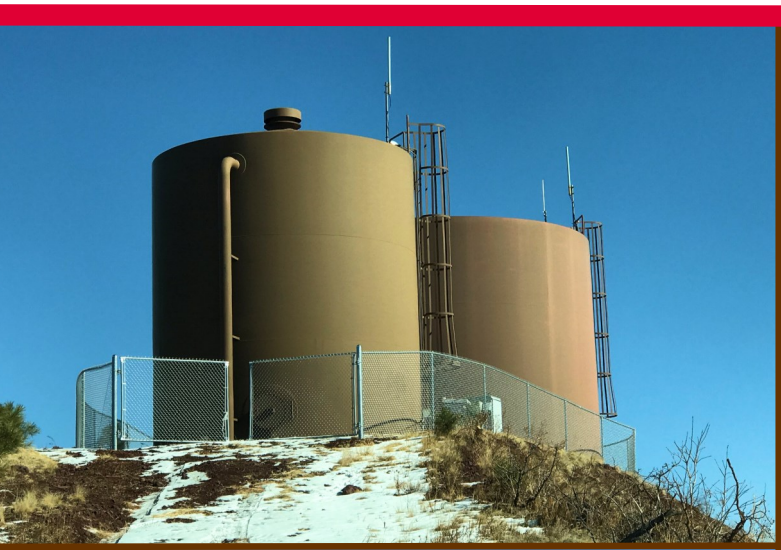

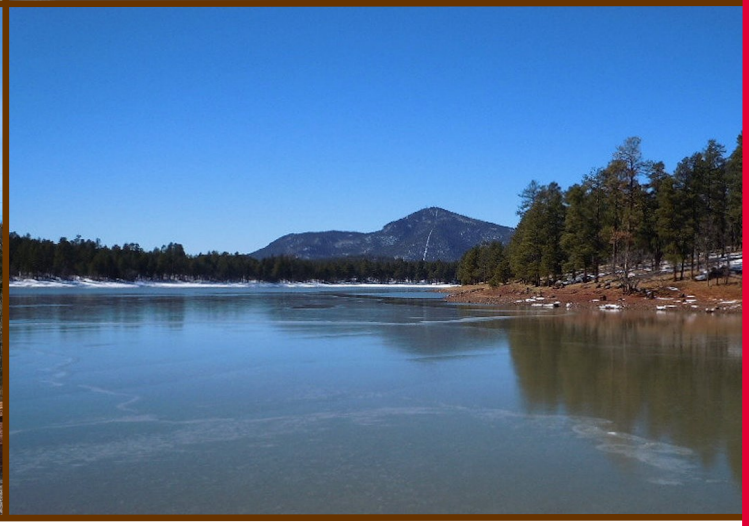

WATER MASTER PLAN

City of Williams
Water Master Plan

May 15, 2018

City of Williams

Registered Professional Engineer (Civil)
CERTIFICATE NO. 49111
MICHAEL S. JANES
DATE SIGNED 5/15/2018
ARIZONA U.S.A.
EXPIRES 12/31/2020

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A. INTRODUCTION AND PROJECT SUMMARY

1. BACKGROUND AND HISTORY

The City of Williams is located in Coconino County, Arizona, Latitude 35.25N; Longitude 112.19W. Williams was founded in 1882 and incorporated in 1901. The City's elevation is 6,770' and is in the center of the Kaibab National Forest. Williams encompasses 44 square miles and has an estimated population of approximately 3,000 people. The economy is based primarily upon tourism. The City is collared on the south by an 18,500 acre watershed contributing to five surface reservoirs. The City's water supply is also supported by two major wells and two minor wells with respect to production rate.

The City provides essential municipal services for its residents. Among the services are water supply and wastewater treatment. Originally the City relied solely on surface water. Since surface water supplies were very low in dry years, the City developed a water conservation ordinance, standard operating procedures for hauling water, public education, and a wastewater reuse plan. Also, in 1996 they began a well drilling program. The first deep well was put into service in 2000.

A previous Water Master Plan was completed in 2006. Since then there has been minor growth within the City both on the residential and commercial side. There have been several completed waterline replacement projects, but no major changes to the water system.

2. PURPOSE AND SCOPE

The City of Williams is currently experiencing a steady period of growth both commercially and residentially. The current growth will require upgrades in the water system to provide reliable and adequate supply and delivery of potable water.

This Water Master Plan has been created to accurately document the existing water system, provide a working water model for future use, evaluate demand, identify system deficiencies, identify system modifications for future growth, identify improvements to increase system performance, and to develop improvement recommendations for the system.

A field survey has been conducted to document the location and existence of water valves, fire hydrants, tanks, wells, and booster pump stations. In addition, as-built drawings and old water system maps were used to build an AutoCAD/GIS map of the system.

A water model has been prepared in WaterGems to simulate the water system under a variety of flow conditions. Input into the model includes: junction nodes, storage reservoirs, elevations, pipe diameters, and system demands. Different scenarios including fire flows were run using the model to analyze how the system reacts to the demands.

A large amount of data has been collected to input into the model for calibration and to closely simulate the system operation. Data were collected for water production, water usage, fire hydrant flow tests, and system component elevations.

3. PLANNING SUMMARY

The City of Williams has maintained a relatively steady population since 2004. There have been approximately 3,000 residents since this time, with City population fluctuating between summer and winter. Steady but moderate residential population growth over the next five years in the City is expected. The City has several known commercial projects that are in design and is projected to have several more. Currently plans have been submitted for 2 new hotels and 1 hotel expansion project. There are vacant lots in existing subdivisions and approved submitted subdivision plans for approximately 695 additional residential lots for development.

At full buildout there could be an additional 2,445 available residential lots and 186 acres of commercial/industrial land available for development. A more detailed description of how growth will affect water demand is described in Section B.6 and D.4.

4. EXISTING SYSTEM DESCRIPTION AND SUMMARY

The City of Williams Water System is comprised of 5 surface reservoirs, 5 wells, 7 finished water storage tanks, approximately 36 miles of potable water lines, approximately 13 miles of raw water lines, and 5 booster pump stations. See Section C for detailed information for each of the systems components listed below.

- **Reservoirs**
  - Dogtown
  - Cataract
  - Santa Fe
  - City Dam (Also referred to as Third Dam or Buckskinner)
  - Kaibab
- **Wells**
  - Dogtown #1
  - Dogtown #3
  - Rodeo
  - Santa Fe
  - Sweetwater (Not Developed)
- **Tanks**
  - Water Treatment Plant #1 Tank (WT #1)
  - Water Treatment Plant #2 Tank (WT #2)
  - 3rd Street Tank
  - One Million Gallon Tank (Also referred to as Cinder Hills #1)
  - Twin Tanks (Also referred to as Cinder Hill #2 and #3)
  - Taber Tank
  - Garland Prairie Fire Storage Tank
- **Booster Pump Stations**
  - Cataract Pump Station
  - Taber Pump Station
  - One Million Gallon Tank Pump Station (Also referred to as Cinder Hills or Cemetery Pump Station)
  - Kaibab Lake Booster Pump Station (Inactive)

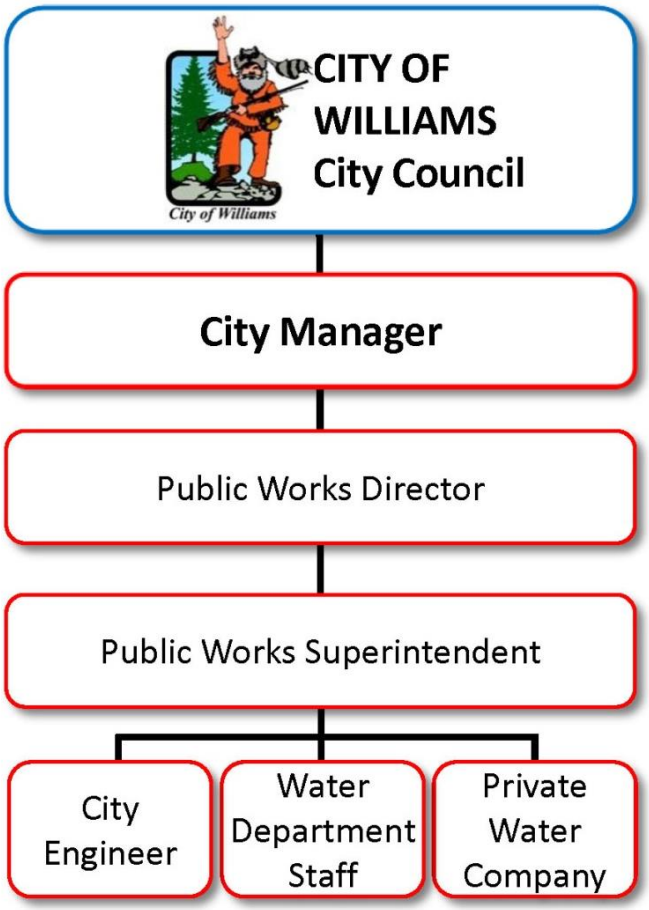
- Lost Canyon Booster Pump Station (Young Life)
- Love's Fire Booster Pump Station

- **Potable Water Distribution System**
  The existing potable distribution system is comprised of approximately 36 miles of waterlines. Sizes vary from 2" to 12" water mains. Water mains are PVC, ductile iron, and asbestos-cement pipe materials. The system is split into four different pressure zones based on the location and elevation in the City and connection to tanks.

- **Raw Water System**
  The existing raw water system is comprised of approximately 13 miles of waterlines. Sizes vary from 8" to 12" and are PVC, asbestos-cement, and ductile iron. The raw waterlines route from the reservoirs and wells to the Cataract Booster Pump Station and then to the Water Treatment Plant.

5. WATER DEPARTMENT OUTLINE

The City of Williams' water system is operated by City Staff and a private water operations company. City Staff operates and maintains the water distribution system, wells, tanks, and reservoirs. The Water Department staff is made up of 4 full time employees. The private water operations company runs the water treatment plant. See organizational chart below:



B. CURRENT AND FUTURE DEMANDS

The City of Williams has provided data for Water Plant production rates, water sales information, number of customers (commercial and residential), high water users, and future growth areas.

1. CUSTOMER BILLING

Over the last 2 years there have been approximately 1,200 residential and 250 commercial customers in the City of Williams. Due to seasonal residents the number of active users fluctuates between summer months and winter months with summer being higher. A summary of gallons of total water sales per year and water sales per month is provided in Table 1 – Water Sales.

	2018	2017	2016	2015	2014	2013	2012	2011
January	9,664	9,488	11,838	9,298	8,160	8,901	7,345	
February		7,226	9,450	6,109	6,528	7,104	6,297	
March		9,310	10,118	6,733	6,740	5,573	6,636	
April		10,599	10,770	10,637	10,420	10,164	8,958	
May		14,226	10,285	9,388	9,028	10,433	11,570	
June		15,891	19,436	15,192	12,676	13,721	15,381	13,662
July		14,961	14,308	12,249	11,705	17,148	15,328	17,906
August		15,187	13,969	11,549	11,429	12,631	13,007	11,495
September		12,117	12,569	12,546	11,562	11,369	10,399	10,910
October		13,353	11,201	9,971	8,978	8,877	12,617	9,197
November		9,767	10,882	9,152	7,429	6,681	6,860	6,433
December		8,723	9,072	8,131	7,111	7,387	7,238	8,050
Total		**140,852**	**143,903**	**120,956**	**111,766**	**119,993**	**121,640**	

Table 1 - Water Sales. (000) gallons

2. WATER PRODUCTION

The City of Williams keeps records of the daily water production from the Water Treatment Plant. The Santa Fe Well has recently been put into operation and is not included in these numbers, and there are no other wells or sources directly pumping into the system. Water is metered to individual users with some known exceptions. Water is not tracked through billing and in some instances not metered to the City Maintenance Building, Swimming Pool, Wastewater Treatment Plant, and the Water Plant for Backwash Operations. The City has estimated amounts of usage for these facilities. Both data for water production and water sales is needed to estimate the amount of loss in the system. System loss is explained and shown in Section B.3. See Table 2 – Water Production and Table 3 – Water Production; High, Low, and Averages, for water production amounts in gallons at the Plant.

Month	2017	2016	2015	2014
January	13,881	16,848	17,920	
February	11,361	15,105	14,630	
March	13,102	18,021	17,725	
April	15,508	16,711	20,276	19,612
May	16,731	17,654	20,520	20,966
June	20,021	21,009	23,601	21,005
July	19,811	19,454	24,624	20,894
August	16,840	17,187	23,551	20,858
September	14,757	17,187	21,311	19,785
October	15,753	14,723	19,987	18,561
November	12,947	12,201	13,600	14,767
December	14,661	13,276	18,604	16,610
TOTAL	**147,032**	**149,405**	**186,078**	**173,062**

Table 2 - Water Production. (000) gallons

Month	Average Daily 2014-2017	Monthly Low	Monthly High	Average Monthly 2014-2017
January	523	13,881	17,920	16,216
February	489	11,361	15,105	13,699
March	525	13,102	18,021	16,283
April	600	15,508	20,276	18,027
May	611	16,731	20,966	18,967
June	713	20,021	23,601	21,409
July	683	19,454	24,624	21,196
August	632	16,840	23,551	19,609
September	608	14,757	21,311	18,260
October	556	14,723	19,987	17,256
November	445	12,201	14,767	13,379
December	509	13,276	18,604	15,788

Table 3 – Water Production: High, Low and Averages. (000) gallons

3. LOSS

The City of Williams tracks monthly the estimated amount of water loss in the system. The loss in the system is estimated by taking the amount of water produced at the Water Treatment Plant and subtracting the amount of water billed and the unbilled uses. Water usage to the City Swimming Pool, Maintenance Building, Water Plant Back Wash, and Wastewater Plant are not billed and in some cases not metered. For the unmetered instances the City estimates the amounts used. Overall this number is not exact and does not account for other infrequent water usage, breaks, or fire hydrant flushing, but on average the City has an 8% to 19% loss in their system. See Appendix 1 for monthly reports.

4. CALCULATED PER CAPITA WATER USE

Monthly water usage data and number of customers per month was provided by the City of Williams. The City of Williams' water usage and population fluctuates between winter months and summer months with the summer being higher. For the water model we used a high monthly total to establish a per capita water usage. For the average commercial usage the top 40 high water users were removed from the calculations. See the Table 4 – Per Capita Usage below for existing system usage.

Description	Active Meters	Demand Type	Residential (gpd)	Residential (gpm)	Commercial (gpd)	Commercial (gpm)	High Commercial Users (gpd)	High Commercial Users (gpm)	Total (gpd)	Total (gpm)
Residential Customers	1166	ADD*	174,000	121	81,112	57	268,000	186	**523,112**	**363**
Commercial Customers	204 (40 high users)	PHD*	522,000	363	243,356	169	804,000	558	**1,569,336**	**1,089**
Per Capita Water Usage	Average per Resident – Includes Commercial Usage								**150**	
Total Monthly Usage (Gallons)									15,900,000 (with high users) June 2017	

*Table 4 – Per Capita Usage. * ADD - Average Daily Demand, PHD - Peak Hour Demand*

5. PEAKING FACTORS

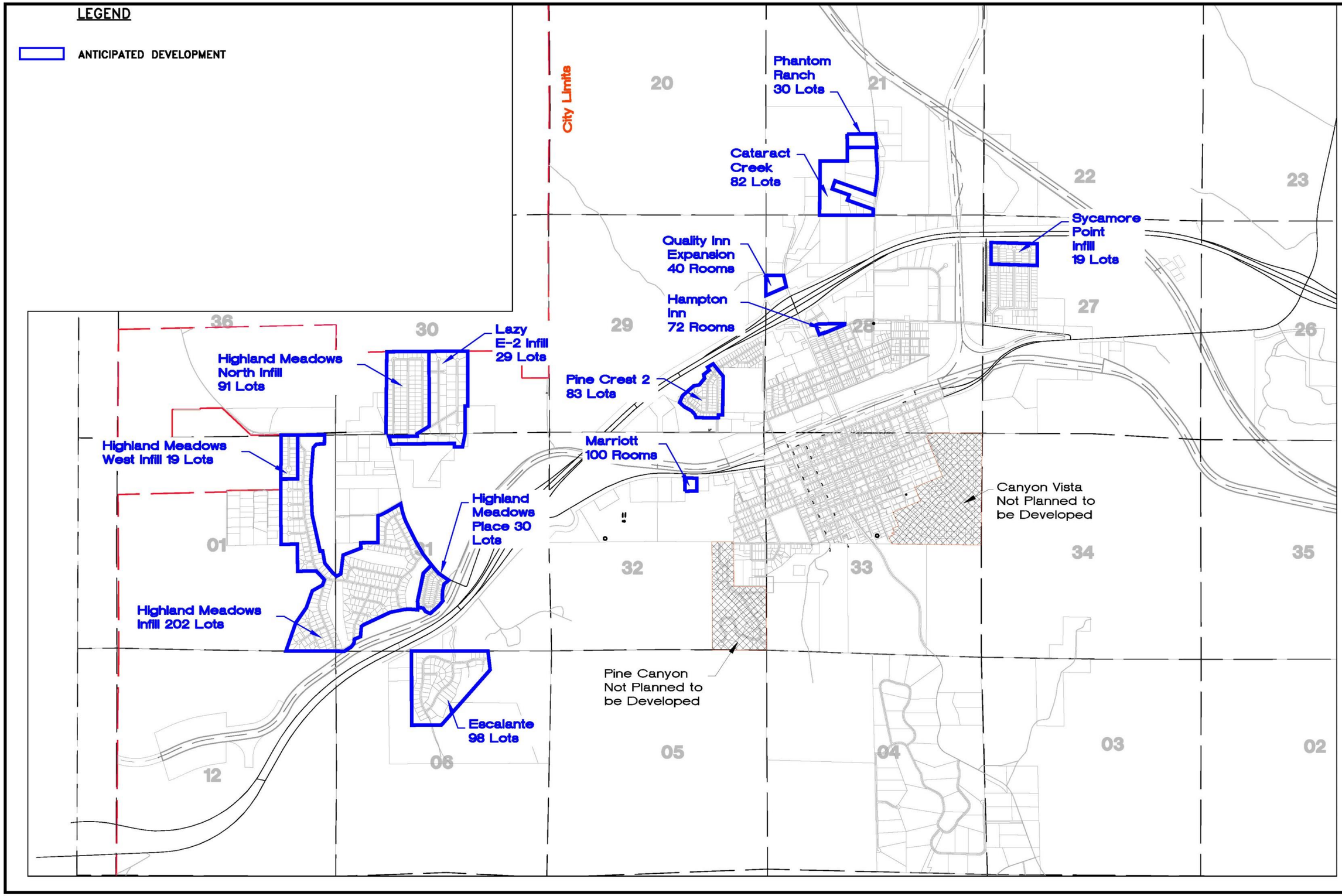
The City does not have data to accurately calculate a peaking factor for the City. A standard peaking factor of 3.0 has been applied to the average flows during June of 2017 to come up with a peak flow condition to apply to the model.

6. ANTICIPATED DEMAND AREAS

The City of Williams is presently experiencing a period of both commercial and residential growth. A combination of infill and new development will increase the water demands on the existing and future system. See Table 5 - Anticipated Development for current approved subdivisions, and subdivisions and commercial projects that have been brought before the City for development review and permitting.

Project Name	Level of Project	# of Lots /Rooms	Average Demand per Unit (gpd)	Average Additional Demand (gpd)	Average Monthly Additional Demand (gal)	Peak Demand per Unit (gpd)	Peak Additional Demand (gpd)	Peak Monthly Additional Demand (gal)
Hampton Inn	Site Plan	72	80	5,760	172,800	240	17,280	518,400
Marriott	Site Plan	100	80	8,000	240,000	240	24,000	720,000
Quality Inn	Concept Plan	40 additional	80	3,200	96,000	240	9,600	288,000
Phantom Ranch	Concept Plan	30	100	3,000	90,000	300	9,000	270,000
Escalante	Constructed - Infill	98	150	14,700	441,000	450	44,100	1,323,000
Cataract Creek Estates	Site Plan	82	150	12,300	369,000	450	36,900	1,107,000
Sycamore Point	Constructed - Infill	19	100	1,900	57,000	300	5,700	171,000
Pine Crest 2	Constructed - Infill	83	150	12,450	373,500	450	37,350	1,120,500
Highland Meadows North	40% Constructed - Infill	91	150	13,650	409,500	450	40,950	1,228,500
Lazy E-2	Constructed - Infill	29	150	4,350	130,500	450	13,050	391,500
Highland Meadows West	Constructed - Infill	19	150	2,850	85,500	450	8,550	256,500
Highland Meadows 4	Constructed - Infill	56	150	8,400	252,000	450	25,200	756,000
Highland Meadows 3	Constructed - Infill	59	150	8,850	265,500	450	26,550	796,500
Highland Meadows 2	Constructed - Infill	87	150	13,050	391,500	450	39,150	1,174,500
Highland Meadows Place	Constructed - Infill	30	150	4,500	135,000	450	13,500	405,000
Totals				**116,960**	**3,508,800**		**350,880**	**10,526,400**

Table 5 - Anticipated Development



WATER DEMAND ANALYSIS

ANTICIPATED DEVELOPMENT
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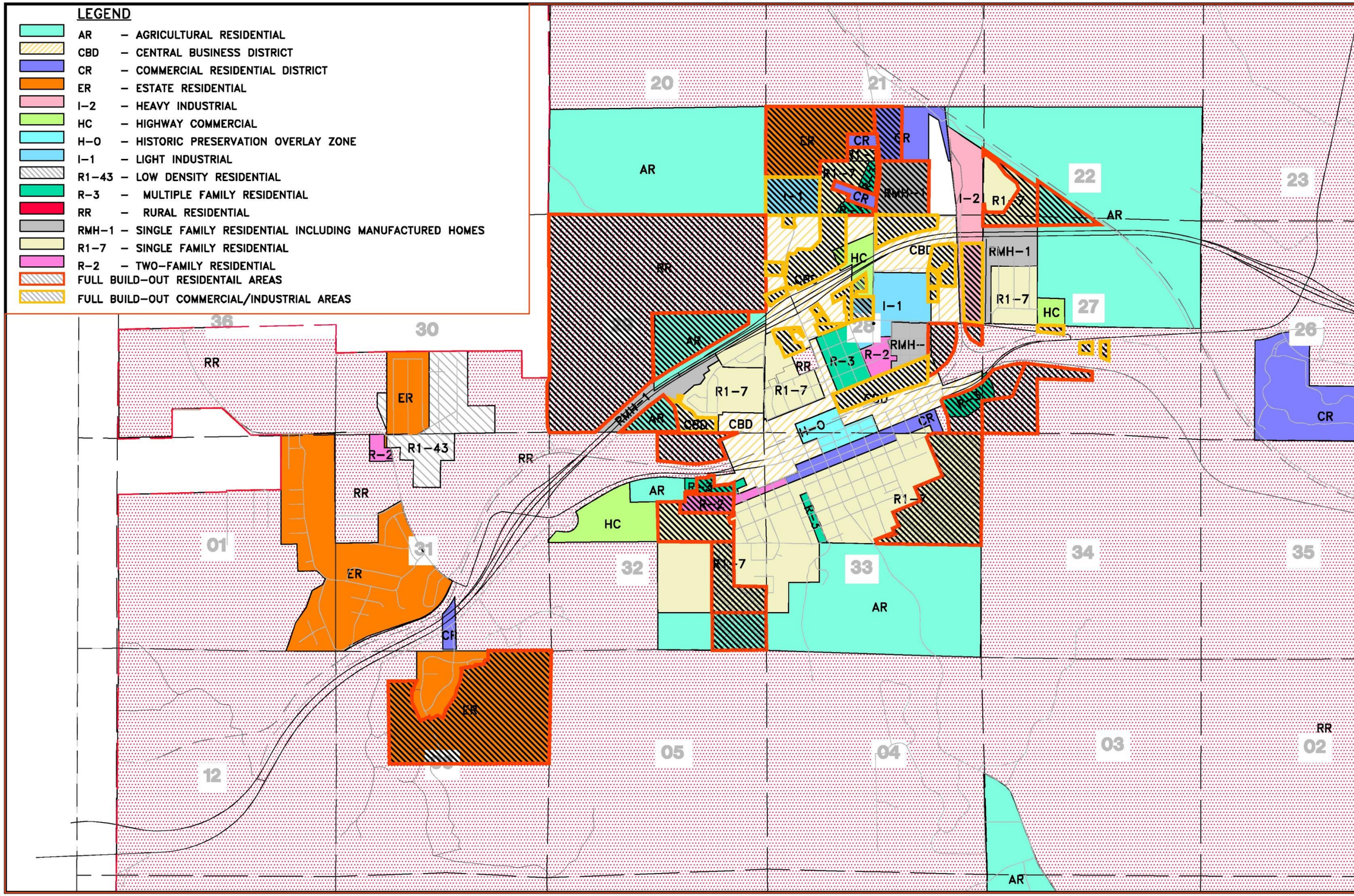
DATE: 4/13/18
PROJ. NO.: 117403
FN: DEMAND ANALYSIS

7. FUTURE FULL BUILDOUT DEMANDS

Future full buildout demands have been calculated by using the current zoning of undeveloped parcels. The rate of usage per zone was determined based on existing usage records. While these demands were calculated they were not modeled in the system because of too many variables in projected development, and the large demand a full build out scenario would place upon the system. If these areas develop in the future they should be evaluated during a Master Plan Update or on a one by one basis. Full build out additional demands could be as follows:

- Average Daily Demand = 600,000 gallons per day
- Peak Daily Demand = 1,800,000 gallons per day
- Peak Monthly Demand = 54,100,000 gallons per month

See following map for undeveloped land and its zoning.



WATER DEMAND ANALYSIS

FULL BUILDOUT BASED ON ZONING

WILLIAMS WATER MASTER PLAN

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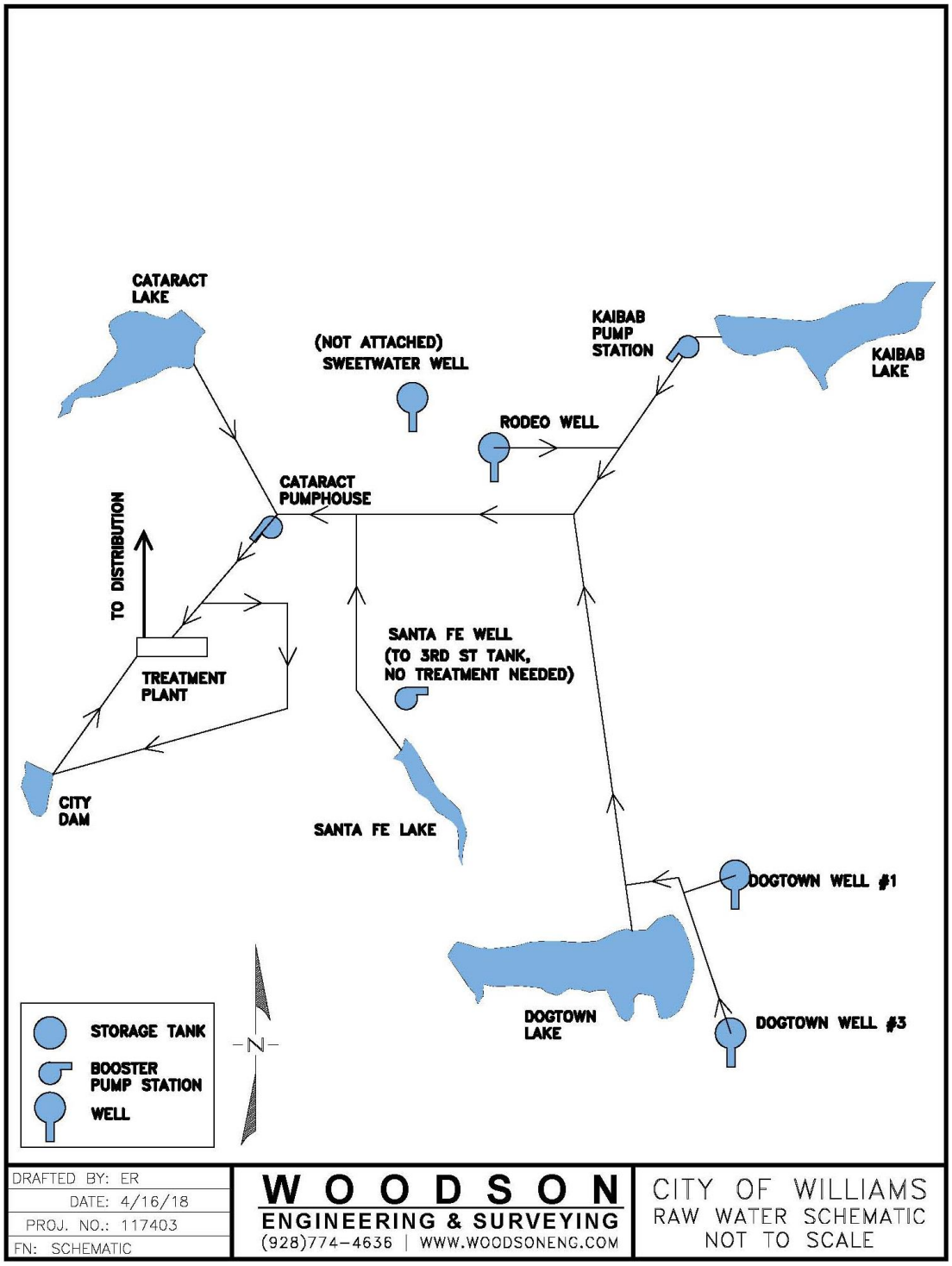
DATE: 4/13/18

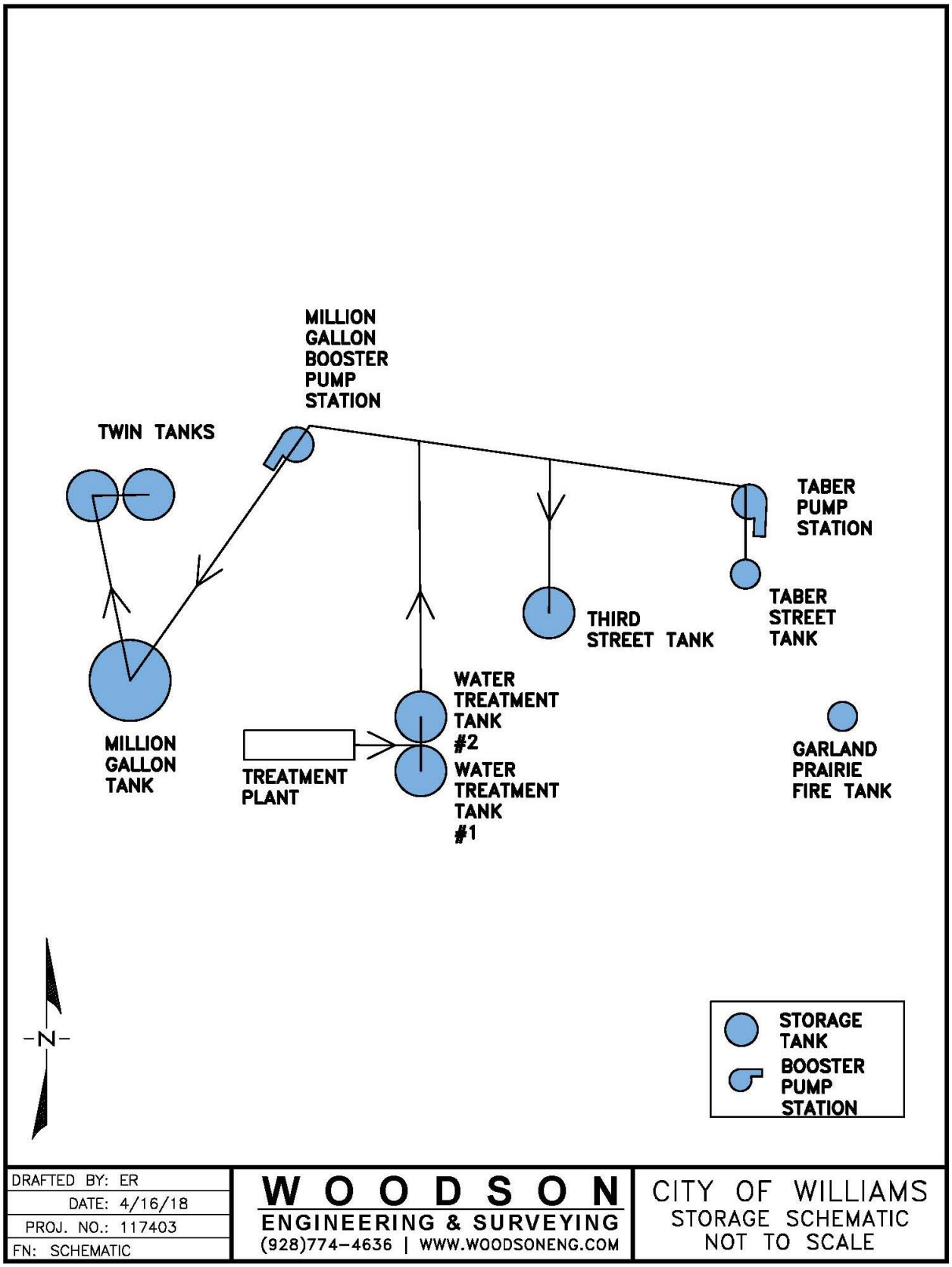
PROJ. NO.: 117403

FN: DEMAND ANALYSIS

C. EXISTING INFRASTRUCTURE

The City has the potential to supply water from 5 reservoirs and 5 wells to the system. Water is treated at the Water Treatment Plant and then stored in 7 potable water storage tanks. These potable water storage tanks provide water to the distribution system through a gravity feed. See following schematics and sections for more details.




MILLION GALLON BOOSTER PUMP STATION
TWIN TANKS
TABER PUMP STATION
TABER STREET TANK
THIRD STREET TANK
WATER TREATMENT TANK #2
WATER TREATMENT TANK #1
MILLION GALLON TANK
TREATMENT PLANT
GARLAND PRAIRIE FIRE TANK
N
STORAGE TANK
BOOSTER PUMP STATION
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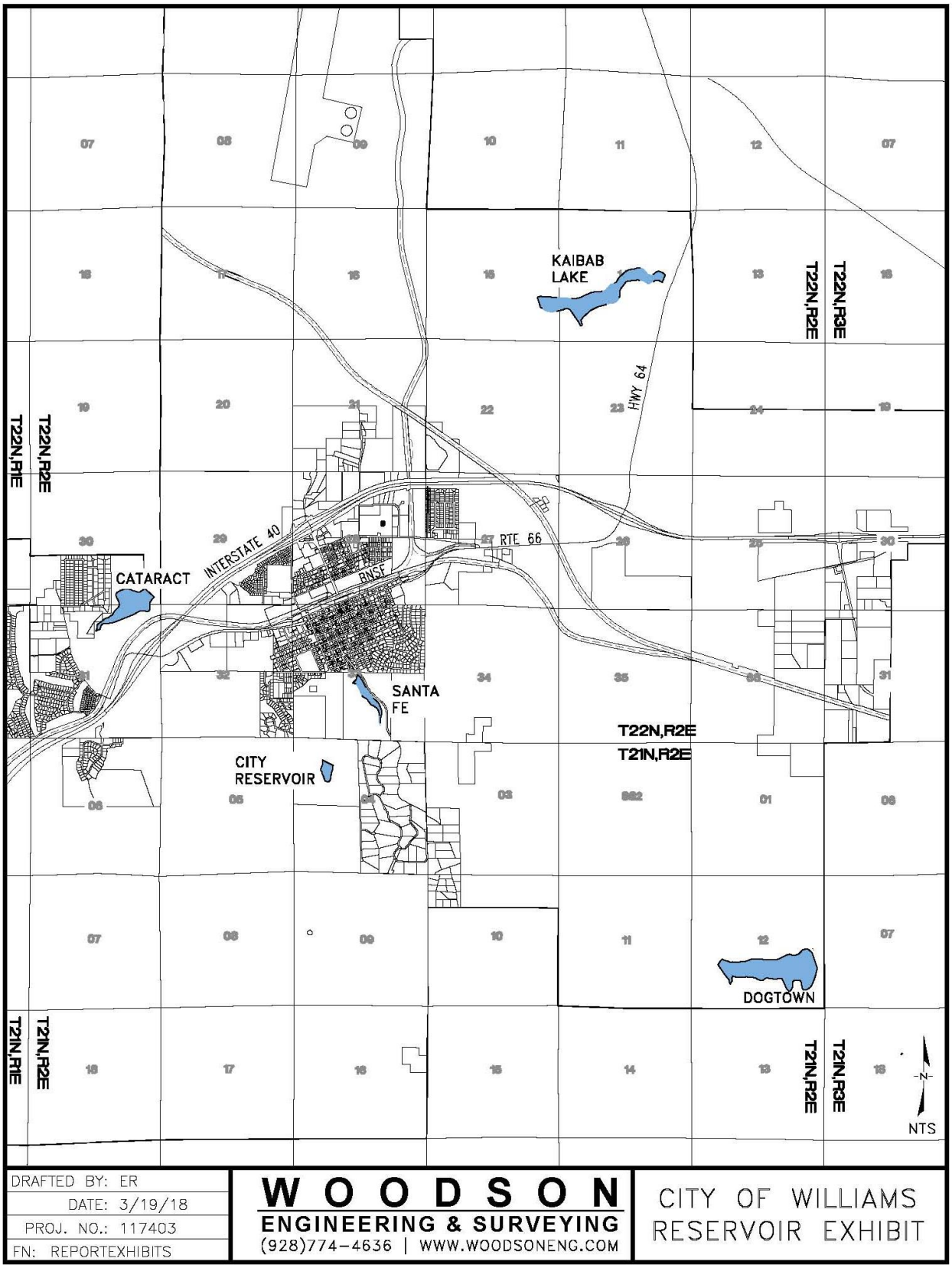
STORAGE SCHEMATIC
NOT TO SCALE

1. RESERVOIRS

The surface water system consists of 5 reservoirs: City Dam, Cataract, Dogtown, Kaibab and Santa Fe. The estimated total storage capacity of these reservoirs is 894 million gallons. The following table gives information on each reservoir. See figure for locations.

Reservoir Name	Location	ID#	Constructed	Capacity (Million Gallons)
Santa Fe	Section 33, Township 22N, Range 2E	U030263	1892	70 MG
City Dam	Section 4, Township 21N, Range 2E	U030262	1916	36 MG
Dogtown	Section 12, Township 22N, Range 2E	U030264	1934	360 MG
Cataract	Section 30, Township 22N, Range 2E	U030261	1947	135 MG
Kaibab	Section 15, Township 22N, Range 2E	U030265	1953	293 MG

Table 6 - Reservoir Information


KAIBAB LAKE
CATARACT
SANTA FE
CITY RESERVOIR
DOGTOWN
INTERSTATE 40
RTE 66
HWY 64
BNSF
T22N,R1E
T22N,R2E
T22N,R3E
T21N,R1E
T21N,R2E
T21N,R3E
T22N,R2E
T21N,R2E
NTS
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RESERVOIR EXHIBIT

2. WELLS

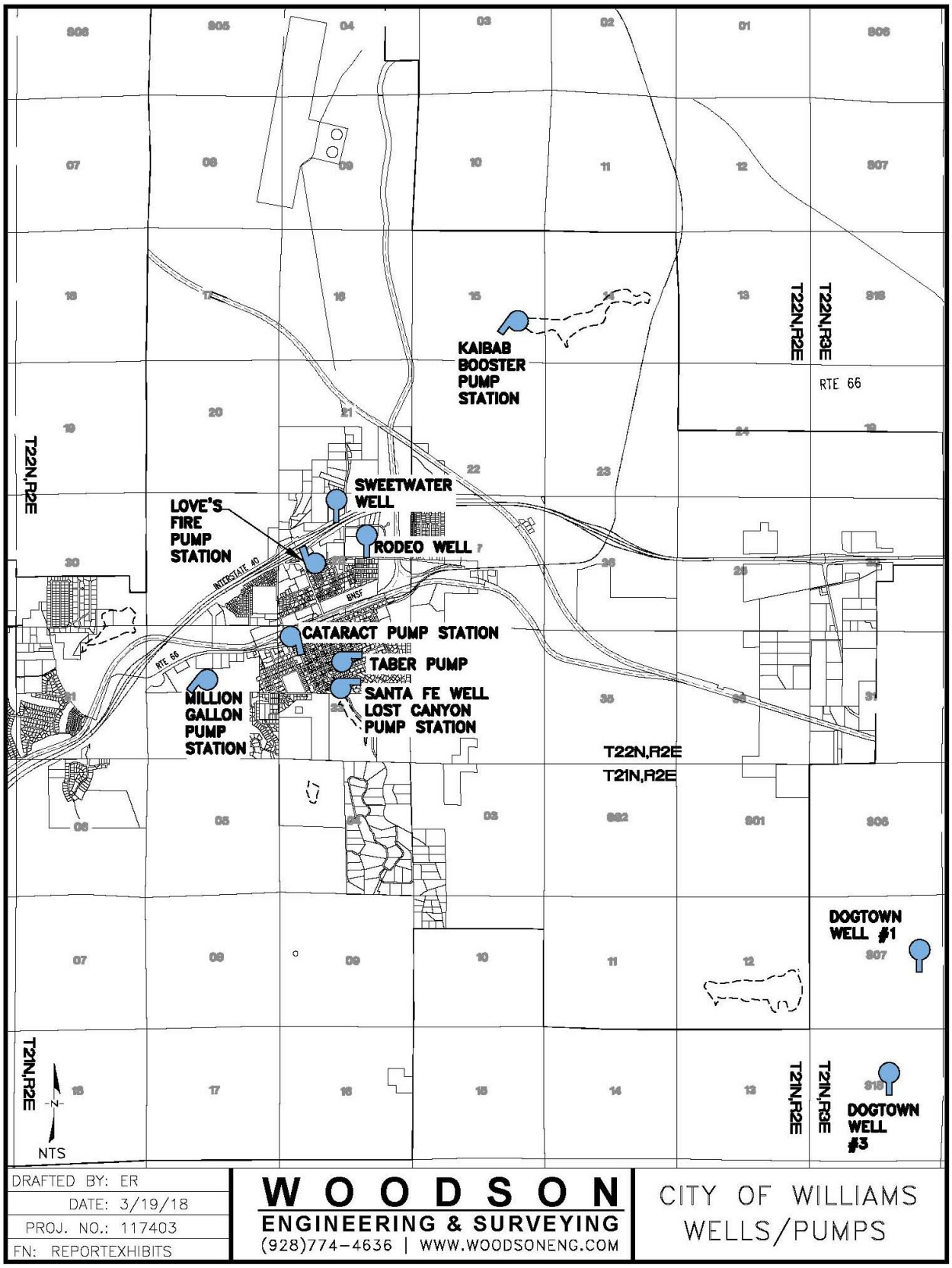
The City's ground water system consists of 5 wells that are combined with water from the 5 reservoirs to provide water to the City. The well water is blended with lake water and sent to the water treatment plant. The first deep well was drilled and put into service in 2000. The City wells are as follows:

1. Santa Fe Well
2. Dogtown #1 Well
3. Rodeo Well
4. Dogtown #3 Well
5. Sweetwater Well

Table 7 includes detailed information on each well; the map on the following page shows general well locations.

Well Name	ADWR ID#	Depth Drilled	Static Level	Date Drilled
Santa Fe	55-529210	990	715	August 1999
Dogtown #1	55-577611	3,500	2,720	February 2000 Re-drilled 2015
Rodeo	55-584106	3,622	2,945	July 2000
Dogtown #3	55-597241	3,655	2,740	May 2004
Sweetwater	55-224424	3,500	2,780	Fall 2015

Table 7 - Well Information


KAIBAB BOOSTER PUMP STATION
SWEETWATER WELL
LOVE'S FIRE PUMP STATION
RODEO WELL
CATARACT PUMP STATION
TABER PUMP
SANTA FE WELL
LOST CANYON PUMP STATION
MILLION GALLON PUMP STATION
DOGTOWN WELL #1
DOGTOWN WELL #3
T22N,R2E
T22N,R3E
T21N,R2E
T21N,R3E
RTE 66
INTERSTATE 40
BNSF
NTS
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WELLS/PUMPS

Santa Fe Well

The Santa Fe Well was drilled in 1999 and pumped continuously at 40 gpm for 6 hours a day. During a dry period the well ran dry and was taken out of service. In 2017-2018 the well underwent maintenance, was re-outfitted, tested, and put back in service. This is currently the only source of potable water that is pumped directly to the distribution system without being treated at the Water Treatment Plant.

Santa Fe Well	
Depth Drilled	990’
Static Water Level	715’
Dynamic Water Level	817’
Pump Setting Depth	950’
Well Head Elevation	6880.34
Casing Diameter	7-7/8”
Column Pipe Diameter	2-7/8”
Pump Make	Franklin
Pump Model	70SR20F66-2263
Pump HP	20 HP
Discharge Diameter	3”
Pumping Rate	35 to 70 gpm
Head on Pump	891’
Discharge Pressure (At Well Head)	32 psi
Pumps To	3rd Street Tank
Year Constructed	1999 – Pump Replaced 2017
Treatment Type	None
Last Date of Maintenance	2017
Recommended Maintenance	None

Table 8 - Santa Fe Well Data

Well Head with Temporary Waterline

Santa Fe Well – Well House

Dogtown Well #1

The Dogtown Well #1 is currently being used as one of the major water sources for the City of Williams. It was constructed in May 2000. After the well pump failed the well was out of service; during the down time the well silted in. The pump was not able to be removed and in 2015 the well was re-drilled, a new pump was installed, and the well was put back in service.

Dogtown #1	
Depth Drilled	3,500’
Static Water Level	2,720’
Dynamic Water Level	2,821’
Pump Setting Depth	3,057’
Well Head Elevation	7027.5
Casing Diameter	7”
Column Pipe Diameter	3.5”
Pump Make	GE
Pump Model	TE7000
Pump HP	2-175 HP
Pump Size	5.38”
Discharge Diameter	2 -7/8”
Pumping Rate	165 gpm
Head on Pump	3,027’
Discharge Pressure (At Well Head)	90 psi
Pumps To	Dogtown Raw Waterline
Year Constructed	2000 – Pump Replaced 2015
Treatment Type	None – Goes to Treatment Plant
Last Date of Maintenance	2015
Recommended Maintenance	None

Table 9 - Dogtown Well #1 Data

Well Head and Discharge Piping

Dogtown #1 – Well House

Rodeo Well

The Rodeo Well is only used as a back-up water source for the City of Williams. The well water quality exceeds the allowable arsenic levels. The well is regularly exercised to prevent silting, but has not been used for source water since February, 2017. In addition, the well is pumped to the Kaibab Lake raw waterline, which connects to the Dogtown Raw Waterline. The Dogtown Waterline is at capacity, so the Dogtown Wells cannot operate when the Rodeo Well is running without causing pipe failures in the Dogtown Waterline.

Rodeo Well	
Depth Drilled	3622’
Static Water Level	2945’
Dynamic Water Level	3051’
Pump Setting Depth	3170’
Well Head Elevation	6737.08
Column Pipe Diameter	2-7/8”
Casing Diameter	10”
Pump Make	ESP
Pump Model	TE 5500
Pump HP	100 HP
Pump Size	53.8”
Discharge Diameter	2-7/8”
Pumping Rate	160 gpm
Head on Pump	3,212’
Discharge Pressure (At Well Head)	70 psi
Pumps To	Kaibab Lake Raw Waterline
Year Constructed	2000 - Pump Replaced 2015
Treatment Type	None – Goes to Treatment Plant
Last Date of Maintenance	2015
Recommended Maintenance	None

Table 10 - Rodeo Well Data

Rodeo Well - Well Head and Well House

Rodeo Well Discharge Assembly

Dogtown Well #3

The Dogtown Well #3 is currently being used as one of the major water sources for the City of Williams. It was constructed in May 2004. In 2011 the well pump failed and the well was out of service. The well pump was replaced in August 2011.

Dogtown #3	
Depth Drilled	3,655’
Static Water Level	2,740’
Dynamic Water Level	2,821’
Pump Setting Depth	3091’
Well Head Elevation	6983.27
Column Diameter	4.5”
Casing Diameter	7”
Pump Make	GE
Pump Model	TE7200
Pump HP	350 HP
Pump Size	5.38”
Discharge Diameter	4”
Pumping Rate	245 gpm
Head on Pump	3,029’
Discharge Pressure (At Well Head)	90 psi
Pumps To	Dogtown Raw Waterline
Year Constructed	2004 – Pump Replaced 2011
Treatment Type	None – Goes to Treatment Plant
Last Date of Maintenance	2011
Recommended Maintenance	None

Table 11 - Dogtown Well #3 Data

Well Head and Discharge Piping

Dogtown #3 – Well House

Sweetwater Well

The Sweetwater Well has been drilled but not yet tested. The water quality, depth, and pumping rate is expected to be similar to the Rodeo Well. The well still needs to be outfitted with well pump and assembly. Based on preliminary field testing Arsenic Treatment is anticipated to be needed for this well. The well is not in use and is not connected to the system.

