inclusive recreational spaces, this program empowers underserved populations and strengthens community engagement for future generations.

PROJECT OBJECTIVES: (200 words)

The Selna-Mongini STEM Park integrates all STEM principles into its infrastructure and programming, emphasizing focus on Verde River conservation and wildlife sustainability, healthy living and interactive learning. The park will be a regional destination, providing educational and recreational opportunities for all ages through interpretive signage and hands-on activities. Through the ASU Project Cities program, Town staff worked with 30 students from ASU on educational signage design, resulting in innovative concepts to be used throughout the park. Each sign will include a QR code, directing users to more learning activities, and a discovery survey used to enhance programming improvements. Partnerships with local educators and organizations like AZ Sci-Tech and ASU will allow visitors to learn about water conservation, solar energy, recycling, geological history and more. Programming development will be integral to the success of educational vision.

Working with local businesses, science educators and local master gardeners to provide on-site hands-on learning opportunities will positively impact the learning experience. Aligning with Clarkdale's mission, the park enhances quality of life by offering innovative amenities that promote healthy living, environmental stewardship and lifelong learning. Its emphasis on sustainability, history, and community engagement ensures the town remains a resilient, forward-thinking leader in education and conservation.

BUDGET NARRATIVE: (200 words)

The total project cost for Clarkdale's Selna-Mongini STEM park is \$3.1 million. To date, \$1.5 million has been secured through federal and state grants, with an additional \$1 million in matching funds from the Town's capital budget. Community partnerships have contributed over \$300,000 in in-kind support, while local businesses and residents have donated over \$200,000 in cash specifically for STEM-related park elements.

Of the total construction budget, \$1,148,800 is allocated for interactive playground equipment, including an outdoor fitness station and STEM-related learning features. The Town is requesting \$100,000 from APS to support the purchase of a \$130,000 outdoor fitness station. If awarded in full, APS funding would cover the majority of this cost, ensuring accessibility to high-quality exercise equipment for residents. Should APS provide a lesser amount, the Town will maximize available funding to incorporate as many STEM related park features as possible. For example, an outdoor music center valued at \$38,000, a kids only STEM club in a converted baseball dugout for \$20,000, and a kinetic energy bench for \$11,000 to name a few.

APS funding will play a critical role in enhancing the park's recreational and learning features, fostering health and wellness opportunities for all visitors.

COMMUNICATIONS: (200 words)

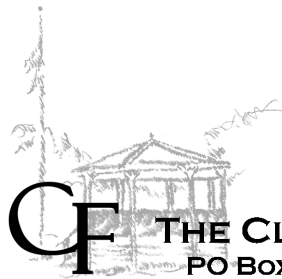
The APS Foundation will be prominently recognized as a key supporter of Clarkdale's Selna-Mongini STEM park through multiple channels, ensuring visibility and appreciation for its generous contributions. A permanent sign at the park entrance will acknowledge the APS Foundation's support, featuring its logo and a message of gratitude. Additionally, during the park's grand opening event, APS Foundation representatives will be invited to participate in a ribbon-cutting ceremony and will be highlighted in public remarks.

Our organization has a strong network of communication assets, including the Town website, social media platforms, weekly email newsletters, and local media partnerships.

Throughout the grant period, we will incorporate messaging about the APS Foundation's support in several ways. Social media posts will highlight project milestones, tagging the APS Foundation and showcasing its impact. Our website will feature a dedicated page with updates on the park's progress, recognizing the Foundation's role. Regular email newsletters will include mentions of the APS Foundation's support, and press releases to local news outlets will acknowledge its contribution. By integrating APS Foundation branding across these platforms, we will ensure sustained recognition of its generosity while reinforcing the Foundation's commitment to community enhancement.

VOLUNTEER OPPORTUNITIES: (100 words)

APS employees can partner with the Town of Clarkdale in celebrating our new Selna-Mongini STEM park through various volunteer opportunities. In-person options could include tree planting, trail maintenance, and hosting community park clean-up days. APS volunteers could also assist with park events, such as the grand opening, sustainability training or educational workshops. Virtual opportunities include helping with social media advocacy, graphic design for park materials, or participating in fundraising campaigns. APS employees with expertise in sustainability or engineering can provide virtual consultations on park improvements. These opportunities will build meaningful partnerships while showcasing APS's commitment to Clarkdale's community development.