Sweetwater Well	
Depth Drilled	3,500 ft
Static Water Level	2,780 ft
Dynamic Water Level	N/A
Pump Setting Depth	N/A
Well Head Elevation	N/A
Casing Diameter	N/A
Column Diameter	N/A
Pump Make	N/A
Pump Model	N/A
Pump HP	N/A
Pimp Size	N/A
Discharge Diameter	N/A
Pumping Rate	N/A
Head on Pump	N/A
Discharge Pressure (At Well Head)	N/A
Pumps To	Not Connected to System
Year Constructed	2015
Treatment Type	N/A
Last Date of Maintenance	N/A
Recommended Maintenance	N/A

Table 12 - Sweetwater Well Data

Well Head

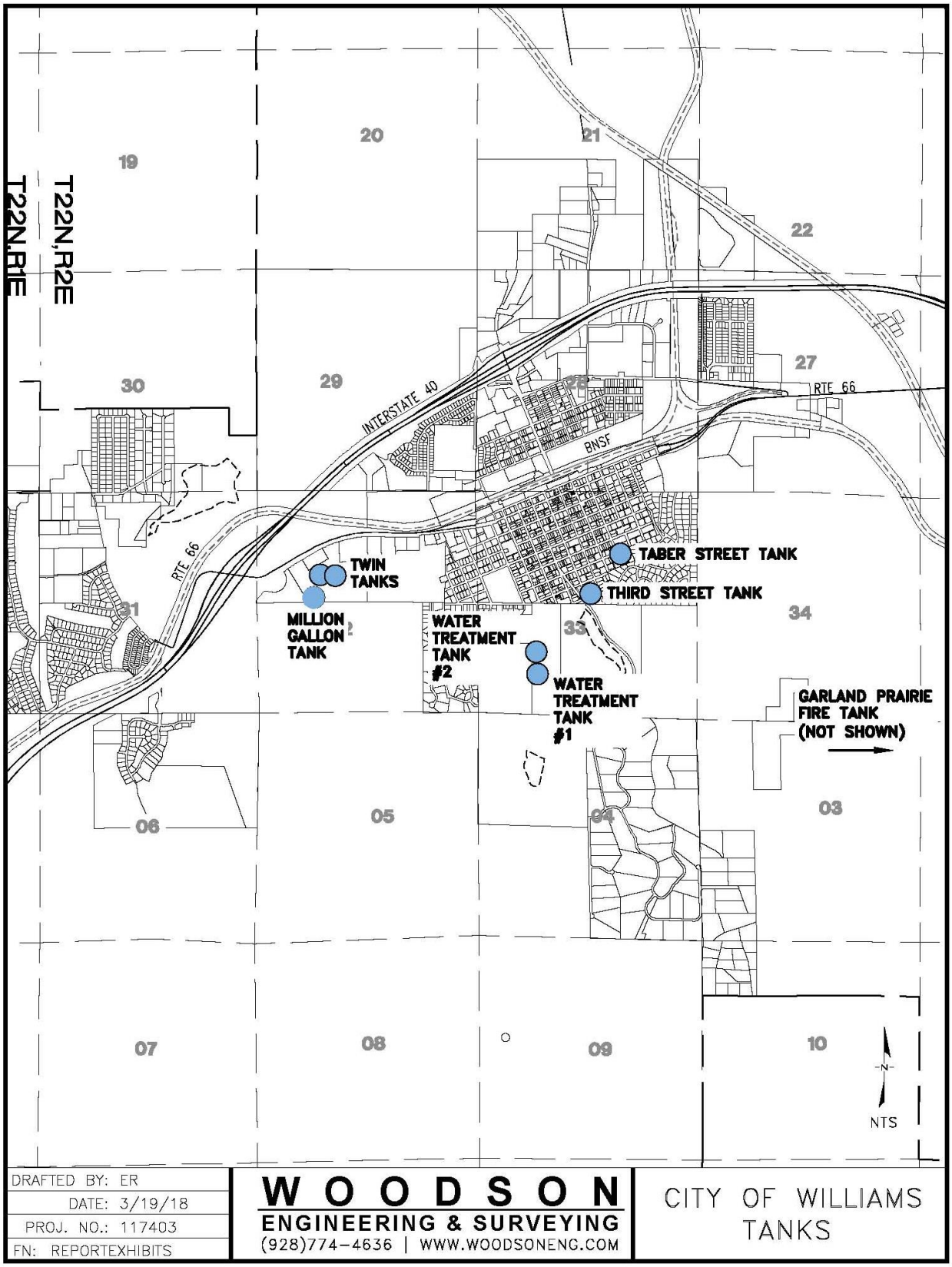
3. TANKS

The City has 7 storage tanks that have a combined total of 2,580,000 gallons of storage with all tanks full. There is an additional tank not connected to the City System located east of Garland Prairie that is used for fire protection. As part of the City's preventative maintenance every five years, the tanks are cleaned of silt and videotaped. Copies of the latest tank inspection reports from 2014 and 2016 are in the Appendix. The tanks are distributed around the City serving specific parts of the City's 4 different pressure zones (see section C7 for pressure zones). Tank locations are shown on the following page.

The following tables provide additional information about each storage tank.

Name	Location	Capacity	Zone	
WT #1	Water Plant	270,000	1	
WT #2	Water Plant	350,000	1	
3rd Street Tank	S. 3rd Street	750,000	1	
Taber Tank	Taber & Meade	25,000	2	
One Million Gallon Tank (Cinder Hill #1)	W. Route 66	1,000,000	3	
Twin Tanks (Cinder Hill #2)	W. Route 66	60,000	4	
Twin Tanks (Cinder Hill #3)	W. Route 66	125,000	4	
Garland Prairie	Hilltop East of Garland Prairie	250,000	N/A	
Total Storage	Zone #1	Zone #2	Zone #3	Zone #4
2,580,000	1,370,000	25,000	1,000,000	185,000

Table 13 - Water Storage Tank Data


T22N,R2E
T22N,R1E
19
20
21
22
27
30
29
28
INTERSTATE 40
RTE 66
BNSF
RTE 66
TWIN TANKS
MILLION GALLON TANK
WATER TREATMENT TANK #2
WATER TREATMENT TANK #1
TABER STREET TANK
THIRD STREET TANK
31
33
34
GARLAND PRAIRIE FIRE TANK (NOT SHOWN)
06
05
04
03
07
08
09
10
N
NTS
DRAFTED BY: ER
DATE: 3/19/18
PROJ. NO.: 117403
FN: REPORTEXHIBITS
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(928)774-4636 | WWW.WOODSONENG.COM
CITY OF WILLIAMS TANKS

WT #1 Tank – Zone #1

Water Treatment Plant Tank #1 (South Tank)	
Height	24’
Diameter	44’
Capacity	270,000 gallons
Material	Steel
Floor Elevation	6914.83
Inlet Pipe Diameter	12”
Outlet Pipe Diameter	8”
Outside Coating Condition	Good
Inside Coating Condition	Good
Year Constructed	1940
Last Date of Maintenance	6-30-2016
Recommended Maintenance	Drain, Clean, and Inspect Tank in 2021

Table 14 - Water Treatment Plant Tank #1 Data

WT #1 Facing Southwest

WT #1 Inside Coating

WT #2 Tank – Zone #1

Water Treatment Plant Tank #2 (North Tank)	
Height	24’
Diameter	50’
Capacity	350,000 gallons
Material	Steel
Floor Elevation	6914.76
Inlet Pipe Diameter	12”
Outlet Pipe Diameter	10”
Outside Coating Condition	Good
Inside Coating Condition	Fair
Year Constructed	1973-74
Last Date of Maintenance	6-30-2016
Recommended Maintenance	Drain, Clean, and Inspect Tank in 2021

Table 15 - Water Treatment Plant Tank #2 Data

WT #2 Facing North

WT #2 Inside Coating

3rd Street Tank – Zone #1

The 3rd Street Tank currently cannot be filled to capacity. The tank is gravity filled by the two tanks at the Water Treatment Plant. The floor elevations of all three tanks are almost exactly the same. So in a static flow condition the tanks should equalize and the tank should be able to be filled. Currently the tank only can fill to a height of 20' and then the tanks and sand filters at the Water Treatment Plant overflow. This results in 110,000 gallons of unusable storage space. Further investigation into this issue needs to be conducted outside of this Master Plan.

3rd Street Tank	
Height	24'
Diameter	74'
Capacity	750,000 gallons Currently can only be filled to 20' which equals 640,000 gallons
Material	Steel
Floor Elevation	6914.97
Inlet Pipe Diameter	12"
Outlet Pipe Diameter	12"
Outside Coating Condition	Fair
Inside Coating Condition	Fair to Poor
Year Constructed	1973
Last Date of Maintenance	11-18-2014
Recommended Maintenance	Recoat Interior and Exterior of Tank

Table 16 - 3rd Street Tank Data

3rd Street Tank Facing Southwest

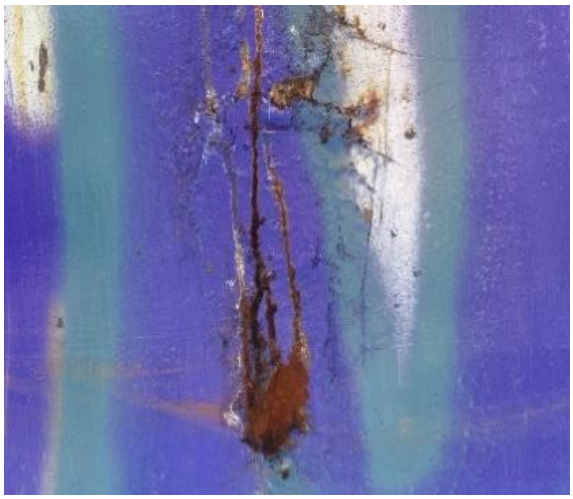
3rd Street Tank Inside Coating

Taber Tank – Zone #2

Taber Tank	
Height	12’
Diameter	20’
Capacity	25,000 gallons
Material	Steel
Floor Elevation	6982.5
Inlet Pipe Diameter	6”
Outlet Pipe Diameter	6”
Outside Coating Condition	Poor
Inside Coating Condition	Poor
Year Constructed	1947
Last Date of Maintenance	Unknown
Recommended Maintenance	Tank should be taken out of service or replaced.

Table 17 - Taber Tank Data

Taber Tank Facing East



Taber Tank Exterior Leaking Blister

One Million Gallon Tank – Zone #3

One Million Gallon Tank (Cinder Hills #1)	
Height	32’
Diameter	74’
Capacity	1,000,000 gallons
Material	Steel
Floor Elevation	7056.9
Inlet Pipe Diameter	8”
Outlet Pipe Diameter	12”
Outside Coating Condition	Good
Inside Coating Condition	Good – Minor Rusting
Year Constructed	1994
Last Date of Maintenance	11-18-2014
Recommended Maintenance	Clean and Inspect Tank in 2019-2020

Table 18 - One Million Gallon Tank Data

1 Million Gal. Tank Facing East

1 Million Gal. Tank Inside Coating

Twin Tanks (West Tank) – Zone #4

Twin Tanks (Cinder Hills #2)	
Height	24’
Diameter	21’
Capacity	60,000 gallons
Material	Steel
Floor Elevation	7006.3
Inlet Pipe Diameter	6”
Outlet Pipe Diameter	8”
Outside Coating Condition	Good
Inside Coating Condition	Fair to Poor
Year Constructed	1989
Last Date of Maintenance	11-18-2014
Recommended Maintenance	Repair Inside Coating

Table 19 - Twin Tanks West Tank Data

Twin Tanks Facing East

Twin Tanks West Tank Inside Coating

Twin Tanks (East Tank) – Zone #4

Twin Tanks (Cinder Hills #3)	
Height	24’
Diameter	30’
Capacity	125,000 gallons
Material	Steel
Floor Elevation	7006.3
Inlet Pipe Diameter	6”
Outlet Pipe Diameter	8”
Outside Coating Condition	Good
Inside Coating Condition	Fair
Year Constructed	1986
Last Date of Maintenance	11-18-2014
Recommended Maintenance	Repair Inside Coating

Table 20 - Twin Tanks East Tank Data

Twin Tanks East Tank Data Plate

Twin Tanks East Tank Inside Coating

Garland Prairie Fire Storage Tank – Zone N/A

The Garland Prairie Tank is only used for fire protection. The tank is not connected to the system and is filled by hauling water. The tank is connected to a fire hydrant located near the existing lumber mill to the west of the tank.

Garland Prairie Fire Storage Tank	
Height	16’
Diameter	52’
Capacity	250,000 gallons
Material	Steel
Floor Elevation	7025.1
Inlet Pipe Diameter	None
Outlet Pipe Diameter	8”
Outside Coating Condition	Poor
Inside Coating Condition	Poor
Year Constructed	Unknown
Last Date of Maintenance	Unknown
Recommended Maintenance	Recoat inside and outside of tank, Cut trees against tank

Table 21- Garland Prairie Fire Storage Tank Data

Garland Prairie Fire Storage Tank

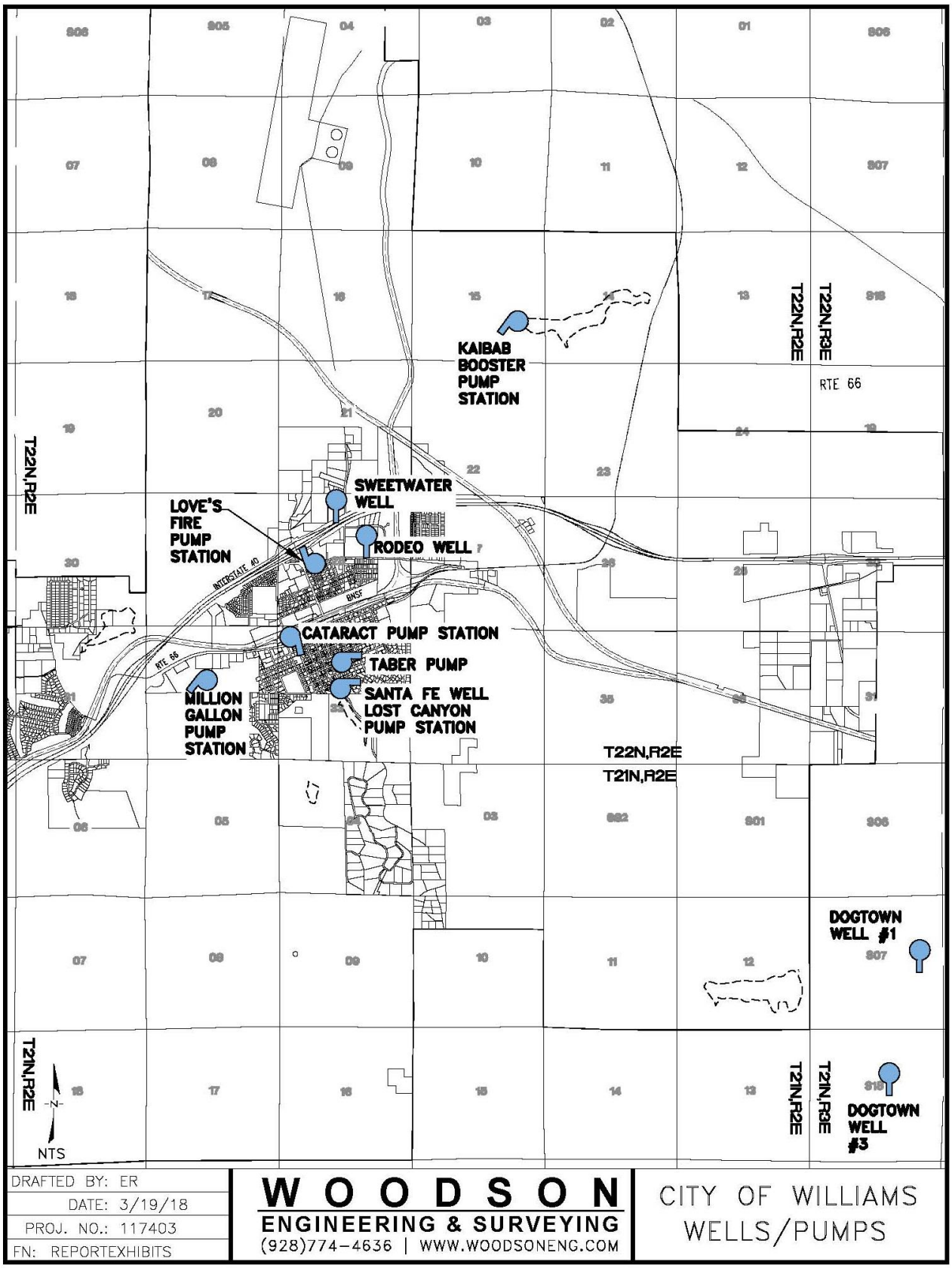
Garland Prairie Tank Outside Coating

4. PUMP STATIONS

The City has 3 potable water booster pump stations, 2 raw water booster pump stations, and 1 fire booster pump station. The potable water booster pump stations pump to water storage tanks which then gravity flow to the system. The Cataract Booster Pump Station takes water from Cataract Lake and the Dogtown Waterline and pumps it to the Water Treatment Plant. The Kaibab Booster Pump Station pumps water from Kaibab Lake to the Dogtown Waterline. The booster pump stations are as follows:

1. Cataract Booster Pump Station
2. One Million Gallon Tank Booster Pump Station (Cemetery Pump Station, Cinder Hills Pump Station)
3. Taber Tank Booster Pump Station
4. Kaibab Lake Booster Pump Station
5. Lost Canyon Booster Pump Station (Young Life)
6. Love's Fire Booster Pump Station

See the map on the following page for general location and tables for details for each pump station.


KAIBAB BOOSTER PUMP STATION
SWEETWATER WELL
LOVE'S FIRE PUMP STATION
RODEO WELL
CATARACT PUMP STATION
TABER PUMP
SANTA FE WELL
LOST CANYON PUMP STATION
MILLION GALLON PUMP STATION
DOGTOWN WELL #1
DOGTOWN WELL #3
T22N,R2E
T22N,R3E
T21N,R2E
T21N,R3E
RTE 66
INTERSTATE 40
BNSF
NTS
DRAFTED BY: ER
DATE: 3/19/18
PROJ. NO.: 117403
FN: REPORTEXHIBITS
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CITY OF WILLIAMS
WELLS/PUMPS

Cataract Booster Pump Station

The Cataract Booster Pump Station is one of the most critical components of the Williams Water System. The Cataract Booster Pump Station takes water from the Dogtown #1 Well, Dogtown #3 Well, Rodeo Well, Dogtown Lake, Kaibab Lake, Santa Fe Lake, and Cataract Lake and boosts it to the Water Treatment Plant or City Dam. Without this booster pump station the only other way the water treatment plant can get water is gravity flow from City Dam. The pump station is equipped with a Danfus VLT Aquadrive VFD.

Cataract Booster Pump Station			
Pump Station Elevation	6765.6	**Middle Pump Model**	B32PLS
Pumping Rate	470 gpm	**Middle Pump Pumping Rate**	470 gpm
Pumping Pressure	87 psi	**Middle Pump Pumping Pressure**	87 psi
Inlet Diameter	10”	**Middle Pump Motor Make**	WEG
Outlet Diameter	10”	**Middle Pump Motor Model**	03036EP3E284JM-W22
Number of Pumps	3	**Middle Pump Motor Year**	2015
North Pump Year Installed	2014	**Middle Pump Motor HP/Power**	30 HP/ 460V
North Pump Type	Centrifugal	**South Pump Year Installed**	2006
North Pump Make	Berkeley Pentair	**South Pump Type**	Centrifugal
North Pump Model	B37PLS	**South Pump Make**	Berkeley Pentair
North Pump Discharge Size	3”	**South Pump Model**	B3ZPLS
North Sump Suction Size	4”	**South Pump Discharge Size**	3”
North Pump Pumping Rate	470 gpm	**South Pump Suction Size**	4”
North Pump Pumping Pressure	87 psi	**South Pump Pumping Rate**	470 gpm
North Pump Motor Make	Baldor Reliance	**South Pump Pumping Pressure**	87 psi
North Pump Motor Model	Super E – JMM2534T	**South Pump Motor Make**	Baldor Reliance
North Pump Motor Year	2014	**South Pump Motor Model**	Industrial – JMM2534T
North Pump Motor HP/Power	30 HP/ 460V	**South Pump Motor Year**	2006
Middle Pump Year Installed	2014	**South Pump Motor HP/Power**	30 HP/ 460V

Middle Pump Type	Centrifugal	**Recommended Maintenance**	Grease Every 2,000 hours
Middle Pump Make	Berkeley Pentair		
Middle Pump Discharge Size	3”		
Middle Pump Suction Size	4”		

Table 22 - Cataract Booster Pump Station Data

Booster Pump Station Building

Booster Pumps and Discharge Header

One Million Gallon Tank Booster Pump Station (Cemetery or Cinder Hills Pump Station)

The One Million Gallon Tank Booster Pump Station boosts water from the gravity system to the One Million Gallon Tank. The pump station is located on the southwest corner of the Cemetery.

One Million Gallon Tank Booster Pump Station			
Pump Station Elevation	6874.9	**North Pump Motor Year**	2016
Pumping Rate	170 gpm to 290 gpm	**North Pump Motor HP/Power**	15 HP/460V
Pumping Pressure	65 psi	**South Pump Year Installed**	Unknown
Inlet Diameter	6”	**South Pump Type**	Centrifugal
Outlet Diameter	6”	**South Pump Make**	Berkeley
Number of Pumps	2	**South Pump Model**	B1-1/2 TPMS
North Pump Year Installed	2016	**South Pump Discharge Size**	1-1/2”
North Pump Type	Centrifugal	**South Pump Suction Size**	2-1/4”
North Pump Make	PACO – by Grundfos	**South Pump Pumping Rate**	170 gpm
North Pump Model	P-20709	**South Pump Pumping Pressure**	65 psi
North Pump Discharge Size	2-3/8”	**South Pump Motor Make**	US Motors
North Pump Suction Size	2-1/2”	**South Pump Motor Model**	Unimount 125 UT-4 TE
North Pump Pumping Rate	290 gpm	**South Pump Motor Year**	
North Pump Pumping Pressure	65 psi	**South Pump Motor HP/Power**	10 HP/ 460V
North Pump Motor Make	Baldor Reliance – Industrial Motor	**Recommended Maintenance**	Grease Every 2,000 hours
North Pump Motor Model	JMM3713T		

Table 23 - One Million Gallon Tank Booster Pump Station Data

Booster Pump Station Building

Booster Pumps and Piping Assembly

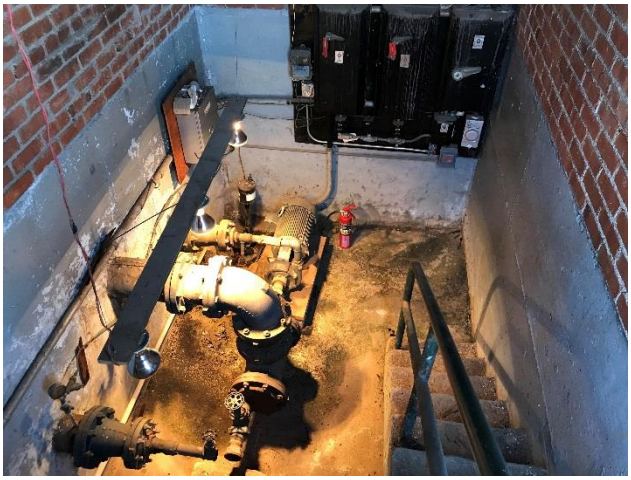
Taber Tank Booster Pump Station

The Taber Tank Booster Pump Station is a small single pump station that boosts water from the gravity potable water line to the Taber Tank.

Taber Tank Booster Pump Station			
Pump Station Elevation	68245.4	**Pump Discharge Size**	2”- piping ruduce to 1.5”
Pumping Rate	Approx. 300 gpm	**Pump Suction Size**	3”
Pumping Pressure	78 psi	**Pump Pumping Rate**	Approx. 300 gpm
Inlet Diameter	8”	**Pump Pumping Pressure**	78 psi
Outlet Diameter	6”	**Pump Motor Make**	US Motors
Number of Pumps	1	**Pump Motor Model**	Unimount 125 – UT-1 TE
Pump Year Installed	Unknown	**Pump Motor Year**	Unknown
Pump Type	Centrifugal – End Suction	**Pump Motor HP/Power**	20 HP/460V
Pump Make	Deming Pump	**Recommended Maintenance**	Grease Every 2,000 hours
Pump Model	2S 4211		

Table 24 - Taber Tank Booster Pump Station Data

Booster Pump Station Building



Booster Pump and Piping Assembly

Kaibab Lake Booster Pump Station

The Kaibab Lake Booster Pump Station is a one pump station that boosts water from Kaibab Lake to the Dogtown Raw Waterline. This station has not been used for several years. Water from Kaibab Lake has not been used due to low levels in the Lake and the high recreational use. Furthermore, the Kaibab Lake waterline connects to the Dogtown Raw Waterline, which as described earlier, is at capacity.

Kaibab Lake Booster Pump Station			
Pump Station Elevation	6759.34	**Pump Model**	DC-918978
Pumping Rate	Unknown	**Pump Pumping Rate**	Unknown
Pumping Pressure	Unknown	**Pump Pumping Pressure**	Unknown
Inlet Diameter	4”	**Pump Motor Make**	US Motors
Outlet Diameter	6”	**Pump Motor Model**	G245A
Number of Pumps	1	**Pump Motor Year**	Unknown
Pump Year Installed	Unknown	**Pump Motor HP/Power**	50 HP / 460 V
Pump Type	Centrifugal	**Recommended Maintenance**	Test Pump and Station, Replace Pumps and Motors if Needed
Pump Make	Deming		

Table 25 - Kaibab Lake Booster Pump Station Data

Booster Pump Station Building

Booster Pump and Piping Assembly

Lost Canyon Booster Pump Station (Young Life)

The Lost Canyon Booster Pump Station is a small dual pump packaged booster pump station that boosts water from the Zone #1 distribution system to the Lost Canyon (Young Life) Tank. The packaged station is a Grundfos BoosterpaQ. This pump station was purchased and installed by the Young Life Camp and then was taken over by the City. It is now owned and operated by the City.

Lost Canyon Booster Pump Station			
Pump Station Elevation	6880.34	**Pump 1 Motor Year**	2010
Pumping Rate	Unknown	**Pump 1 Motor HP/Power**	15 HP/460 V
Pumping Pressure	Unknown	**Pump 2 Year Installed**	2010
Inlet Diameter	8”	**Pump 2 Type**	Vertical Multistage Centrifugal
Outlet Diameter	8”	**Pump 2 Make**	Grundfos
Number of Pumps	2	**Pump 2 Model**	2CR20-06
Pump 1 Year Installed	2010	**Pump 2 Pumping Rate**	Unknown
Pump 1 Type	Vertical Multistage Centrifugal	**Pump 2 Pumping Pressure**	Unknown
Pump 1 Make	Grundfos	**Pump 2 Motor Make**	Baldor Reliance
Pump 1 Model	2CR20-06	**Pump 2 Motor Model**	84Z00019 IP44
Pump 1 Pumping Rate	Unknown	**Pump 2 Motor Year**	2010
Pump 1 Pumping Pressure	Unknown	**Pump 2 Motor HP/Power**	15 HP/460 V
Pump 1 Motor Make	Baldor Reliance	**Recommended Maintenance**	Grease Every 2,000 hours
Pump 1 Motor Model	84Z00019 IP44		

Table 26 - Lost Canyon Booster Pump Station Data

Booster Pumps and Control Panels

Booster Pumps and Piping Assembly

Love's Fire Booster Pump Station

The Love's Fire Booster Pump Station is a packaged fire booster pump station to provide the required fire flows in the area around the Love's Travel Stop. The packaged station is a custom Talco Fire Systems commercial pump station G-1250 @ 65 psi. This pump station was constructed as part of the Love's Travel Stop construction and then was taken over by the City. It is now owned and operated by the City.

Love's Fire Booster Pump Station			
Pump Station Elevation	6736.52	**Pump Model**	6-481-15C
Pumping Rate	1,250 gpm	**Pump Pumping Rate**	1,250 gpm
Pumping Pressure	65 psi	**Pump Pumping Pressure**	65 psi
Inlet Diameter	10"	**Pump Motor Make**	WEG
Outlet Diameter	10"	**Pump Motor Model**	075180P3EFP365TS
Number of Pumps	1	**Pump Motor Year**	2013-2014
Pump Year Installed	2013-2014	**Pump Motor Power**	460V
Pump Type	Centrifugal – Split Case	**Recommended Maintenance**	None
Pump Make	Pentair - Aurora		

Table 27 – Love's Fire Booster Pump Station Data

Booster Pump Station Enclosure

Booster Pump and Electrical Panels

5. DISTRIBUTION

The City's distribution system has 4 different pressure zones, 5 booster stations, 7 storage tanks, fire hydrants and many different sizes of pipe. Most of this system is gravity fed from Zone #1, which comes directly from the water plant storage tanks and the 3rd Street Tank. The booster stations pump water from Zone #1 into storage tanks for Zone #2 and Zone #3. The water then gravity flows from these tanks into each Zone. The City's distribution system is well maintained but not many as-built plans exist. See attached water system map in Appendix.

Besides potable water, this system is also used for fire protection. There are over 400 fire hydrants in this system. Every year, as part of the routine maintenance, the City flushes fire hydrants to ensure they operate properly as well as to clean build up out of the water mains. The flushing program began twenty (20) years ago and the data shows that the fire flows from the hydrants have increased. An Insurance Services Office fire rating study was just completed and the City's entire system scored very well. The report concluded that the City's fire rating was excellent, which has a direct effect on insurance premiums. See attached water system map in Appendix - G.5

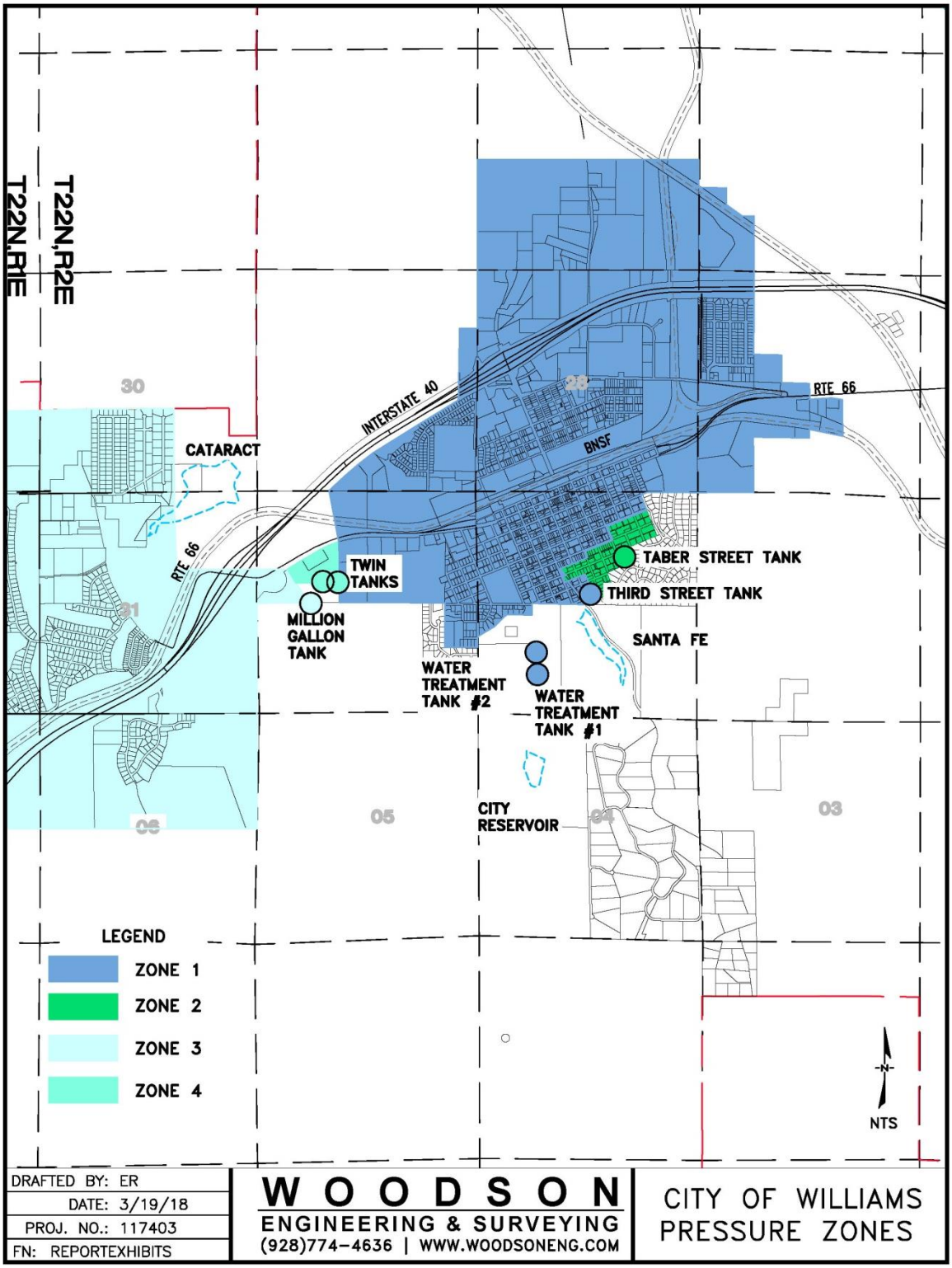
6. TREATMENT PLANT

The potable water in Williams is produced at the Water Treatment Plant located on 6th Street, Public Water System (PWS) ID# 03-026. The plant was constructed in 1940, and had the ability to treat 400,000 gpd. In 1946, the capacity of the plant was increased to treat 800,000 gpd. In 2006, upgrades were done to the existing plant as well as adding a sediment basin and filters to bring the total capacity to 1,500,000 gpd. However, all the piping and equipment was not installed for the 3rd sand filter chamber, which limits the plant from operating at full capacity. Currently the plant is estimated to be able to produce 1,000,000 gpd. To date the existing system experienced a peak day usage of approximately 750,000 gallons during the summer of 2017. This is a conventional treatment plant in which the general layout is aeration, chemical injection (alum, polymer and chlorine), flocculation, sedimentation, filtration and disinfection. All of the above mentioned surface and ground water sources are treated at this plant with the exception of the Santa Fe Well.

7. PRESSURE ZONES

The existing distribution system is comprised of 4 different zones. Previous reports identify these as 3 zones, however this is not completely accurate. The zones have been defined above as Zones #1 thru #4. Zone #1 is defined as the "main" part of the City. Potable water is stored in Zone #1 in the two Water Treatment Plant Tanks and the 3rd Street Tank. Water is gravity fed from these tanks to the Zone #1 distribution lines. Zone #2 is defined as the area served by the Taber Street Tank. Potable water is pumped from Taber Tank Booster Pump Station, which is fed by the Zone #1 distribution lines, to the Taber Tank. Water is then gravity fed to the Zone #2 distribution lines. It is unclear how many or which residences are in this Zone. Discussions with City of Williams Staff indicate that only 8 to 10 residences may be served by the Taber Tank. Zone #3 is defined as the Country Club Area which is served by the One Million Gallon Tank. Potable water is pumped from the One Million Gallon Tank Booster Pump Station, which is fed by the Zone #1 distribution lines, to the One Million Gallon Tank. Water is then gravity fed to the Zone #3 distribution lines. Zone #4 is defined as the area served by the Twin Tanks.

Previously this Zone was included with Zone #3. This is not accurate due to the fact that the Twin Tanks do not provide storage for the Country Club Area. Zone #4 includes the Best Western, Shell Gas Station, Kicks on Route 66 Restaurant, and the Days Inn. See map below for Zone locations.



8. VULNERABILITIES

The existing water system has some vulnerabilities that need to be addressed as funding allows. The overall system has vulnerabilities when it comes to supply, treatment, and storage.

- The supply vulnerability is tied to delivering water to the Treatment Plant. The water from Dogtown Reservoir, Dogtown Well #1, and Dogtown Well #3 are all combined and delivered through the Dogtown Waterline. In addition, water from Kaibab Lake and the Rodeo Well also connect to this waterline. The waterline is shallow and old and has had a history of breaks and failures. The Dogtown Waterline is currently operating at capacity and will not allow all 5 of these sources to operate at the same time.

  The Dogtown Waterline connects to the Cataract Booster Pump Station and water is pumped up to the Water Treatment Plant or City Dam. In addition, water from Cataract Lake and Santa Fe Lake flow to the Cataract Booster Pump Station and is also pumped to the Water Treatment Plant or City Dam. This means that almost every source of water for the City must be pumped through the Cataract Booster Pump Station to get to the Water Treatment Plant. This has not allowed the City to shut down the Cataract Booster Pump Station for any amount of time.

- The City's treatment vulnerability is due to there not being a redundancy in the system to supply water without the Water Treatment Plant, with the exception of the Santa Fe Well. The re-outfitting of the Santa Fe Well is a needed first step in addressing redundancy, but it does not produce enough water to meet demands. The Dogtown Wells produce water that is acceptable for direct distribution with only providing simple chlorination for treatment. However, these wells are connected to the Dogtown Raw Waterline, and once the well water is mixed with lake water it must all be treated at the Water Treatment Plant. Separating the well water from the lake water and directly connecting the potable well waterline to the distribution system would achieve additional source redundancy in the system. Such an adjustment would also reduce the cost of treatment.

- The City's storage vulnerability is due to the amount of storage capacity of the potable water storage tanks. Currently the tanks have enough capacity to provide water to the City for 2.5 days, during average water use, if the tanks are starting from full. This would not include a fire flow event. The storage needs are discussed in more depth in later sections.

D. WATER SYSTEM MODEL

1. SYSTEM PERFORMANCE STANDARDS

The existing system should meet the minimum requirements as outlined by ADEQ. The existing system should maintain pressure of 40 psi to 75 psi at normal flow conditions. During a fire flow event the system should maintain pressures of 20 psi. Fire hydrants in residential areas should provide 1,000 gpm and provide 1,500 gpm in commercial areas. While most of the system is capable of meeting these requirements there are some areas that require modifications and upgrades to do so. These areas and modifications are discussed below.

2. WATER MODEL

A water model has been prepared in WaterGems to simulate the water system under a variety of flow conditions. Input into the model includes: junction nodes, storage reservoirs, elevations, pipe diameters, and flow demands. Different scenarios including fire flows were run using the model to analyze how the system reacts.

A large amount of data has been collected to input into the model for calibration and to simulate closely the actual system operation. Data were collected for water production, water usage, fire hydrant flow tests, and system component elevations.

The water model was run to identify existing system deficiencies and future anticipated system deficiencies. Improvements to address deficiencies are presented in Section E. This water model should be updated periodically as changes occur within the system and as the system expands. The model can be used to evaluate new demands on the system and if improvements are needed to support these new demands.

3. HYDRANT TESTS

On March 7, 2018, 9 fire hydrant tests were conducted in various locations around Williams. The fire hydrant tests were conducted by the City of Williams. Tests were performed using a Geneq Inc. hydrant flow gauge and static pressure gauge on the 2.5" discharge. This information was used to calibrate the water system model. The results and available flow calculation results are shown below:

DATE	LOCATION	FLOWRATE (gpm)	DYNAMIC PRESSURE (psi)	STATIC PRESSURE (psi)	Available Flow (gpm) @ 20 psi	Use
3/7/2018	3RD & HANCOCK	1140	40	50	**2063**	**Res.**
3/7/2018	TABER & HANCOCK	650	15	27	**486**	**Res.**
3/7/2018	5TH & GRANT	1120	44	70	**1594**	**Comm.**
3/7/2018	RT. 66 WEST OF COMFORT INN	1160	48	70	**1807**	**Comm.**
3/7/2018	RAILROAD & LEWIS	1000	45	75	**1387**	**Comm.**
3/7/2018	BURBANK & GRAND CANYON	1060	40	80	**1319**	**Comm.**

3/7/2018	MORSE & PINECREST	1160	48	81	**1616**	**Res.**
3/7/2018	HIGHLAND MEADOWS NORTH OF PEBBLE BEACH	1120	44	100	**1358**	**Res.**
3/7/2018	QUARTER HORSE & SHEEPMENS	880	27.5	90	**936**	**Res.**

Table 28 - Hydrant Test Data, (Res. = 1,000 gpm, Comm. = 1,500 gpm Required)

4. EXISTING SYSTEM DEFICIENCIES

Supply

The existing water supply transmission system currently is not deficient in its operations, but its configuration leaves the system vulnerable (previously discussed) and limits the amount of water that can be delivered to the Water Treatment Plant, potable distribution system, and City Dam. Since the Dogtown Wells' and the Dogtown Reservoir's water is brought to the City through a common raw waterline, the amount of water that can be delivered to the City from these sources is limited. The waterline is old in age and has a history of pipe breaks when drawing water from the Wells and from the Lake. With these being the major sources of water for the City this severely limits supply transmission. In addition, water from Kaibab Lake, Rodeo Well, and Santa Fe Lake also are delivered through this line. Those sources cannot operate when the Dogtown Wells and Dogtown Lake are being used.

Distribution

Some isolated areas of the distribution system experience deficiencies in fire flow rates and in system pressure. Some of these areas experience both. The flow rate deficiency is due to undersized pipes, while the pressure deficiency is due to elevation in the system with respect to storage tanks. Improvements to address these deficiencies are discussed in Section E.

Fire Flow

The existing fire hydrant flows in the Kaibab Estates neighborhood and near the Taber Tank currently do not meet the minimum flowrate of 1,000 gpm at 20 psi during a fire flow and current average demands.

The fire hydrants along Rt. 66 and Railroad from Locust Street east to the turnaround do not meet the minimum commercial flowrate of 1,500 gpm at 20 psi during a fire flow and current average demands.

The fire hydrants in the Arnold Acres Neighborhood do not meet the minimum flow rate of 1,000 gpm at 20 psi during a fire flow and current average demands.

See the Existing System Distribution - Fire Flow Analysis map in Section G - Figures.

System Pressure

System pressures overall meet the low pressure requirement of 40 psi. However, system pressure deficiency is experienced in the neighborhood fed by the Taber Tank and the Arnold Acres Neighborhood.

Storage

It is desirable for the system to have enough storage of potable water to provide for 3 days of average daily demand plus one fire flow event. Currently there is a total water storage volume of 2.58 million gallons and the average daily demand is approximately 524,000 gallons. The required fire flow would be 1,500 gpm for two hours, or 180,000 gallons. So the City would need 1.752 million gallons of storage.

While the total system has storage of 2.58 million gallons, the entire storage volume is not available to the system as a whole as discussed in Section C. The other zones are fed by the Zone 1 Storage Tanks. Zone 1 includes the 3rd Street Tank and the two Water Treatment Plant Tanks. To conservatively estimate the storage needed, the Zone 1 capacity should meet the system requirements. Currently the Zone 1 Tank Capacity is 1.37 million gallons with the tanks full. Therefore, an additional, 382,000 gallons of storage is needed in Zone 1 with the 3rd Street Tank full and 492,000 gallons are needed in its current operation.

5. FUTURE SYSTEM DEFICIENCIES

While the items outlined in Section D.4 depict deficiencies within the existing system during current demands, future development and future area buildout will place additional demands on the system. This report will evaluate anticipated development demands based on current building permits and plan submittals to the City and the effects of those demands on the system. We will not evaluate the effects of the demands on the system at full buildout due to the uncertainty of growth and timing. However, as new projects are brought to the City the new Water Model can be used to evaluate the impacts on the system. Future anticipated system deficiencies are as follows.

Supply

During existing conditions the average demand can be met by running only the Dogtown Wells; this may be desirable during low lake levels. During future average daily demand the current Dogtown Well pumps would be short of meeting the demand. The Treatment Plant production capacity would also be exceeded during peak daily demands. The other supply issues outlined for the current demand would still exist.

Distribution

The areas that are deficient during existing conditions will have marginally less fire flow rates and lower pressures during future demands. However, no new areas would become deficient with the anticipated future development demands on the distribution system.

Storage

The desired amount of storage would increase with anticipated demands by 356,280 gallons. Since the existing system is already short on meeting desired storage demands this amount would compound that deficiency. So the future storage deficiency would be 382,000 gallons plus 356,280 gallons or 738,280 gallons with addressing the issue at the 3rd Street Tank, and 848,280 gallons without.

E. FUTURE WATER SYSTEM IMPROVEMENTS

Improvements to the existing water system can be made to address the above detailed system deficiencies and vulnerabilities. Improvements can be made in the areas of supply, supply transmission, distribution and storage.

1. ADDRESS EXISTING DEFICIENCIES AND VULNERABILITIES

Supply

The existing configuration of how well water is delivered to the distribution system should be changed. Well water should be treated and directly delivered to the potable water system and not sent to the Water Treatment Plant. Water from Dogtown Well #1 and #3 would only require chlorine injection to be suitable for potable distribution. This will save on treatment costs, improve supply reliability, and greatly increase the potable water supply.

The existing Dogtown Waterline should be replaced to increase the transmission capacity from the City's main sources of water. The replacement should include the installation of dual waterlines, one potable waterline dedicated to the Wells and one raw waterline dedicated to the Lake. The Well water could then be connected directly to the potable water distribution system. Only the lake water would need to be treated at the Water Treatment Plant. An alignment study to determine the location of the existing waterline, easements, and to establish a new alignment for new waterline is needed. Then a more accurate construction cost estimate can be completed.

The Sweetwater Well should be developed and made operational. This project should be concurrently completed with installing a packaged Arsenic Treatment Plant to treat water from the Sweetwater Well and the Rodeo Well. This would include installing a waterline from the Rodeo Well to the Sweetwater Well. This water would then be connected to the existing potable water distribution system in Grand Canyon Blvd.

These two projects would allow the City to meet current and anticipated future demands for the City using only well water. This would be advantageous during periods of extreme drought where surface water from the reservoirs is not available. See Table 27 – Supply Improvements for estimated costs and timing recommendations.

Project Name	Magnitude of Cost	Importance	Timing
Dogtown Waterline Replacement	Study = $50k to $75K Design and Construction = $8 to $12 Million	Very High	Immediate
Sweetwater Well & Rodeo Well Improvements	Design and Construction = $3.4 million	Medium	Within 5 years

Table 29 - Supply Improvements

Distribution

The existing issues within the distribution system can be attributed to undersized pipe sizes, single feed areas, or a combination of issues.

Fire Flow

The fire flow amount in the Kaibab Estates neighborhood is due to the subdivision being fed by one 6" waterline. A waterline connection can be made between the 8" waterline in Ellen Way to the 8" waterline near the Grand Canyon Railroad Maintenance Yard. This will provide a 2nd feed and an 8" connection to the system.

The fire flow amount along Rt. 66 and Railroad Ave. from Locust Street east to the turnaround is due to undersize waterlines in the area. The waterline at Rt. 66 and Pine Street should be upsized with an 8" waterline east to the turnaround. It should then be extended north to Railroad Ave. and then extended to the west to connect to the 6" waterline at Railroad Ave and Pine Street.

Pressure

The existing system pressure and fire flow amount in the Arnold Acres Neighborhood is due to the neighborhood's high elevation in the system. Since system pressures in the system are mainly gravity feed and affected by elevation, an inline booster pump station and hydropneumatic tank is needed to boost the pressures in this neighborhood. This will also provide over the minimum fire flow required.

The existing system pressure and fire flow amounts in the neighborhood fed by the Taber Tank, can both be remedied with the same project. The Taber Tank is also in poor condition and should be taken off line. The pressures are due to the elevation between the Taber Tank and the houses served not being great enough. The fire flow amount in this area is due to low pressures and undersized waterlines. To address these issues the Taber Tank should be disconnected and taken out of service. Undersized waterlines should be replaced with 8" waterlines and a hydropneumatic tank and VFD should be installed at the Taber Pump Station.

These projects, while not necessarily critical in nature, should be addressed to improve the operation, pressure, and fire flow availability of the system. See Table 28 for estimated costs and timing recommendations.

Project Name	Magnitude of Cost	Importance	Timing
Kaibab Estates Waterline Extension	Design and Construction = $100,000 to $150,000	Medium	Within 5 years
Taber Tank Demo and Water System Improvements	Design and Construction = $250,000 to $300,000	High	Within 5 years
RT. 66 and Railroad Ave. Waterline Upgrades	Design and Construction = $150,000 to $200,000	Medium	5 years +
Arnold Acres Booster Pump Station	Design and Construction = $150,000 to $200,000	Medium	5 years +

Table 30 - Pressure Improvements

Storage

The existing system could use approximately 500,000 gallons of additional storage in its current operating conditions and average demands. Repairs to the current system can be made to help this and a new storage tank is needed.

A new one million gallon storage tank should be installed in the Zone 1 Area. The tank should be oversized from the current deficiency to allow for future demands on the system. It is more cost effective to address a current deficiency as well as the future demand deficiency together, by installing one larger oversized tank. A one million gallon bolted steel storage tank should be sited and installed.

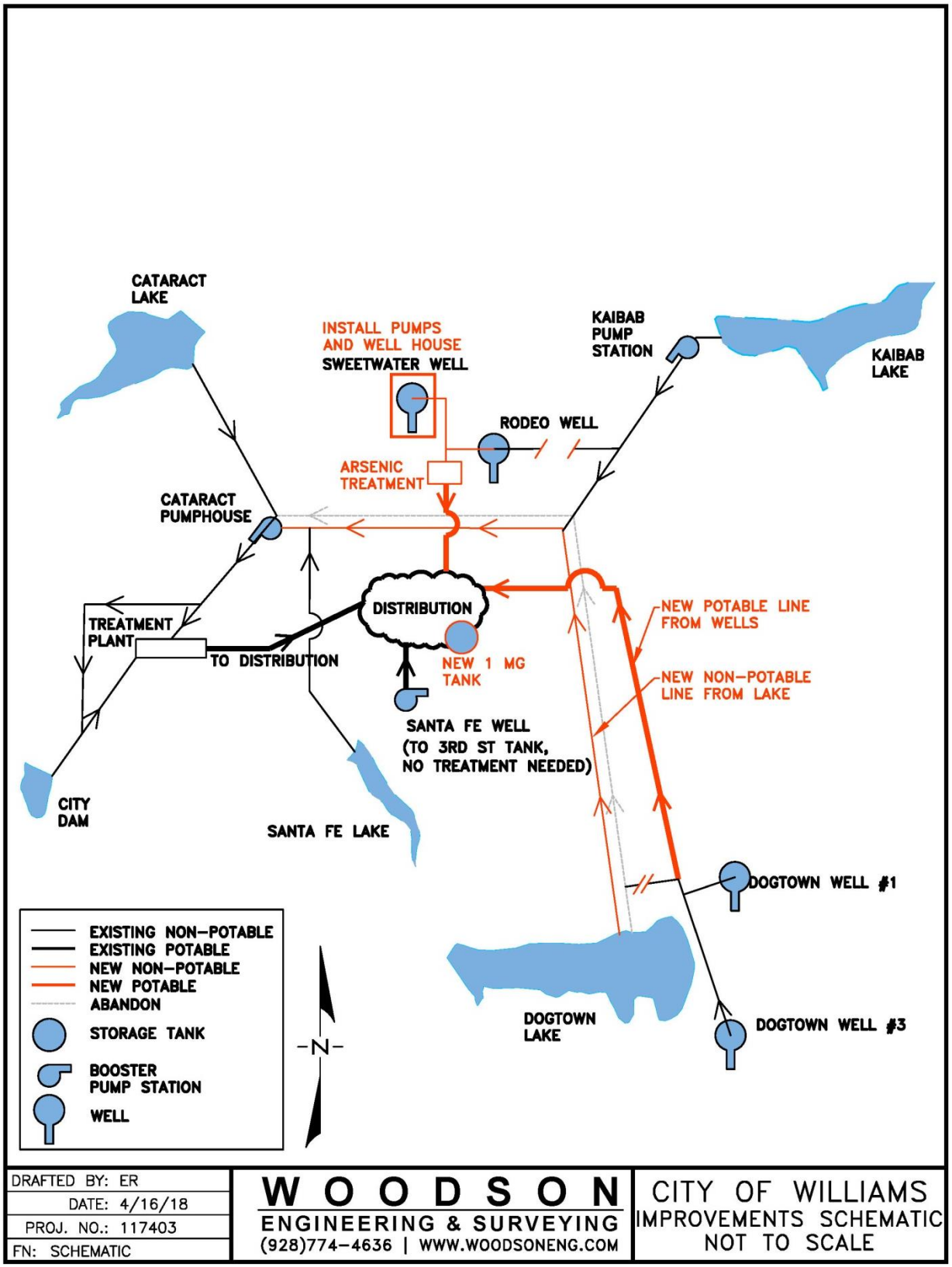
The lost storage in the 3rd Street Tank should be addressed. While the tank is at the same elevation as the Water Plant Tanks, it is suspected that pressure losses in the line prevent the tank from fully filling up. This can be addressed by installing a small inline booster pump station. A full investigation of this particular system and the Water Treatment Plant is needed to fully define this scope of work.

Project Name	Magnitude of Cost	Importance	Timing
New One Million Gallon Storage Tank	Design and Construction = $750,000 to $800,000	Very High	Immediate
3rd Street Tank Booster Pump Station	Design and Construction = $100,000 to $150,000	Medium	Within 5 years

Table 31 - Storage Improvements

2. ADDRESS FUTURE DEFICIENCIES AND VULNERABILITIES

Many of the improvements identified in the Existing Deficiencies and Vulnerabilities section will not only address the current issues but also provide for future demands on the system. The biggest change would be the deficient amount of storage on the system. This amount would increase an additional 356,000 gallons, but would be addressed by oversizing a new water storage tank to one million gallons. Should additional demands beyond those modeled at this point be presented to the City, additional improvements may be needed to accommodate the demand.


CATARACT LAKE
INSTALL PUMPS AND WELL HOUSE
SWEETWATER WELL
KAIBAB PUMP STATION
KAIBAB LAKE
RODEO WELL
ARSENIC TREATMENT
CATARACT PUMPHOUSE
DISTRIBUTION
NEW POTABLE LINE FROM WELLS
TREATMENT PLANT
TO DISTRIBUTION
NEW 1 MG TANK
NEW NON-POTABLE LINE FROM LAKE
SANTA FE WELL (TO 3RD ST TANK, NO TREATMENT NEEDED)
CITY DAM
SANTA FE LAKE
DOGTOWN WELL #1
EXISTING NON-POTABLE
EXISTING POTABLE
NEW NON-POTABLE
NEW POTABLE
ABANDON
STORAGE TANK
BOOSTER PUMP STATION
WELL
N
DOGTOWN LAKE
DOGTOWN WELL #3
DRAFTED BY: ER
DATE: 4/16/18
PROJ. NO.: 117403
FN: SCHEMATIC
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CITY OF WILLIAMS
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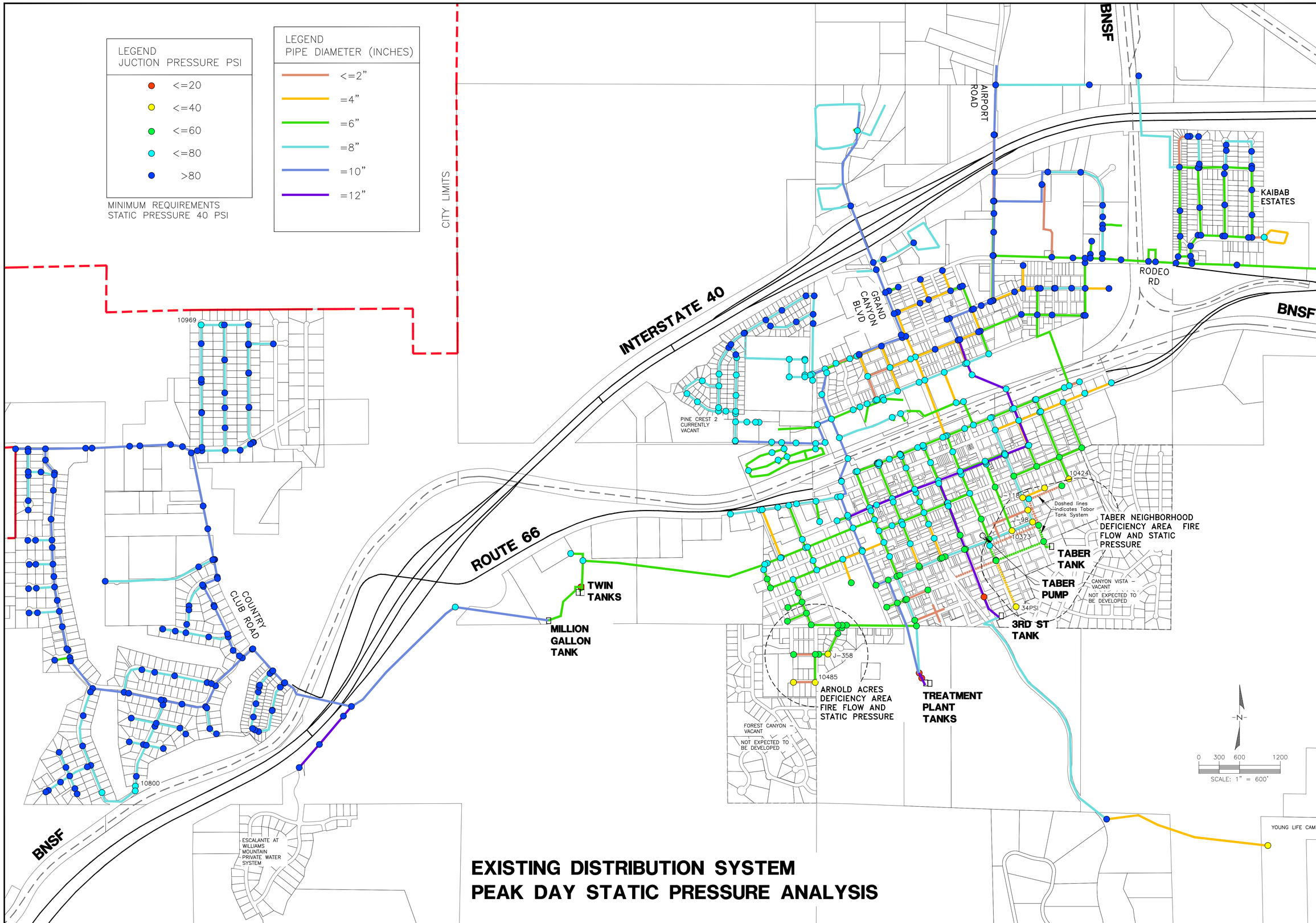
NOT TO SCALE

F. WATER CONSERVATION

The City of Williams has adopted a Water Conservation and Water Related Emergencies Ordinance in the Zoning Code. The Code outlines overall water conservation practices and incentives for residents and businesses to conserve water. The Code also has provisions on how to evaluate water supply and when to implement water restrictions. The Code is included in the Appendix – H.2.

G. FIGURES

1. EXISTING DISTRIBUTION SYSTEM – PEAK DAY STATIC PRESSURE ANALYSIS



EXISTING DISTRIBUTION SYSTEM PEAK DAY STATIC PRESSURE ANALYSIS

117403

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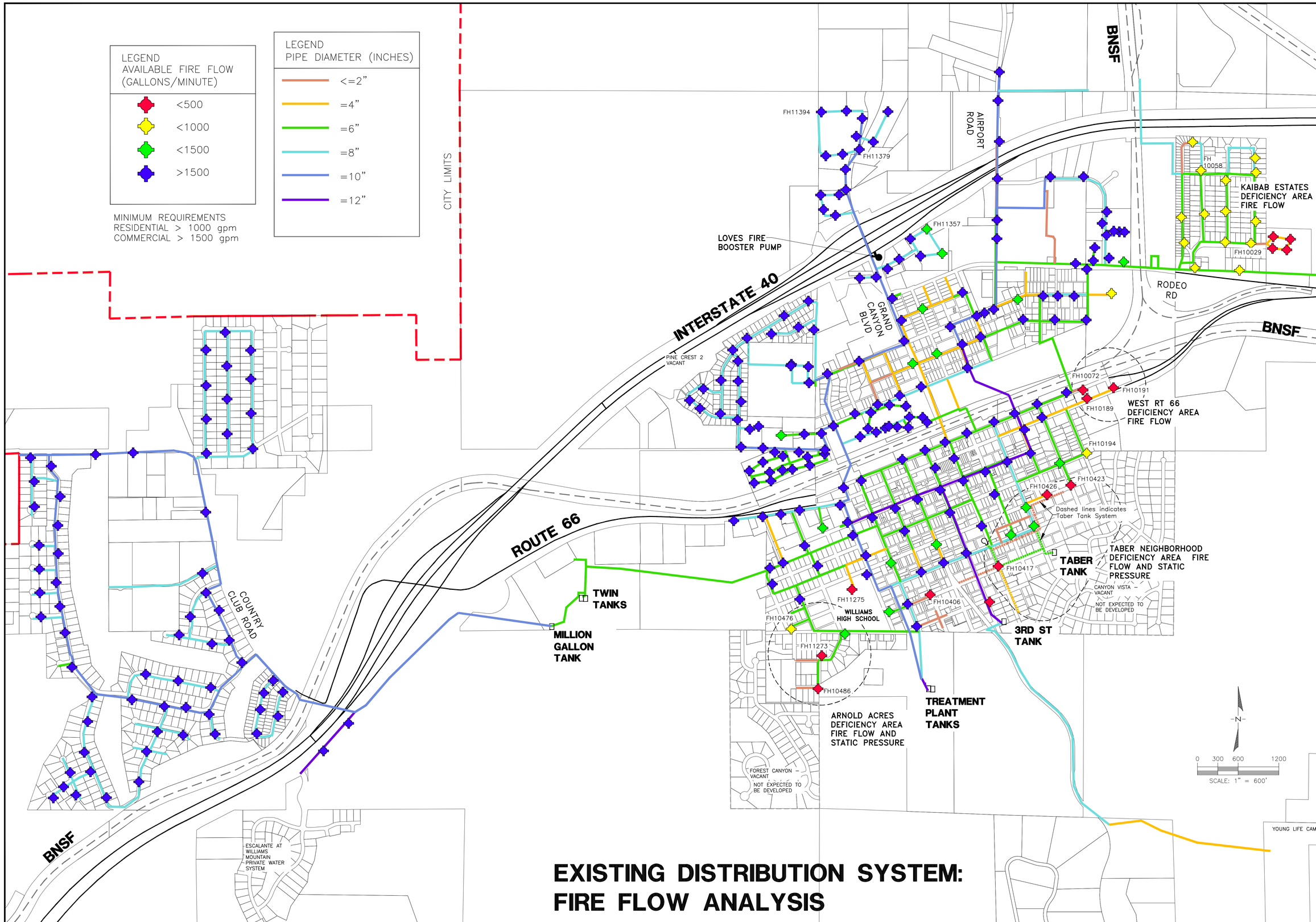
4/11/18

CITY OF WILLIAMS
WATER MASTER PLAN
DISTRIBUTION SYSTEM STATIC ANALYSIS PEAK DAY

DRAFTED BY: AAS
DATE: 3/22/18
PROJ. NO.: 117403
FN: EXISTING STATIC

2. EXISTING DISTRIBUTION SYSTEM – FIRE FLOW ANALYSIS



EXISTING DISTRIBUTION SYSTEM: FIRE FLOW ANALYSIS

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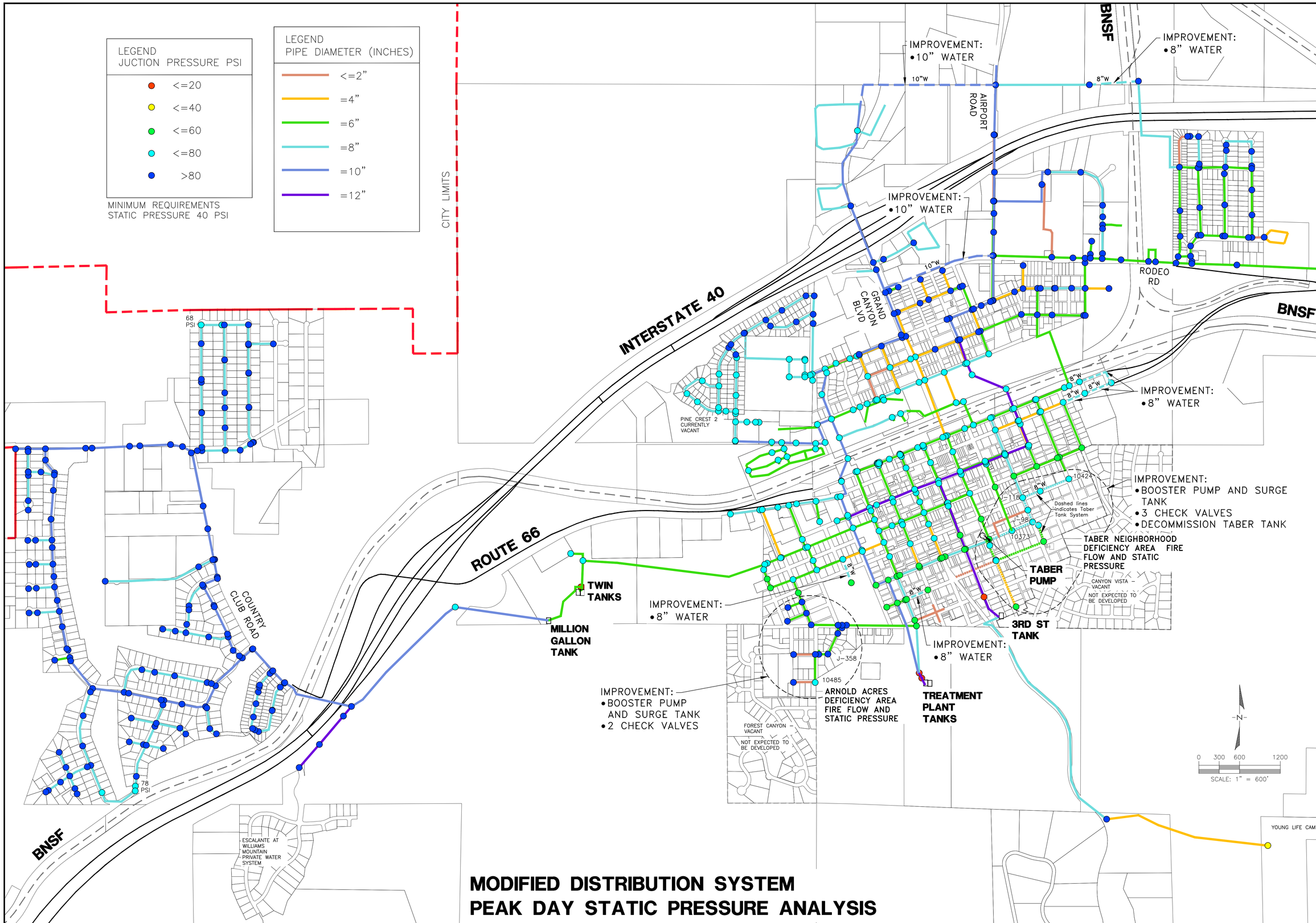
4/11/18

CITY OF WILLIAMS
WATER MASTER PLAN
DISTRIBUTION SYSTEM FIRE FLOW ANALYSIS PEAK DAY

DRAFTED BY: AAS
DATE: 3/22/18
PROJ. NO.: 117403
FN: EXISTING STATIC

3. MODIFIED DISTRIBUTION SYSTEM – PEAK DAY STATIC PRESSURE ANALYSIS



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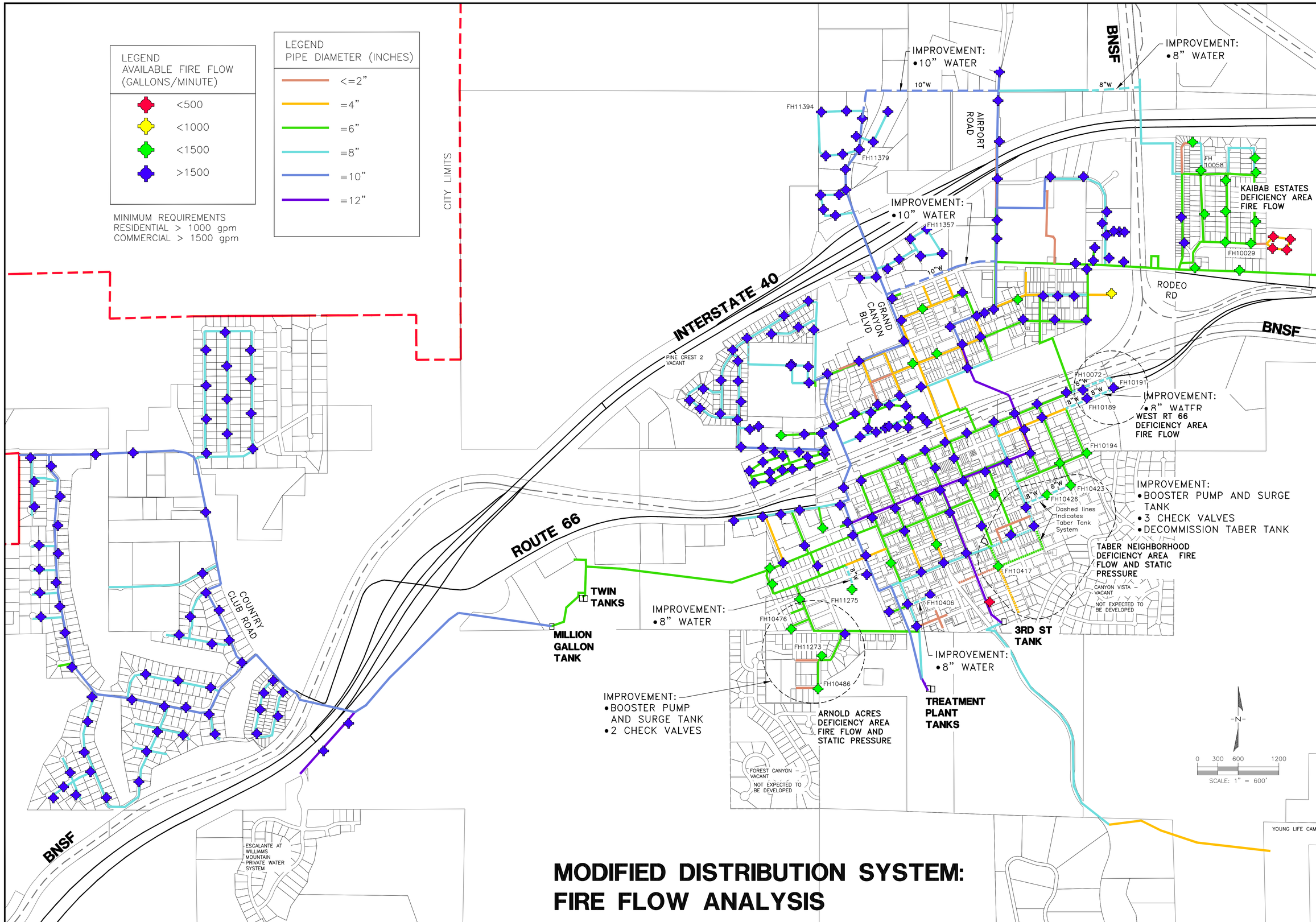
4/11/18

CITY OF WILLIAMS
WATER MASTER PLAN
MODIFIED DISTRIBUTION SYSTEM STATIC ANALYSIS PEAK DAY

DRAFTED BY: AAS
DATE: 3/22/18
PROJ. NO.: 117403
FN: EXISTING STATIC

4. MODIFIED DISTRIBUTION SYSTEM – FIRE FLOW ANALYSIS



MODIFIED DISTRIBUTION SYSTEM: FIRE FLOW ANALYSIS

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4/11/18

CITY OF WILLIAMS
WATER MASTER PLAN
MODIFIED DISTRIBUTION SYSTEM FIRE FLOW ANALYSIS PEAK DAY

DRAFTED BY: AAS
DATE: 3/22/18
PROJ. NO.: 117403
FN: EXISTING STATIC

5. WATER SYSTEM MAP

WATER SYSTEM MAP

CITY OF WILLIAMS

COCONINO COUNTY
ARIZONA

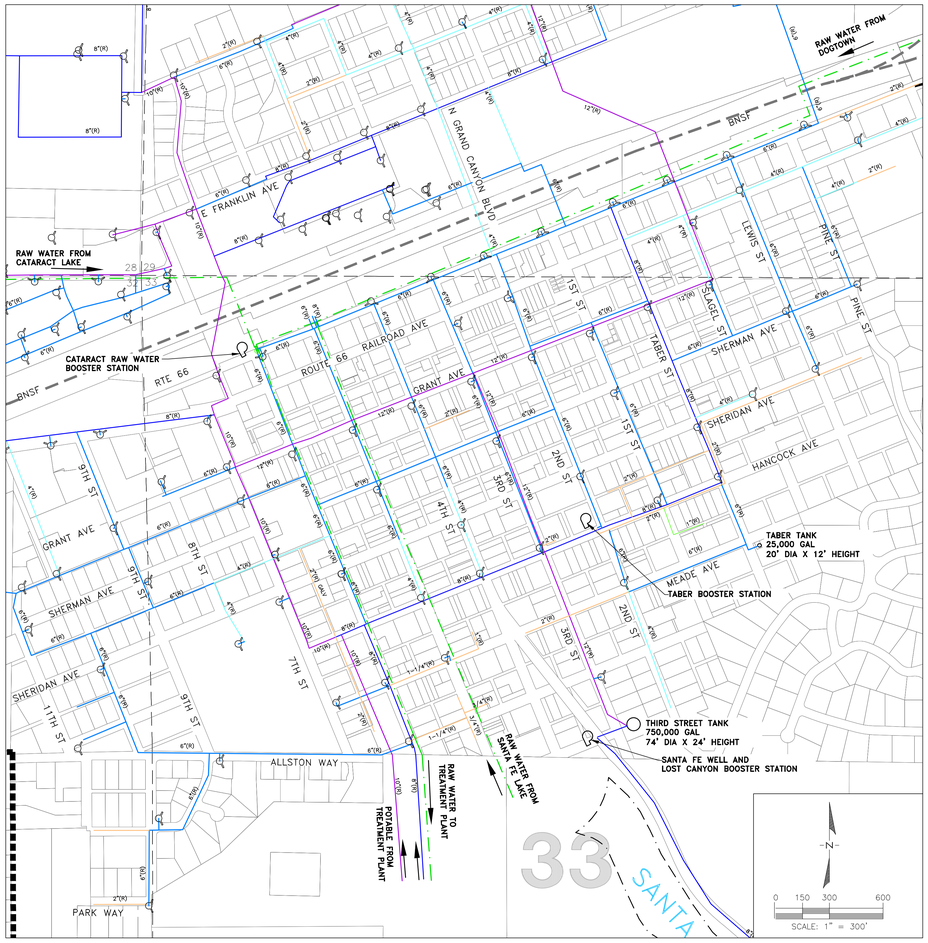
LEGEND

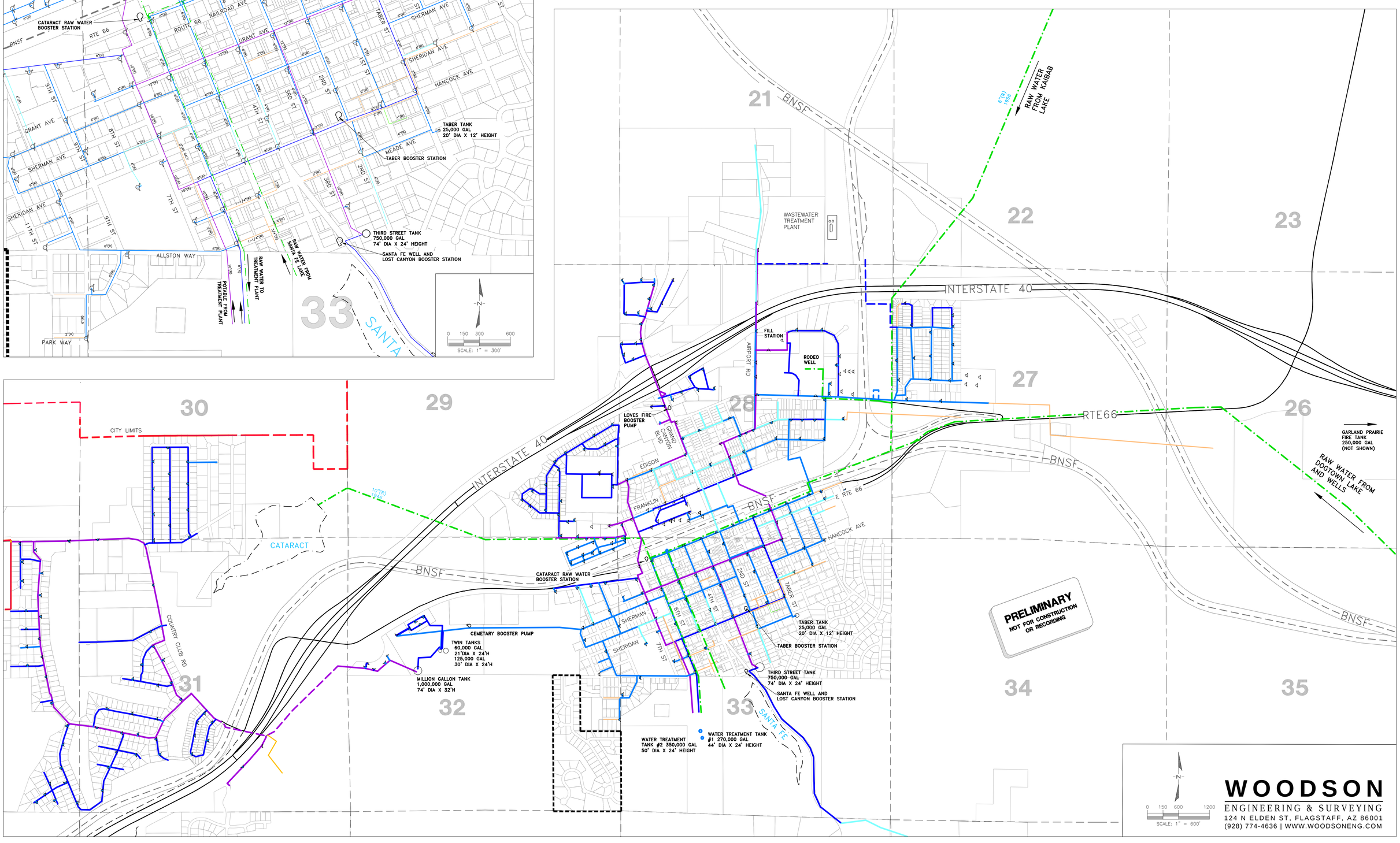
- WATER LINE, 3" and smaller
- WATER LINE, 4"
- WATER LINE, 6"
- WATER LINE, 8"
- WATER LINE, 10" and greater
- RAW WATER LINE
- WATER LINE, ESTIMATED (COLOR INDICATES SIZE)
- SECTION LINES, GIS
- PARCEL/RIGHT OF WAY BOUNDARY, GIS
- CITY LIMITS BOUNDARY, GIS
- FIRE HYDRANT, EXISTING
- WATER VALVE

DATUM:
VERTICAL: NAVD 83
HORIZONTAL: HORIZONTAL POSITIONS ARE BASED ON AN ASSUMED COORDINATE SYSTEM.

DISCLAIMER:
THIS MAP IS BASED ON BEST AVAILABLE DATA. THE CITY OF WILLIAMS AND WOODSON ENGINEERING 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.





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PRINTED IN MAY 2018
SHEET 1 OF 1

H. APPENDICES

1. MONTHLY WATER REPORTS

a Quality Water co.

Utilities Operation & Management

To: City of Williams

Re: Water Report 3/8/18

3/8/18 Dogtown Lake has approximately 209 million gallons compared to 231 million on 2/8/18, 80% is treatable water or 167 million gallons. (338 million total capacity)

3/8/18 City Dam (Buck Skinner) has approximately 36 million gallons compared to 31 million on 2/8/18, 80% treatable water or 29 million gallons. (37 million total capacity)

3/8/18 Cataract has approximately 76 million gallons compared to 76 million on 2/8/18 80% treatable water or 61 million gallons. (135 million total capacity)

3/8/18 Santa Fe has approximately 64 million gallons compared to 66 million on 2/8/18 80% treatable water or 52 million gallons. (70 million total capacity)

3/8/18 Kaibab has approximately 235 million gallons compared to 242 million on 2/8/18, 80 % treatable water or 193 million.

We are currently using Dogtown 1, Dogtown 3 and Dogtown Lake as our source water. The Santa Fe well will be online this week. Our current system demand is ~500k gpd or 347 gpm, total flow through the water treatment plant was 13,095,000 (February 2018). At current system demand, not calculating in the well water, we have 33.0 months of treatable water in the lakes, this number does not reflect evaporation or leakage. Comparing last year to this year, 3/20/17 we had 770 million gallons of treatable water in the lakes (lakes full) with an avg. daily demand of 420k gpd. 3/8/18 we have 502 million of treatable water in the lakes. Avg. System % loss by the month (water produced at the treatment plant compared to water delivered to customers) February 2018 system loss was ~19.1%

a Quality Water co.

Utilities Operation & Management

To: City of Williams

Re: Water Report 2/8/18

2/8/18 Dogtown Lake has approximately 231 million gallons compared to 258million on 11/15/17, 80% is treatable water or 184 million gallons. (338 million total capacity)

2/8/18 City Dam (Buck Skinner) has approximately 31 million gallons compared to 33 million on 11/15/17, 80% treatable water or 25 million gallons. (37 million total capacity)

2/8/18 Cataract has approximately 76 million gallons compared to 92 million on 11/15/17 80% treatable water or 61 million gallons. (135 million total capacity)

2/8/18 Santa Fe has approximately 66 million gallons compared to 64 million on 11/15/17 80% treatable water or 51 million gallons. (70 million total capacity)

2/8/18 Kaibab has approximately 242 million gallons compared to 245 million on 11/15/17, 80 % treatable water or 194 million.

We are currently using Dogtown 1 and Dogtown Lake as our source water. Dogtown 3 has been offline this month. Rodeo well will be exercised this month for 48hrs. New source sampling was completed and results show very good water quality for the Santa Fe well, ADEQ has given permission to use the well, there are some requirements for engineering that we need to address. The well will be online as soon as the piping to the tank is complete. Our current system demand is ~480k gpd or 333 gpm, total flow through the water treatment plant was 12,100,000 (January 2018). At current system demand, not calculating in the well water, we have 34.6 months of treatable water in the lakes, this number does not reflect evaporation or leakage. Comparing last year to this year, 2/22/17 we had 697 million gallons of treatable water in the lakes (lakes full) with an avg. daily demand of 447k gpd. 2/8/18 we have 515 million of treatable water in the lakes with an avg. daily demand of 480k gpd. System % loss by the month (water produced at the treatment plant compared to water delivered to customers) for the month of January 2017 we had a system loss of ~21.0% (major leak) compared to 2/22/17 ~23.0%.

a Quality Water co.

Utilities Operation & Management

To: City of Williams

Re: Water Report 12/5/17

11/15/17 Dogtown Lake has approximately 258 million gallons compared to 267million on 9/11/17, 80% is treatable water or 206 million gallons. (338 million total capacity)

11/15/17 City Dam (Buck Skinner) has approximately 33 million gallons compared to 28 million on 9/11/17, 80% treatable water or 26 million gallons. (37 million total capacity)

11/15/17 Cataract has approximately 92 million gallons compared to 94 million on 9/11/17 80% treatable water or 74 million gallons. (135 million total capacity)

11/15/17 Santa Fe has approximately 64 million gallons compared to 70 million on 9/11/17 80% treatable water or 51 million gallons. (70 million total capacity)

11/15/17 Kaibab has approximately 245 million gallons compared to 250 million on 9/11/17, 80 % treatable water or 196 million.

We currently have the wells shut down and are using City Dam as our source water. Wells will be off line for the next month or longer depending on weather. Rodeo well was exercised for 48 hrs. during November. New source sampling was completed on the Santa Fe well on 12/6 and delivered to the lab. per ADEQ requirements. Our current system demand is ~430k gpd or 298 gpm, total flow through the water treatment plant was 12,947,000 (November 2017). At current system demand, not calculating in the well water, we have 43.8 months of treatable water in the lakes, this number does not reflect evaporation or leakage. Comparing last year to this year, 12/7/16 we had 261 million gallons of treatable water in the lakes with an avg. daily demand of 420k gpd. 11/15/17 we have 553 million of treatable water in the lakes with an avg. daily demand of 430k gpd. System % loss by the month (water produced at the treatment plant compared to water delivered to customers) for the month of November 2017 we had a system loss of ~9.6% compared to 12/6/16 ~9.0%.

a Quality Water co.

Utilities Operation & Management

To: City of Williams

Re: Water Report 9/11/17

9/11/17 Dogtown Lake has approximately 267 million gallons compared to 279 million on 7/11/17, 80% is treatable water or 213 million gallons. (338 million total capacity)

9/11/17 City Dam (Buck Skinner) has 28 million gallons compared to 26 million on 7/11/17, 80% treatable water or 22 million gallons. (37 million total capacity)

9/11/17 Cataract has approximately 94 million gallons compared to 85million on 7/11/17 80% treatable water or 75 million gallons. (135 million total capacity)

9/11/17 Santa Fe has 70 million gallons compared to 60 million on 7/11/17 80% treatable water or 56 million gallons. (70 million total capacity)

9/11/17 Kaibab has 250 million gallons compared to 257 million on 7/11/17, 80 % treatable water or 200 million.

We are currently using Dogtown Lake and the Dogtown wells (1) 165 gpm (3) 245 gpm for our source supply water. Our current system demand is 500k gpd or 347 gpm, total flow through the water treatment plant was 16,840,000 (August 2017). At current system demand, not calculating in the well water, we have 37.7 months of treatable water in the lakes, this number does not reflect evaporation or leakage. Comparing last year to this year, 9/22/16 we had 243 million gallons of treatable water in the lakes with an avg. daily demand of 500k gpd. 9/11/17 we have 566 million of treatable water in the lakes with an avg. daily demand of 500k gpd. System % loss by the month (water produced at the treatment plant compared to water delivered to customers) for the month of August 2017 we had a system loss of ~8.2%. We picked up some water in the lakes from the summer rains. Equipment has been ordered and should be installed in the next couple week for the Santa Fe well.

a Quality Water co.

Utilities Operation & Management

To: City of Williams

Re: Water Report 7/11/17

7/11/17 Dogtown Lake has approximately 279 million gallons compared to 317 million on 5/28/17, 80% is treatable water or 223 million gallons. (338 million total capacity)

7/11/17 City Dam (Buck Skinner) has 26 million gallons compared to 31 million on 5/28/17, 80% treatable water or 21 million gallons. (37 million total capacity)

7/11/17 Cataract has approximately 85 million gallons compared to 89 million on 5/28/17 80% treatable water or 68 million gallons. ** (135 million total capacity)

7/11/17 Santa Fe has 64 million gallons compared to 70 million on 5/28/17 80% treatable water or 51 million gallons. (70 million total capacity)

7/11/17 Kaibab has 257 million gallons compared to 260 million on 5/28/17, 80 % treatable water or 205 million.

We are currently using Dogtown Lake and the Dogtown wells (1) 165 gpm (3) 245 gpm for our source supply water. Our current system demand is 675k gpd or 468 gpm, total flow through the water treatment plant was 20,021,000 (June 2017). At current system demand, not calculating in the well water, we have 26.5 months of treatable water in the lakes, this number does not reflect evaporation or leakage. Comparing last year to this year 7/27/16 we had 232 million gallons of treatable water in the lakes with an avg. daily demand of 640k gpd. 7/11/17 we have 538 million of treatable water in the lakes with an avg. daily demand of 675k gpd. System % loss by the month (water produced at the treatment plant compared to water delivered to customers) for the month of June 2017 we had a system loss of ~9.5%.

** Cataract loss: is due to the Golf Course usage

a Quality Water co.

Utilities Operation & Management

To: City of Williams

Re: Water Report 5/28/17

5/28/17 Dogtown Lake has approximately 315 million gallons compared to 338 million on 3/20/17, 80% is treatable water or 252 million gallons. (338 million total capacity)

5/28/17 City Dam (Buck Skinner) has 31 million gallons compared to 37 million on 3/20/17, 80% treatable water or 25 million gallons. (37 million total capacity)

5/28/17 Cataract has approximately 89 million gallons compared to 135 million on 3/20/17 80% treatable water or 71 million gallons. ** (135 million total capacity)

5/28/17 Santa Fe has 70 million gallons compared to 70 million on 3/20/17 80% treatable water or 56 million gallons. (70 million total capacity)

5/28/17 Kaibab has 260 million gallons compared to 293 million on 3/20/17, 80 % treatable water or 208 million. ** (293 million total capacity)

We are currently using Dogtown Lake and the Dogtown wells (1) 165 gpm (3) 245 gpm for our source supply water as the wells need to be exercised. Our current system demand is 550k gpd or 381 gpm, total flow through the water treatment plant was 16,730,000 (May 2017). At current system demand, not calculating in the well water, we have 37.0 months of treatable water in the lakes, this number does not reflect evaporation or leakage. Comparing last year to this year 5/26/16 we had 239 million gallons of treatable water in the lakes with an avg. daily demand of 660k gpd. 5/28/17 we have 612 million of treatable water in the lakes with an avg. daily demand of 550k gpd. System % loss by the month (water produced at the treatment plant compared to water delivered to customers) for the month of May 2017 we had a system loss of ~9%.

** Cataract loss: is due to the Golf Course usage

** Kaibab loss: may be possible the dam/lake has a leak. We will monitor this and keep updating

2. CITY OF WILLIAMS WATER CONSERVATION AND WATER RELATED EMERGENCIES ORDINANCE

City of Williams Ordinance: Article 8-4.08 - Water Conservation and Water Related Emergencies

(a) Adoption of a Water Conservation Code: This Code shall be added to any legal Plumbing Code approved by the Mayor and Council of the City and will be a stand alone ordinance fostering water conservation efforts in the City of Williams.

(b) Purpose: The purpose of this Code is to establish maximum rates of flow for plumbing fixtures and other devices in order to conserve water and to regulate the use of water resources within the City of Williams and its water service area.

(c) Regulations:

(1) Scope: The provisions of this section shall apply to all new construction, remodeling and replacement of fixtures in all existing structures. (Ord. 834, 2004; Ord. 825, 2002; Ord. 809, 2001; Ord. 801 §1, 2000; Ord. 799 §1, 2000; Ord. 753 (part), 1996: Ord. 751 (part), 1996)

(2) Water Closets and/or Urinals: Water closets shall be designed so as to be operable and adequately flushed with no more than 1.6 gallons of water per flush. Urinals shall be of the waterless type. (Ord. 907, 2008; Ord. 834, 2004; Ord. 825, 2002; Ord. 809, 2001; Ord. 801 §1, 2000; Ord. 799 §1, 2000; Ord. 753 (part), 1996: Ord. 751 (part), 1996)

(3) Shower Heads: Shower heads shall be designed, manufactured and/or installed so that the flow will not exceed 2.5 gallons per minute.

(4) Kitchen and Lavatory Faucets: All kitchen and lavatory faucets shall be designed, manufactured and/or installed so that the flow will not exceed 2.5 gallons per minute for kitchen and 2.0 gallons per minute for lavatory.

(5) Public Restrooms: Faucets located in restrooms intended for unrestricted use by the general public shall be of the metering or self-closing type and shall comply with subsection (c)(4) of this section.

(6) Pressure Reducing Valve: A pressure reducing valve shall be installed by the property owner, in all new construction or remodeling where line pressure exceeds fifty (50) psi. This valve shall be adjusted so that the pressure at the highest point of use in the building shall not exceed fifty (50) psi. The provisions of this subsection are not intended to interfere with any provisions in the Uniform Fire Code.

(d) Prohibition of Potable Water Flowing into Streets:

(1) It shall be unlawful for any person, firm or entity to allow raw or potable water used for irrigation to flow into or upon a public street for a period of ten (10) minutes or longer.

(2) If the irrigation water which is flowing into or upon a street is a direct result of an antiquated irrigation system (as determined by the Water Superintendent), the responsible individual shall provide an implementation plan within sixty (60) days of issuance of the notice of violation. This implementation plan shall provide for the upgrade, modernization and/or repair of the irrigation system, together with specific time frames to accomplish same. The period to complete the plan shall be as soon as possible given the nature and cost of repairs and the size of the system to be repaired, but in no event shall it exceed twelve (12) months. Upon approval of the implementation plan, the responsible party shall not be subjected to any civil sanctions pursuant to subsection (g), provided that the upgrading and/or repairs are continuing in accordance with the approved time

frames set forth in the plan. (Ord. 834, 2004; Ord. 825, 2002; Ord. 809, 2001; Ord. 801 §1, 2000; Ord. 799 §1, 2000; Ord. 753 (part), 1996: Ord. 751 (part), 1996)

(e) Incentive Program: The City Manager shall administer a program to provide a credit incentive for retrofitting of old plumbing fixtures and drought resistant landscaping improvements to any City of Williams water customers located within the city's water distribution system who meets any or all of the following criteria.

(1) Installs a dual-flush water closet, or a waterless urinal. (Ord. 907, 2008; Ord. 834, 2004; Ord. 825, 2002; Ord. 809, 2001; Ord. 801 §1, 2000; Ord. 799 §1, 2000; Ord. 753 (part), 1996: Ord. 751 (part), 1996)

(2) Installs shower heads using 2.5 gallons per minute or less, kitchen faucets using 2.5 gallons per minute or less and /or lavatory faucets using 2.0 gallons per minute or less, that also are not otherwise required to be installed pursuant to any building or plumbing code.

(3) Installs an irrigation timer or a drip irrigation system for any existing turf.

(4) Installs on a minimum of seventy-five percent (75%) of the total landscape area an inorganic ground cover (river rock, gravel, crushed rock, decomposed granite, cinders, etc.) and is in accordance with the City of Williams zoning code. (Ord. 834, 2004; Ord. 825, 2002; Ord. 809, 2001; Ord. 801 §1, 2000; Ord. 799 §1, 2000; Ord. 753 (part), 1996: Ord. 751 (part), 1996)

(5) A minimum of seventy-five percent (75%) of the new plantings on a lot must be drought resistant shrubs and trees, or acceptable xeriscape.

CREDIT INCENTIVE TABLE:

Dual-flush water closet $50.00

Waterless urinal 40.00

Shower head 10.00

Kitchen faucets 20.00

Lavatory faucets 15.00

Irrigation timer 25.00

Turf conversion .25/sq. ft. up to a maximum of 350.00

Drip irrigation - 50% of cost not to exceed 50.00

(Ord. 907, 2008; Ord. 834, 2004; Ord. 825, 2002; Ord. 809, 2001; Ord. 801 §1, 2000; Ord. 799 §1, 2000; Ord. 753 (part), 1996: Ord. 751 (part), 1996)

(f) Restrictions During Water Shortages: The City Manager, upon the recommendation of the Water Superintendent, is hereby authorized to declare Water Conservation Levels. The conservation levels shall be initiated based upon the resource status which assessed the relationships between water demand, municipal safe production capability and reservoir storage levels, weather conditions and historic data. The City Manager shall evaluate resource status levels no less than once per week. Such evaluation criteria shall be documented and made available to the public.

(1) The following Resource Levels are hereby defined as follows:

(A) Resource Status Level 1: When water demand is equal to or less than safe production capability. Safe production shall be defined as a daily system demand of one million gallons per day/reservoir storage reserves of eighteen (18) months supply or more.

(B) Resource Status Level 2: When water demand is greater than safe production capability for three (3) consecutive days or reservoir storage reserves are less than twelve (12) months supply in or before December of any year.

(C) Resource Status Level 3: When water demand is greater than safe production capability for more than one (1) week, or reservoir storage reserves are less than ten (10) months supply in or before February of any year.

(D) Resource Status Level 4: When water demand exceeds total production capability and distribution storage reserves are at fifty percent (50%); or reservoir storage reserves are less than ten (10) months supply any time after April.

(2) The following Water Conservation Measures shall govern the use of water by Williams water users, as prescribed below correlating to the Resource Status levels established in subsection 1.

(A) Resource Status Level 1: Water Awareness. Water users are specifically encouraged to minimize waste in water used for irrigation, vehicle and pavement washing, construction and all other uses.