THE CLARKDALE FOUNDATION
PO Box 345, CLARKDALE, AZ 86324

FISCAL SPONSORSHIP GRANT AGREEMENT

On March 31, 2025, The Clarkdale Foundation, Inc. ("Grantor") decided that financial support of the Capital Campaign for Selna-Mongini S.T.E.A.M. Park and other agreed to Grants with the Town of Clarkdale ("the project"), more particularly described in the attached proposal dated March 31, 2025 ("the proposal"), will further Grantor's tax-exempt purposes under Section 501(c)(3) of the Internal Revenue Code ("IRC"). With regard to the selection of Grantee or any other beneficiary to conduct the project, Grantor has exercised and shall retain full discretion and control over the selection process, acting completely independently of Grantee or any funding source.

Grantor has created a restricted fund (Selna-Mongini STEAM Park) designated for the project and has decided to grant all amounts that it may receive (less any administrative charge set forth below), and deposit to the appropriate fund, to Grantee as described in the proposal, subject to the following terms and conditions:

1. Grantee's separate legal existence, for all purposes including tax reporting, is established by the following: Grantee is a political subdivision of the state of Arizona, Yavapai County, which is, and shall be maintained throughout the duration of this Agreement.

Grantee shall conduct the project "Capital Campaign for Selna-Mongini STEAM Park" and other agreed to Grants for tax-exempt purposes which advance education or science, or erect or maintain public buildings, monuments or works which serve the public good.

2. The term of this agreement shall begin April 9, 2025 and end on December 31, 2025 or earlier if the project has been completed and or if written notice is provided to the other party as provided for in the provisions of this agreement. The term of this agreement may be extended for an additional defined period or more upon amendment and agreement of the Grantor and Grantee.
3. Grantee shall use the grant solely for the project described in the proposal, and the Grantee shall repay the Grantor any portion of the amount granted which is not used for that project. Any changes in the purposes for which grant funds are spent must be approved in writing by Grantor before implementation. Grantor retains the right, if Grantee breaches this agreement, or if Grantee's conduct of the project jeopardizes Grantor's legal or tax status, to withhold, withdraw, or demand immediate return of grant funds, and to spend such funds as to accomplish the purposes of the project as nearly as possible within Grantor's sole judgment. Any tangible or intangible property, including copyrights, obtained or created by Grantee as part of this project shall remain the property of the Grantee. The amount and date of each disbursement of funds to Grantee shall be within the discretion of Grantor. At its sole discretion, the Grantor may elect to maintain a positive balance in its restricted project fund pending receipt and acceptance of appropriate reports from Grantee.

4. Grantee may solicit gifts, contributions, and grants to Grantor, earmarked for Grantor's restricted fund(s) for this project. Grantee's choice of funding sources to be approached, and the text of Grantee's fundraising materials, are subject to Grantor's prior written approval. The solicitation shall be made only on the condition that the Grantor retains complete control over the use of all contributions it receives. That element of discretion and control must be known, in writing, to the funding sources. All grant agreements, pledges, or other commitments with funding sources to support this project via Grantor's restricted fund shall be executed by Grantor. The cost of any reports or other compliance measures required by such funding sources shall be borne by Grantee.
5. An administrative charge shall be deducted by Grantor to defray Grantor's costs of administering the restricted fund(s) and this grant. For grants received, an administrative charge of two and one-half percent (2.5%), or a minimum of one-thousand dollars (\$1,000.00), whichever is greater, shall be deducted by Grantor to defray Grantor's costs of administering the restricted fund and this grant.
6. Nothing in this Agreement shall constitute the naming of Grantee as an agent or legal representative of Grantor for any purpose whatsoever except as specifically and to the extent set forth herein. This Agreement shall not be deemed to create any relationship of agency, partnership, or joint venture between the parties hereto, and Grantee shall make no such representation to anyone.
7. Distribution of grant funds will be handled as described in the proposal. Grantee shall submit full and complete reports to Grantor as provided in the proposal.
8. This grant is not earmarked to be used in any attempt to influence legislation within the meaning of Internal Revenue Code (IRC) Section 501(c)(3). No agreement, oral or written, to that effect has been made between Grantor and Grantee.
9. Grantee shall not use any portion of the funds granted herein to participate or intervene in any political campaign on behalf of or in opposition to any candidate for public office, to induce or encourage violations of any law or public policy, to cause any private inurement or improper private benefit to occur, nor to take any other action inconsistent with IRC Section 501 (c)(3).
10. Grantee shall notify grantor immediately of any change in (a) Grantee's legal or tax status, or (b) Grantee's executive staff or key staff responsible for achieving the grant purposes.
11. Grantor shall not be responsible for the community programs, public information work, fundraising events, accounts payable and receivable, negotiation of leases and contracts, insurance, day-to-day disbursement of project funds, or other matters related to activities conducted by Grantee other than specified in the proposal. No one working on the project shall be an employee of or independent contractor with Grantor. Grantee shall assume full and complete responsibility for all liabilities to

third parties incurred in connection with the project including but not limited to any and all claims whether asserted or unasserted while this Agreement is in effect.

12. Grantee hereby irrevocably and unconditionally agrees, to the fullest extent permitted by law, to defend, indemnify and hold harmless Grantor, its officers, directors, trustees, employees and agents, from and against any and all claims, liabilities, losses and expenses (including reasonable attorney's fees) directly, indirectly, wholly or partially arising from or in connection with any act or omission of Grantee, its employees or agents, in applying for or accepting the grant, in expending or applying the funds furnished pursuant to the grant or in carrying out the program or project to be funded or financed by the grant, except to the extent that such claims, liabilities, losses or expenses arise from or in connection with any act or omission of Grantor, its officers, directors, trustees, employees or agents.
13. This Agreement shall terminate at the end of the term of this agreement or when the objectives of the project can no longer reasonably be accomplished by Grantee. If the objectives of the project can still be accomplished but either the Grantor or Grantee desires to terminate Grantor's fiscal sponsorship of the project, the following understandings shall apply. Either Grantor or the Grantee may terminate this Agreement on 60 days' written notice to the other party, so long as another nonprofit corporation which is tax-exempt under IRC Section 501(c)(3), and is not classified as a private foundation under Section 509(a) (a Successor), is willing and able to sponsor the project and is approved in writing by both parties by the end of the 60-day period. If the parties cannot agree on a Successor to sponsor the project, the Grantee shall have an additional 60 days to find a Successor willing and able to sponsor the project. If a Successor is found, the balance of assets in Grantee's restricted fund for the project, together with any other assets held or liabilities incurred by Grantor in connection with the project, shall be transferred to the Successor at the end of the notice period or any extension thereof, subject to the approval of any third parties that may be required. If the Grantee has formed a new organization qualified to be a Successor as set forth in this Paragraph, such organization shall be eligible to receive all such assets and liabilities so long as such organization has received a determination letter from the Internal Revenue Service, indicating that such qualifications have been met, no later than the end of the notice period or any extension thereof. If no Successor is found, Grantor may dispose of the project assets and liabilities in any manner consistent with applicable tax and charitable trust laws. Either party to this Agreement may terminate this Agreement, based upon a material breach of this Agreement by the other party, by giving 30 days' written notice to the other party.
14. Any controversy between the parties regarding the construction or application of the terms, covenants or conditions of the Agreement shall be submitted to arbitration on the request of either party, and the arbitration shall comply with and be governed by the provisions of the commercial arbitration rules of the American Arbitration Association. Clarkdale, AZ shall be the jurisdiction for arbitration.

15. This Agreement shall be governed by and construed in accordance with the laws of the State of Arizona applicable to agreements made and to be performed entirely within the State.
16. This Agreement shall supersede any prior oral or written understandings or communications between the parties and constitutes the entire agreement of the parties with respect to the subject matter hereof. This Agreement may not be amended or modified, except in a writing signed by both parties hereto.

IN WITNESS WHEREOF, the parties have executed this Grant Agreement effective on April 9, 2025.