(B) Resource Status Level 2: Water Restrictions. The following water uses are restricted or prohibited. No person shall:

(i) Irrigate or wash vehicles, except as provided herein and subject to such additional restrictions as contained herein. Even numbered addresses are restricted to said uses on Monday, Wednesday, Friday and Sunday; odd numbered addresses and all others are restricted to said uses on Tuesday, Thursday, Saturday and Sunday. Irrigation may take place only between the hours of 5:00 a.m. to 8:00 a.m. and 6:00 P.M. to 10:00 P.M.

(ii) Wash vehicles with a bucket and hose with a positive type shutoff nozzle. No restrictions at commercial car washes.

(iii) Wash paved areas such as driveways or sidewalks.

(iv) Use fire hydrants for other than emergencies.

(C) Resource Status Level 3: Water Emergency.

(i) In addition to the restrictions set forth in the previous status levels, the following water uses are further restricted or prohibited:

(1) Filling or refilling swimming pools, spas or wading pools.

(2) No irrigation of golf course fairways and roughs. No restrictions if treated effluent is used.

(3) No landscaped areas may be irrigated more than two (2) times per week; additionally, irrigation may only take place between the hours of 6:00 p.m. and 10:00 p.m. on Thursday and Sunday for even numbered addresses, and on Wednesday and Saturday for odd numbered addresses and all others. No restrictions if treated effluent is used.

(D) Resource Status Level 4: Water Crisis.

(i) The following water uses are restricted or prohibited. No person shall:

(1) Do any of the acts prescribed in previous status level restrictions.

(2) Use potable or raw water for irrigation.
(3) Use potable or raw water for any purpose other than public health or emergency purposes.
(4) Use potable or raw water in violation of any other restriction deemed necessary by the City Council.
(5) No new commercial or residential building permits will be issued.
(6) All commercial water hauling is stopped except for residential purposes.

(g) Excessive Water Consumption Rates: During Resource Status Level 3 and Resource Status Level 4, Single Family Residential rates shall increase to one hundred fifty percent (150%) of the established rate for any water consumption between fifteen thousand (15,000) and twenty thousand (20,000) gallons. Rate shall increase to two hundred percent (200%) of the established rate for any water consumption greater than twenty thousand (20,000) gallons per billing cycle. Rate increases shall take effect with the billing cycle(s) following implementation of Resource Status Level 3.

(h) New Landscape Permits: Daily irrigation of new landscape may be allowed for elective landscaping and will be allowed for required landscaping, by obtaining a Special Use Irrigation Permit from the Building Department.

(1) The permit shall be good for a maximum of thirty (30) days.

(2) The fee for the permit shall be determined by the square feet of landscaping to be installed at twenty-five cents ($0.25) per square foot, with a maximum of two thousand five hundred (2,500) square feet per permit, plus a ten dollar ($10.00) fee to cover administration and printing.

(3) The permit shall be obtained prior to landscape installation and prominently posted at the irrigation site.

(4) The determination of provision of an elective landscaping permit shall be made by a representative of the Utilities Department and may be appealed by the application to the City Council, if thought to have been unreasonably denied. The decision of the City Council shall be final.

(5) Resource Status Level 2 restrictions shall apply to all Special Use Irrigation Permit(s).

(6) No new elective or required Special Use Irrigation Permits for landscaping will be issued when at Resource Status Level 4.

(7) Landscaping not installed and required by the City of Williams to meet the Land Development 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 acceptable to the Community Development Department.

(i) Violation Surcharges and Appeals: When a violation of the Water Restrictions is observed by one of the designated City Employees, that employee will photograph the violation and fill out a water violation report and turn it in to the Code Enforcement Officer. The following surcharges will apply to all violations deemed to be valid by the Code Enforcement Officer:

(1) A surcharge of twenty-five dollars ($25.00) shall be assessed to the account of record for a violation of Resource Status Level 2.

(2) A surcharge of thirty-five dollars ($35.00) shall be assessed to the account of record for a violation of Resource Status Level 3.

(3) A surcharge of one hundred dollars ($100.00) shall be assessed to the account of record for a violation of Resource Status Level 4.

(4) Surcharges shall double for every repeat violation. Each succeeding surcharge under the prevailing Resource Status Level may be twice the previous surcharge assessed for the previous violation.

(5) The assessment of the surcharge may be informally appealed, in writing, within fifteen (15) calendar days of the notice of the surcharge assessment. The written appeal shall be received by the City of Williams Utilities Department within the said fifteen (15) day time limit or the right to such appeal shall be permanently waived. Address all surcharge related correspondence to the City of Williams Utility Department.

(j) Penalties: A violation of any provision of subsection (c), (d) and (f) shall be a civil violation and shall be subject to penalties for each day the violation continues; provided, however, that a second offense of said violation shall result in a mandatory minimum sanction of one hundred dollars ($100.00) and a third offense shall result in a mandatory minimum sanction of two hundred and fifty dollars ($250.00). Mandatory minimum sanctions shall not be waived. In addition to any legal or equitable remedy to enforce the provisions of this Code, the City may terminate or suspend water service to property owned or controlled by any party in violation. The City Manager or designee may cause a notice of water termination to be served upon the violating party stating that service will be discontinued in five (5) days unless a hearing is requested. If a hearing is requested, the City Manager or designee shall convene a hearing within three (3) days of the request. Upon finding that a violation has occurred, the City Manager or designee may order that water service be terminated or suspended pending compliance with this Code. (Ord. 834, 2004; Ord. 825, 2002; Ord. 809, 2001; Ord. 801 §1, 2000; Ord. 799 §1, 2000; Ord. 753 (part), 1996: Ord. 751 (part), 1996)

3. TANK INSPECTION REPORTS

Field Report

City of Williams – Tank 1

June 30, 2016

Submitted To:

Kyle Christiansen
City of Williams, AZ
113 South First Street
Williams, AZ 86046

Office Phone: 928-635-4451

Email: kchristiansen@williamsaz.gov

Submitted By:

Applied Diving Services, Inc.
A Rubicon Company
2127 S. Priest Dr., Suite #406
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Office Phone: 602-258-1116
Office Fax: 480-214-0118
Cell Phone: 623-334-6523
Email: smoses@applieddiving.com
John Kennedy - Supervisor

Arizona Licence No. ROC 160416 *

California Lic. No. 942354 *

Member – Association of Diving Contractors

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1.0 Introduction

The following is the report of the Dive cleaning and inspection done by Applied Diving Services, Inc. on 6/30/16 for the Potable Water Storage Tank located at the end of 6th Street

2.0 Overview

The Water Storage Tank has a nominal capacity of 280,000 gallons and has a diameter of 50' and a height of 26'. The tank construction is welded steel.

3.0 Recommendations

Applied Diving Services makes the following recommendations:

1. Continue the tank inspection at 4-5 year intervals
2. Consider scheduling the tank to be refurbished

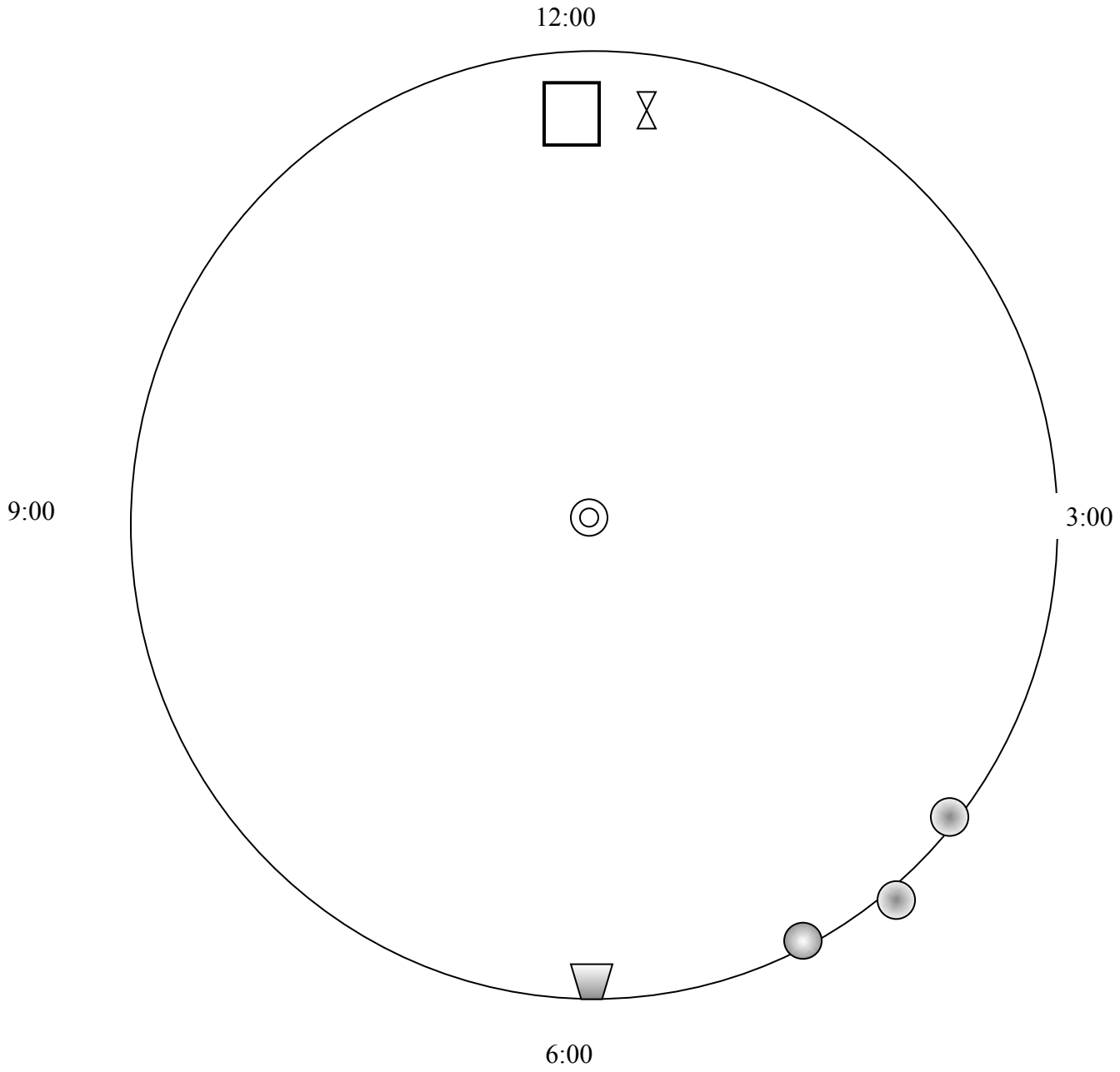
4.0 Deficiencies

Coating Concerns and Level Indicator cables broken

5.0 Conclusion

The tank appeared to be fully functional and should continue to provide potable water as designed.

6.0 Structure Diagram



	Entry Hatch		**Column**
	Inlet Pipe		**Vent**
	Outlet Pipe		**Telemetry**
	Overflow		**Liquid Level Indicator**
	Capped Off Penetration		**Man Way**

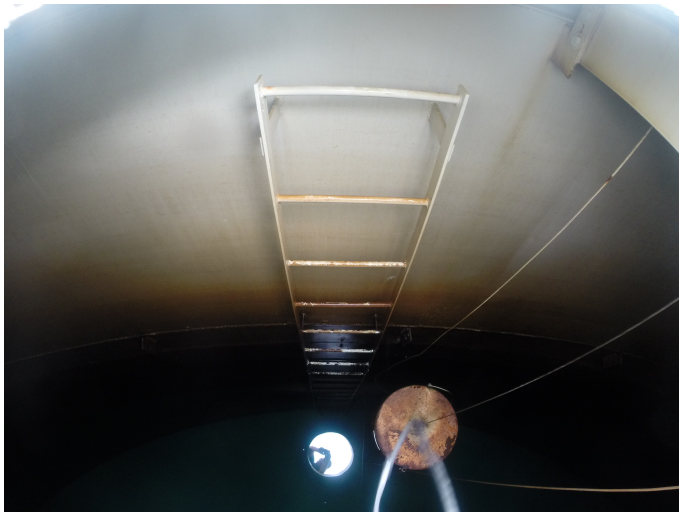
Drawing not to scale

Exterior Ladder

Description:

The exterior ladder was in good condition and locked securely at the base

Hatch, Interior Ladder, and Liquid Level Indicator



Description:

The hatch was in good condition and found to be locked upon arrival. The level indicator was working properly, though the bottom cables were not attached

Center Vent

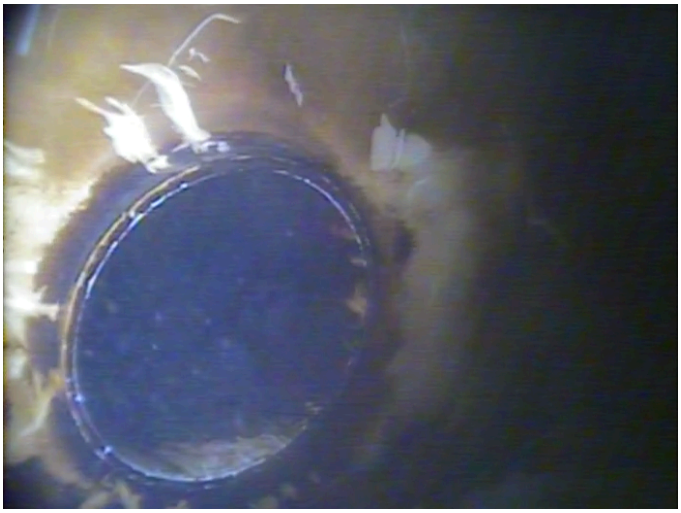
Description:

The center vent appeared to be in average condition and the screen was intact. The paint on the roof was wearing through

Overflow

Description: The overflow appeared to be unobstructed and clear to perform as designed. However, low water levels prevented a close interior inspection

Inlet and Crossover



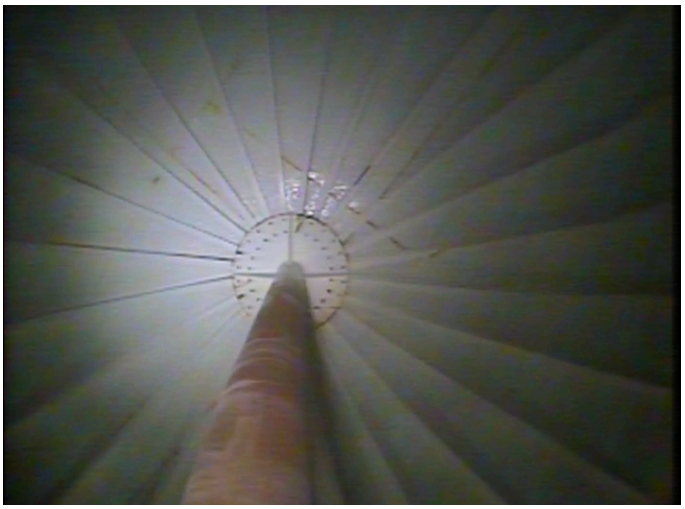
Description:

The inlet was unobstructed but had considerable corrosion

Outlet

Description: The outlet had significant corrosion but appeared to be working as intended

Center Column and Ceiling



Description:

The center column and ceiling appeared to be in good condition. No significant corrsoion or delamination was noted

Interior Walls

Description:

While the walls and floors had significant staining, their condition was moderate. The coating was nearing ithe end of its useful life

Field Report

City of Williams – Tank 2

June 30, 2016

Submitted To:

Kyle Christiansen
City of Williams, AZ
113 South First Street
Williams, AZ 86046

Office Phone: 928-635-4451

Email: kchristiansen@williamsaz.gov

Submitted By:

Applied Diving Services, Inc.
A Rubicon Company
2127 S. Priest Dr., Suite #406
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1.0 Introduction

The following is the report of the Dive cleaning and inspection done by Applied Diving Services, Inc. on 6/30/16 for the Potable Water Storage Tank located at the end of 6th Street

2.0 Overview

The Water Storage Tank has a nominal capacity of 350,000 gallons and has a diameter of 50' and a height of 26'. The tank construction is welded steel.

3.0 Recommendations

Applied Diving Services makes the following recommendations:

1. Continue the tank inspection at 4-5 year intervals
2. Consider scheduling the tank to be refurbished

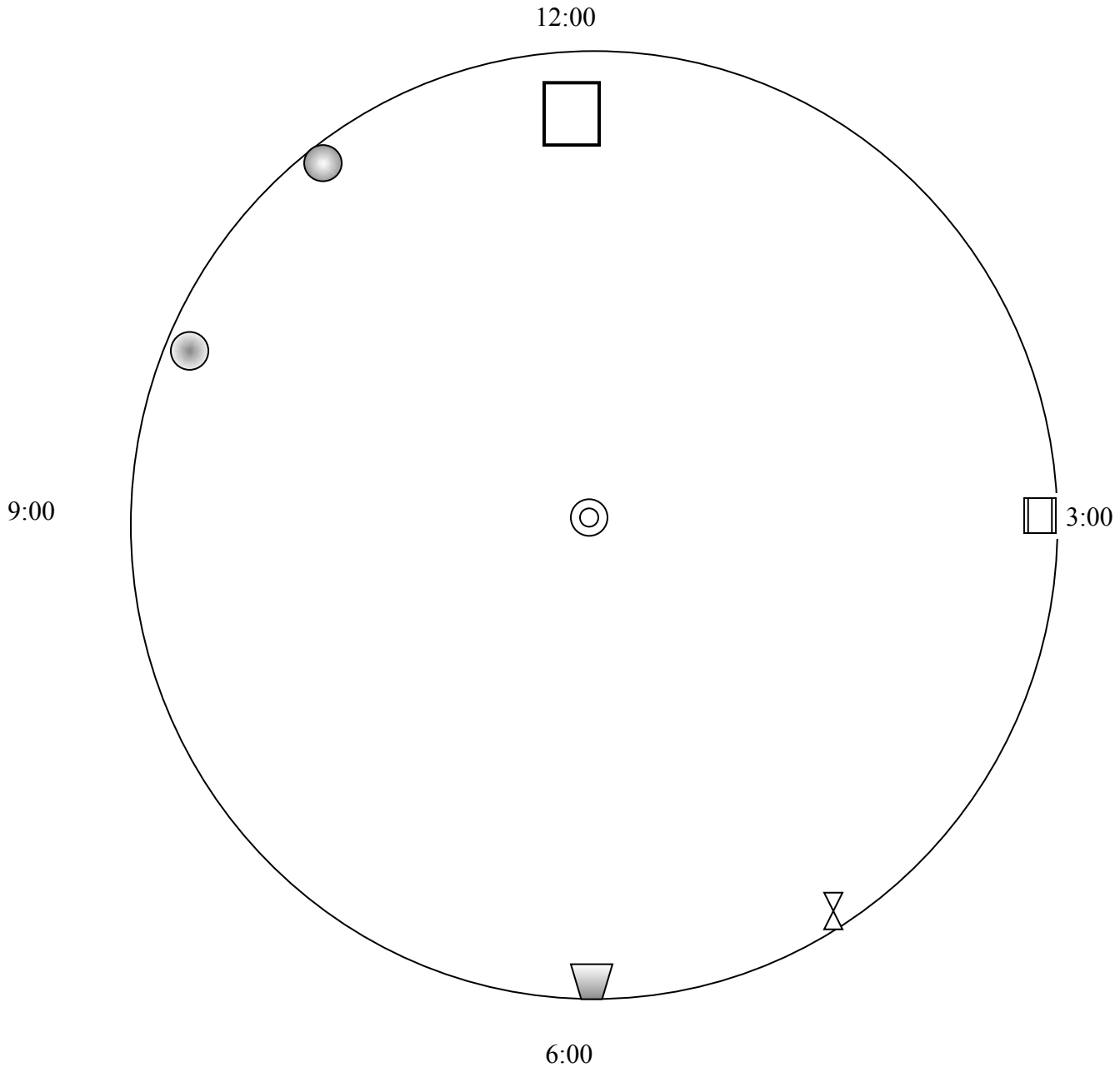
4.0 Deficiencies

Coating Concerns and one Float cable broken

5.0 Conclusion

The tank appeared to be fully functional and should continue to provide potable water as designed.

6.0 Structure Diagram



	Entry Hatch		**Column**
	Inlet Pipe		**Vent**
	Outlet Pipe		**Telemetry**
	Overflow		**Liquid Level Indicator**
	Capped Off Penetration		**Man Way**

Drawing not to scale

Exterior Ladder

Description: **The exterior ladder was in good condition and locked securely at the base**	

Hatch, Interior Ladder

Description: **The hatch was in good condition and found to be locked upon arrival. The level indicator was working properly, though the bottom cables were not attached**	

Center Vent

Description:

The center vent appeared to be in average condition and the screen was intact. The paint on the roof was wearing through

Overflow

Description: The overflow appeared to be unobstructed and clear to perform as designed. However, low water levels prevented a close interior inspection

Man Way

Description:

The Man Way hardware and seal were in place and funtioning

Outlet

Description: The outlet had significant corrosion but appeared to be working as intended

Liquid Level Indicator

Description:

The liquid level indicator appeared to be funtioning as desgined. One of the guy cables was not attached on the floor.

Interior Walls

Description:

The walls and floor appeared to have been coated with a caol tar epoxy or similar. The coating is well past its effective life and the tank should be recoated.

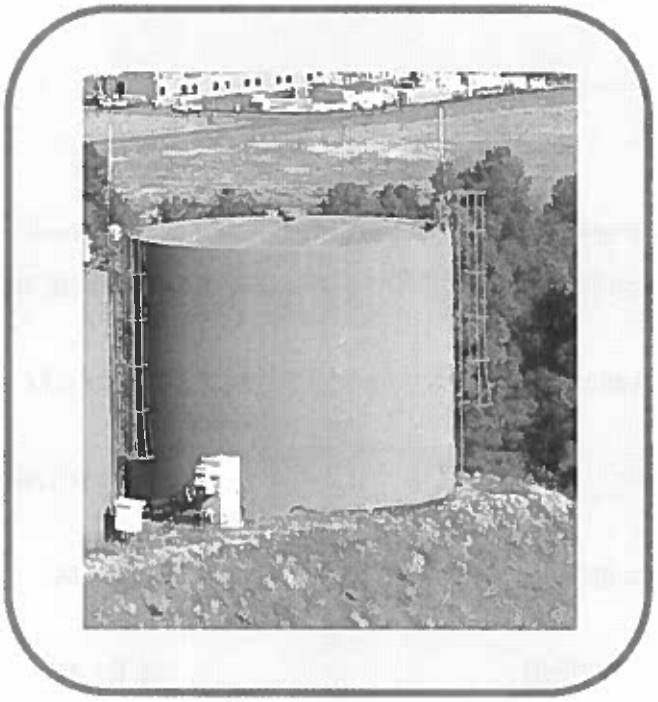
Center Column and Ceiling

Description:
The center column and ceiling appeared to be in good condition. No significant corrsoion or delamination was noted. The tank level was low and the black coating did not allow for enough light to reach the ceiling for photography and evaluation.

SUPERIOR TANK SOLUTIONS

Summary Assessment Report

City of Williams, AZ



CLOVERHILL TANK – 125,000 GALLONS

Date: November 18, 2014

Matt Tasch
(480) 390-0487
MTasch@superiortanksolutions.com

SUMMARY ASSESSMENT REPORT

CITY OF WILLIAMS, AZ

ASSESSMENT INTRODUCTION

Superior Tank Solutions, Inc. conducted a visual assessment at the customer's request. The purpose of the assessment was to determine the condition of the ***interior and exterior coating systems*** along with the extent of corrosion and the severity of degradation. The tank ***structure*** was evaluated in reference to the original "as built" design criteria and the applicable AWWA D.100 construction standard. Regulatory compliancy assessments were conducted in accordance with ***sanitary*** (Arizona Department of Environmental Quality), ***safety*** requirements (Federal OSHA 29 CFR 1910 & 1926 and ADOSH) and ***security*** guidelines (US Dept of Homeland Security & AWWA Security Recommendations).

TANK INFORMATION	
Inspection Date	November 18, 2014
Tank Location	Williams, AZ
Year Built	December 1986
Tank Size (gallons)	125,000
Dimensions (feet)	30'D x 24'H
Design Standard	AWWA D 100 and D 102
Tank Style	Ground Storage Tank

COATINGS, DEFICIENCIES, AND CONCERNS

IMPORTANT COMMENTS

- **Lead could be present in the exterior primer.**

EXTERIOR COATINGS

The exterior coating is in poor condition. The coatings have heavily deteriorated due to age and exposure to the elements. The top coat is chalking and fading to the point where prime coat shadow through is visible. The sidewalls show a large number of small mechanically damaged sites where isolated rusting is present. The roof has little to no top coat remaining, bare steel is exposed in many locations. The exterior is reaching the end of the recoat period when renovation can be performed economically. The high likelihood of lead present in the exterior primer further impacts the need to encapsulate the exterior immediately.

INTERIOR COATINGS

The interior coatings are starting to fail. The coatings have failed on the roof and rafters resulting in widespread rusting with isolated corrosion. There are several large areas on the roof where the epoxy coating is delaminating in sheets. The atmospheric zone are covered in pinhole rusting sites. The coatings on the sidewalls are fair condition with isolated rusting and pinhole failures. Due to the poor visibility, the tank being completely full, and heavy staining the lower areas of the tank were not able to be assessed. It was observed that sediment covered most of the floor except where the inlet was located.

SAFETY, SECURITY, AND STRUCTURAL DEFICIENCIES

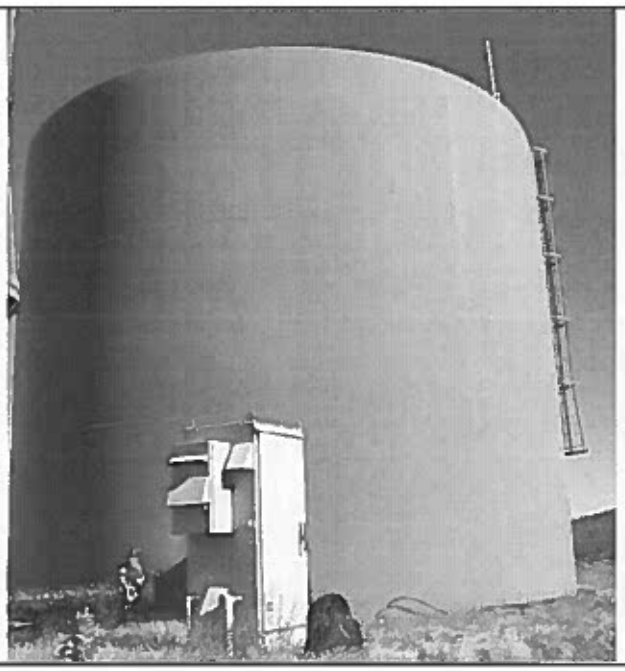
- The access ladder cage should have expanded metal installed around the base to prevent the cage from being used as a ladder.
- The access ladder should have a locking ladder gate to prevent unauthorized entry.
- The steel grade band and gravel foundation is failing in several areas. In other locations the grade band is lifting up and allowing gravel to spill out beneath the grade band.
- It is recommended to install a second shell manway to facilitate confined space requirements.

CONCERNS AND WATER QUALITY

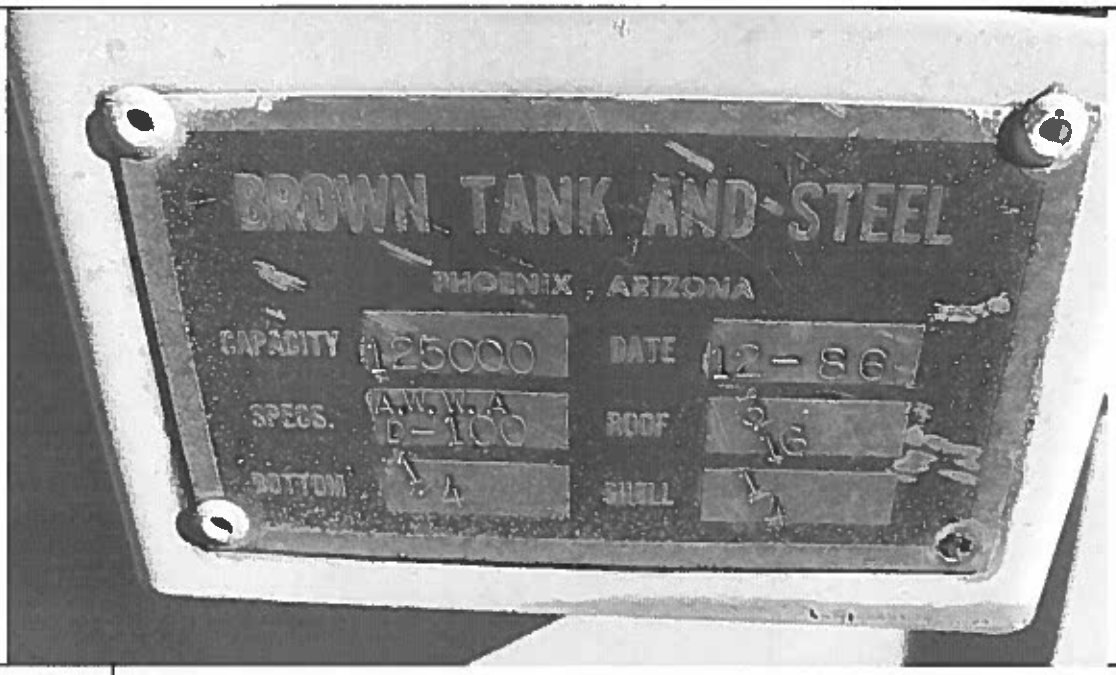
- Water Quality is a concern in this tank. The presence of bio-film and apparent stagnation are evident in this tank. This can be observed by the buildup on the shell at the fluctuating water line and through the presence of debris on the surface of the water. The tank is most likely short circuiting resulting in thermal stratification. This allows the water to stagnate and biofilm to develop in the boundary areas.

RECOMMENDATIONS

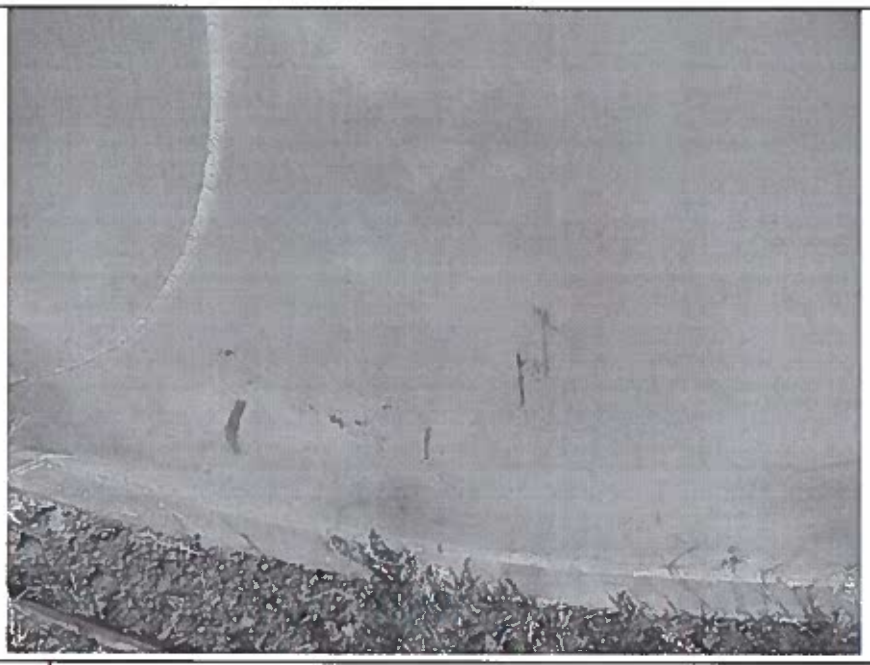
- All exterior surfaces require a high pressure wash, spot prep and prime, and a 2 coat overcoat of a compliant coatings system.
- All interior surfaces require renovation by means of an SSPC-SP 10 blast and application of a compliant NSF coating system.
- To prevent unauthorized access on the tank expanded metal should be installed around the lower section of the exterior ladder cage.
- A locking ladder gate should be installed on the access ladder.
- The foundation steel grade band should be repaired and anchored.
- Install a second shell manway.
- It is strongly recommended that an active mixing be installed in the tank to improve water quality.



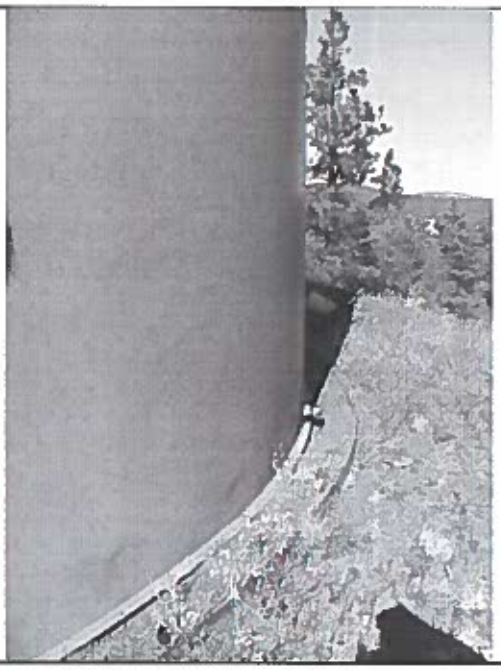
EXTERIOR	Fading and chalking on sidewall.



EXTERIOR	Name Plate



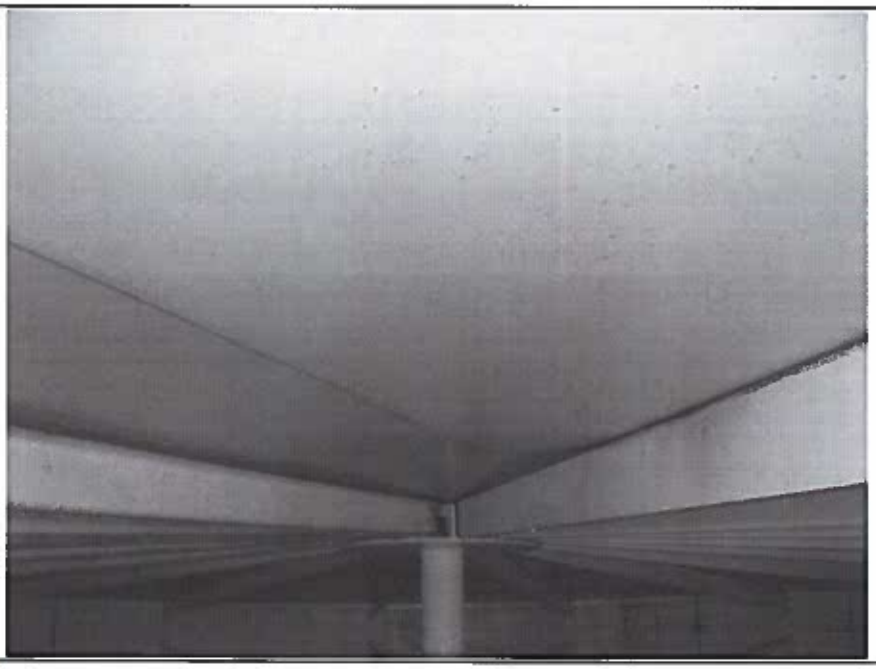
EXTERIOR	Abrasion marks.



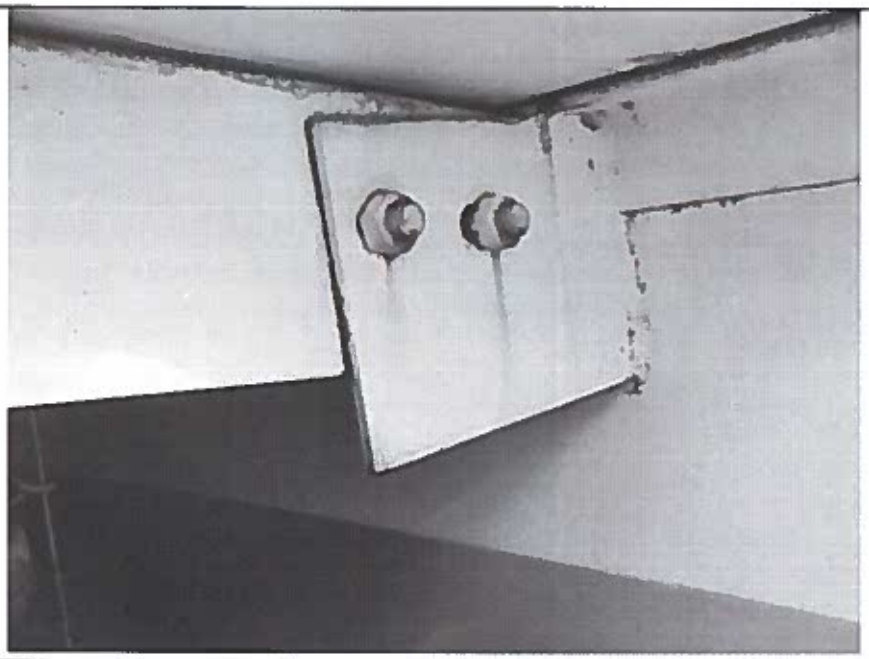
EXTERIOR	Fading and chalking on shell.

EXTERIOR	Roof - Exposed primer and bare steel.

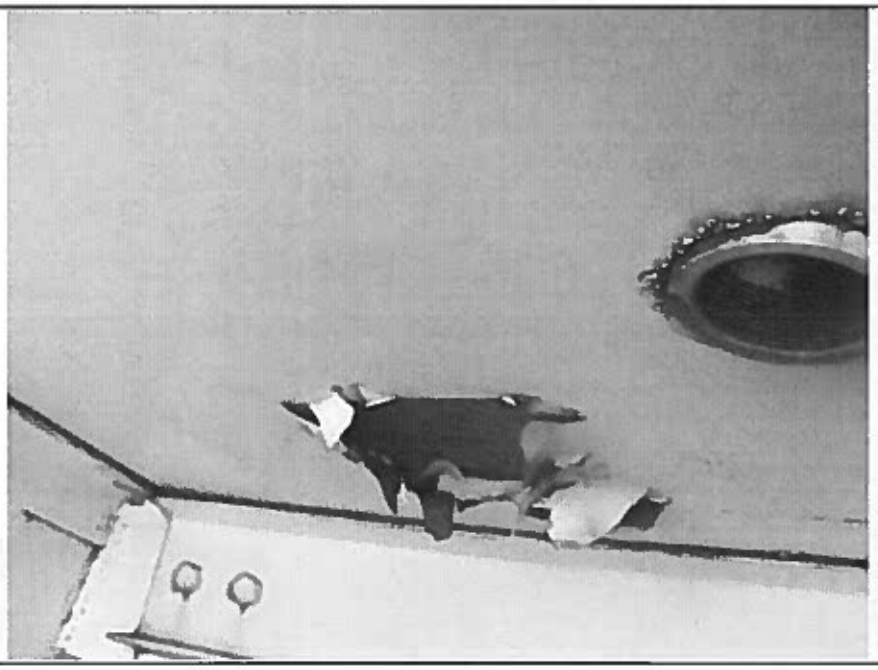
EXTERIOR	Roof - Exposed primer and bare steel.



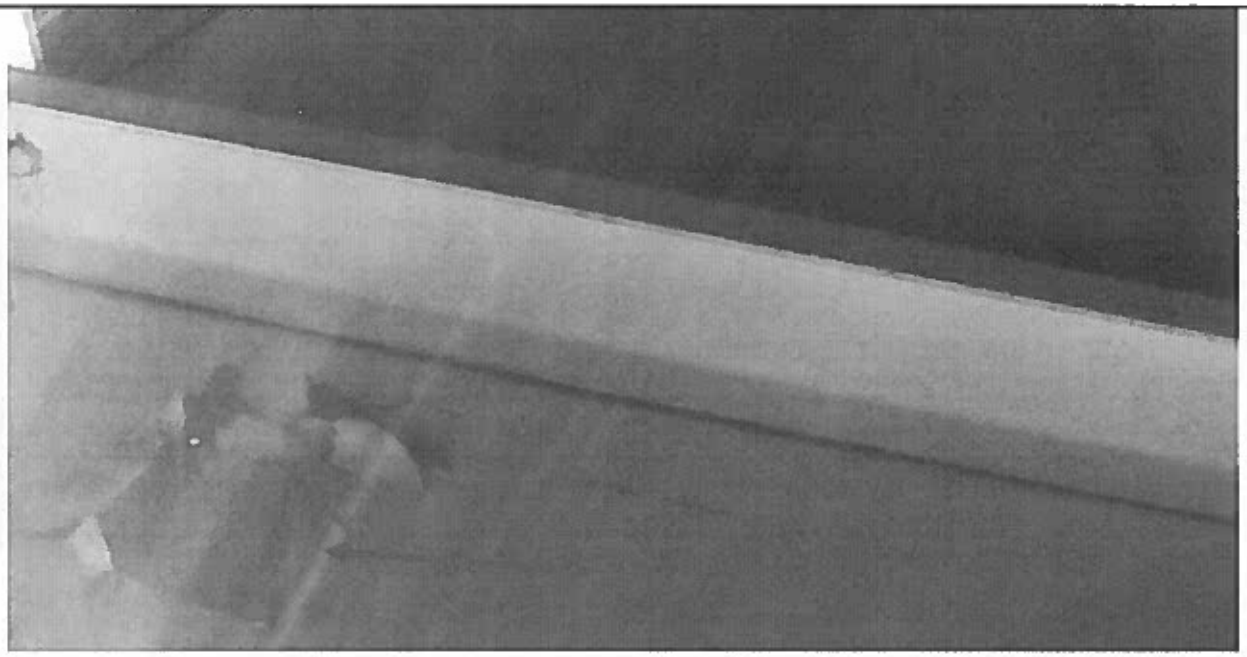
INTERIOR	Atmospheric zonen.



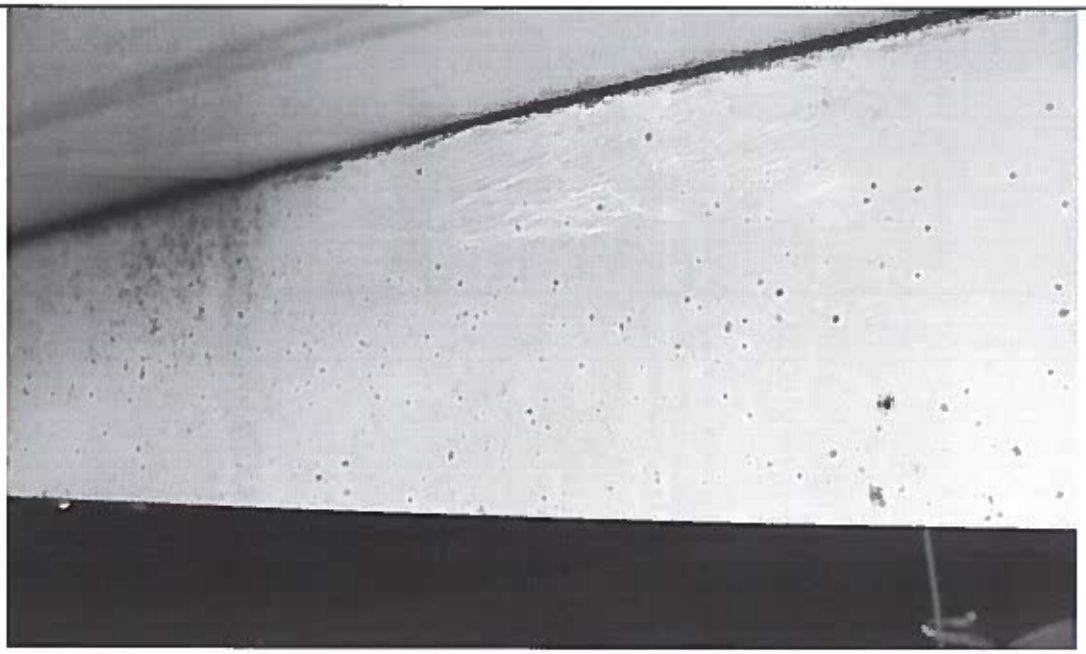
INTERIOR	Rusting around connection point.



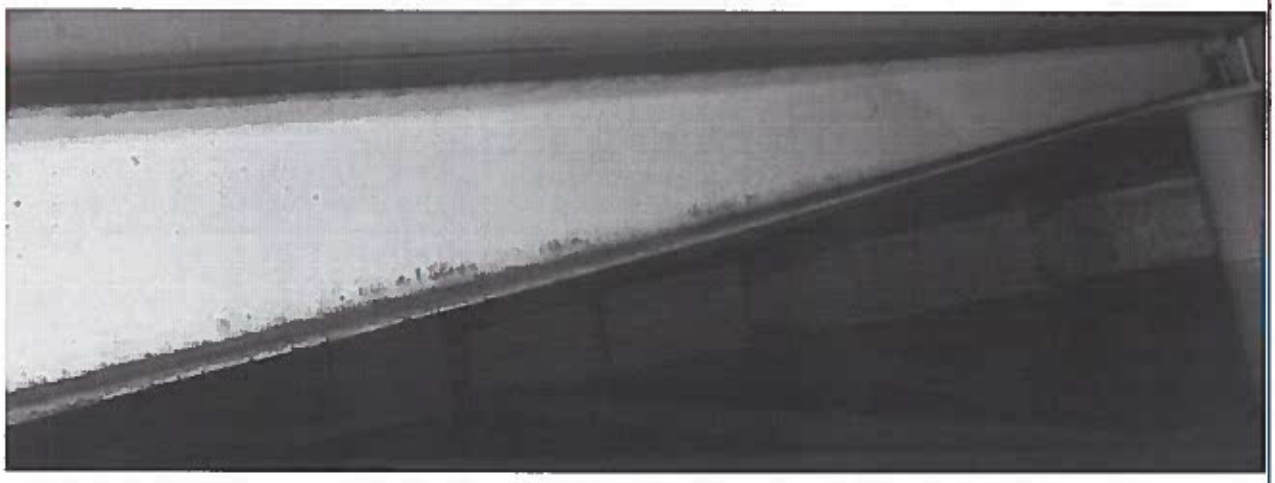
INTERIOR	Delamination of the roof coating.



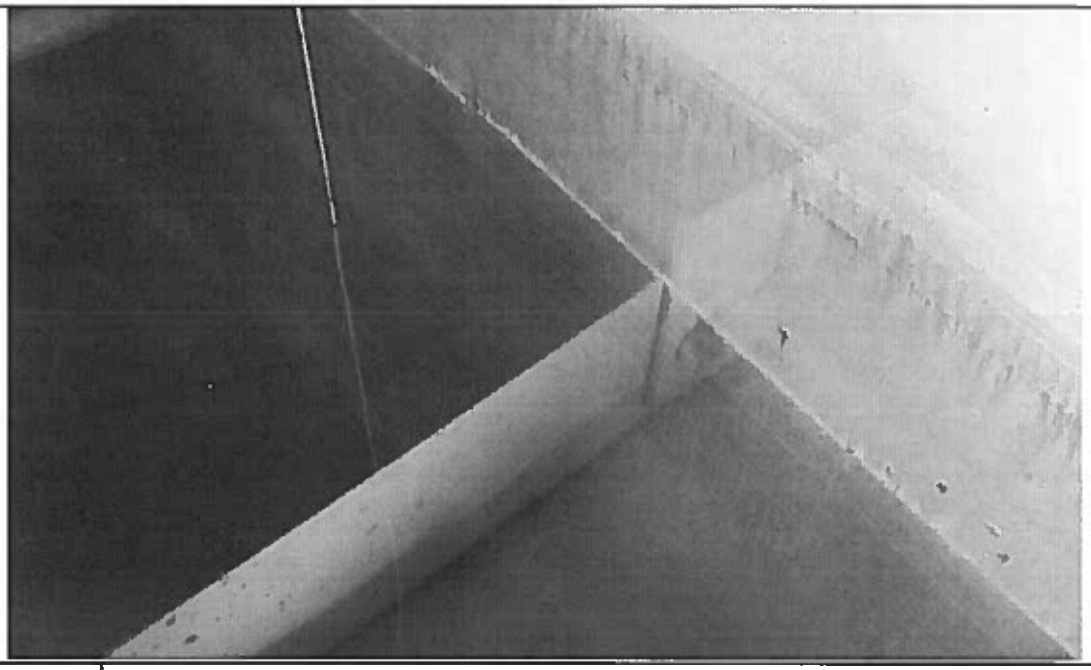
INTERIOR	Reflection of delamination of roof coating.