The Clarkdale Foundation Inc., Grantor

By: _____ Dated: _____
Henri Prud'homme, President

Town of Clarkdale, Grantee

By: _____ Dated: _____
Susan Guthrie, Town Manager

**Proposal - Selna-Mongini STEAM Park Capital Campaign
between The Clarkdale Foundation and the Town of Clarkdale**

March 31, 2025

The Clarkdale Foundation (CF) and The Town of Clarkdale (TOC) plan to work in a Fiscal Sponsorship arrangement to raise funds for the Selna-Mongini STEAM (science, technology, engineering, art, math) Park Capital Campaign (“the project”). The project furthers CF’s charitable purpose, Mission, and Goals to enhance Clarkdale’s community facilities and to advance education and science. The project supports the TOC’s goal of creating a unique educational Park for all members of the community and public to enjoy.

The CF shall retain complete control and discretion over the use of all funds it receives as tax deductible 501c3 donations and grants.

The CF’s role in the project will take the form of CF accepting tax deductible donations and grants on behalf of funding the Selna-Mongini STEAM Park. This will include activities such as, but not limited to, receiving and separately accounting for the funds (less administrative fees), ensuring their use in keeping with the project and charitable purposes, satisfying donor restrictions and reporting, disbursing approved funds to accomplish the project (including making payments directly to vendors for project invoices on behalf of the TOC), and documenting how the funds are used.

The TOC’s role in the project will take the form of soliciting donations and grants on behalf of the project, accounting for and ensuring the project grant funds are used appropriately for the project in keeping with charitable purposes, managing completion of the STEAM Park project, and timely and complete reporting to CF about how the grant funds are used. This will include responsibilities, activities and associated costs such as, but not limited to, fundraising, Park design, planning, engineering, equipment and systems selection, permitting, contracting, inspections, purchasing, construction, accounting, insurance, supplies, services, etc. The TOC shall be solely responsible and liable for the Park, its equipment, including warranty issues, damage, flaws in installation, product defects, etc.

The key people responsible for this project between the CF-TOC and points of contact are:

CF- Henri Prud’homme, President (primary)

TOC - D.K. Green, Grants Manager (primary)

Requests by the TOC for disbursement of available restricted funds must be made in writing via email or paper document to the CF. The request must describe how the funds will be used to complete the project, the amount requested, a breakdown of materials, labor, shipping, tax, fees, etc., and any other information that would be needed in understanding and tracking how the expenditure satisfies the goals of the project. Disbursement requests should be made to CF at least 5-7 business days in advance of any payment deadlines to allow sufficient time for CF to review the request, resolve any questions, approve, and issue the disbursement.

The TOC shall submit a written report(s) to the CF upon request and at the final completion of the project.

The report(s) may include accounting, pictures, descriptions, paid invoices and contracts, lien releases, certificate of occupancy, certificate of substantial completion, inspection reports, etc. which are intended to demonstrate and confirm how the funds were used and that the result has met the intended charitable project purposes.

If multiple grants (sub-grants) have been made by the CF from the Selna-Mongini Capital Campaign Park restricted funds, the final report must include a summary listing each sub-grant amount and the total of sub-grants. A separate reporting shall be made for each sub-grant to confirm how funds were used.



Staff Report

Item Number: 6.C.

Agenda Item: **Ratification of a Grant Application to the Water Infrastructure Finance Authority of Arizona's Water Conservation Grant Fund (WIFA WCGF), for the Design of Purple Pipe to Selna-Mongini Park and Town Park**

Discuss, consider, and act upon a request by staff to ratify the submission of a grant application to the Water Infrastructure Finance Authority of Arizona's Water Conservation Grant Fund (WIFA WCGF), for the design of Purple Pipe to Selna-Mongini Park and Clarkdale Town Park, in the amount of \$165,000.

Staff Contact: D.K. Green, Grants Manager

Meeting Date: April 8, 2025

Strategic Goal: This agenda item supports the following Clarkdale Strategic Goal Area:

- Goal Area 4 - Plan for the maintenance and growth of quality infrastructure that is sustainable and resilient.
- Goal Area 6 - Adopt water conservation strategies that prevent negative aquifer impacts and no degradation of Verde River Flows.

Background: Per Clarkdale's mission of sustainably and resiliently planning for the future, and our vision of sustainably enhancing our infrastructure, this project represents a critical investment in innovative water management, environmental resilience, and responsible maintenance of public spaces, all of which are essential to the Town of Clarkdale and the Verde River Watershed.