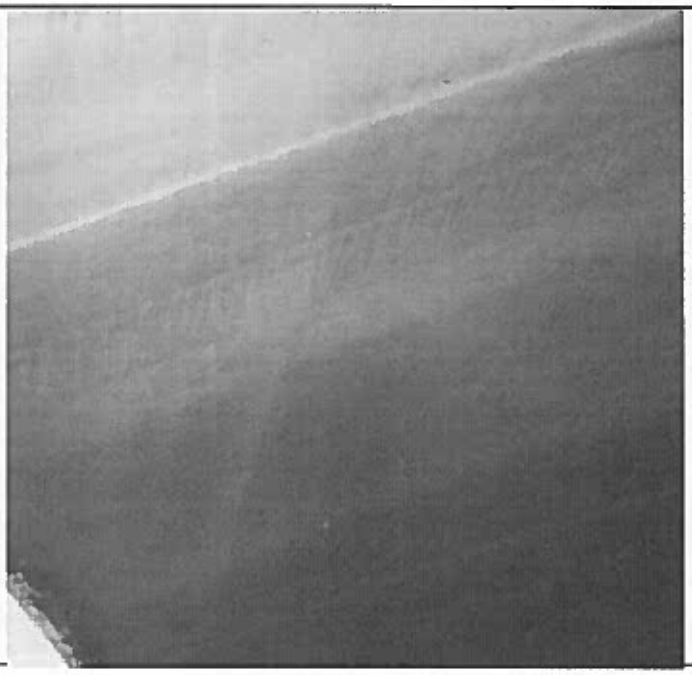
INTERIOR	Mass pinhole rusting.



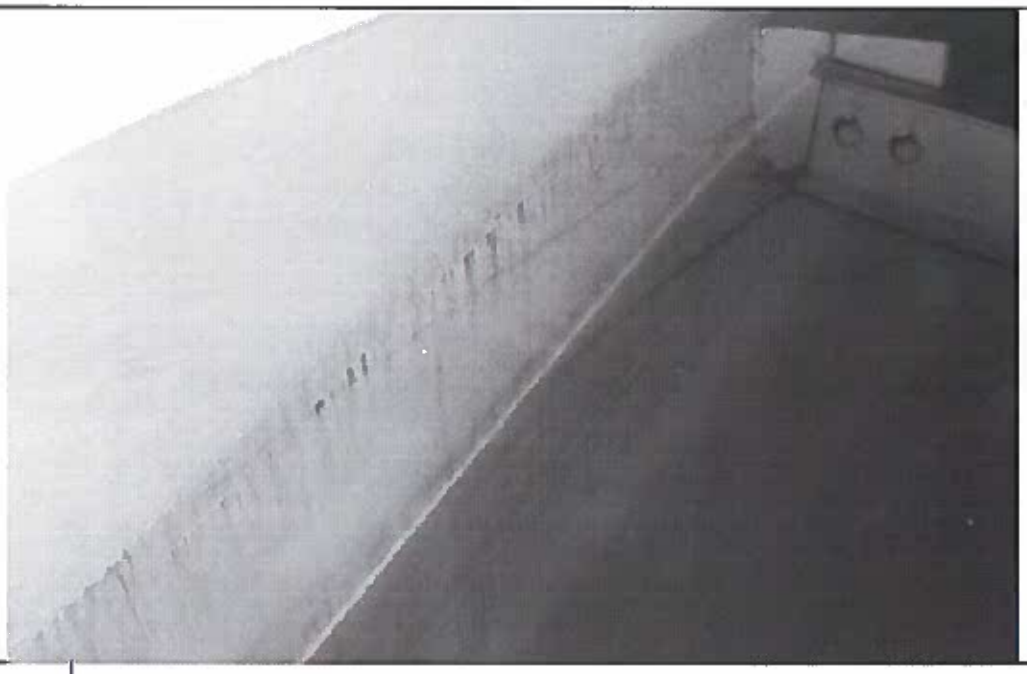
INTERIOR	Corrosion on the rafter lower lip.



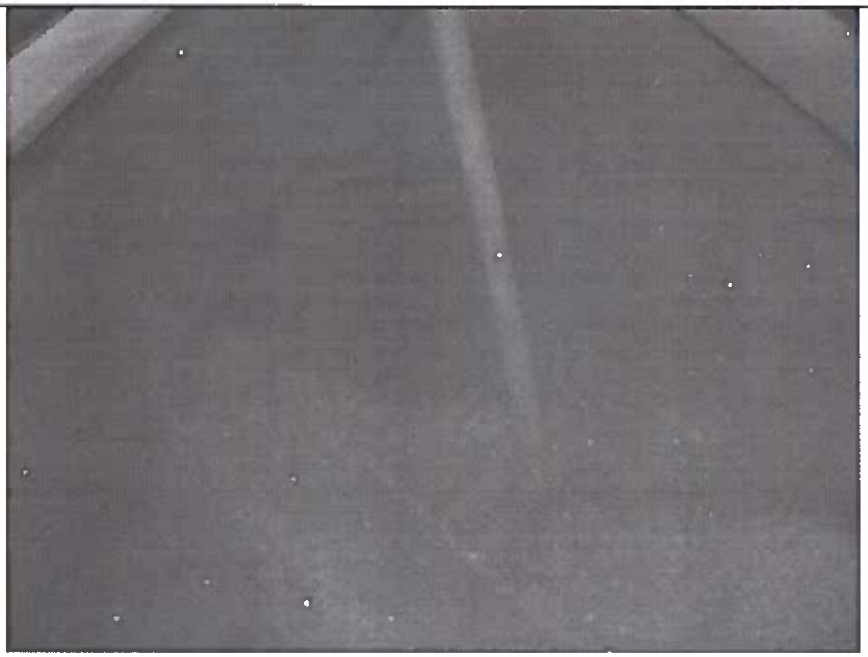
INTERIOR	Small rust sites at the fluctuating water line.



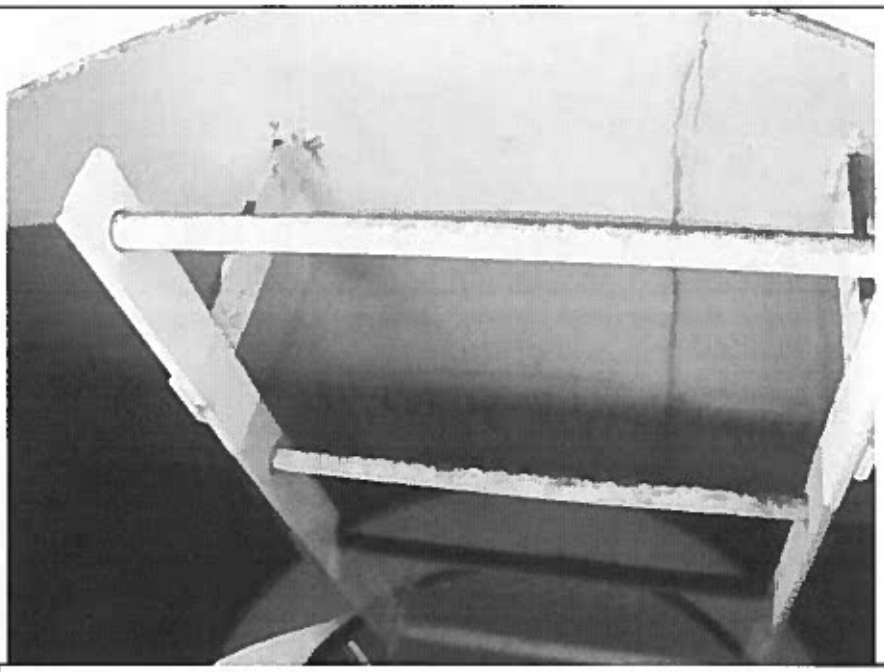
INTERIOR	Staining and buildup on sidewalls.



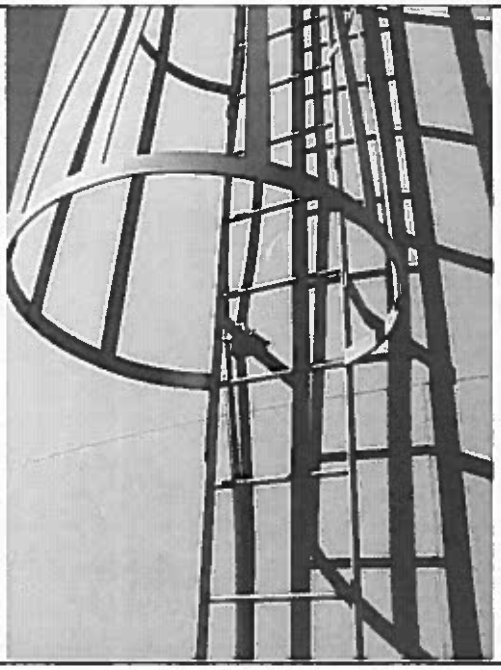
INTERIOR	Small rust sites at the fluctuating water line.



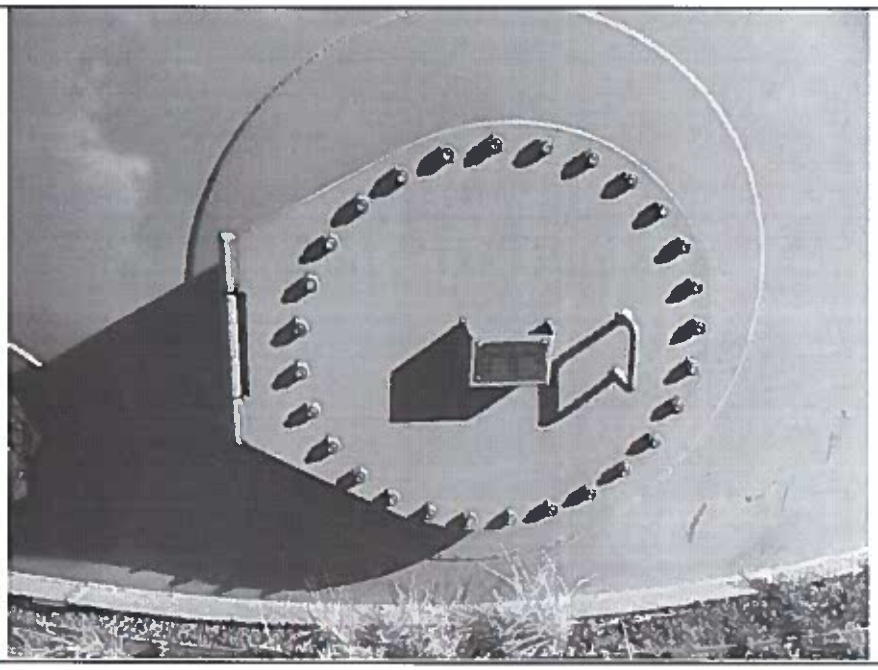
INTERIOR	Sediment on the tank floor.



Rusting on interior ladder.



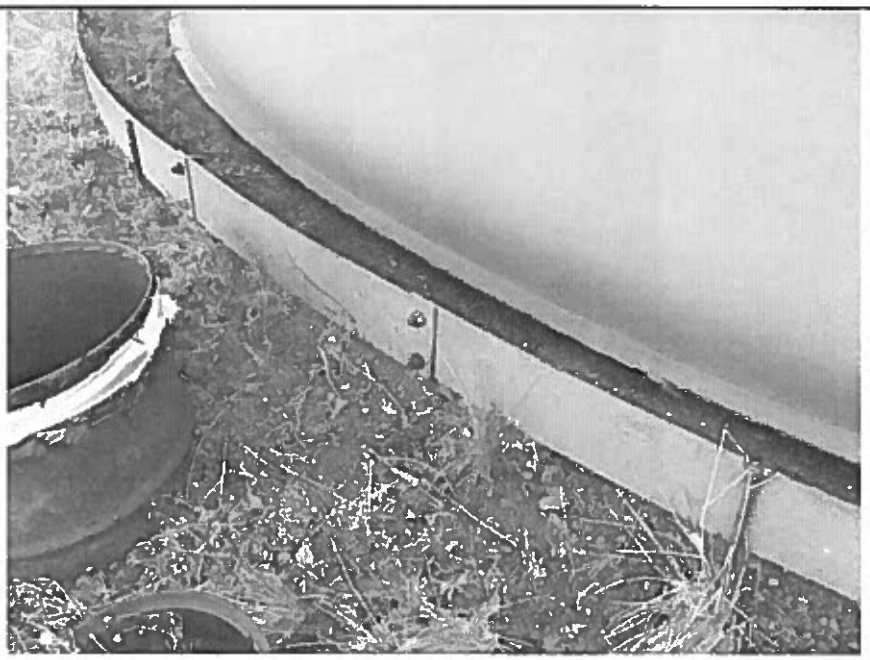
Access ladder.



Shell manway.

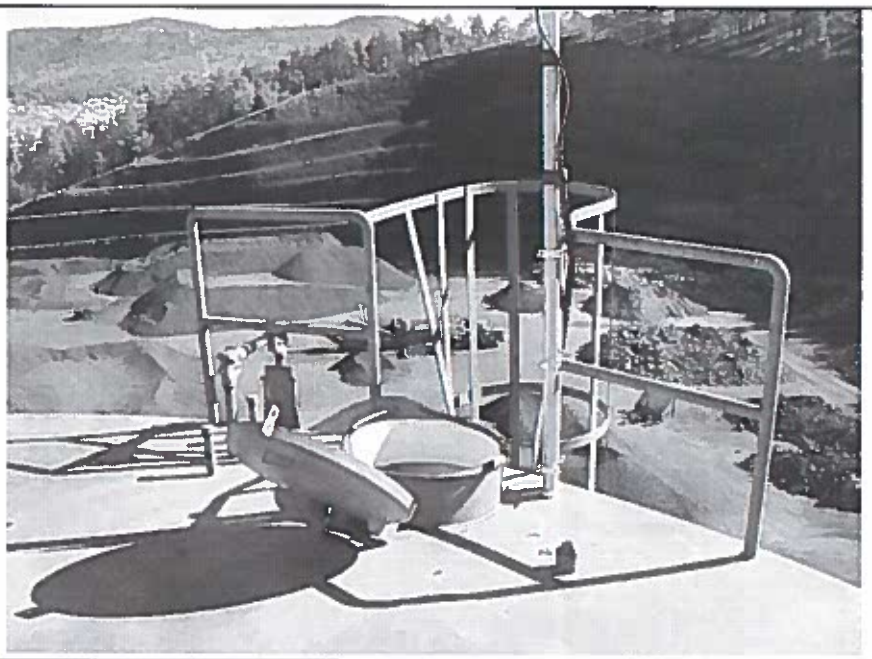
Liquid level indicator float

Foundation buried.

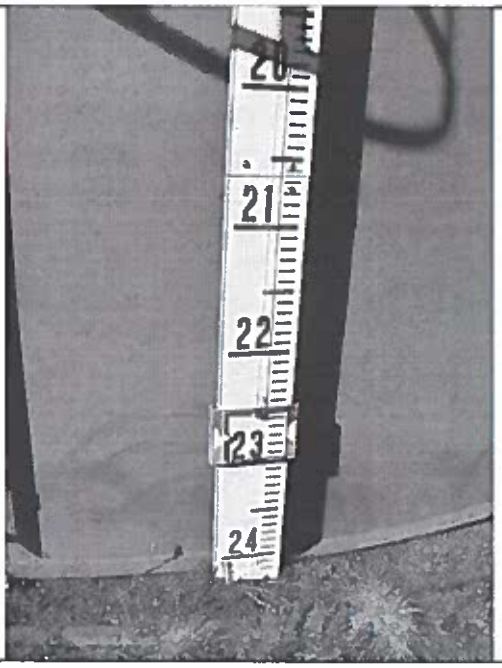


Steel Grade Band has lifted and gravel fill is spilling out.

Superior Tank Solutions



Roof access area and roof hatch.

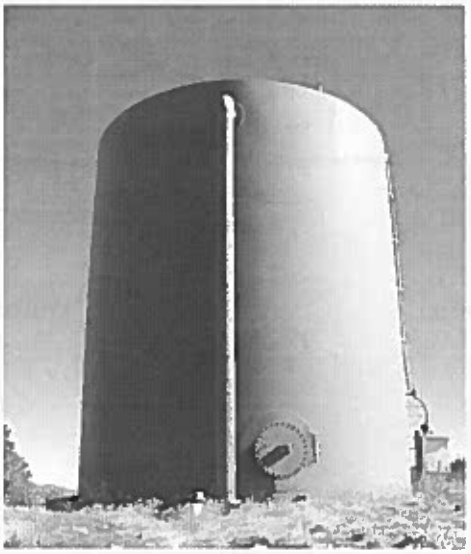


Liquid level indicator gauge board.

SUPERIOR TANK SOLUTIONS

Summary Assessment Report

City of Williams, AZ



CLOVERHILL TANK – 75,000 GALLONS

Date: November 18, 2014

Matt Tasch
(480) 390-0487
MTasch@superiortanksolutions.com

SUMMARY ASSESSMENT REPORT

CITY OF WILLIAMS, AZ

ASSESSMENT INTRODUCTION

Superior Tank Solutions, Inc. conducted a visual assessment at the customer's request. The purpose of the assessment was to determine the condition of the ***interior and exterior coating systems*** along with the extent of corrosion and the severity of degradation. The tank ***structure*** was evaluated in reference to the original "as built" design criteria and the applicable AWWA D.100 construction standard. Regulatory compliancy assessments were conducted in accordance with ***sanitary*** (Arizona Department of Environmental Quality), ***safety*** requirements (Federal OSHA 29 CFR 1910 & 1926 and ADOSH) and ***security*** guidelines (US Dept of Homeland Security & AWWA Security Recommendations).

TANK INFORMATION	
Inspection Date	November 18, 2014
Tank Location	Williams, AZ
Year Built	1989
Tank Size (gallons)	75,000
Dimensions (feet)	23'D x 24'H
Design Standard	AWWA D 100 and D 102
Tank Style	Standpipe

COATINGS, DEFICIENCIES, AND CONCERNS

IMPORTANT COMMENTS

- **Lead could be present in the exterior primer.**
- **The Cathodic Protection is not functioning as intended.**

EXTERIOR COATINGS

The exterior coating is in fair to poor condition. The coatings are failing uniformly from natural deterioration and exposure. The top coat is heavily chalking and faded. There are numerous sites of abrasion and minor rusting. The prime coat is showing though on the roof. The high likelihood of lead present in the exterior primer further impacts the need to encapsulate the exterior immediately.

INTERIOR COATINGS

The interior coatings have failed. The coatings at and above the fluctuating water line are covered in pinholes and delaminating, rusting and corrosion are present in these locations. Mass blistering below the water line is likely. However, due to the poor visibility, the tank being completely full, and heavy staining the lower areas of the tank assessment was limited. It was observed that only a minor dusting of sediment is present on the floor.

SAFETY, SECURITY, AND STRUCTURAL DEFICIENCIES

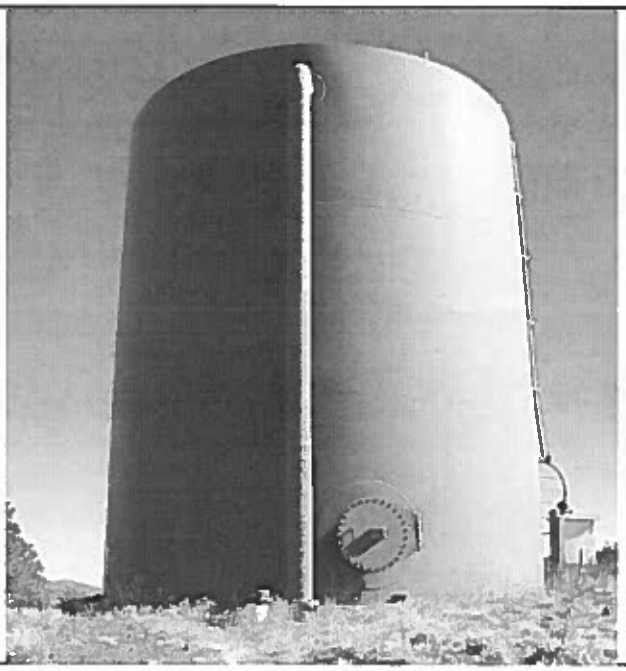
- The access ladder cage should have expanded metal installed around the base to prevent the cage from being used as a ladder.
- The roof has a very large number of penetrations for CP hand holds. These penetrations are currently not compliant and represent a sanitary risk. It is strongly recommended to either upgrade the penetrations to meet compliance or remove the CP then seal the holes.
- The cathodic protection system is not functioning properly and should be repaired, removed or replaced.
- It is recommended to install a second shell manway to facilitate confined space requirements.

CONCERNS AND WATER QUALITY

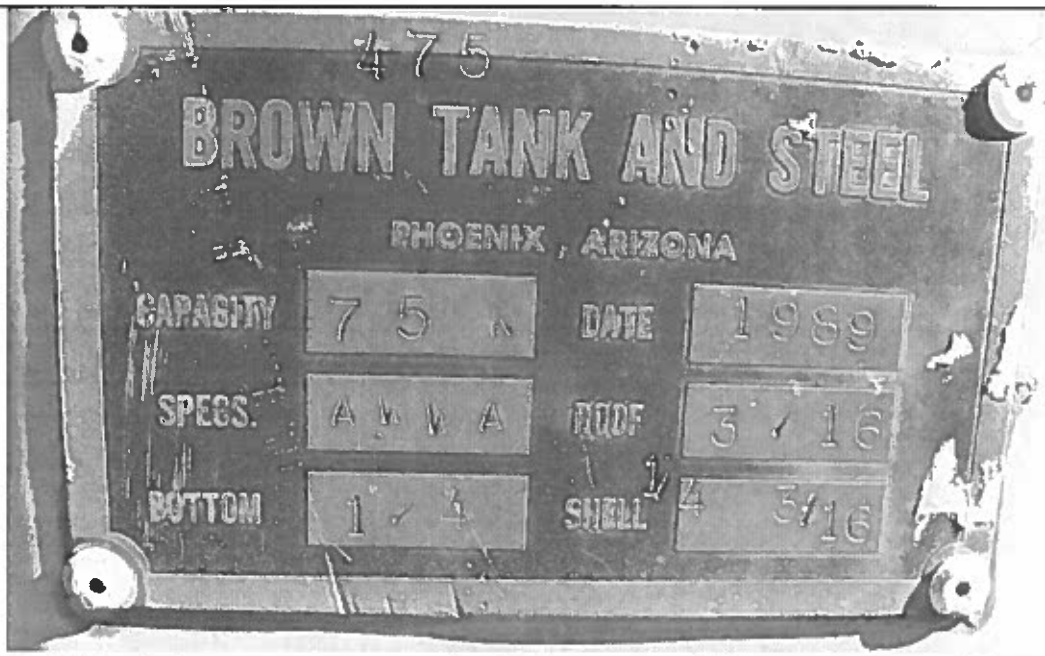
- Water Quality is a concern in this tank. The presence of bio-film and apparent stagnation are evident in this tank. This can be observed by the buildup on the shell at the fluctuating water line and through the presence of debris on the surface of the water. The tank is most likely short circuiting resulting in thermal stratification. This allows the water to stagnate and biofilm to develop in the boundary areas.

RECOMMENDATIONS

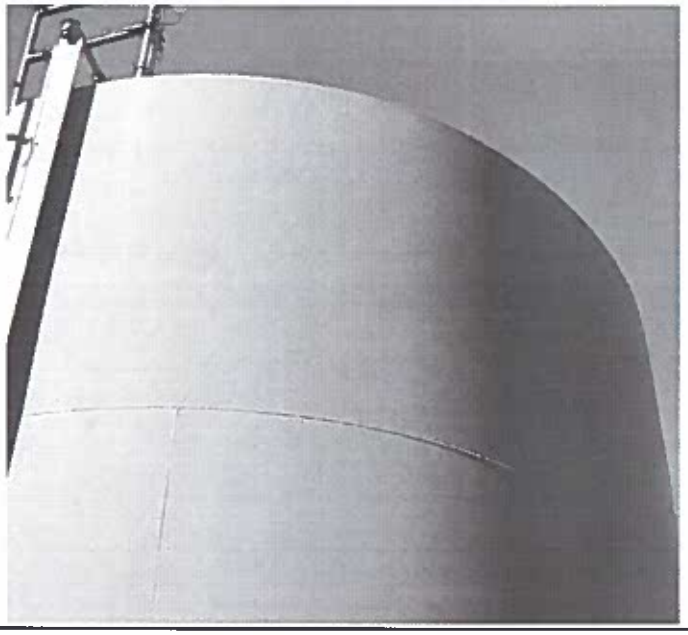
- All exterior surfaces require a high pressure wash, spot prep and prime, and a 2 coat overcoat of a compliant coatings system.
- All interior surfaces require renovation by means of an SSPC-SP 10 blast and application of a compliant NSF coating system.
- To prevent unauthorized access on the tank expanded metal should be installed around the lower section of the exterior ladder cage.
- The Cathodic Protection roof entry points should be raised off the roof 4" with a locking cap or sealed with steel plates.
- The cathodic protection system should be repaired, removed, or replaced.
- Install a second shell manway.
- It is strongly recommended that an active mixing be installed in the tank to improve water quality.



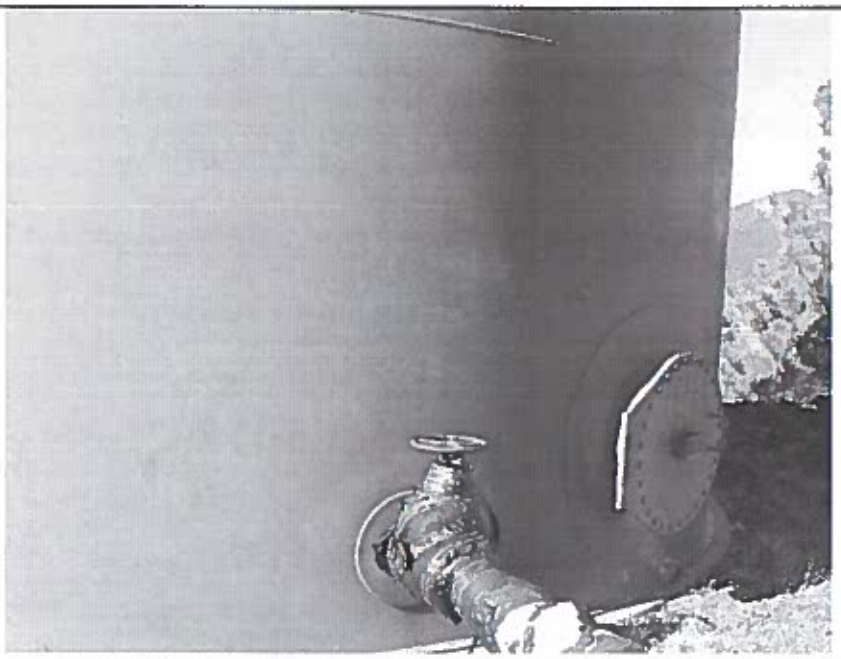
EXTERIOR	Fading and chalking on sidewall.



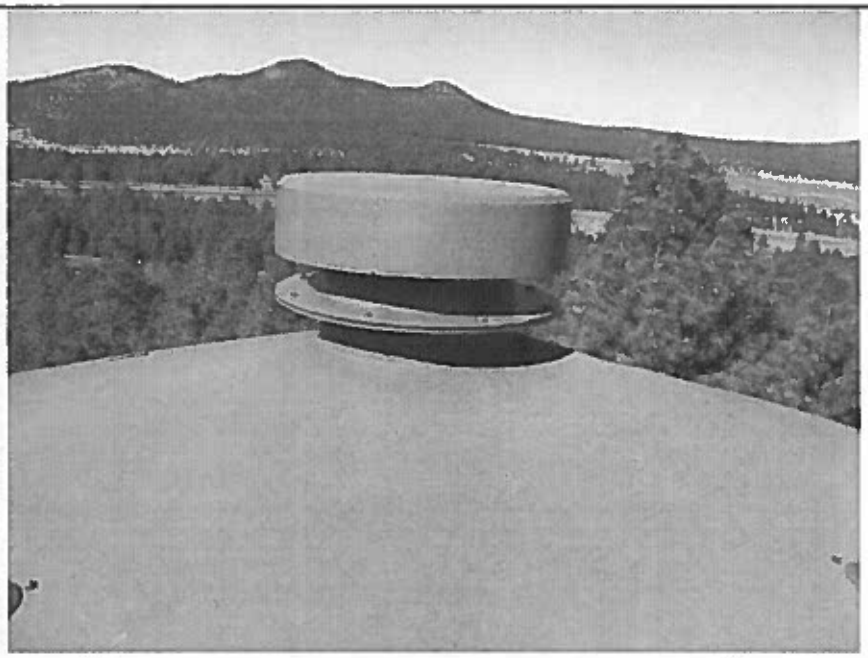
EXTERIOR	Name plate.



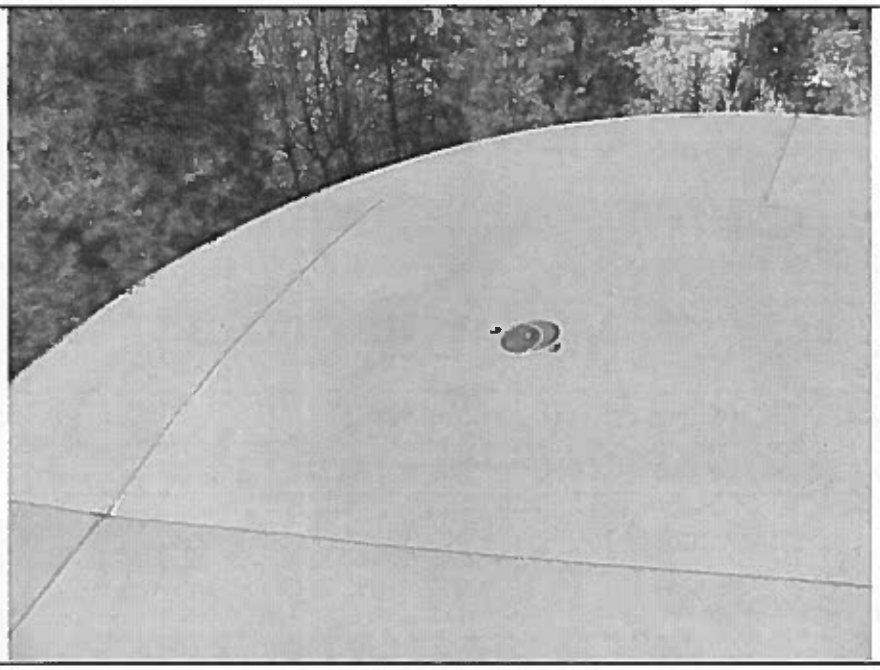
EXTERIOR	Top coat fading, showing painters rings.



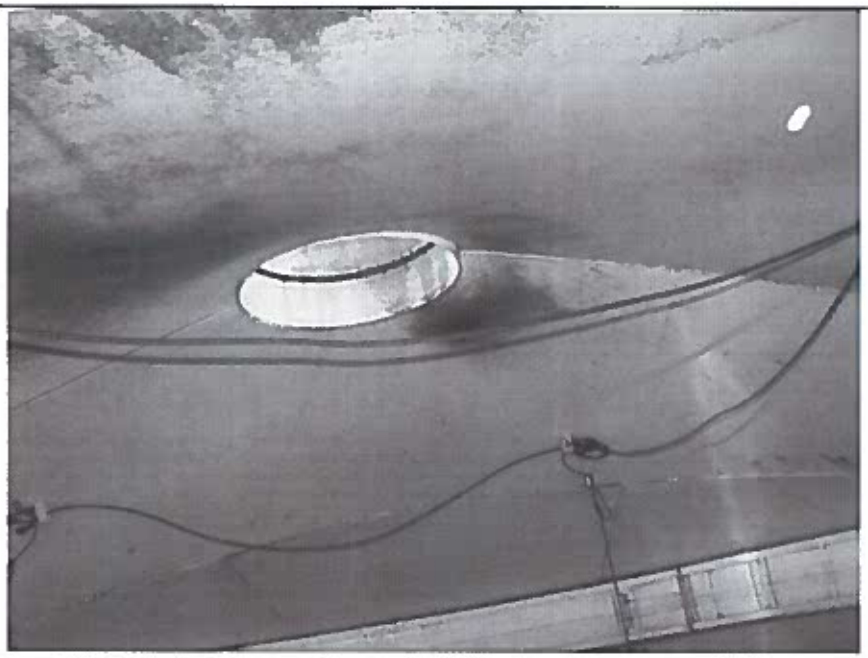
EXTERIOR	Dissimilar coating around the roof vent, coating deterioration.



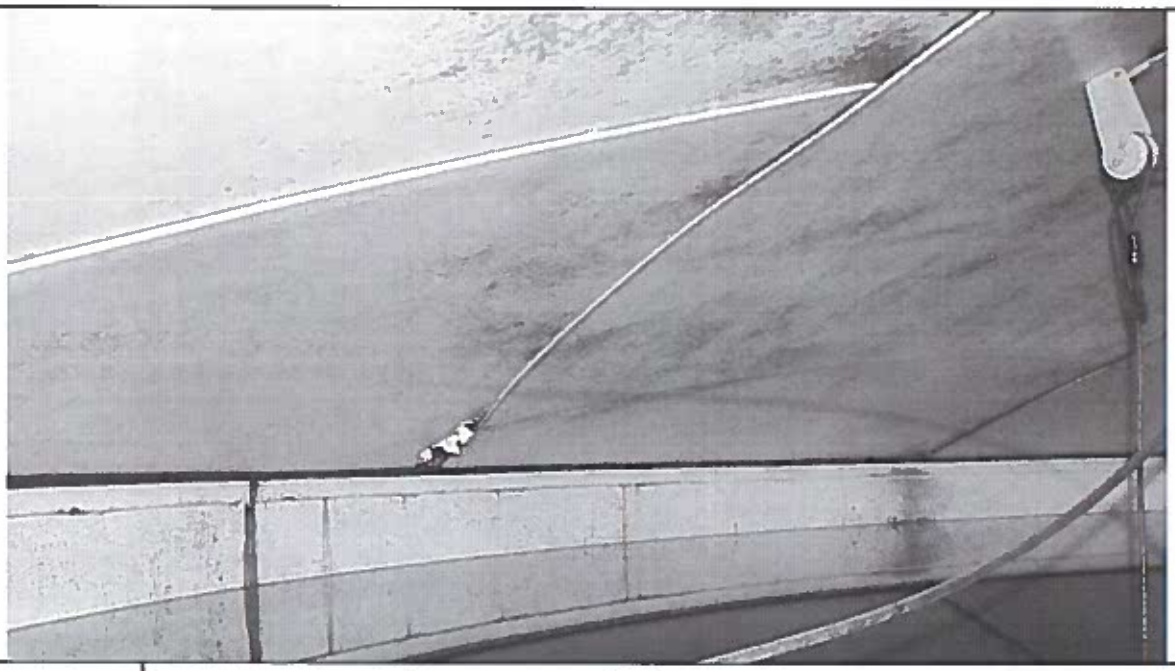
EXTERIOR	Roof and vent.



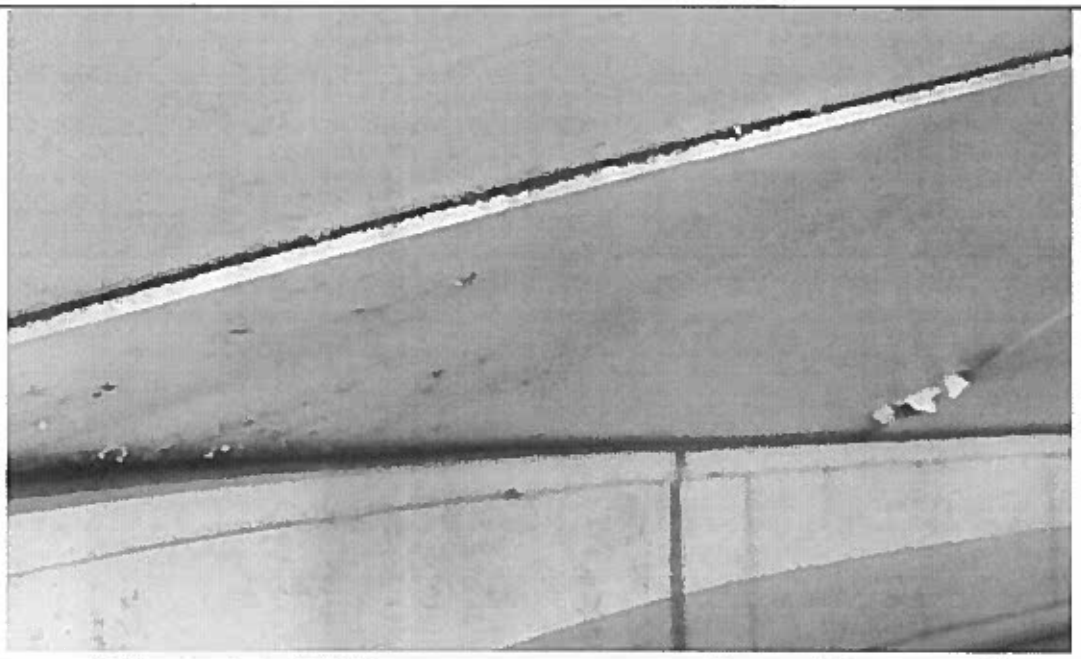
EXTERIOR	Primer exposed on the roof.



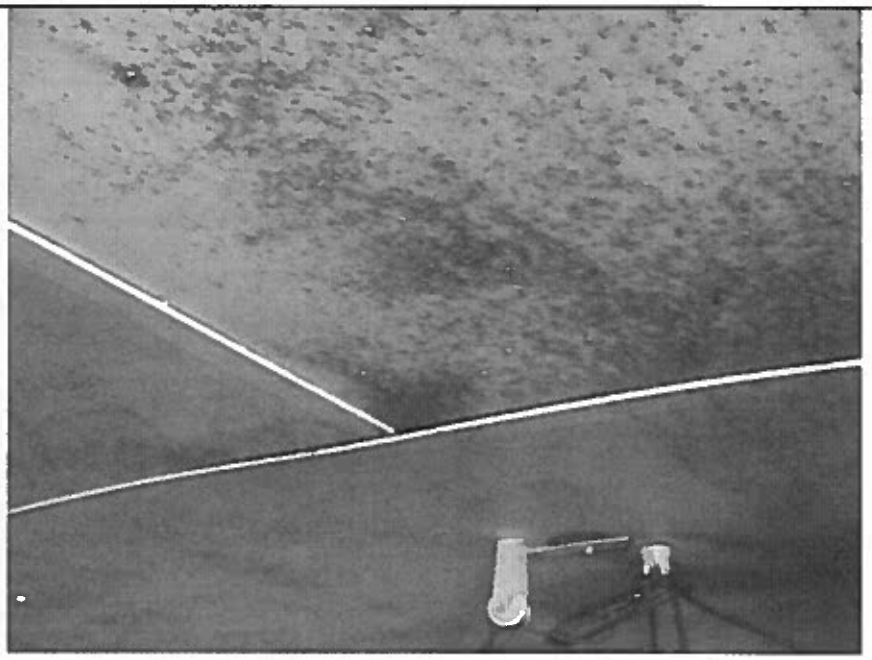
INTERIOR	Mass rusting on the roof.



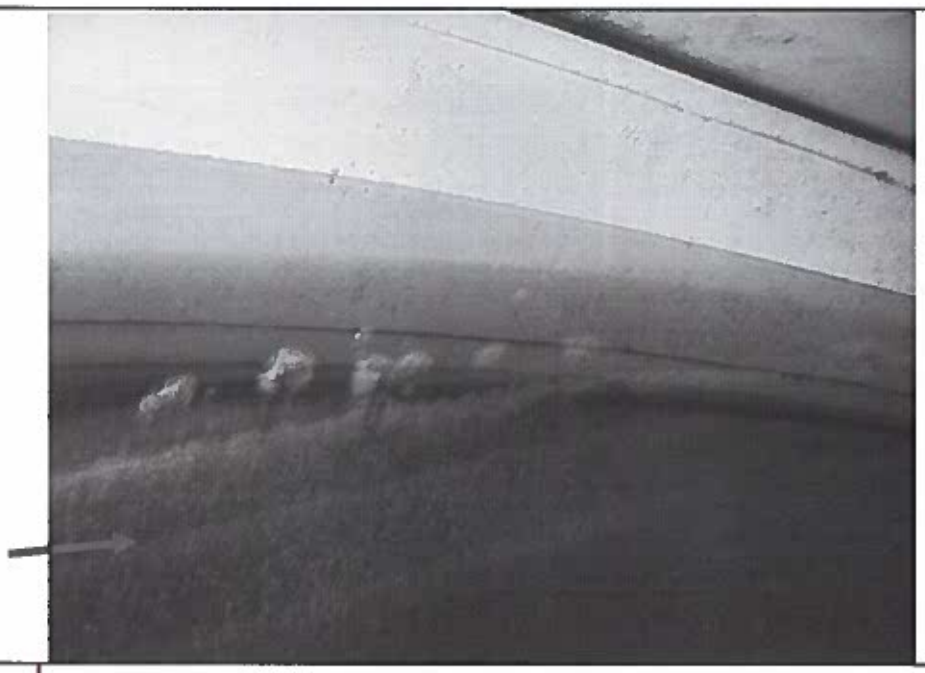
INTERIOR	Mass rusting and isolated delamination in the atmospheric zone.



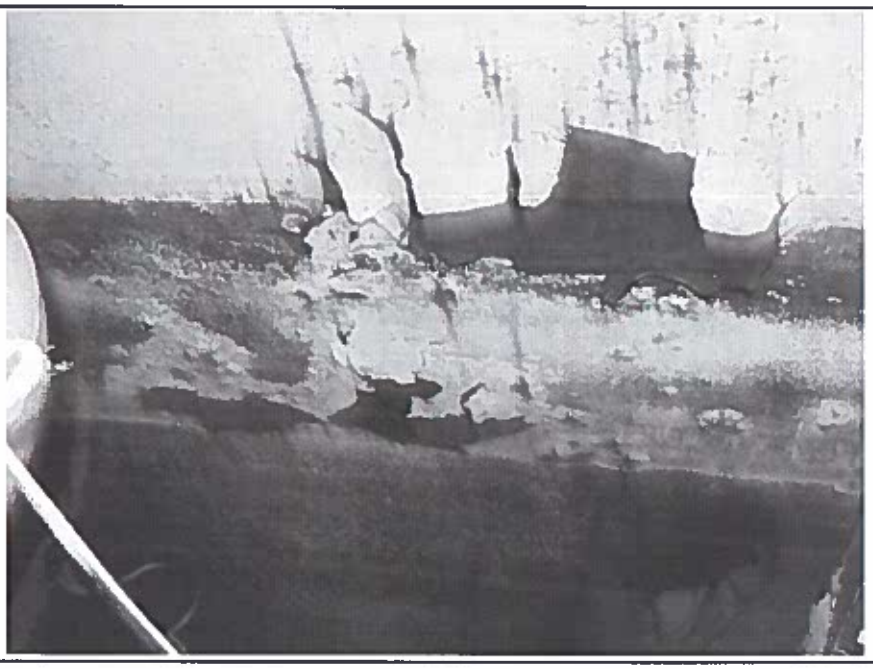
INTERIOR	Rusting and flaking.



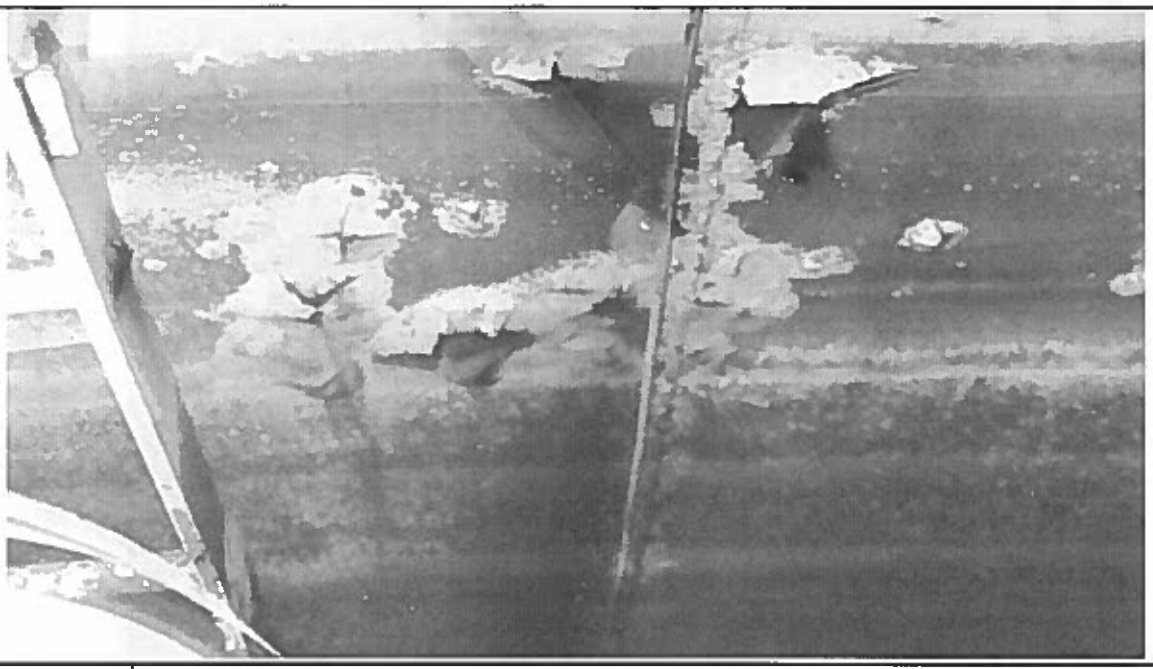
INTERIOR	Large coating flake removed from the roof above the dollar plate.



INTERIOR	Large blisters and below them mass small blistering.

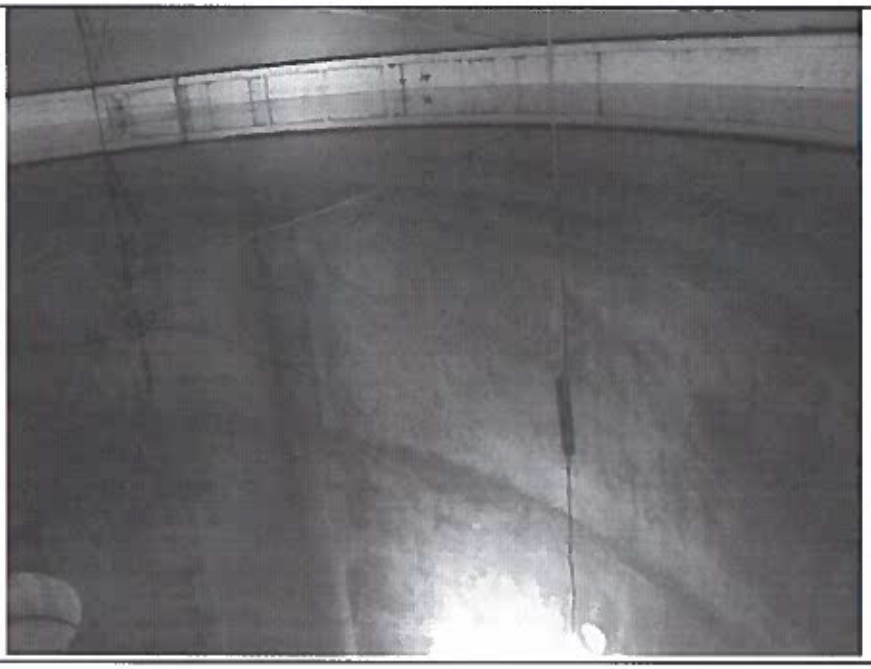


INTERIOR	Coating delaminating off the shell.