Assistant Public Works Director Virginia Smith, has been instrumental in working with WIFA to obtain funding for several Town water projects, including \$900,000 for the Cemetery Drainage project as well as \$562,000 for the Town cellular water meter project. The Town will pursue additional grant funding for completion of this project, once the design is complete.

Upon completion, this project would immediately yield savings of 7 acre-feet of water per year. Selna-Mongini Park is currently under construction and is expected to use 3 to 4.5 acre feet per year based on a Reclaim Feasibility Study completed by Sunrise Engineering for the Town of Clarkdale in 2023 and the Water and Wastewater Master Plan drafted in 2024. Clarkdale Town Park uses an average of 4 acre-feet per year based on the previous seven

years of potable water bills. The majority of this consumption is for irrigation. This reclaim water line would also be made available for customer connections and could be extended in the future to provide additional water savings.

The Town received letters of support for this project from Yavapai-Apache Nation, The Nature Conservancy and the Verde River Institute.

Budget Impact: The grant request is for \$165,000 with a local match of \$55,000, for a total project design cost of \$220,000.

Recommendation: Staff recommends that the Council approve the ratification of the submission of a grant application to the Water Infrastructure Finance Authority of Arizona's Water Conservation Grant Fund (WIFA WCGF), for the design of Purple Pipe to Selna-Mongini Park and Clarkdale Town Park, in the amount of \$165,000 and authorize the Town Manager to sign all required documents related to this grant.

WATER CONSERVATION GRANT FUND (WCGF) APPLICATION
American Rescue Plan Act (ARPA) Funding
FY 2025

I. General Information

1. Title of

Project/Program:

Reclaim Water Line to Selna-Mongini and Clarkdale Parks

2. Type of Conservation Activity (A.R.S. § 49-1332(B)) (select one):

- ☒ Education and research programs on how to reduce water consumption, increase water efficiency or increase water reuse.
- ☐ Programs and projects for rainwater harvesting, gray water systems, efficiency upgrades, installing drought-resistant landscaping, turf removal and other practices to reduce water use.
- ☐ Programs or projects to promote groundwater recharge and improved aquifer health.
- ☐ Programs or projects to improve groundwater conservation and surface water flows.
- ☐ Landscape watershed protection, restoration, and rehabilitation, including through green infrastructure and low-impact development to conserve or augment water supplies.
- ☐ Projects facilitating coordinated water management, including groundwater storage and recovery.
- ☐ Programs or projects to reduce structural water overuse issues.

3. Category of Conservation Activity (select one):

- ☒ Advanced Meters / System Upgrades
- ☐ Agriculture System Upgrades
- ☐ Education / Research / Studies
- ☐ Efficient Fixtures
- ☐ Recharge / Reuse
- ☐ Turf Removal
- ☐ Vegetation Management
- ☐ Other: _____

- 4. Is this for an individual Water Conservation Project or a general Water Conservation Program? If it is a program, please describe the specific components that make it a program. *Pursuant to A.A.C. R18-15-1003(C)(1), "Program" means activities that occur in multiple phases over an established timeframe, and that may result in multiple deliverables. Pursuant to A.A.C. R18-15-1003(C)(2), "Project" means activities that are confined to a particular time and place, and that result in a single deliverable.**

This application is for a Water Conservation Project which would install a reclaim water line from our current fill station to Selna-Mongini Park (under major renovation) and Clarkdale Park.

WATER CONSERVATION GRANT FUND (WCGF) APPLICATION
American Rescue Plan Act (ARPA) Funding
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5. **What is the specific location of conservation activity?** *Include information about the city/town, county, all applicable water provider service area(s), congressional/ legislative districts, watersheds, [ADWR Groundwater Basin\(s\)](#), Active Management Area and/or Irrigation Non-Expansion area (if applicable)*

Town of Clarkdale, Yavapai County
Congressional District 2, Legislative District 1
Verde River Watershed, Not in Active Management Area, Designation of Water Adequacy

6. **Conservation Activity Cost**

Amount requested from the WCGF for this activity:	\$ 165,000
Amount of matching funds:	\$ 55,000
Total conservation activity cost:	\$ 220,000

When applying for the grant, note that a single water conservation program grant may not exceed \$3,000,000. A single water conservation project grant may not exceed \$250,000. The WCGF requires at least a twenty-five percent match from a non-WIFA source for each water conservation program or project. Funds will be distributed on a reimbursement basis and the final request for reimbursement must be submitted to WIFA no later than June 30, 2026. Indirect costs are eligible for funding under the grant but may not count toward the matching requirement. WIFA will accept an applicant's current negotiated indirect cost rate (NICR). Applicants should upload a copy of their NICR documentation to the application. If you do not have a NICR, WIFA will accept the minimis indirect cost rate of up to 15% of Modified Total Direct Costs.

7. **Are indirect costs included in the amount requested?** *If yes, provide the amount of indirect costs and if using a NICR upload a copy with this application.*

No

8. **What are the estimated water savings in acre-feet per year?** *Explain your calculation, which should include detailed citations to published sources and reported annual water use that were used to calculate your estimated water savings.*

Upon completion, this project would immediately yield a savings of 7 acre-feet per year. Selna Mongini Park is currently under construction and is expected to use 3-4.5-acre feet per year based on a Reclaim Feasibility Study completed by Sunrise Engineering for the Town of Clarkdale in 2023 and the Water and Wastewater Master Plan drafted in 2024. Clarkdale Park uses an average of 4-acre feet per year based on the previous 7 years of potable water bills. The majority of this consumption is for irrigation as the winter usage numbers are minimal. This reclaim water line would also be made available for customer connections and could be extended in the future to provide additional water savings.

WATER CONSERVATION GRANT FUND (WCGF) APPLICATION
American Rescue Plan Act (ARPA) Funding
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9. Will all expenditures related to the proposed conservation activity be complete by June 30, 2026?

☒ **Yes**

☐ No (explain):

10. What is the expected duration of the conservation activity? Please include a detailed explanation of the work planned (or completed) with estimated dollar amounts (grant and match) for the following timeframes:

- July 6, 2022* – Date of Anticipated Grant Award
- Grant Award Date – June 30, 2025
- July 1, 2025 – September 30, 2025
- October 1, 2025 – December 31, 2025
- January 1, 2026 – March 31, 2026
- April 1, 2026 – June 30, 2026

The Town completed a Reclaim Feasibility Study with Sunrise Engineering in the amount of \$38,370 March-October 2023 which identified reclaim water use at the parks as a possible project. The Water and Wastewater Master Plan is in its final stages and includes preliminary estimates for reclaim pipe projects. Design for this portion of reclaim pipe is estimated at \$180,652 (15% of total project cost) and would begin upon receipt of award documents. Design is expected to take less than a year to complete.

**Pre-award costs made in anticipation of the grant award and incurred after July 6, 2022, are eligible for reimbursement under the grant. Pre-award costs may be used as matching funds. Such costs are allowable only to the extent that they would have qualified for reimbursement if incurred after the date of the award, and only with the approval of the WIFA Board. The following spending benchmarks will be required for awarded grants:*

- *Expend 10% of the Award by August 1, 2025*
- *Expend 50% of the Award by December 31, 2025*
- *Expend 75% of the Award by March 31, 2026*

WATER CONSERVATION GRANT FUND (WCGF) APPLICATION
American Rescue Plan Act (ARPA) Funding
FY 2025

II. Conservation Activity Benefits and Results

11. Describe in detail the water conservation activity you propose to fund with grant monies?

Please include a detailed explanation of the specific project/program components that will comprise the conservation activity's scope of work.

This grant would fund design of approximately 5,100 feet of 6" forcemain reclaim pipe from our reclaim fill station to Selna-Mongini Park continuing on to Clarkdale Park.

12. What is the source of the water that will be conserved? If it is mainstem Colorado River water or Colorado River water delivered through the Central Arizona Project, please clearly indicate so.

The Town's wells penetrate the Verde, Mississippian Redwall Limestone, Devonian Martin, and Cambrian Tapeats Formations.