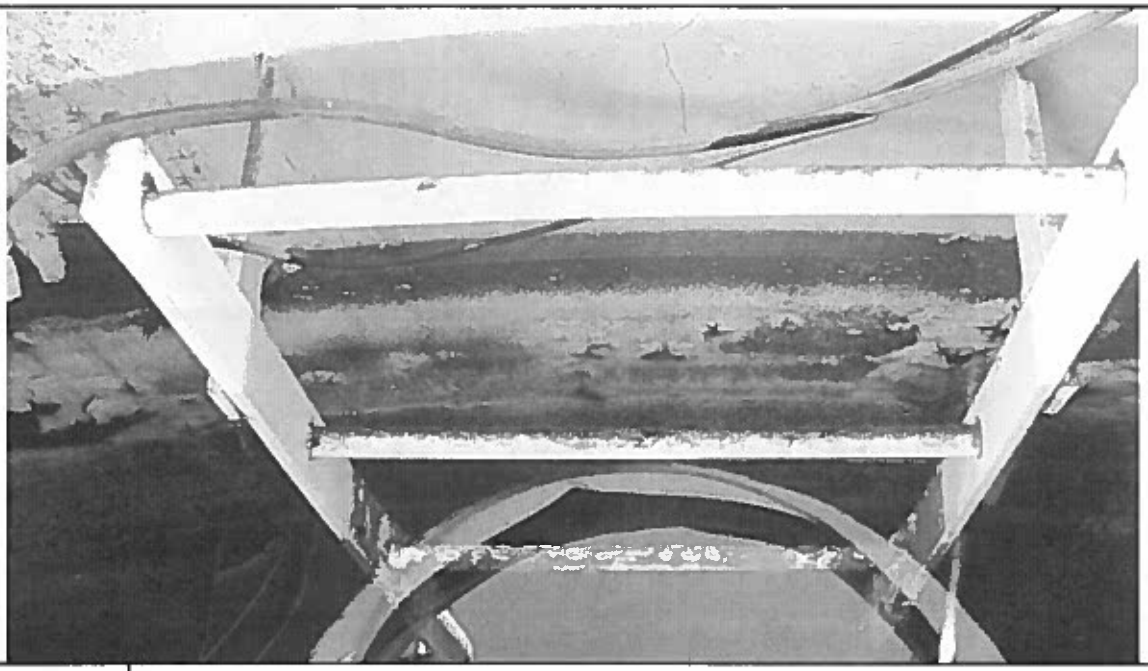
INTERIOR	Large blisters cracked and flaking. Mass small blistering below.

INTERIOR	Coating delaminating off the shell.

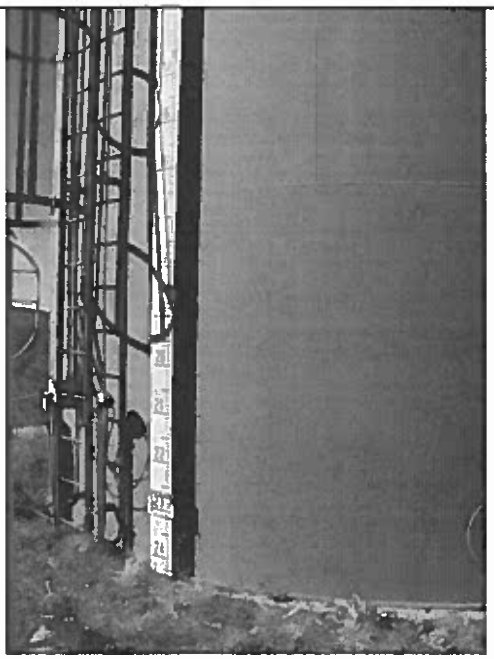


INTERIOR	Heavy staining below the water line.

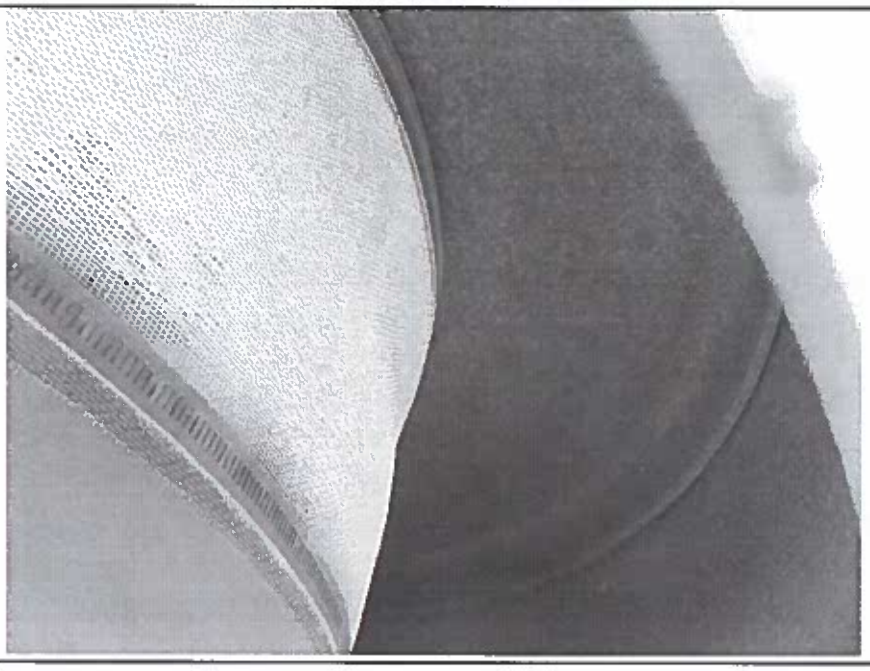
INTERIOR	Tank floor and debris floating on the water surface.



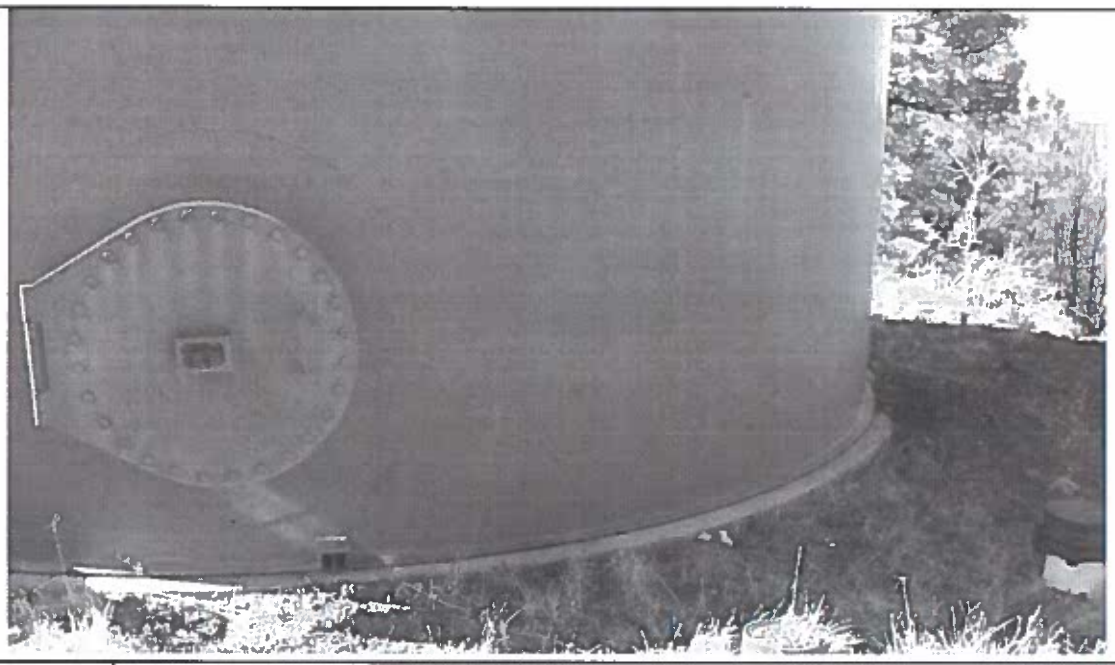
Interior ladder.



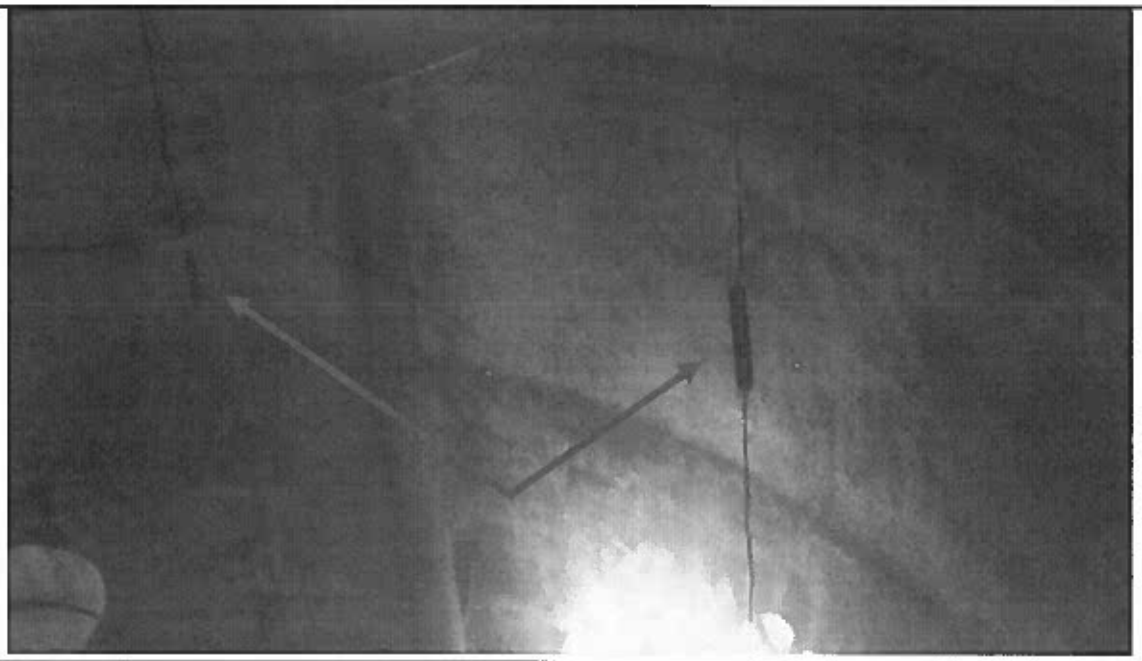
Access ladder and liquid level indicator gauge board.



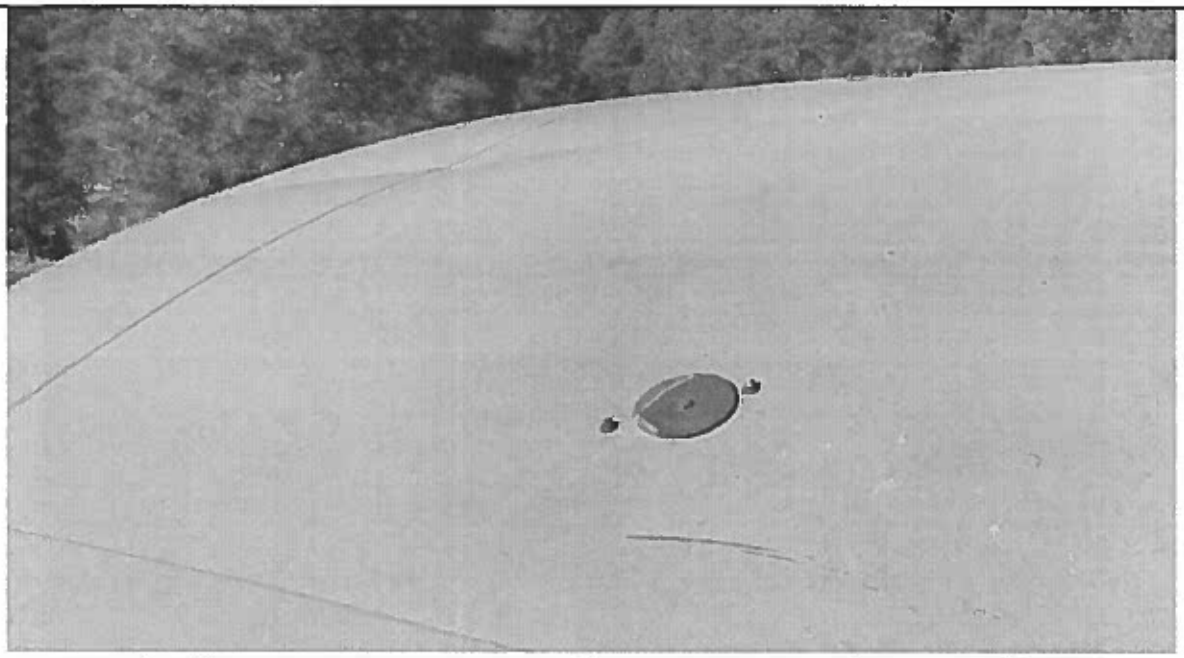
Roof Vent



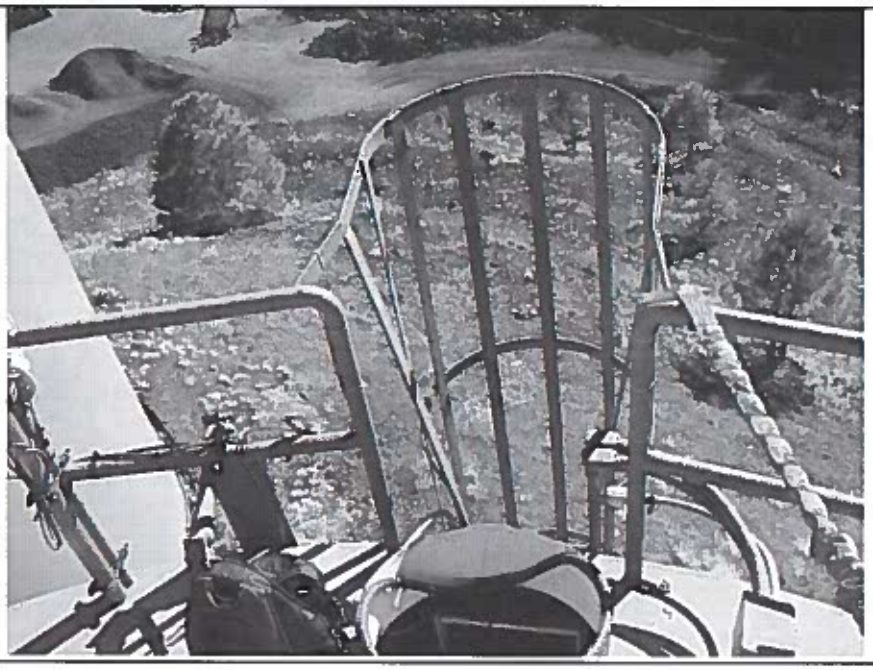
Concrete foundation and shell manway.



Cathodic protection anodes.



Cathodic protection handhold.



Roof access and roof hatch.

Liquid level indicator float.

SUPERIOR TANK SOLUTIONS

Summary Assessment Report

City of Williams, AZ

1MG TANK – 1,000,000 GALLONS

Date: November 18, 2014

Matt Tasch
(480) 390-0487
MTasch@superiortanksolutions.com

SUMMARY ASSESSMENT REPORT

CITY OF WILLIAMS, AZ

ASSESSMENT INTRODUCTION

Superior Tank Solutions, Inc. conducted a visual assessment at the customer's request. The purpose of the assessment was to determine the condition of the ***interior and exterior coating systems*** along with the extent of corrosion and the severity of degradation. The tank ***structure*** was evaluated in reference to the original "as built" design criteria and the applicable AWWA D.100 construction standard. Regulatory compliancy assessments were conducted in accordance with ***sanitary*** (Arizona Department of Environmental Quality), ***safety*** requirements (Federal OSHA 29 CFR 1910 & 1926 and ADOSH) and ***security*** guidelines (US Dept of Homeland Security & AWWA Security Recommendations).

TANK INFORMATION	
Inspection Date	November 18, 2014
Tank Location	Williams, AZ
Year Built	1994
Tank Size (gallons)	1,000,000
Dimensions (feet)	74'D x 32'H
Design Standard	AWWA D 100 and D 102
Tank Style	Ground Storage Tank

COATINGS, DEFICIENCIES, AND CONCERNS

IMPORTANT COMMENTS

- **N/A**

EXTERIOR COATINGS

The exterior coating is in fair condition. The coatings are fading and chalking due to exposure. The top coat on the roof is deteriorating quickly resulting in prime coat exposure. There are several low areas at the roof edge where water is pooling and causing accelerated coating failure. Rusting and flaking are present in these low spots.

INTERIOR COATINGS

The interior coatings are starting to fail. There is a large amount of rust bleed from the vapor areas coating the rafters and sidewalls. Rusting and corrosion were observed on the rafters lower lips, on roof plate edges, and at connection points. Only isolated pinhole rust sites were noted below the high water line. Sediment covered the tank floor.

SAFETY, SECURITY, AND STRUCTURAL DEFICIENCIES

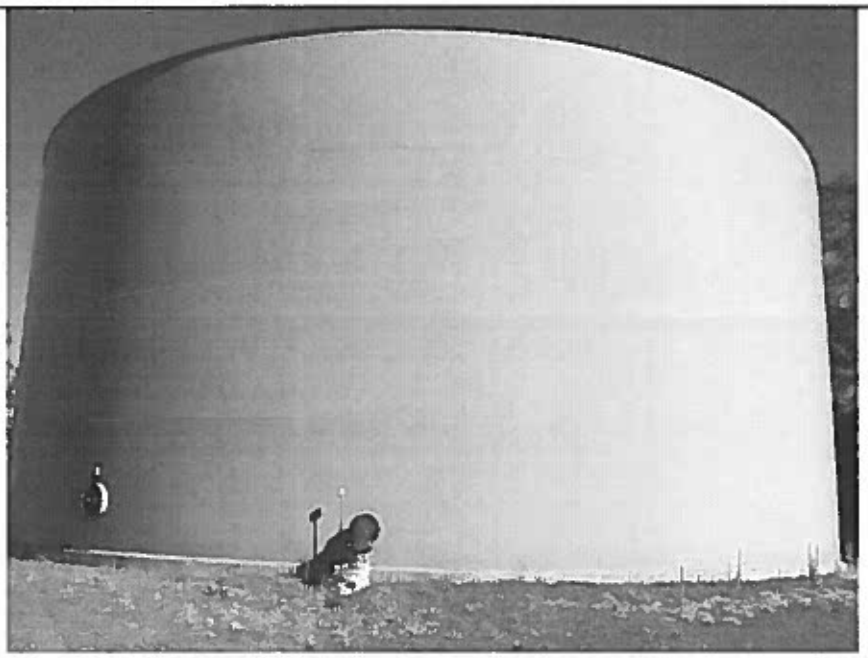
- The roof vent requires a compliant screen to prevent insects from entering the tank.
- The access ladder cage should have expanded metal installed around the base to prevent the cage from being used as a ladder.
- The access ladder ladder gate should be replaced with a swing style gate for ease of use.

CONCERNS AND WATER QUALITY

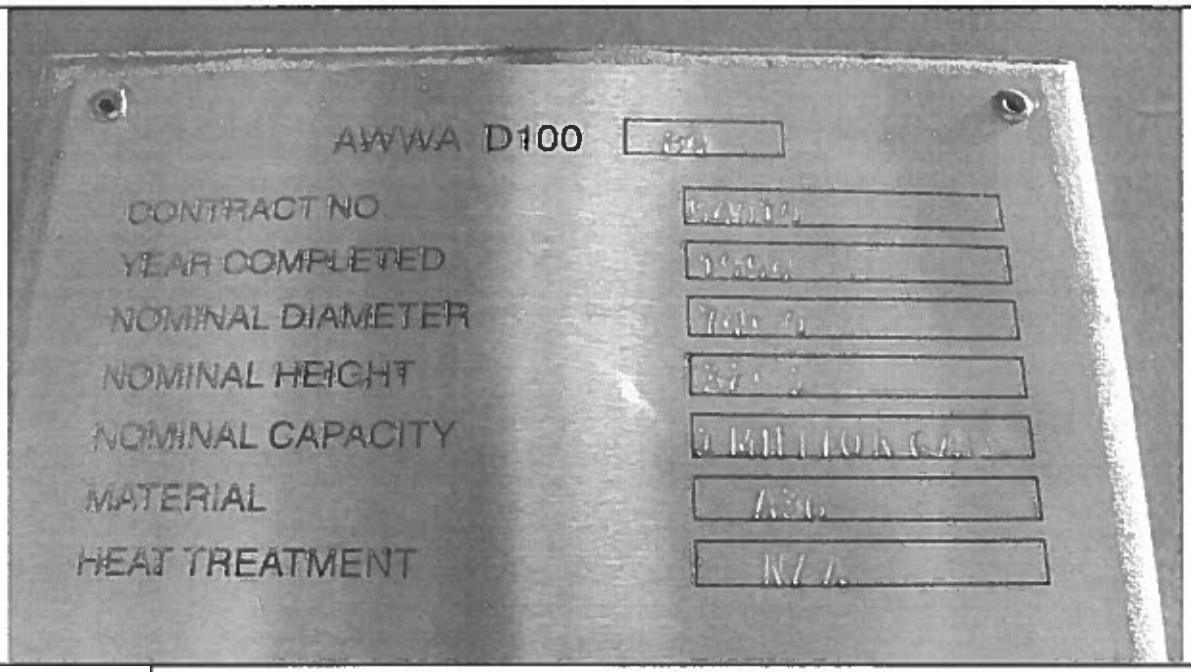
- Water Quality is a concern in this tank. The presence of bio-film and apparent stagnation are evident in this tank. This can be observed by the buildup on the shell at the fluctuating water line and through the presence of debris on the surface of the water. The tank is most likely short circuiting resulting in thermal stratification. This allows the water to stagnate and biofilm to develop in the boundary areas.

RECOMMENDATIONS

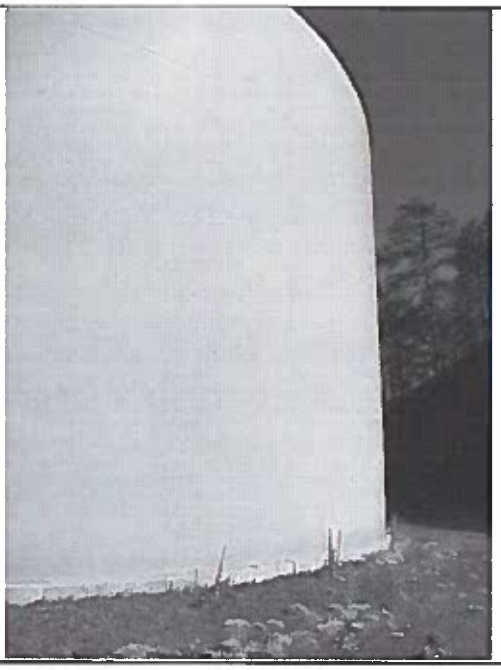
- All exterior surfaces require a high pressure wash, spot prep and prime, and a 2 coat overcoat of a compliant coatings system.
- All interior surfaces require renovation by means of an SSPC-SP 10 blast and application of a compliant NSF coating system.
- The vent should have a compliant screen installed
- To prevent unauthorized access on the tank expanded metal should be installed around the lower section of the exterior ladder cage.
- The ladder gate should be replaced with a swing style gate.
- It is strongly recommended that an active mixing be installed in the tank to improve water quality.



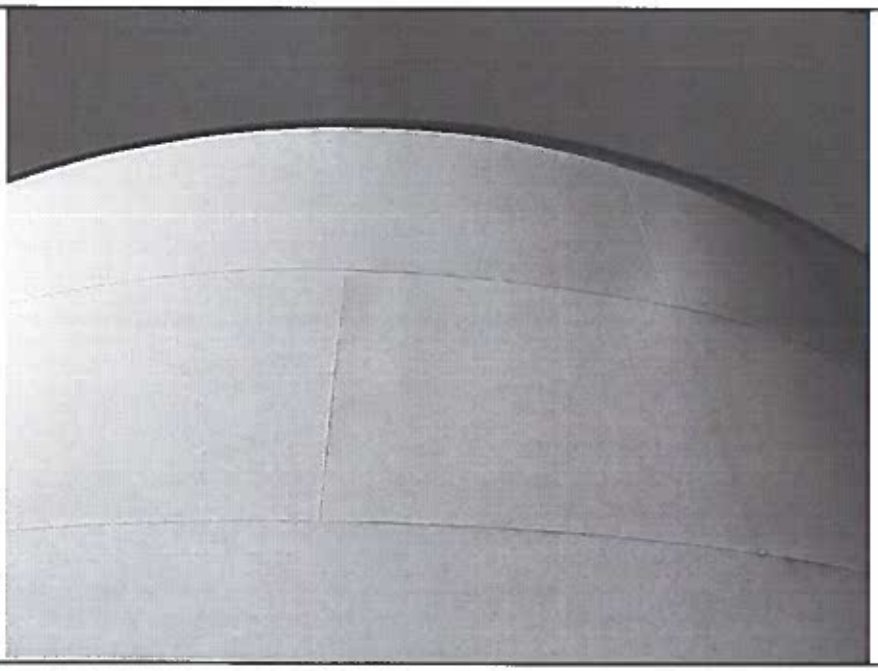
EXTERIOR	Fading and chalking on sidewall.



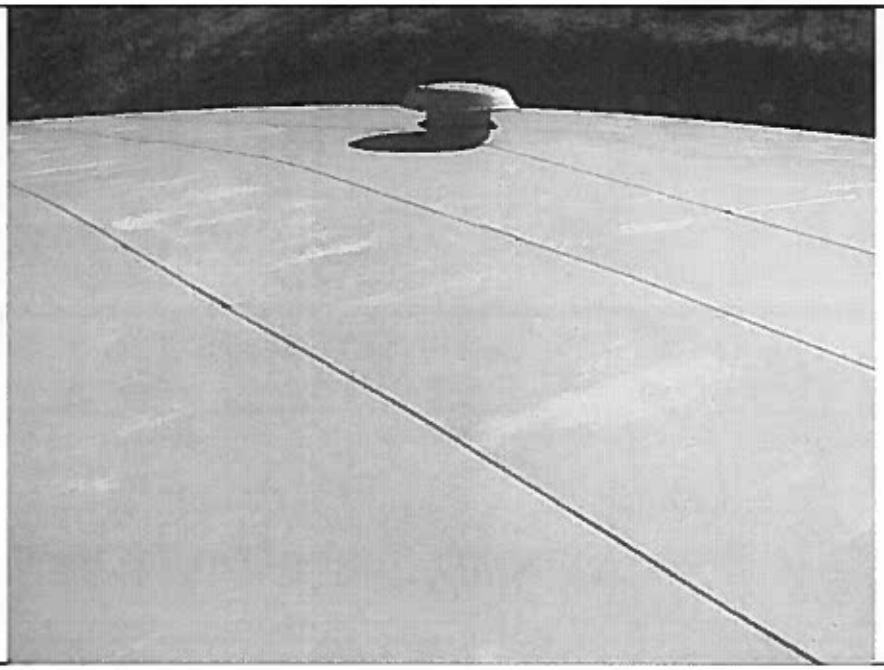
EXTERIOR	Name plate.



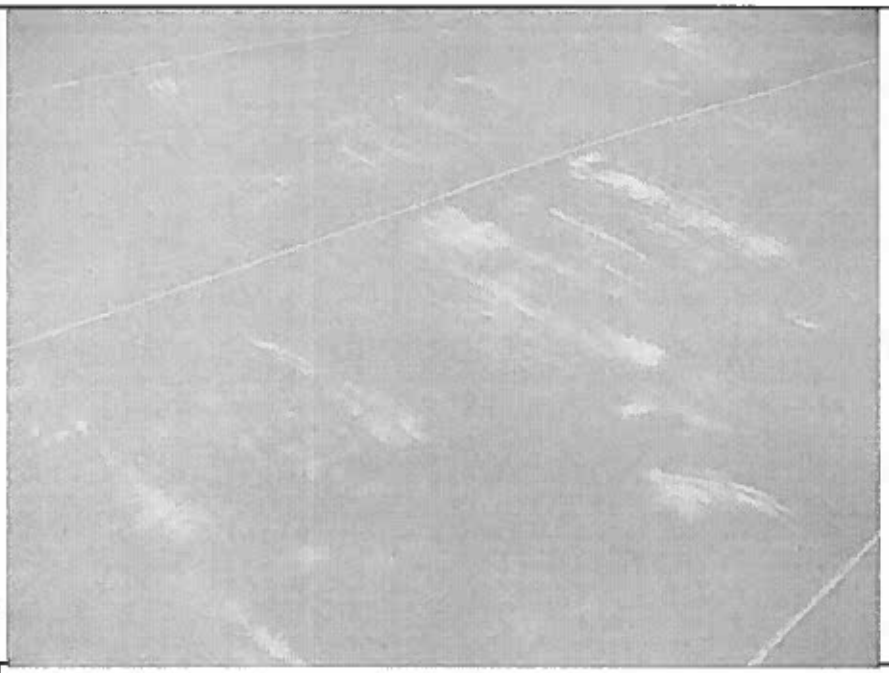
EXTERIOR	Top coat fading.



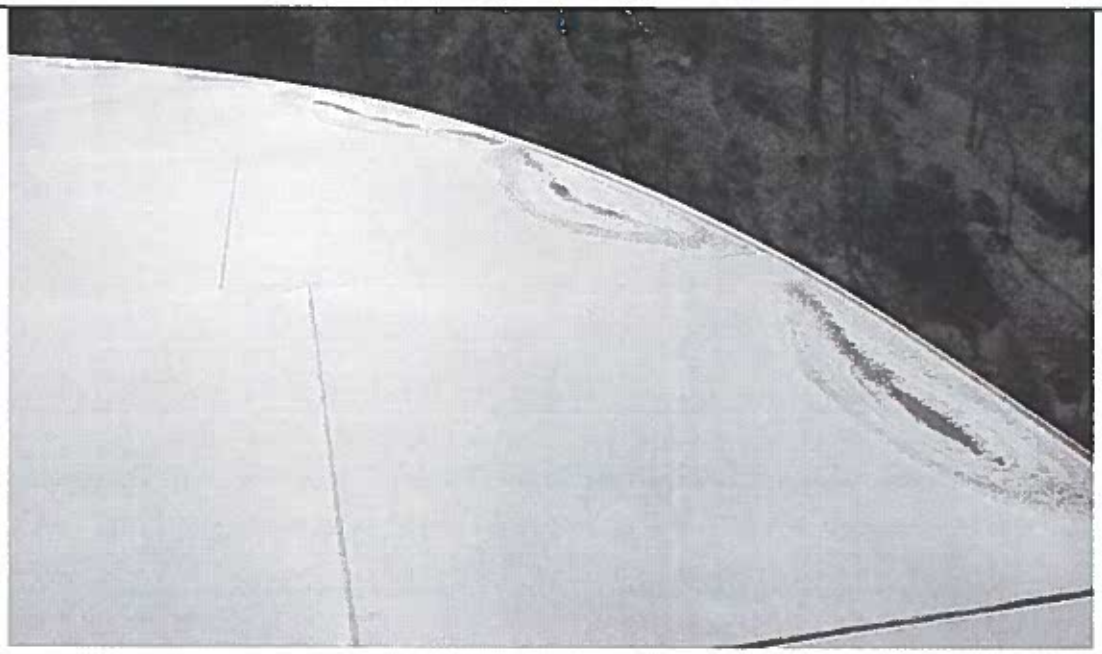
EXTERIOR	Fading and chalking.



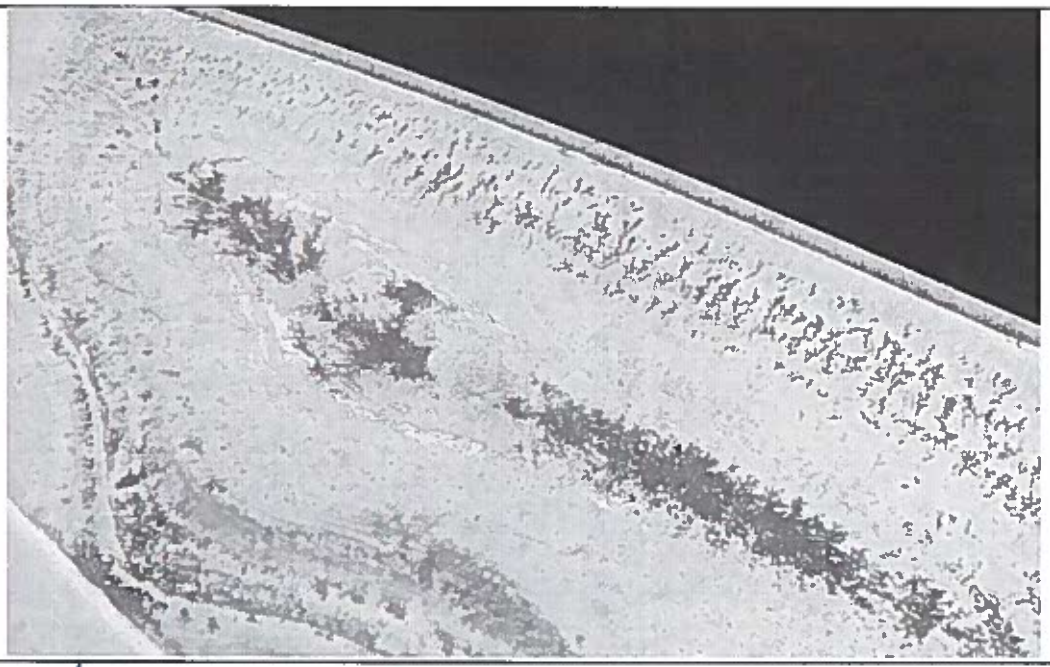
EXTERIOR	Primer exposed



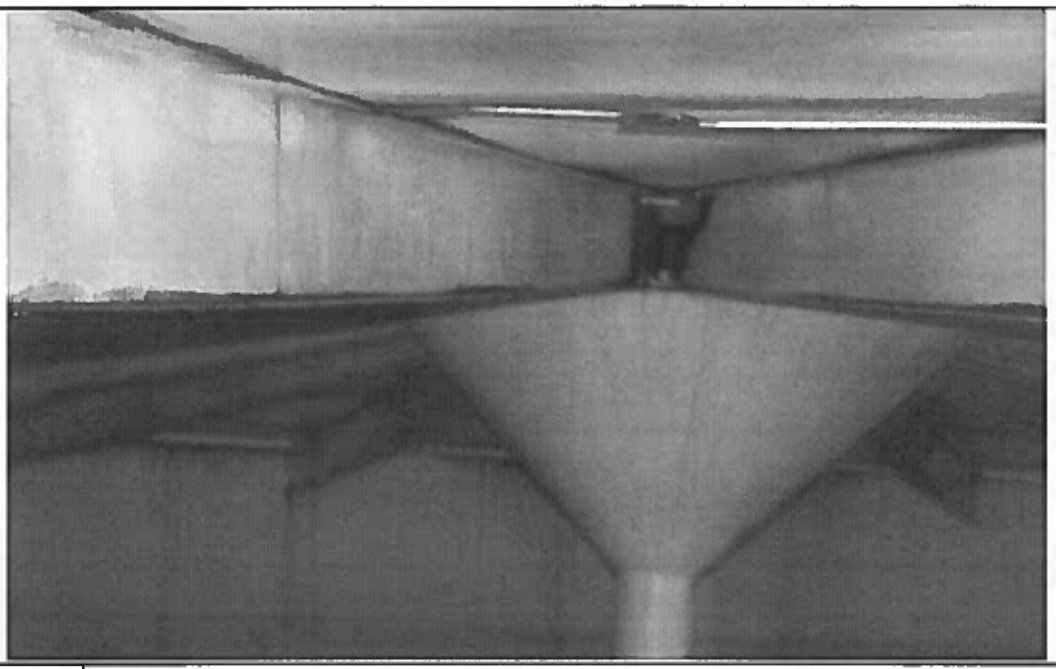
EXTERIOR	Exposed primer.



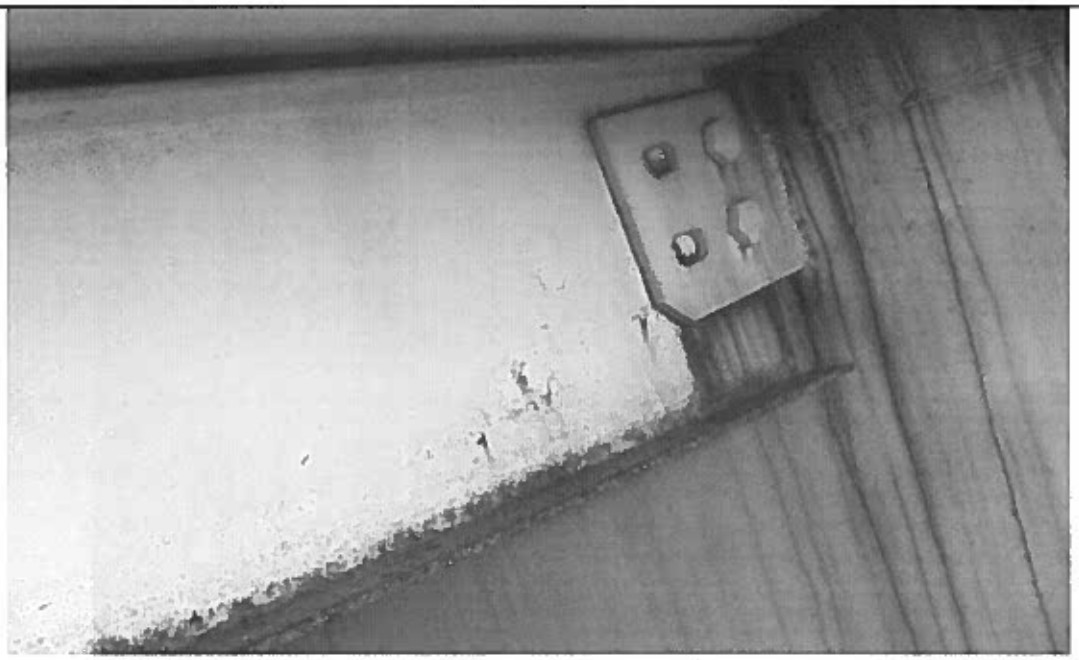
EXTERIOR	Low areas around roof edge where water pools.



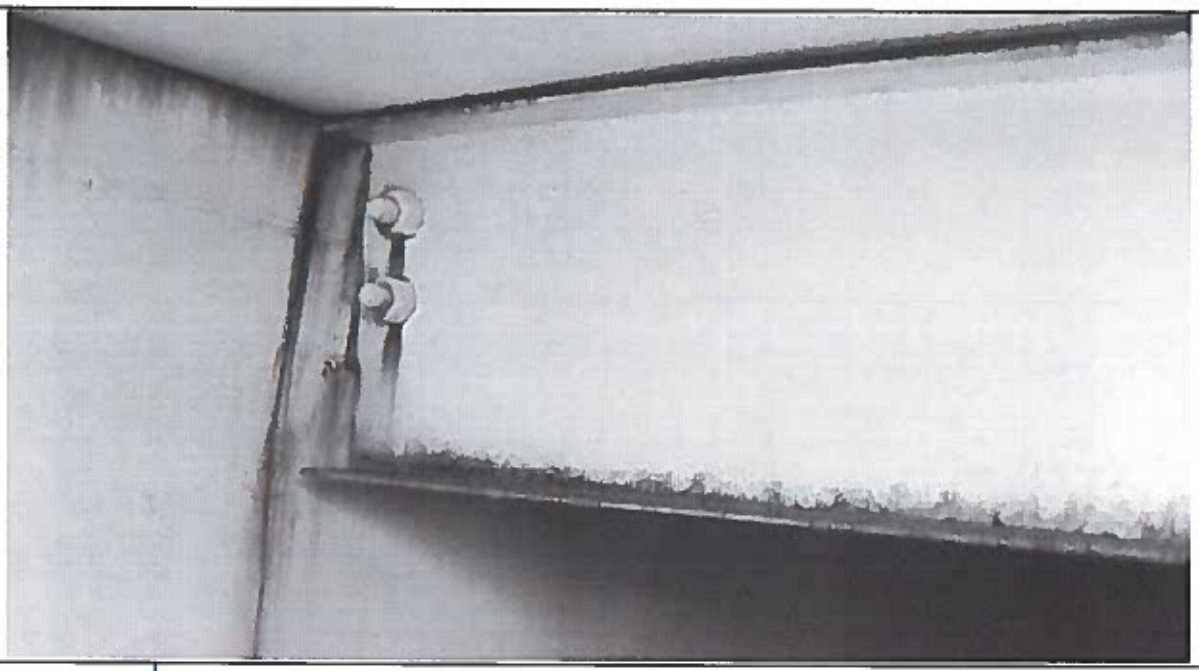
EXTERIOR	Top coat flaking in low area.



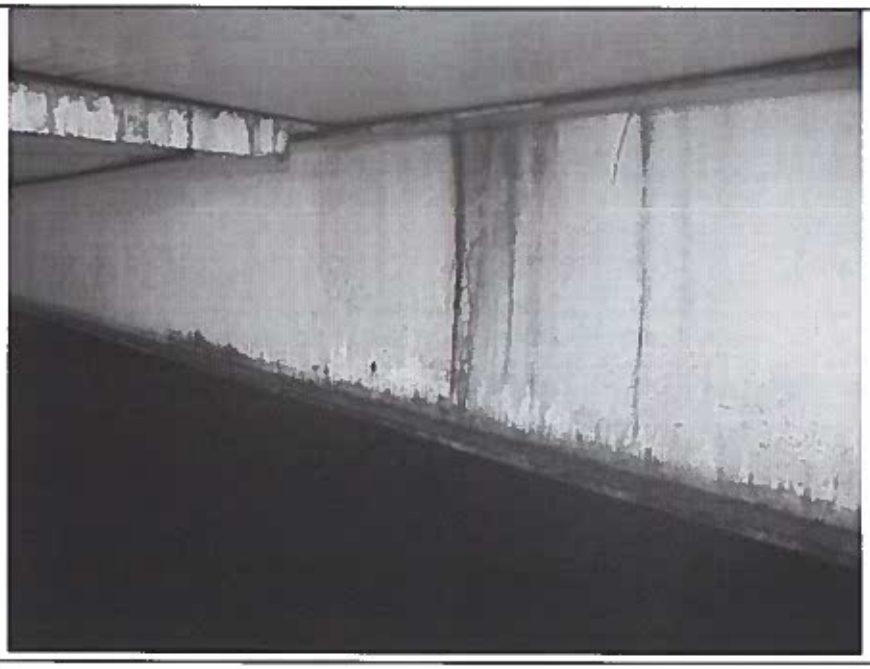
INTERIOR	Rafter connection to the dollar plate.



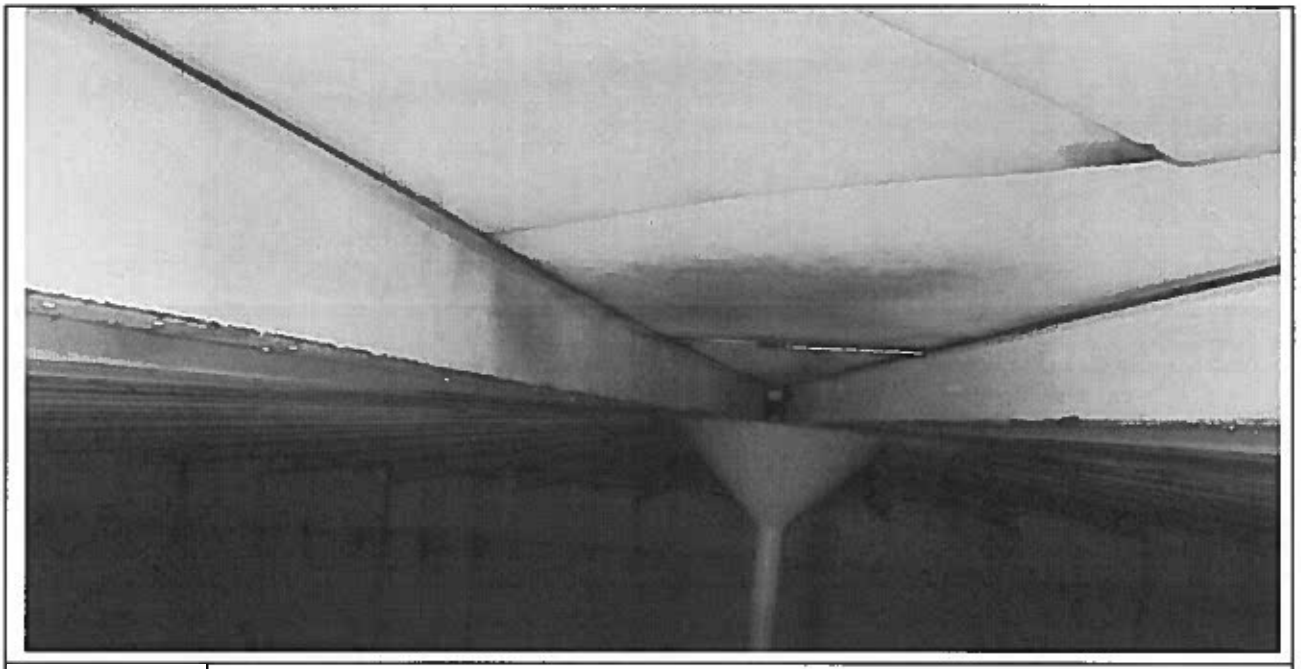
INTERIOR	Rusting at connection point.



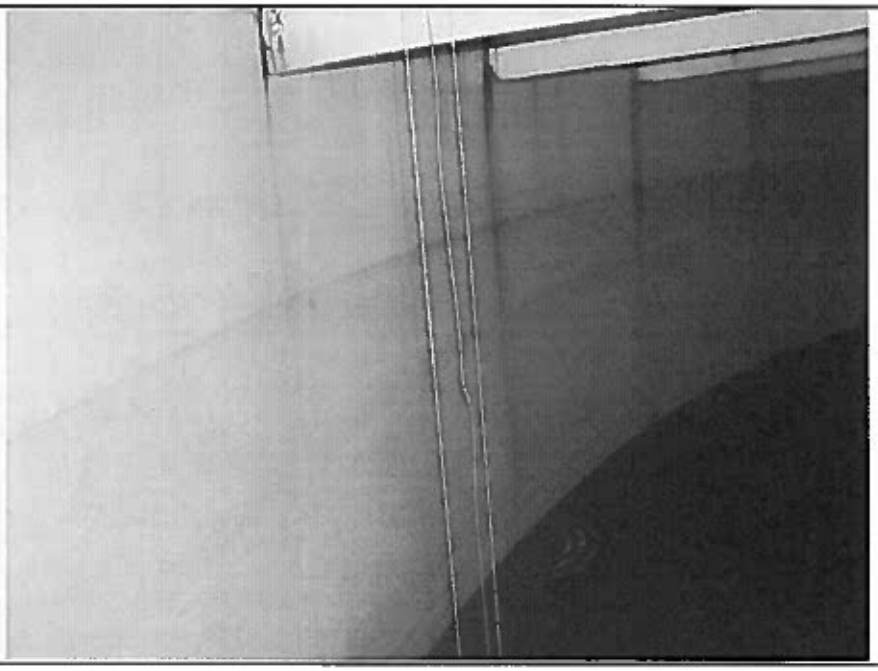
INTERIOR	Rusting at connection point.



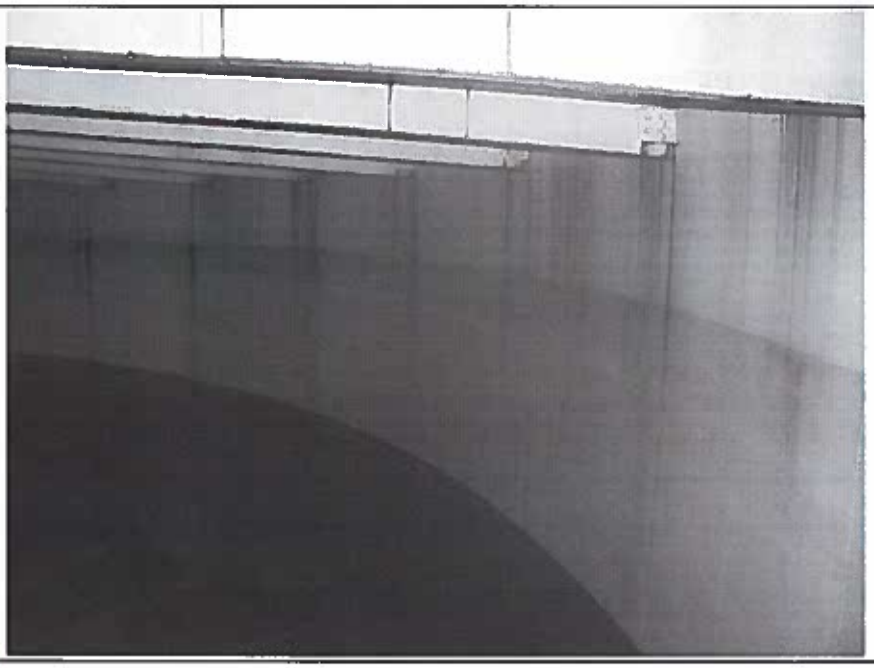
INTERIOR	Rusting on rafter lower lip.



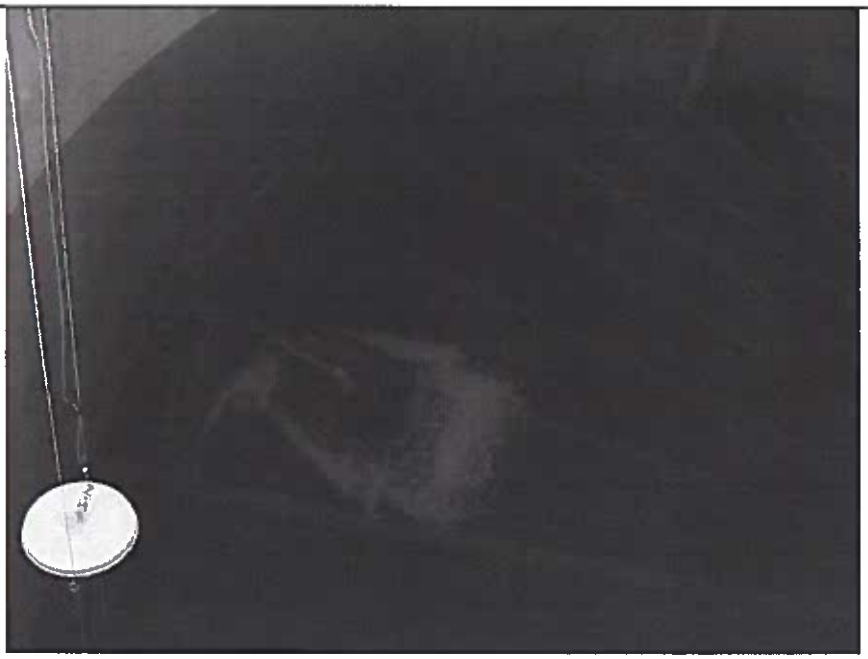
INTERIOR	Rusting on rafters and roof plate edges.



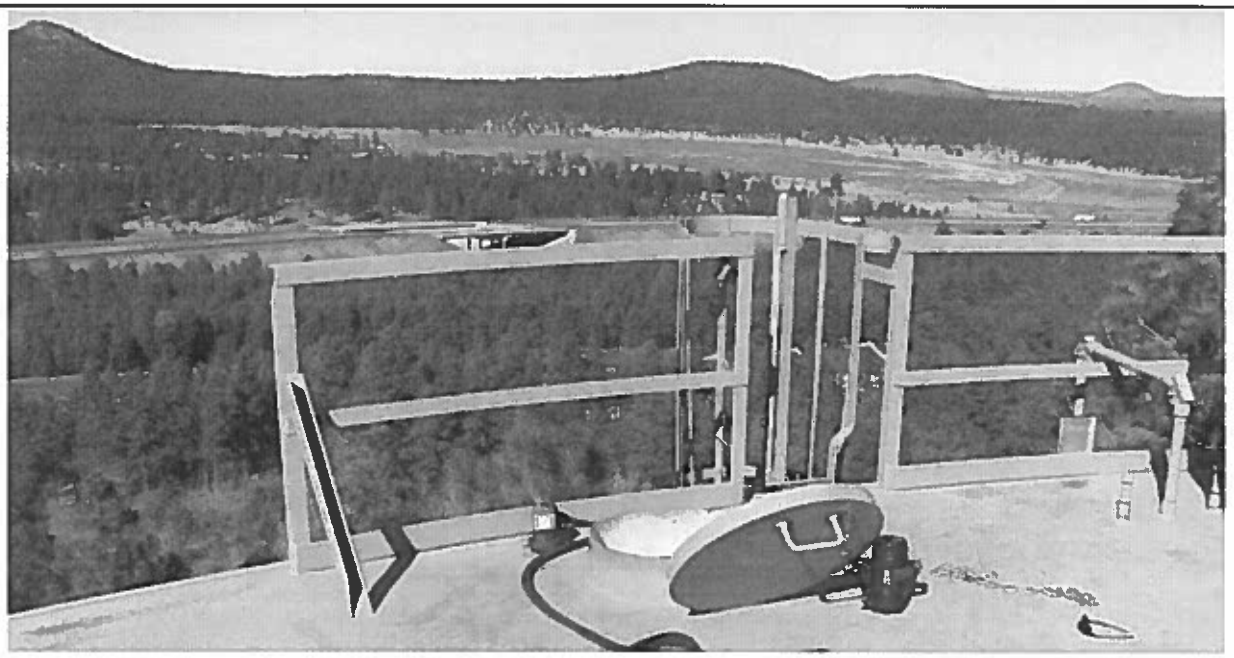
INTERIOR	Staining on shell.



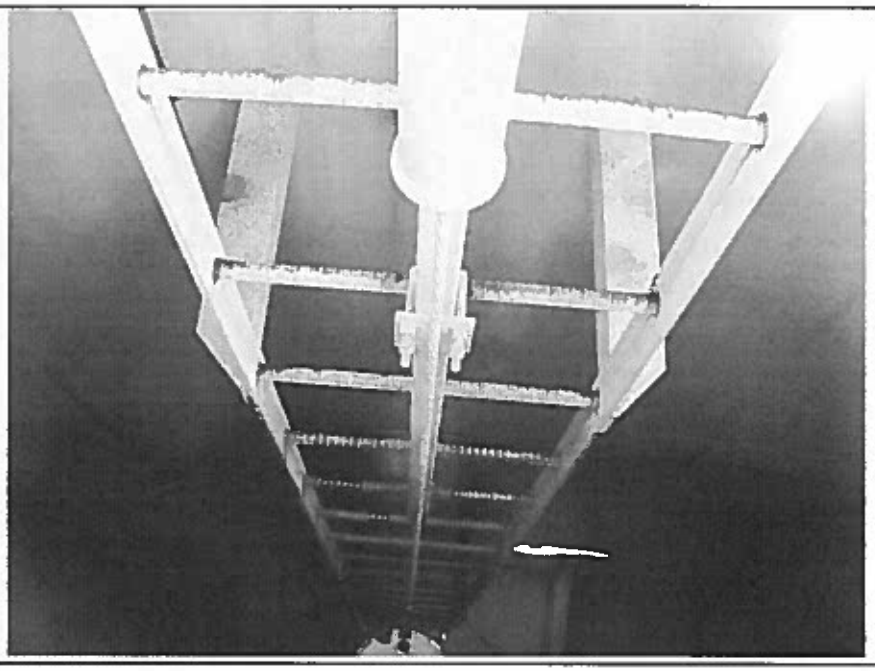
INTERIOR	Staining on shell.



INTERIOR	Sediment on the tank floor.

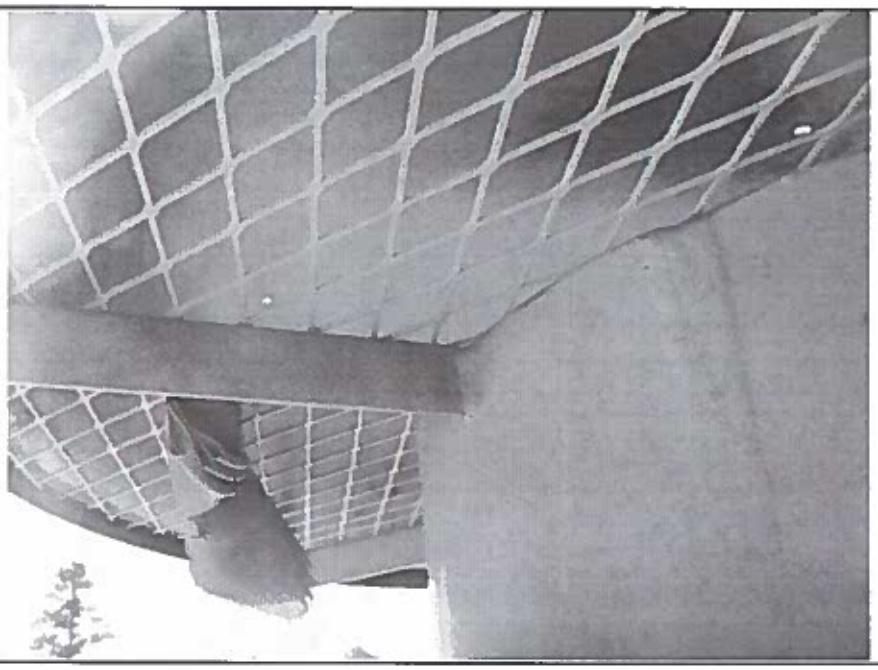


Roof access area and roof hatch.



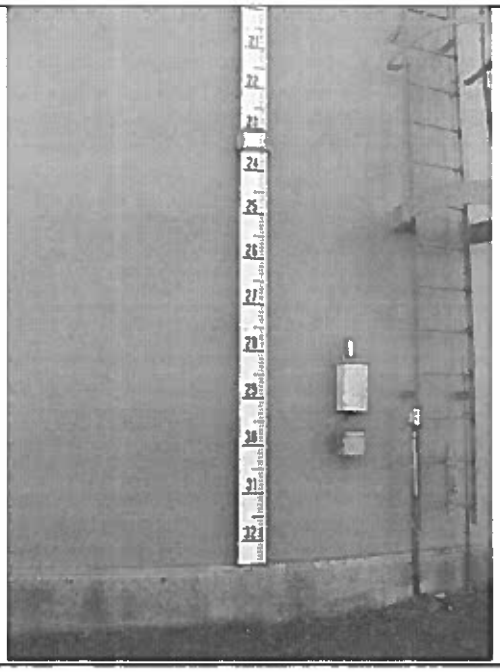
Interior ladder.

Access ladder.



Roof vent. NO fine mesh screen.

Concrete foundation.

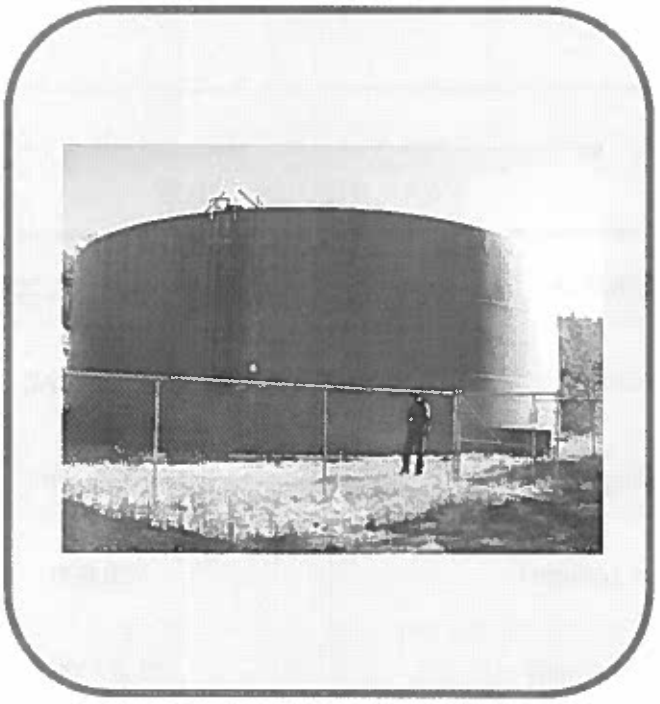


Liquid level indicator.

SUPERIOR TANK SOLUTIONS

Summary Assessment Report

City of Williams, AZ



3RD STREET TANK – 750,000 GALLONS

Date: November 18, 2014

Matt Tasch
(480) 390-0487
MTasch@superiortanksolutions.com

SUMMARY ASSESSMENT REPORT

CITY OF WILLIAMS, AZ

ASSESSMENT INTRODUCTION

Superior Tank Solutions, Inc. conducted a visual assessment at the customer's request. The purpose of the assessment was to determine the condition of the ***interior and exterior coating systems*** along with the extent of corrosion and the severity of degradation. The tank ***structure*** was evaluated in reference to the original "as built" design criteria and the applicable AWWA D.100 construction standard. Regulatory compliancy assessments were conducted in accordance with ***sanitary*** (Arizona Department of Environmental Quality), ***safety*** requirements (Federal OSHA 29 CFR 1910 & 1926 and ADOSH) and ***security*** guidelines (US Dept of Homeland Security & AWWA Security Recommendations).

TANK INFORMATION	
Inspection Date	November 18, 2014
Tank Location	Williams, AZ
Year Built	Unknown
Tank Size (gallons)	750,000
Dimensions (feet)	73'D x 24'H
Design Standard	AWWA D 100 and D 102
Tank Style	Ground Storage Tank

COATINGS, DEFICIENCIES, AND CONCERNS

IMPORTANT COMMENTS

- **LEAD is present in the exterior primer.**
- **The exterior was poorly overcoated sometime in the past.**

EXTERIOR COATINGS

The exterior coating is in bad condition. The top coat is wearing away exposing the primer. Additionally there are adhesive and cohesive coating issues causing exposed metal, flaking, and cracking. The original primer contains high levels of LEAD. Additionally the exterior was overcoated in the past with a two coat system. This recoat was very poorly done. As a result there is poor inter-coat adhesion and numerous coating imperfections. Coating thickness readings and adhesion tests were performed. Since the exterior coating will continue to degrade it is recommended to perform further testing on the exterior when the City is ready to renovate the tank to determine if over coating is an option.

INTERIOR COATINGS

The interior is coated with a coal tar coating. The coating has completely failed on the roof and rafters. These areas are all rusting with areas of more aggressive corrosion. The coating on the shell has failed but is still intact in many locations. Large areas of rusting are present on the shell along with rusting throughout the cracked coating system. The floor and lower shell were not assessed as they were not accessible.

SAFETY, SECURITY, AND STRUCTURAL DEFICIENCIES

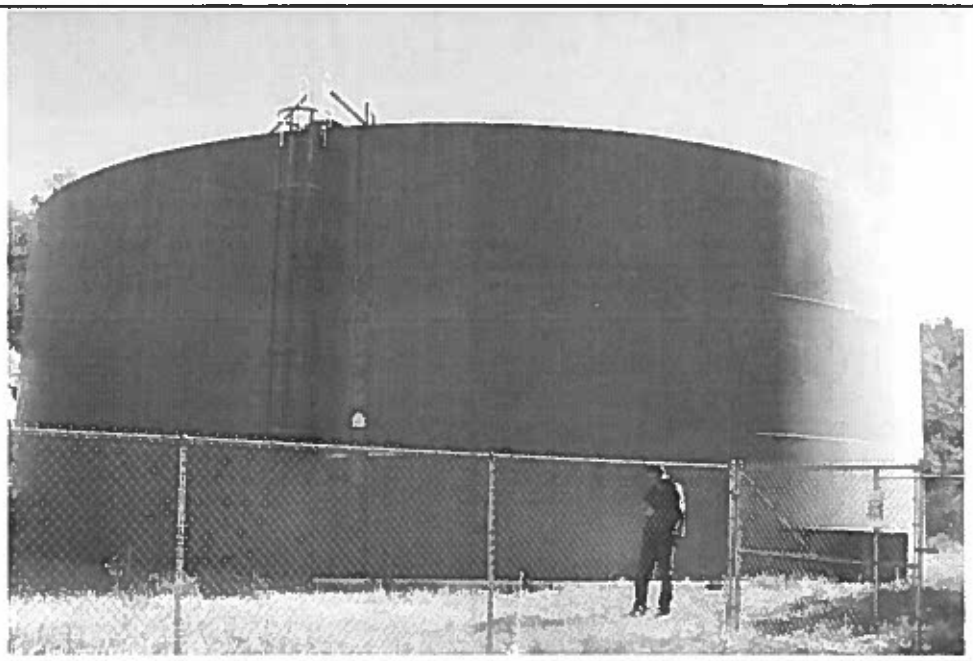
- The roof vent is too small and corroding. The vent should be replaced with a larger compliant vent.
- The access ladder cage should have expanded metal installed around the base to prevent the cage from being used as a ladder.
- The access ladder gate should be removed and replaced with a working swing style locking ladder gate.
- OSHA compliant roof railing should be installed to each side of the access ladder.
- It is recommended to install a second shell manway to facilitate confined space requirements.

CONCERNS AND WATER QUALITY

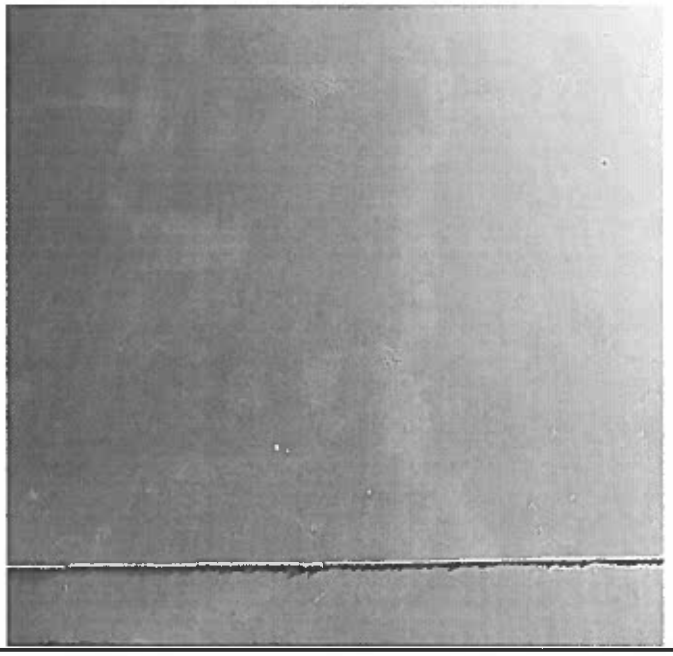
- Water Quality is a concern in this tank. The presence of bio-film and apparent stagnation are evident in this tank. This can be observed by the buildup on the shell at the fluctuating water line and through the presence of debris on the surface of the water. The tank is most likely short circuiting resulting in thermal stratification. This allows the water to stagnate and biofilm to develop in the boundary areas.

RECOMMENDATIONS

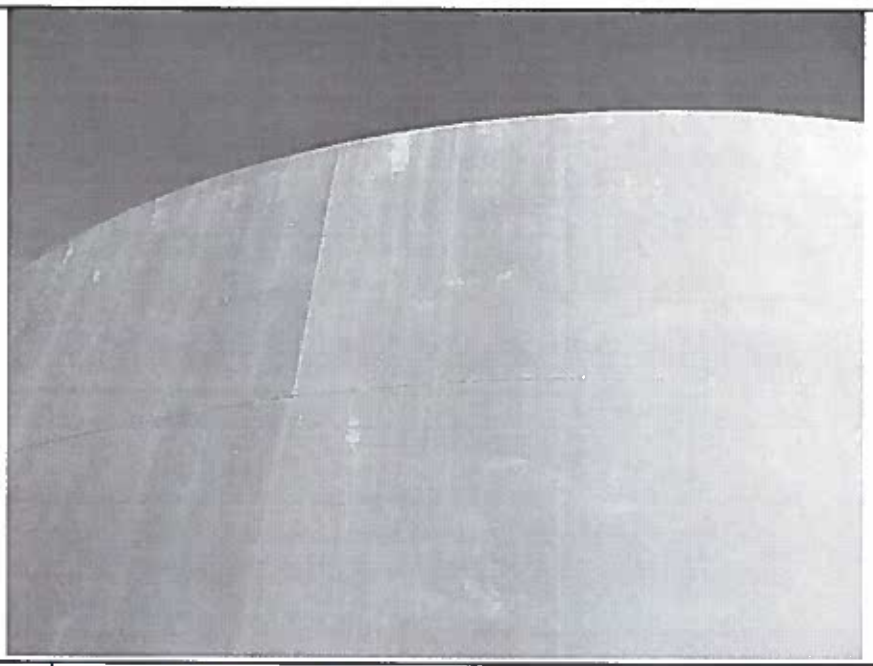
- All exterior surfaces should be further evaluated to determine if over coating is an option or if the LEAD based coating must be removed.
- All interior surfaces require renovation by means of an SSPC-SP 10 blast and application of a compliant NSF coating system.
- The existing corroded roof vent should be replaced with a larger compliant mushroom vent.
- To prevent unauthorized access on the tank expanded metal should be installed around the lower section of the exterior ladder cage.
- A new locking swing ladder gate should be installed on the access ladder.
- OSHA compliant roof railing should be installed on the roof to each side of the access ladder.
- Install a second shell manway.
- It is recommended that an active mixing be installed in the tank to improve water quality.



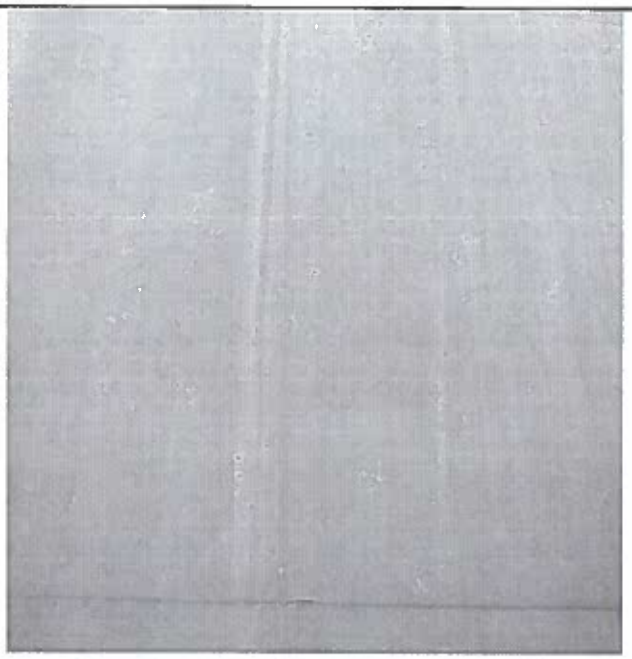
EXTERIOR	Overview - fading and chalking on shell.



EXTERIOR	Inconsistent coating and poor workmanship.



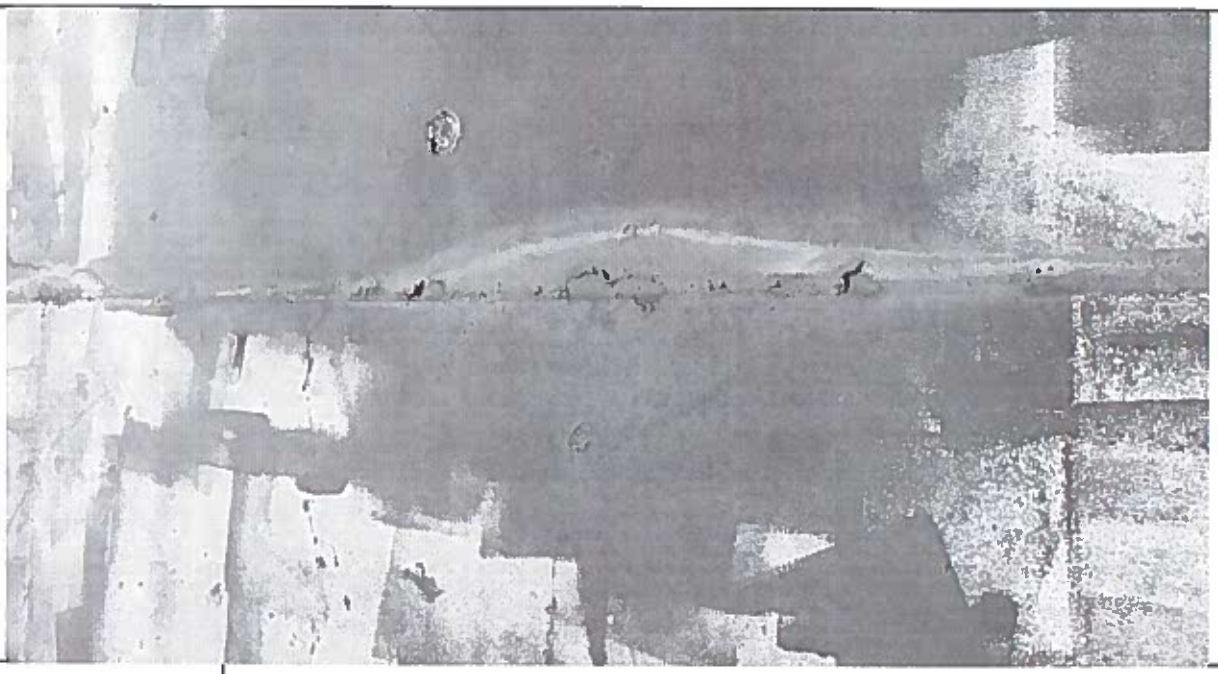
EXTERIOR	Top coat fading, exposing base coats.



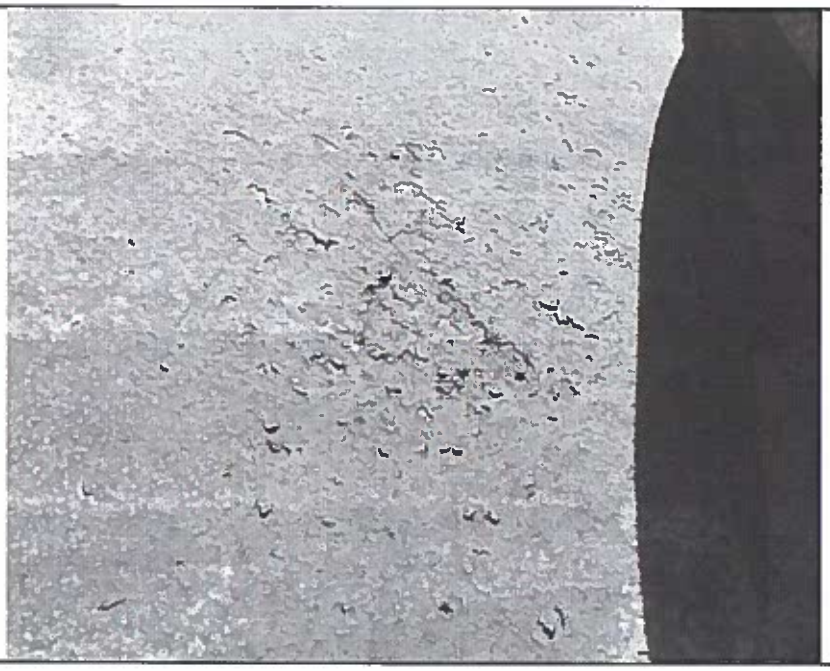
EXTERIOR	Numerous small rusting sites.

EXTERIOR	Exposed primers.

EXTERIOR	Coating failure resulting in rusting.



EXTERIOR	Coating is flaking off and rusting.

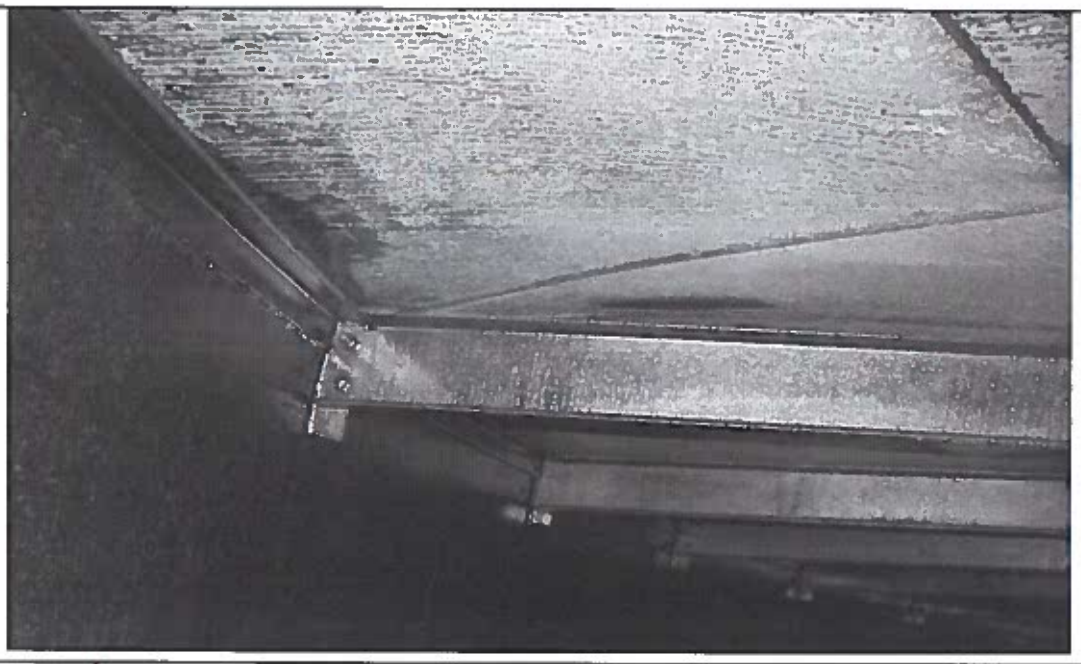


EXTERIOR	Coating flaking and rusting bare metal.

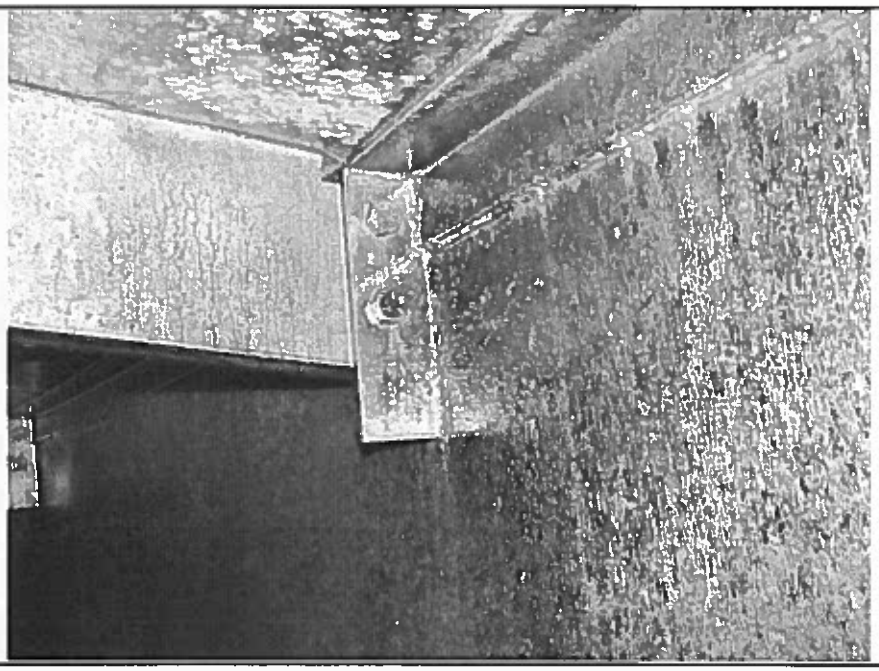
INTERIOR	Exposed primers and rusting.

INTERIOR	Coating flaking and rusting bare metal.

INTERIOR	Rusting on the roof and rafter.

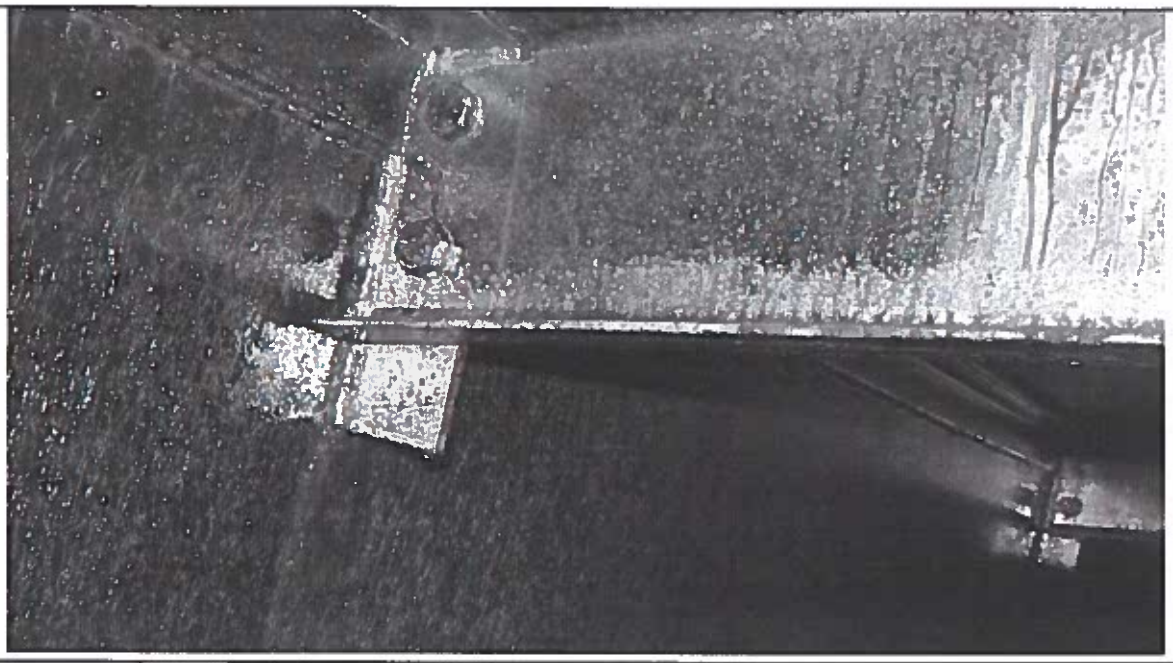


INTERIOR	Rusting on roof and rafters.

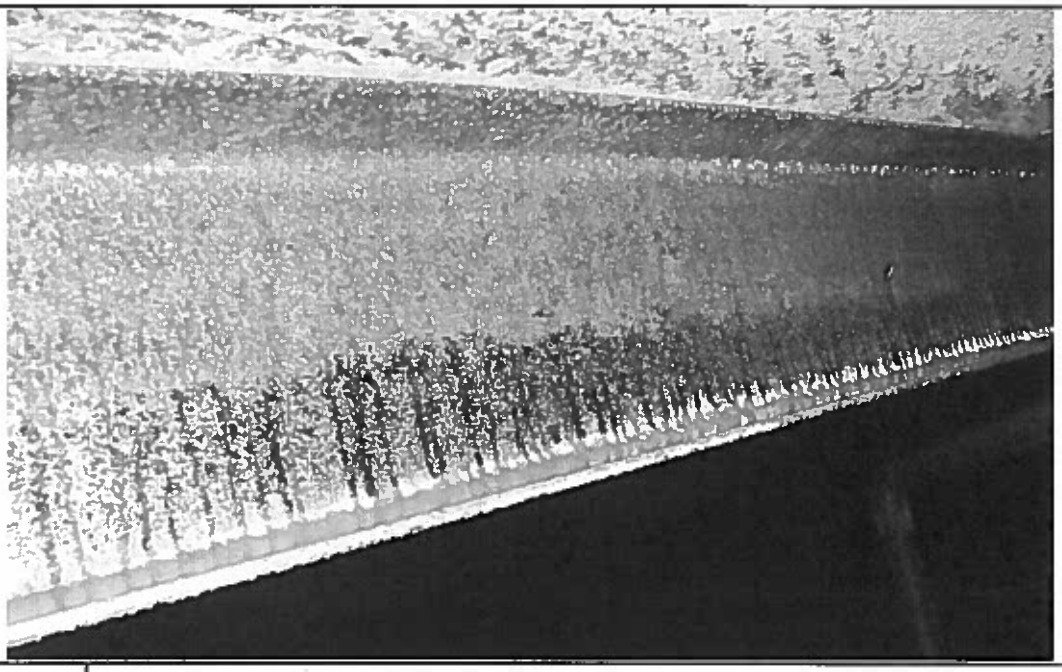
	
INTERIOR	Coal tar coating has cracked on shell.

INTERIOR	Rusting and corrosion on roof and rafters.

INTERIOR	Coating failure and rusting on shell.

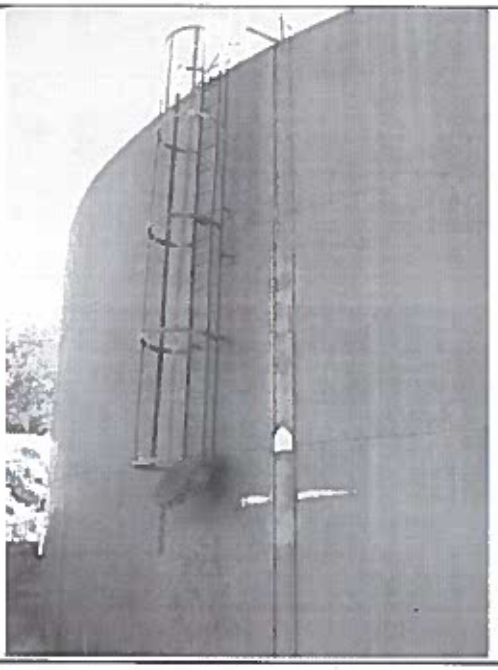


INTERIOR	Rusting at connection point.

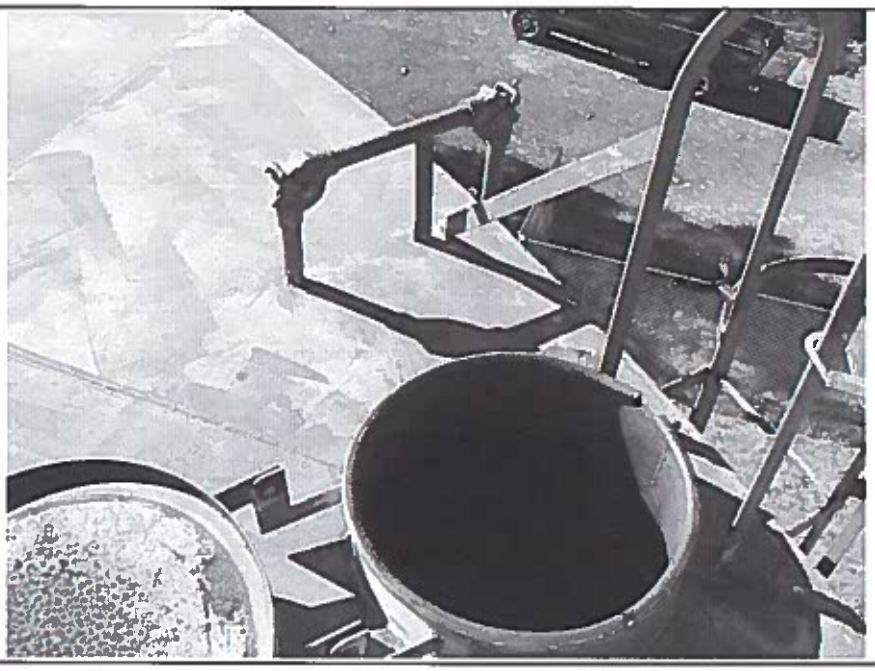


INTERIOR	Corrosion and Rusting on the rafter.

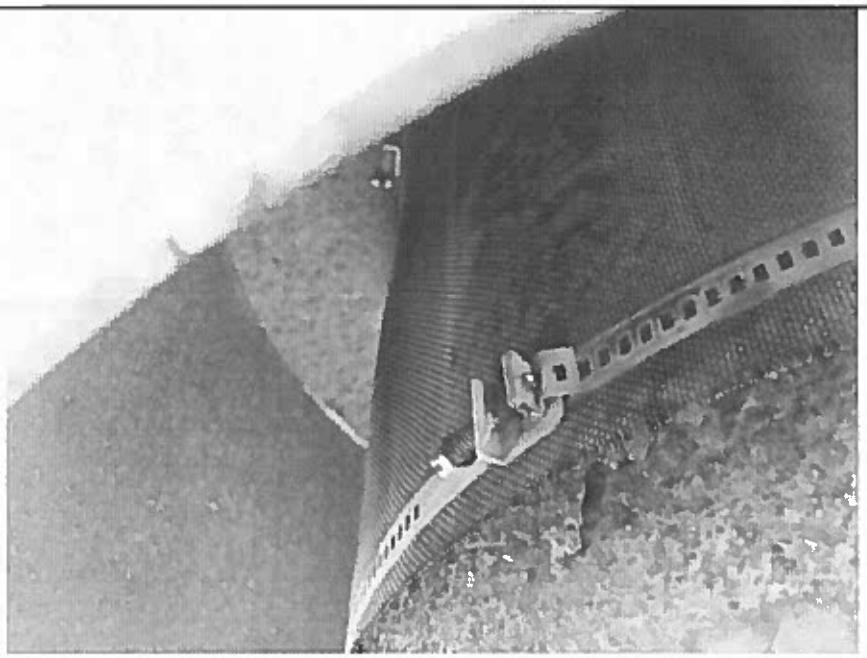
INTERIOR	Coating failure and rusting on shell.



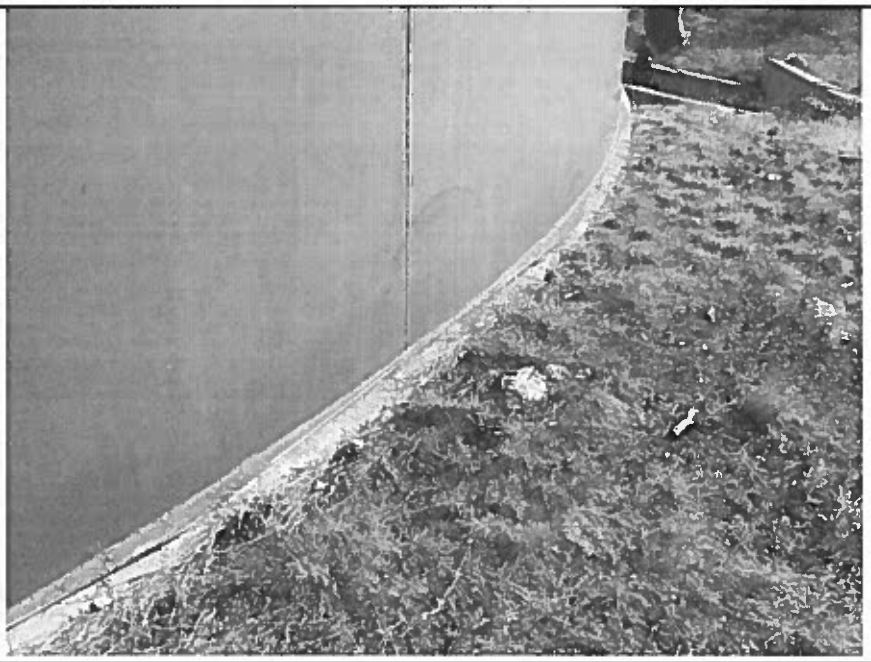
Access ladder.



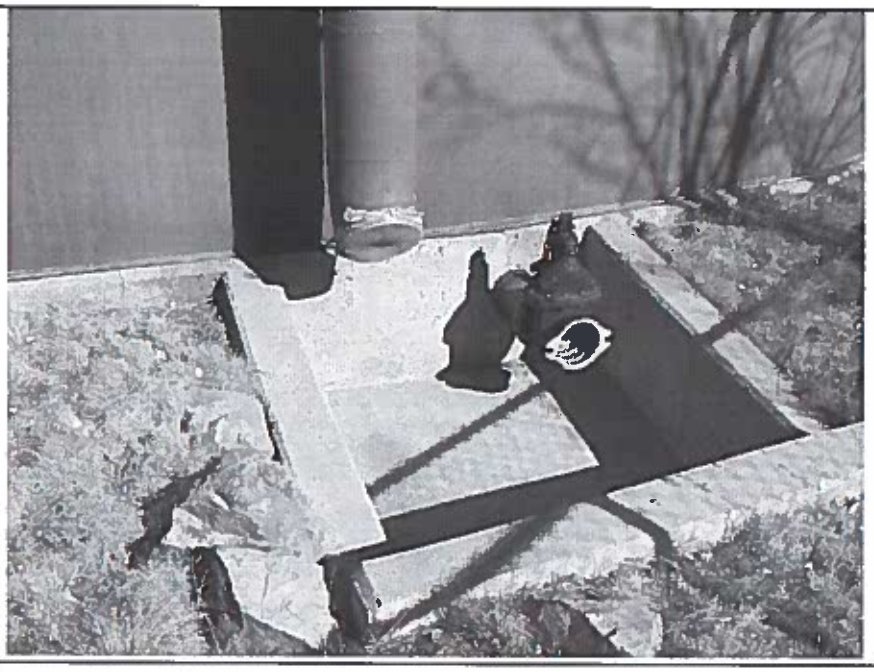
Roof hatch and roof access area.



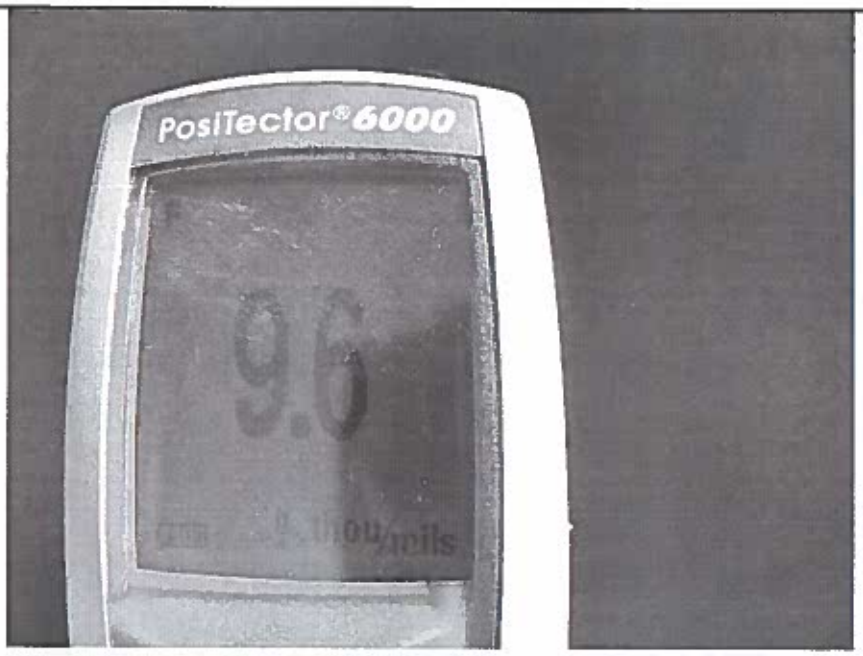
Roof vent screen. Corrosion around the vent throat.



Foundation.



Overflow termination.



Mil reading on exterior shell. Indicates that several coats of paint have been applied to the exterior.

City of Williams, AZ

Example Tank Renovation Plan

TANK NAME		2015	2016	2017	2018	COMMENTS
Water Treatment 1	Exterior		E			Due to the presence of lead in the exterior paint it is a priority to encapulate the lead based paint
	Interior		I			The coal tar coating is falling in the atmospheric zone, rusting and corrosion are present
Water Treatment 2	Exterior			E		Due to the presence of lead in the exterior paint it is a priority to encapulate the lead based paint
	Interior			C		Chemical cleaning and touch up to improve water quality and maximize the coating life
3rd street	Exterior	E				High lead and failing exterior requires immediate attention
	Interior	I				The coating has failed and is no longer protecting the steel
Clover Hill 75k	Exterior	E				Due to the presence of lead in the exterior paint it is a priority to encapulate the lead based paint
	Interior	I				The epoxy coating has completely failed
Clover Hill 125k	Exterior	E				Due to the presence of lead in the exterior paint it is a priority to encapulate the lead based paint
	Interior		I			The epoxy coating is failing, rusting and corrosion are already present
1MG	Exterior			E		Due to the top coat deteriroation on the roof and areas of standing water overcoating is necessary
	Interior			I		The epoxy coating is failing in the atmospheric zone and corrosion is starting.

THE SCHEDULE IS BASED ON THE FOLLOWING FACTORS:

* The known or high potental presence of lead on the exterior of several tanks requires immediate attention. If the lead is allowed to leave the tank environmental contamination will occur resulting in substantial fines, hazardous remediation, and potentially jail time.

** The extent of interior coating failure with the associated existing and ongoing steel loss due to interior corrosion.

*** The attempt to spread the necessary work over a reasonable period to lessen the financial burden.

Superior Tank Solutions will work with the City to develop a work and cost schedule that meets the City's needs. For example STS will finance the tank work over four years allowing the City to make balanced regular payments while rehabilitating the storage tanks on an accellerated schedule.

CITY OF WILLIAMS

Sample Scope and Budgetary Estimates

OVERVIEW:

All renovation and repair operations are designed to comply with AWWA D.100 and AWWA D.102 recommendations and are predicated on tank construction compliance with AWWA D.100 recommendations for welded steel tanks. All provided labor will be Confined Space Certified and Competent in all pertinent OSHA regulations, 1910 and 1926.