13. List the annual water use (in acre-feet) for the last 3 years as reported to the Arizona Department of Water Resources (ADWR) and include attachments of the annual water use reports with this application. If you are not subject to the state's annual water use reporting requirements, please include the estimated water use of users impacted by this project/program.

2023: 549.097 acre-feet
2022: 554.798 acre-feet
2021: 686.54 acre-feet

14. Describe the community (population size, demographics, principal economic activities, etc.) impacted by the conserved water.

The Town of Clarkdale was founded in 1912 as a company smelter town by William A. Clark, for his copper mine in nearby Jerome. The mine and smelter closed in 1953. The Town's water system has approximately 2,250 connections, including portions of the Yavapai Apache Nation, a Community College and the only railway service in the Verde Valley. The current population is estimated at 4,600 and water use is approximately 596 acre-feet per year.

WATER CONSERVATION GRANT FUND (WCGF) APPLICATION
American Rescue Plan Act (ARPA) Funding
FY 2025

15. What is the extent to which your water conservation activity achieves one or more of the following:

- Long-term reductions in water use
- Improvements in water use efficiency.
- Improvements in water reliability

This project would reduce potable water usage by at least 7 acre-feet per year. Additionally, Selna-Mongini Park is being constructed as a S.T.E.A.M. park. Bringing reclaim water to this park not only will decrease potable water usage but could also be used in educational water features.

16. What is the extent to which your water conservation activity addresses one or more of the following:

- Water supply shortages
- Reliance on non-renewable water supplies
- Groundwater depletion
- Water quality issues
- Natural disasters that may impact water supply infrastructure

1. Decreasing potable water use/loss decreases our reliance on non-renewable water supplies.
2. Any water savings ultimately affects groundwater as all of our supply is from wells that draw upon groundwater.
3. Our arsenic plant has limited treatment capacity. By decreasing use, we are better able to meet the demand and ensure water quality.

17. How will your water conservation activity align with a local, regional, or statewide water plan or integrated resource management plan?

N/A

18. What are the costs of your water conservation activity, including any environmental impacts?

Estimated total costs of the two phases of reclaim pipe for design and construction are estimated at \$1,385,000.

Include detailed cost estimates and/or quotes as attachments to application.

19. What are the benefits of your water conservation activity, including any environmental impacts?

Benefits include annual potable water use savings resulting in less groundwater withdrawals and potential resident education on alternative water sources. Environmental impacts could include use of the reclaim water at public facilities; however, reclaim water quality is monitored in accordance with the Town's Type 3 Reclaim Permit through ADEQ. Additionally, reclaim distribution would be a more effective use of effluent. Currently, unused effluent is sprinkled on approximately 60 acres of land. The Town is still working with The Nature Conservancy to study other potential uses and discharge methods.

20. How will you measure the effectiveness of the conservation activity?

Effectiveness can be measured by decreased potable water use at the parks, verified by meter reads and billing, and decrease in annual groundwater withdrawals.

WATER CONSERVATION GRANT FUND (WCGF) APPLICATION
American Rescue Plan Act (ARPA) Funding
FY 2025

III. Funding Sources

21. If your water conservation activity is eligible for funding from WIFA's Long-Term Water Augmentation Fund or Water Supply Development Fund, does the nature of your conservation activity make funding from those funds impractical, and why?

The draft Water and Wastewater Master Plan recommends a total of \$27 million in Sewer Capital Improvement Projects and \$38 million in Water Capital Improvement Projects. All but \$3 million is associated to delivering potable water and providing sewer collection services to our residents. It is those types of projects which the Town could recommend for loan programs. Recharge and reclaim projects are forced into secondary priorities when we consider the needs of Town residents and therefore would not get completed without funding assistance.

22. Would the conservation activity be otherwise implemented without this grant funding?

Without grant funding, this project is unlikely to be implemented. The draft Water and Wastewater Master Plan recommends a total of \$27 million in Sewer Capital Improvement Projects and \$38 million in Water Capital Improvement Projects. All but \$3 million is associated to delivering potable water and providing sewer collection services to our residents. The Town hopes to utilize this grant funding to create a shovel ready project which opens additional grant opportunities for construction.

23. To what extent will your water conservation activity maximize or leverage multiple available funding sources, including federal funding?

In Fiscal Year 2023, the Town contracted with Sunrise Engineering for a Reclaim Feasibility Study to determine benefits and costs associated to the various possible reclaim uses. The Town utilized local funding in the amount of \$38,370. In 2024, The Nature Conservancy funded an additional study completed by Montgomery & Associates that also evaluated Effluent, Stormwater, and Recharge Opportunities. Also in 2024, the Town contracted with the Town Engineering Firm, Ardurra, to create a Water and Wastewater Master Plan, which included evaluation and cost estimates for this reclaim line. The full master plan is being locally funded in the amount of \$273,615.

24. Are there cost-sharing opportunities with other applicants or other parties?

The Nature Conservancy has gathered information in preparation for a Pulliam grant application. The Friends of the Verde River has also expressed in this project.

25. What is the source and amount of the match? Cash resources from a non-WIFA source or in-kind services, goods, and equipment may satisfy the 25% match requirement. If match will be provided by cash provide the source and the date funds were made available or will be made available. If match is provided by in-kind then provide documentation regarding the value and source of the in-kind goods, equipment, or services.

WATER CONSERVATION GRANT FUND (WCGF) APPLICATION
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The Town paid Sunrise Engineering in FY 2023 with local funds. Additional local funding is available in current and next fiscal year budget for additional match requirements for design.

WATER CONSERVATION GRANT FUND (WCGF) APPLICATION
American Rescue Plan Act (ARPA) Funding
FY 2025

IV. Capacity, Feasibility, & Public Comment

26. What qualifications and capacity do you have for completing your proposed water conservation activity? *Include any name(s) and qualifications of the individual(s) or entities who will be managing this activity.*

The Town's Engineering firm, lead by Michael Janes, that was selected via formal bid process will complete design with input from the Town's Public Works Director Lou Andersen and Utilities Director Joshua Tomerlin.

27. Will there be significant management impacts as the result of the proposed conservation activity, or any technology associated with the conservation activity? *(For example: additional costs or staffing requirements)*

Upon completion of construction, minimal additional maintenance for booster pumps and/or reclaim lines may be required. Metered reclaim water would require set up in the Town's systems, but readings would not require additional staff due to cellular metering.

28. Will the proposed conservation activity promote collaborative partnerships to address water-related issues?

Starting the reclaim distribution system could lead to partnerships to expand the system to current or future parcels as water and cost savings incentives. Reclaim educational materials at the park could lead to additional collaborative partnerships and promote conservation initiatives.

29. What is the stakeholder involvement in the conservation activity planning process?

30. Will the proposed conservation activity include public outreach and opportunities for the public to learn about the conservation activity?

The Town hopes to receive stakeholder (resident) feedback on this project, as well as the others recommended in the Water and Wastewater Master Plan during our Open House on March 24.

Selma-Mongini Park is being constructed as a S.T.E.A.M. park. Bringing reclaim water to this park would be used to highlight reclaim water educational. One reuse demonstration project is already integrated into the Park plans through funding from Friends of the Verde River without reclaim water availability. Additional educational features that demonstrate the water cycle and aspects of the Verde River are on hold due to the lack of reclaim water availability and potable water conservation efforts by the Town.

WATER CONSERVATION GRANT FUND (WCGF) APPLICATION
American Rescue Plan Act (ARPA) Funding
FY 2025

31. Is there community and/or sector support for the conservation activity?

The Town hopes to receive stakeholder (resident) feedback on this project, as well as the others recommended in the Water and Wastewater Master Plan during our Open House on March 24. Overall, the Town's residents are receptive to conservation efforts, as demonstrated by the low average residential GPCD.

32. How feasible is it to complete your water conservation activity?

Project feasibility is entirely based on funding.

33. If the conservation activity is a continuation of ongoing activities, has the activity been shown to be effective? If a new activity, has the proposed project, technology, or technique previously been implemented?

While the Town offers a reclaim fill station for construction water use, there is no reclaim distribution system currently. The neighboring city of Cottonwood, as well as many cities through the United States, have successfully installed and utilize reclaim water distribution systems.

34. Will the proposed conservation activity implement an established Best Management Practice?

Use of alternative water sources such as reclaim water is a best management practice as noted by the United States Environmental Protection Agency.