SCOPE OF WORK:

Interior Coating Rehabilitation:

- SSPC-SP 10 "Near White Metal Blast" all interior surfaces
- Grind rough or irregular welds prior to coating activities
- Apply ANSI/NSF 61 approved epoxy coatings per AWWA D102 standards
    - Apply **100% solids coating** on the shell and floor in one coat to a minimum of 25 mils minimum DFT
    - Apply polyamide epoxy on the roof in two coats to an average of 12-16 mils minimum DFT
    - Apply stripe coat over welds in immersion zone and on heavily corroded rafter edges
    - Apply caulking to the roof/shell juncture
- Tank will be cleaned and rinsed to remove all debris and residual contaminants

Exterior Coating Repair:

- Pressure wash all exterior areas with minimum 3,000 psi
- Spot preparation to damaged areas and to all newly installed tank components
    - All areas of rusting or bare steel to an SSPC-SP 15
    - Spot prime these areas with a rust inhibitive epoxy primer
- Prime coat – Apply rust inhibitive primer to all exterior areas
    - Applied in one coat to an average of 2-4 mils DFT
- Finish Coat - Apply compliant coat to all exterior areas
    - Applied in one coat to an average of 2-6 mils DFT
    - Owner shall choose the color

Upgrades and Modifications:

- Upgrades and repairs as referenced in the tank inspection reports
- Provide and Install new gaskets on the shell manway
- Steel repairs and patching as necessary

Clean Up and Disinfection:

- Tank site will be cleaned of all trash, waste, and debris brought onto the site or generated.
- Tank will be cleaned and rinsed to remove all debris and residual contaminants.
- Perform disinfection of the tank in accordance with AWWA C-652 – Method 2 Disinfection of Water Tanks.

Example Tank Renovation Plan

TANK NAME		2015	2016	2017	2018	COMMENTS
Water Treatment 1	Exterior		E			Due to the presence of lead in the exterior paint it is a priority to encapulate the lead based paint
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1MG	Exterior			E		Due to the topcoat deterioation on the roof and areas of standing water overcoating is necessary
	Interior			I		The epoxy coating is failing in the atmospheric zone and corrosion is starting

Renovation Budgetary Estimates - The tanks are prioritized from the highest need to least:

3rd Street Tank -	$ 230,000 *
Clover Hill 75K -	$ 60,000
Clover Hill 125K -	$ 75,000
Water Treatment Plant 1 -	$ 140,000
Water Treatment Plant 2 -	$ 50,000
1,000,000 Gallon Tank -	$ 210,000

*Assuming the exterior can be overcoated

3rd Street Tank Additional Option Estimates:

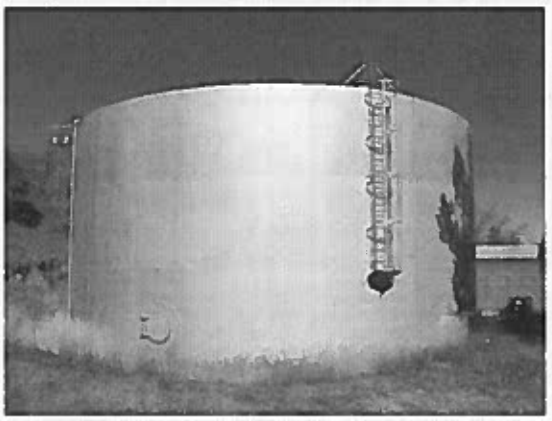
With Exterior Lead Abatement -	$ 320,000
One New 750,000 Gallon Bolted Steel Tank -	$ 320,000
Two New 750,000 Gallon Bolted Steel Tanks -	$ 620,000
One New 1,500,000 Gallon Bolted Steel Tank -	$ 600,000

*Above costs do not include demo of the existing tank, grading site, or foundation.

SUPERIOR TANK SOLUTIONS

Summary Assessment Report

City of Williams, AZ



WATER TREATMENT PLANT 1 – 350,000 GALLONS

Date: November 18, 2014

Matt Tasch
(480) 390-0487
MTasch@superiortanksolutions.com

SUMMARY ASSESSMENT REPORT

CITY OF WILLIAMS, AZ

ASSESSMENT INTRODUCTION

Superior Tank Solutions, Inc. conducted a visual assessment at the customer's request. The purpose of the assessment was to determine the condition of the ***interior and exterior coating systems*** along with the extent of corrosion and the severity of degradation. The tank ***structure*** was evaluated in reference to the original "as built" design criteria and the applicable AWWA D.100 construction standard. Regulatory compliancy assessments were conducted in accordance with ***sanitary*** (Arizona Department of Environmental Quality), ***safety*** requirements (Federal OSHA 29 CFR 1910 & 1926 and ADOSH) and ***security*** guidelines (US Dept of Homeland Security & AWWA Security Recommendations).

TANK INFORMATION	
Inspection Date	November 18, 2014
Tank Location	Williams, AZ
Year Built	Unknown
Tank Size (gallons)	350,000
Dimensions (feet)	50'D x 24'H
Design Standard	AWWA D 100 and D 102
Tank Style	Ground Storage Tank

COATINGS, DEFICIENCIES, AND CONCERNS

IMPORTANT COMMENTS

- **Lead could be present in the exterior primer.**

EXTERIOR COATINGS

The exterior coating consists of a metallic alkyd. There is a high probability that lead exists in the prime coat. The coating has held up well and has good adhesion. There are many small abrasion sites on the shell and some show signs of minor rusting. The top coat has deteriorated on the roof exposing the primer in many locations.

INTERIOR COATINGS

The interior is coated with an aged coal tar system. The coating is still intact on most of the interior. There are many isolated failure sites above the high water line on the interior structure, mostly on the rafters and exposed edges. These areas are rusting and corroding in isolated areas. The shell coating is more intact with a heavy build up of deposits and biofilm. The lower shell and floor could not be properly assessed since the tank was in-service.

SAFETY, SECURITY, AND STRUCTURAL DEFICIENCIES

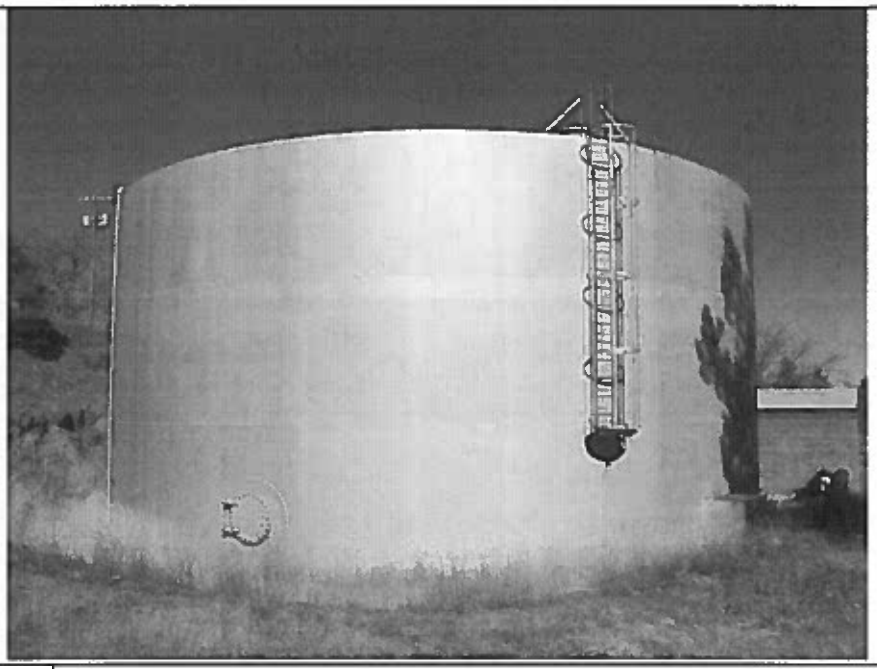
- The access ladder cage should have expanded metal installed around the base to prevent the cage from being used as a ladder.
- The access ladder gate should be replaced with a swing style locking ladder gate.
- The access ladder safety cage should be extended to above the tank roof level.
- OSHA compliant roof railing should be installed to each side of the access ladder.
- It is recommended to install a second shell manway to facilitate confined space requirements.

CONCERNS AND WATER QUALITY

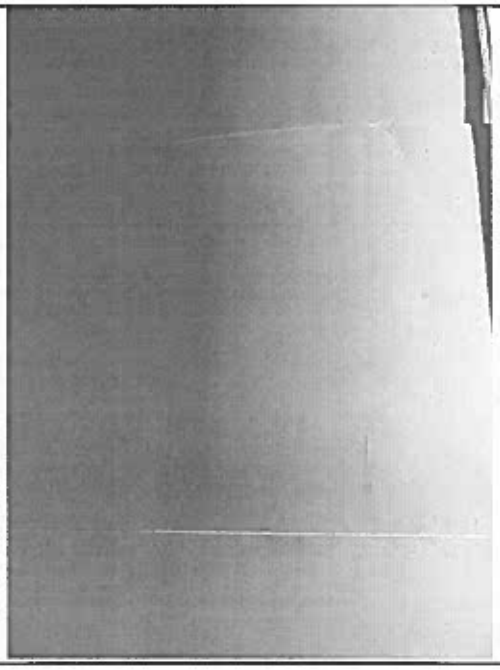
- Water Quality is a concern in this tank. The presence of bio-film and apparent stagnation are evident in this tank. This can be observed by the buildup on the shell at the fluctuating water line and through the presence of debris on the surface of the water. The tank is most likely short circuiting resulting in thermal stratification. This allows the water to stagnate and biofilm to develop in the boundary areas.

RECOMMENDATIONS

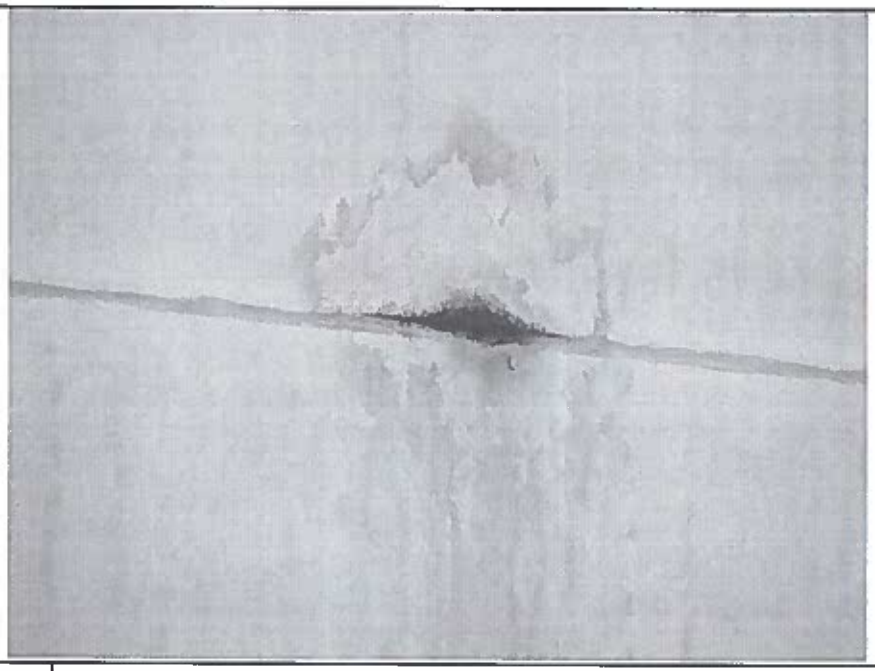
- All exterior surfaces require a high pressure wash, spot prep and prime, and a 2 coat overcoat of a compliant coatings system.
- All interior surfaces require renovation by means of an SSPC-SP 10 blast and application of a compliant NSF coating system.
- The access ladder gate should be replaced with a swing style gate.
- The access ladder cage should be extended a few feet above the tank roof.
- OSHA complaint railing should be installed to each side of the access ladder.
- To prevent unauthorized access on the tank expanded metal should be installed around the lower section of the exterior ladder cage.
- Install a second shell manway.
- It is strongly recommended that an active mixing be installed in the tank to improve water quality.



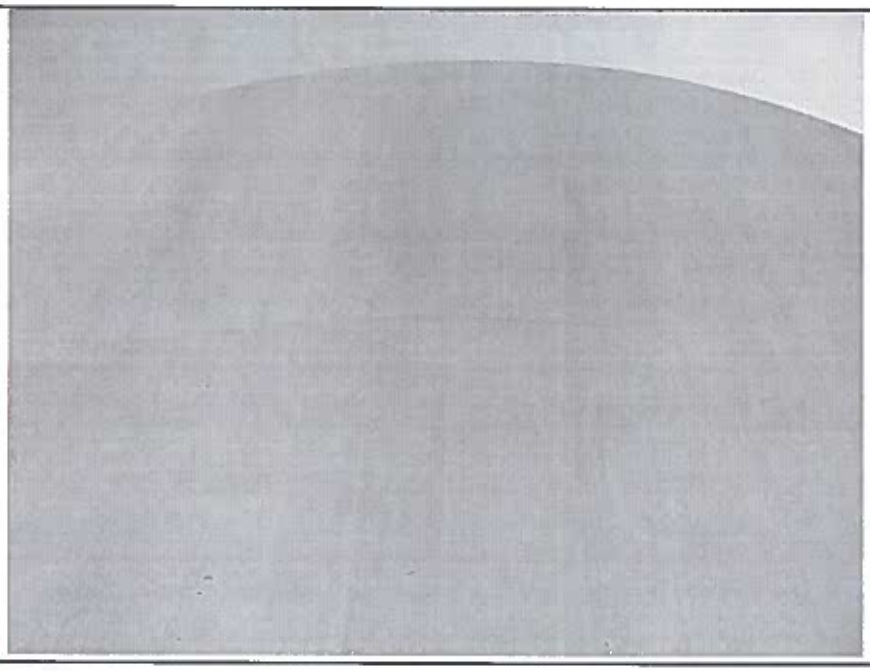
EXTERIOR	Exterior



EXTERIOR	Small mechanical damage sites



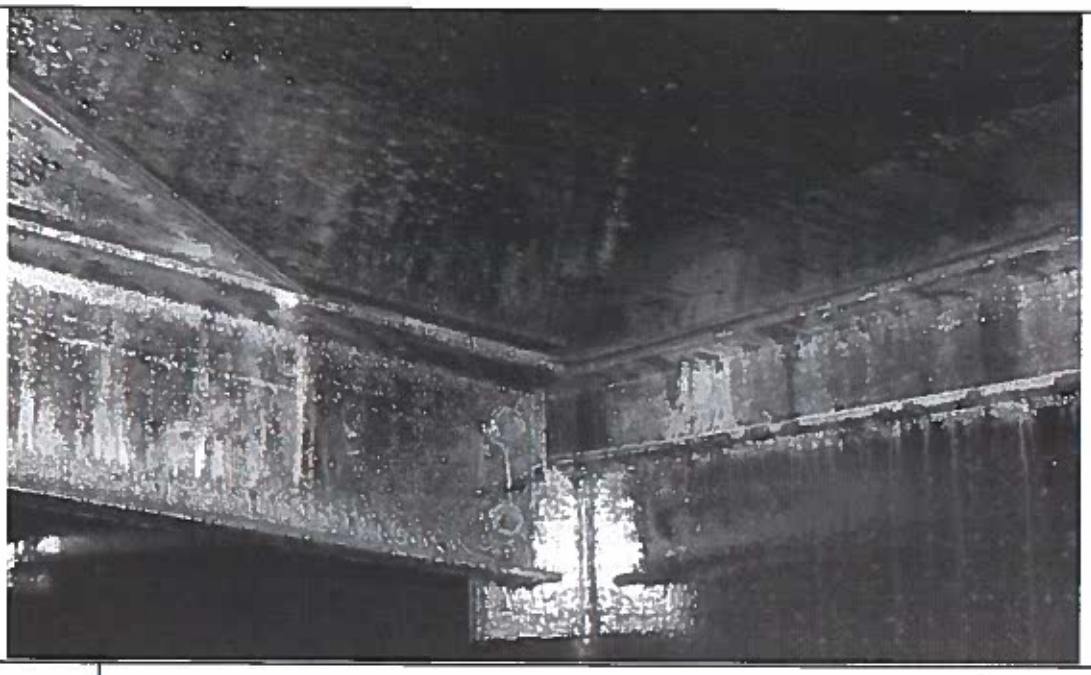
EXTERIOR	Exposed primer and coating damage.



EXTERIOR	Fading and chalking of coating.

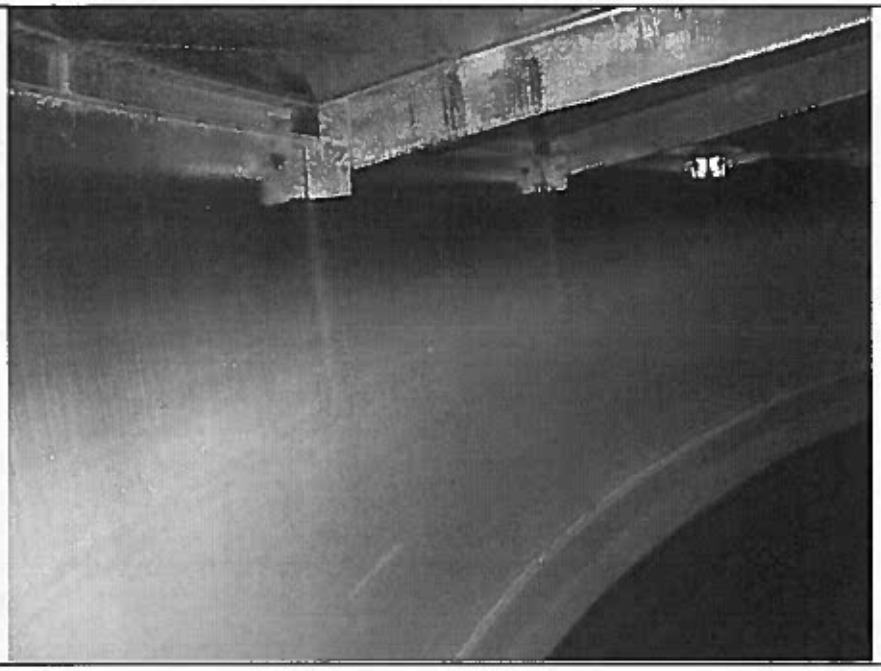
EXTERIOR	Top coat deterioration and exposed primer.

EXTERIOR	Top coat deterioration and exposed primer.

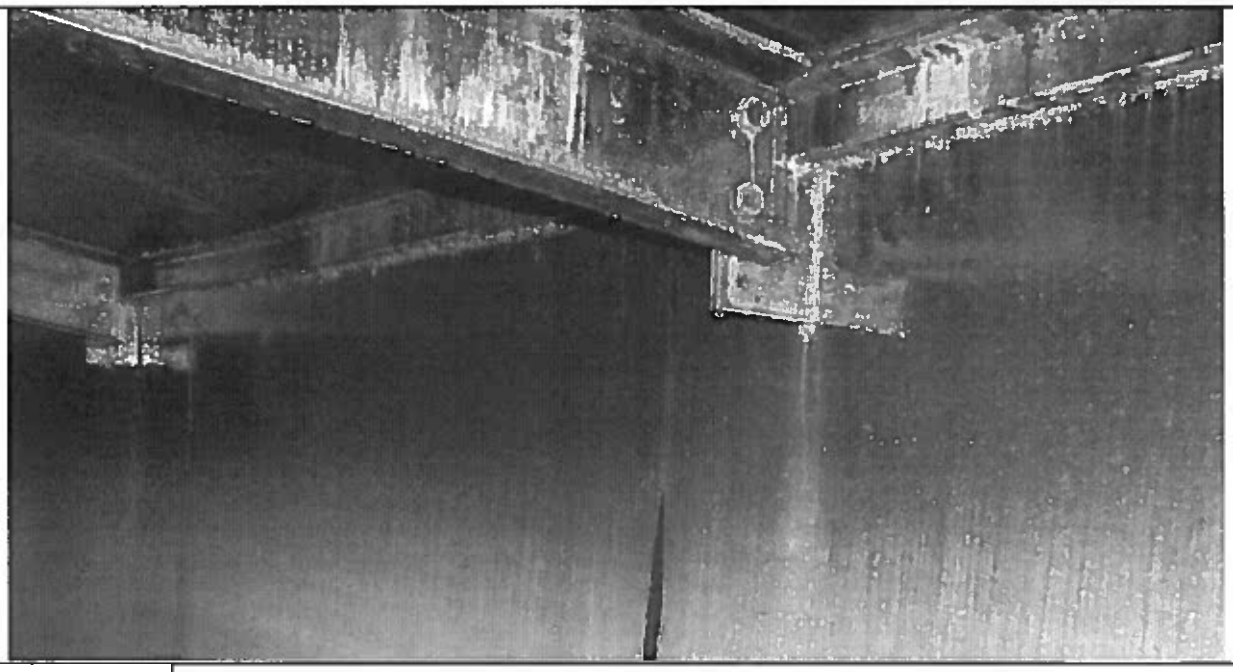


INTERIOR	Rusting on the rafters and edges.

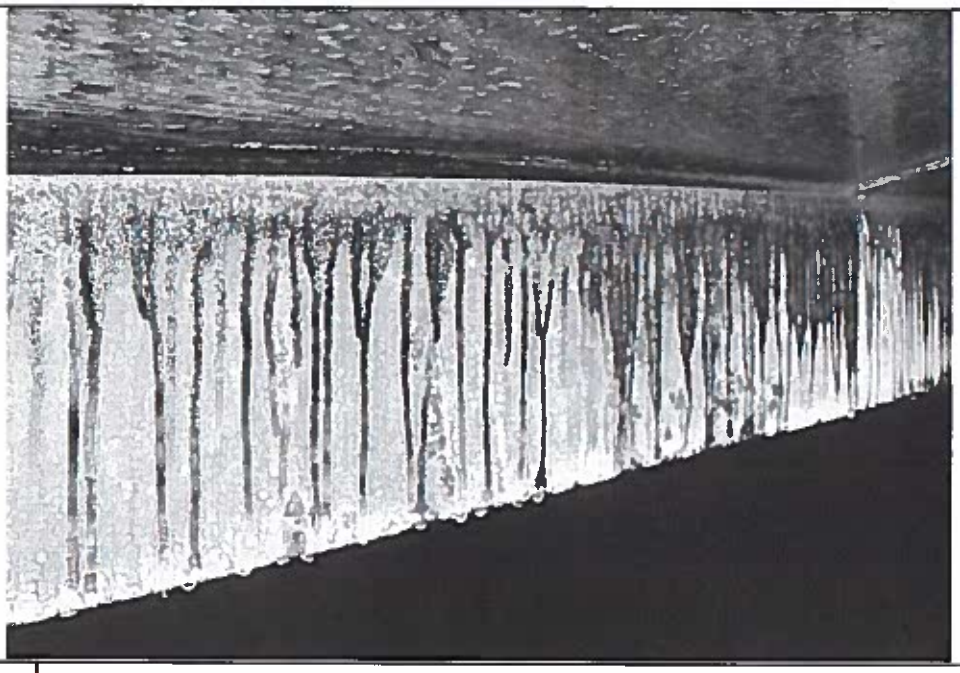
INTERIOR	Corrosion and rusting around the connection point.



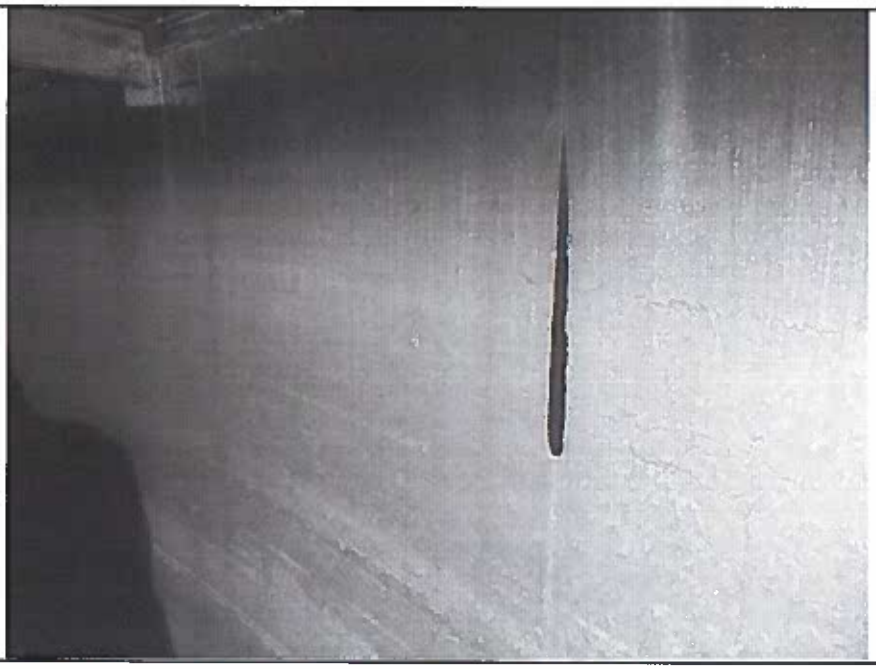
INTERIOR	Staining and build up shell.



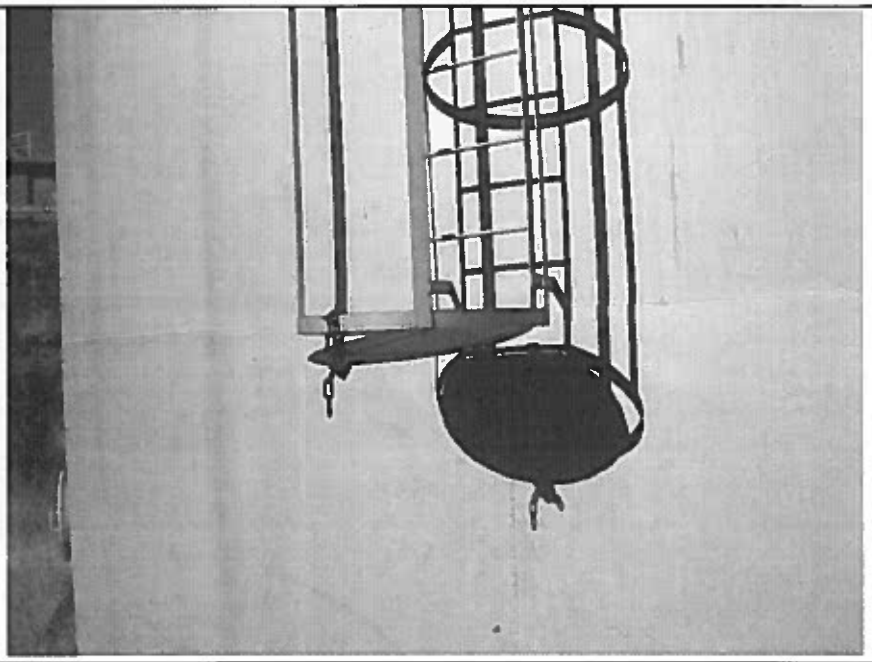
INTERIOR	Rusting on the rafters and structure.



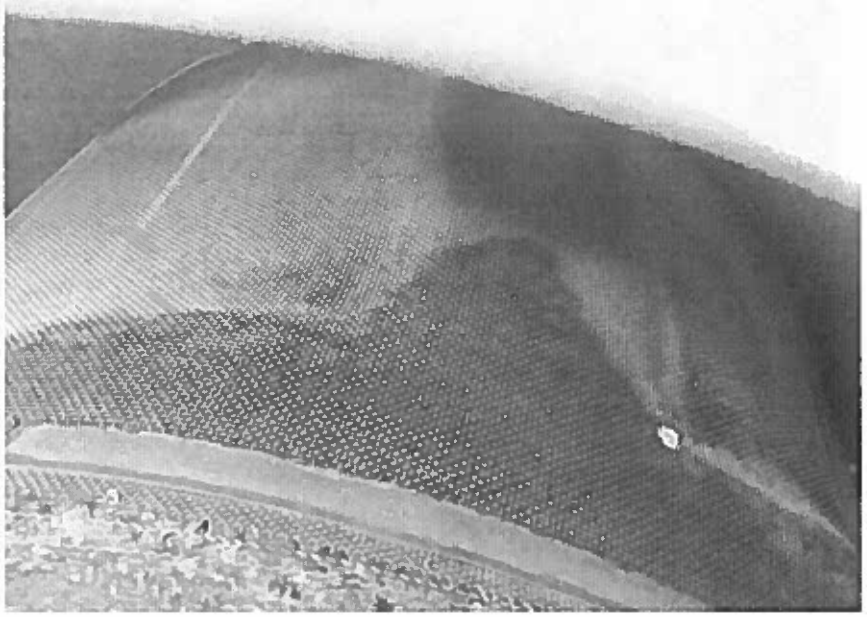
INTERIOR	Corrosion and Rusting on the rafters and roof.



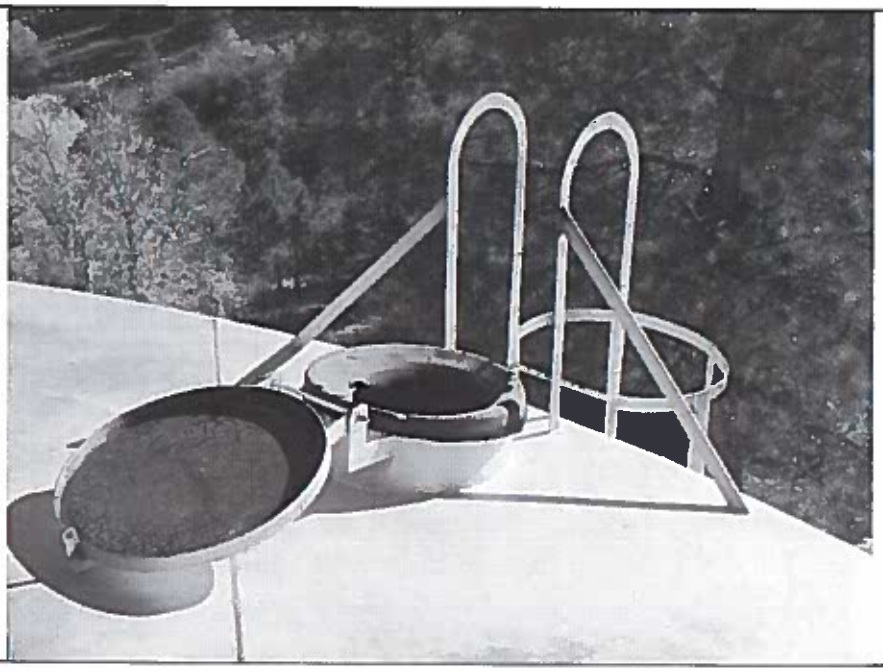
INTERIOR	Staining and biofilm on shell at the fluctuating water line.



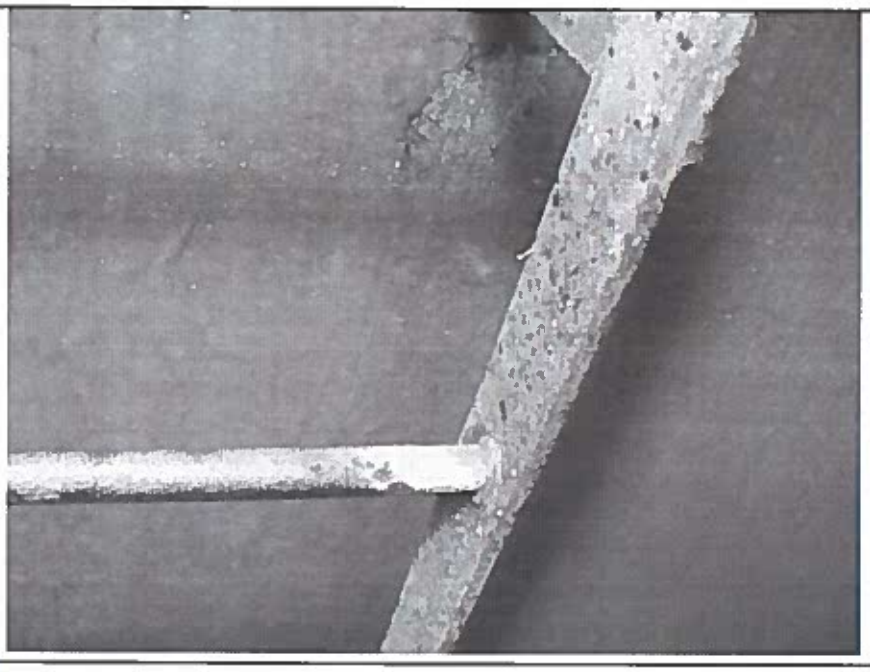
Access ladder.



Vent Screen.

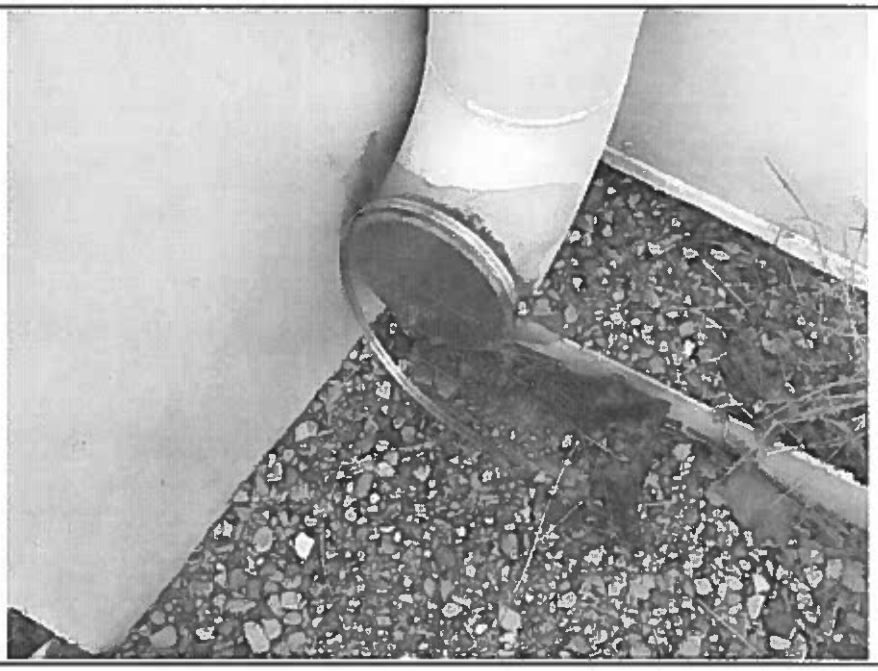


Roof hatch and roof access.

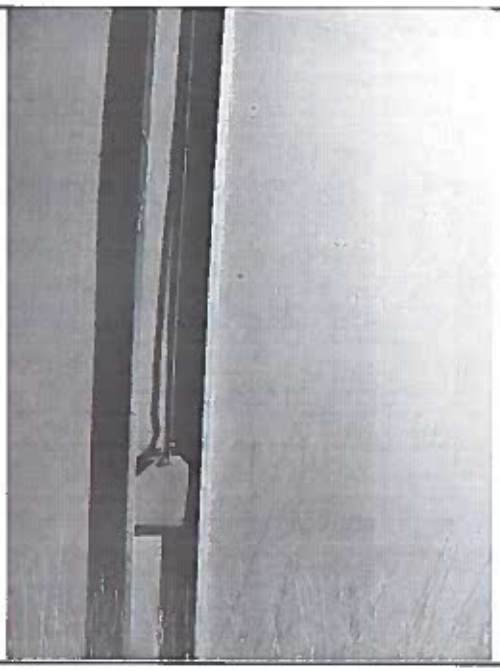


Interior ladder.

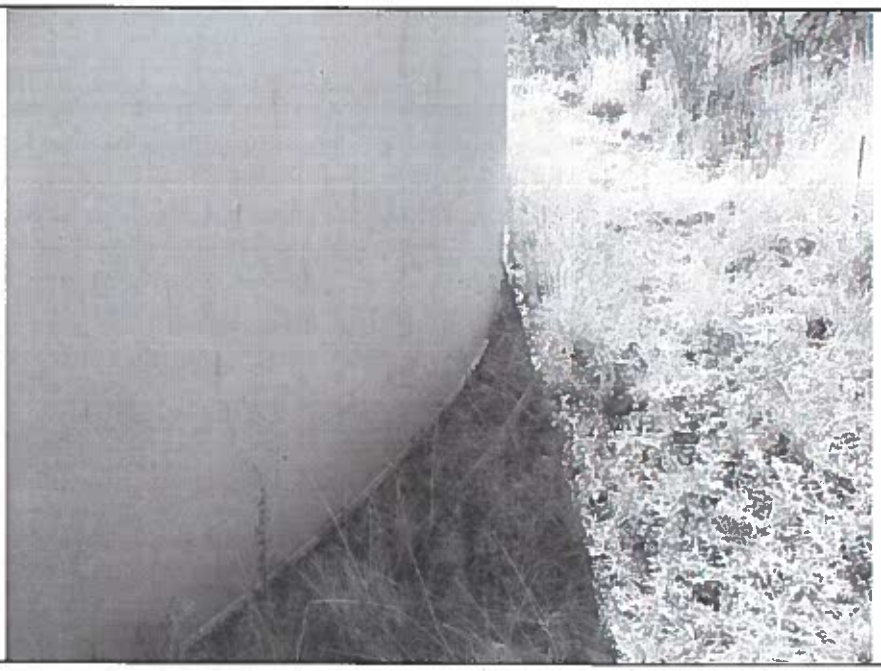
Roof Vent.



Overflow termination.



Liquid level indicator gauge board and target.

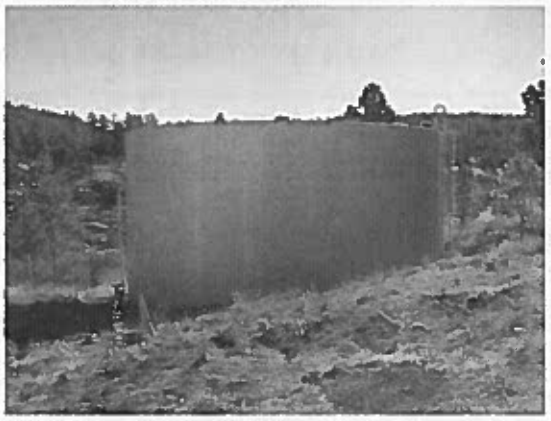


Gravel foundation.

SUPERIOR TANK SOLUTIONS

Summary Assessment Report

City of Williams, AZ



WATER TREATMENT PLANT 2 – 280,000 GALLONS

Date: November 18, 2014

Matt Tasch
(480) 390-0487
MTasch@superiortanksolutions.com

SUMMARY ASSESSMENT REPORT

CITY OF WILLIAMS, AZ

ASSESSMENT INTRODUCTION

Superior Tank Solutions, Inc. conducted a visual assessment at the customer's request. The purpose of the assessment was to determine the condition of the ***interior and exterior coating systems*** along with the extent of corrosion and the severity of degradation. The tank ***structure*** was evaluated in reference to the original "as built" design criteria and the applicable AWWA D.100 construction standard. Regulatory compliancy assessments were conducted in accordance with ***sanitary*** (Arizona Department of Environmental Quality), ***safety*** requirements (Federal OSHA 29 CFR 1910 & 1926 and ADOSH) and ***security*** guidelines (US Dept of Homeland Security & AWWA Security Recommendations).

TANK INFORMATION	
Inspection Date	November 18, 2014
Tank Location	Williams, AZ
Year Built	Unknown
Tank Size (gallons)	280,000
Dimensions (feet)	45'D x 24'H
Design Standard	AWWA D 100 and D 102
Tank Style	Ground Storage Tank

COATINGS, DEFICIENCIES, AND CONCERNS

IMPORTANT COMMENTS

- **Lead could be present in the exterior primer.**
- **Potential floor corrosion issues.**

EXTERIOR COATINGS

The exterior coating is a metallic alkyd. The coating has good adhesion on the shell. The top coat on the roof is deteriorating allowing the primer to become exposed. There is a high probability the primer contains lead and should therefore not be exposed to the environment. There are many small damage sites on the shell from abrasion. The lower few inches of the shell coating is deteriorating due to exposure to corrosive conditions resulting from poor draining around the tank and/or build up against the tank.

INTERIOR COATINGS

The interior was recoated several years ago with an epoxy. The coating is in good condition with isolated areas of rusting on the rafters and exposed edges. The coating is heavily stained below the water line. The floor is covered in a layer of sediment.

SAFETY, SECURITY, AND STRUCTURAL DEFICIENCIES

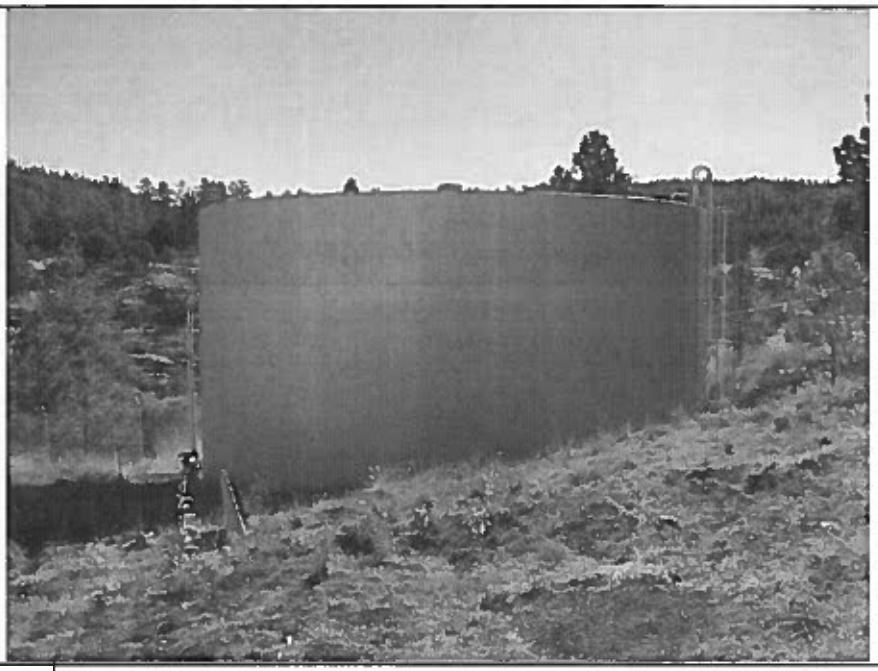
- The access ladder cage should have expanded metal installed around the base to prevent the cage from being used as a ladder.
- The access ladder gate should be replaced with a swing style locking ladder gate.
- The access ladder safety cage should be extended to above the tank roof level.
- OSHA compliant roof railing should be installed to each side of the access ladder.
- It is recommended to install a second shell manway to facilitate confined space requirements.
- The roof hatch should be replaced with a locking shoebox style hatch.
- The roof has a very large number of penetrations for CP hand holds. These penetrations are currently not compliant and represent a sanitary risk. It is strongly recommended to either upgrade the penetrations to meet compliance or remove the CP then seal the holes.
- The steel grade band and gravel foundation is buried. It should be exposed to allow proper draining from around and beneath the tank.
- It is recommended to install a second shell manway to facilitate confined space requirements.

CONCERNS AND WATER QUALITY

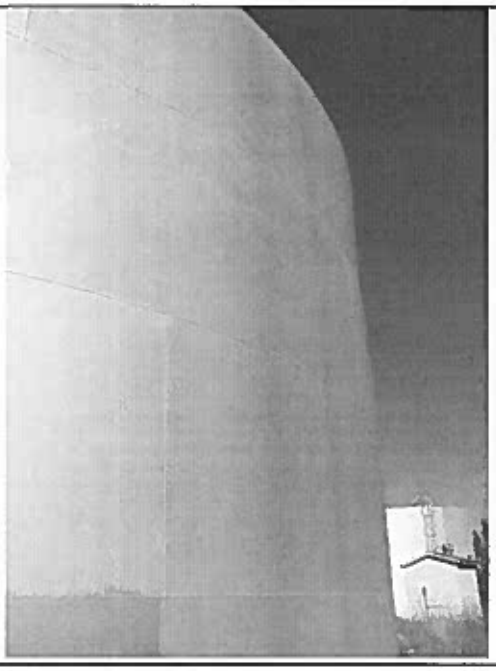
- Water Quality is a concern in this tank. The presence of bio-film and apparent stagnation are evident in this tank. This can be observed by the buildup on the shell at the fluctuating water line and through the presence of debris on the surface of the water. The tank is most likely short circuiting resulting in thermal stratification. This allows the water to stagnate and biofilm to develop in the boundary areas.

RECOMMENDATIONS

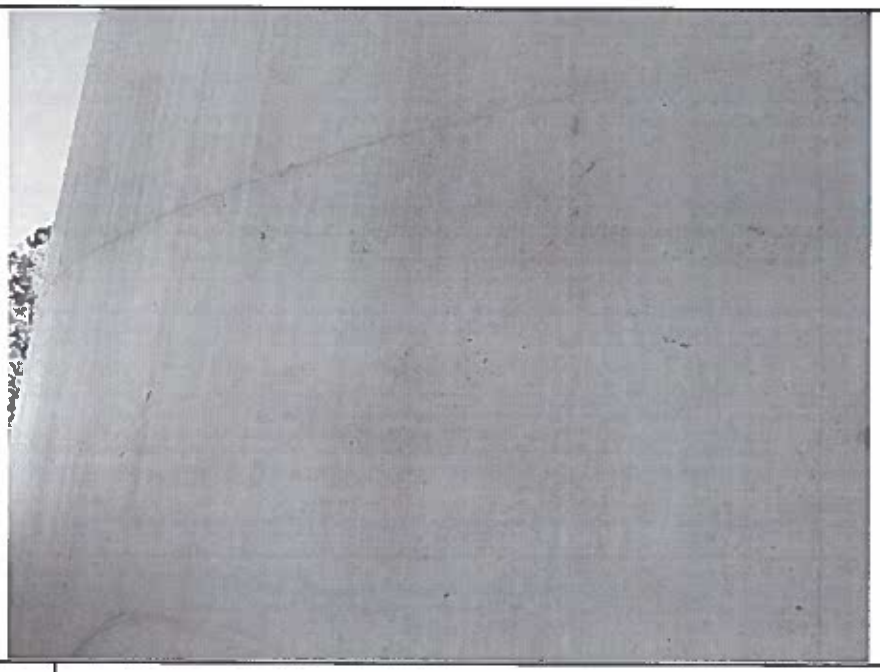
- All exterior surfaces require a high pressure wash, spot prep and prime, and a 2 coat overcoat of a compliant coatings system.
- All interior surfaces require renovation by means of an SSPC-SP 10 blast and application of a compliant NSF coating system.
- The roof vent should have a compliant screen installed.
- The roof hatch should be replaced with a locking shoebox style hatch.
- The access ladder gate should be replaced with a swing style gate.
- The access ladder cage should be extended a few feet above the tank roof.
- OSHA complaint railing should be installed to each side of the access ladder.
- To prevent unauthorized access on the tank expanded metal should be installed around the lower section of the exterior ladder cage.
- The Cathodic Protection roof entry points should be raised off the roof 4" with a locking cap or sealed with steel plates.
- The foundation is buried. It should be exposed to allow proper drainage.
- Install a second shell manway.
- It is strongly recommended that an active mixing be installed in the tank to improve water quality.



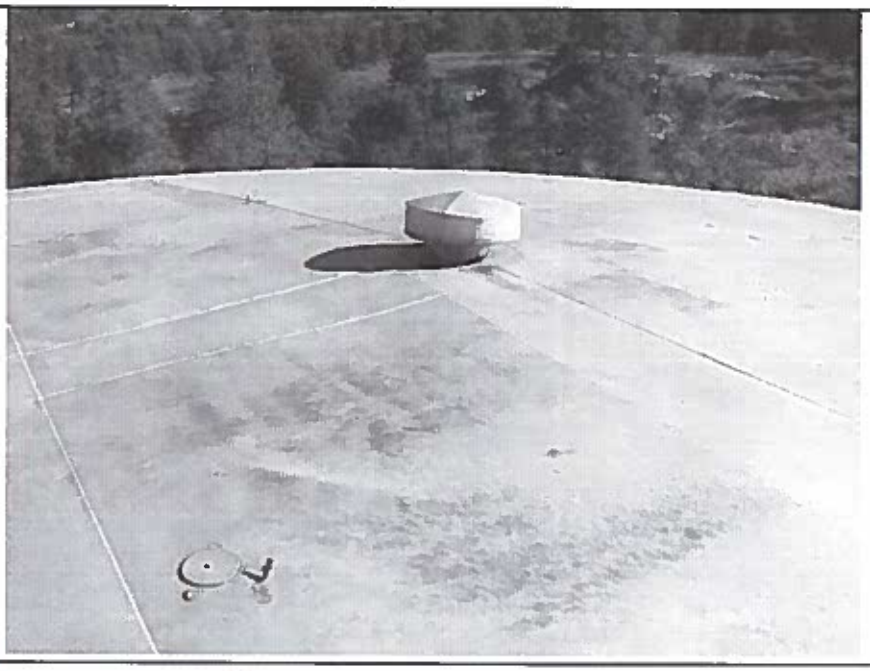
EXTERIOR	Fading and chalking on sidewall.



EXTERIOR	Dissimilar coating on shell.

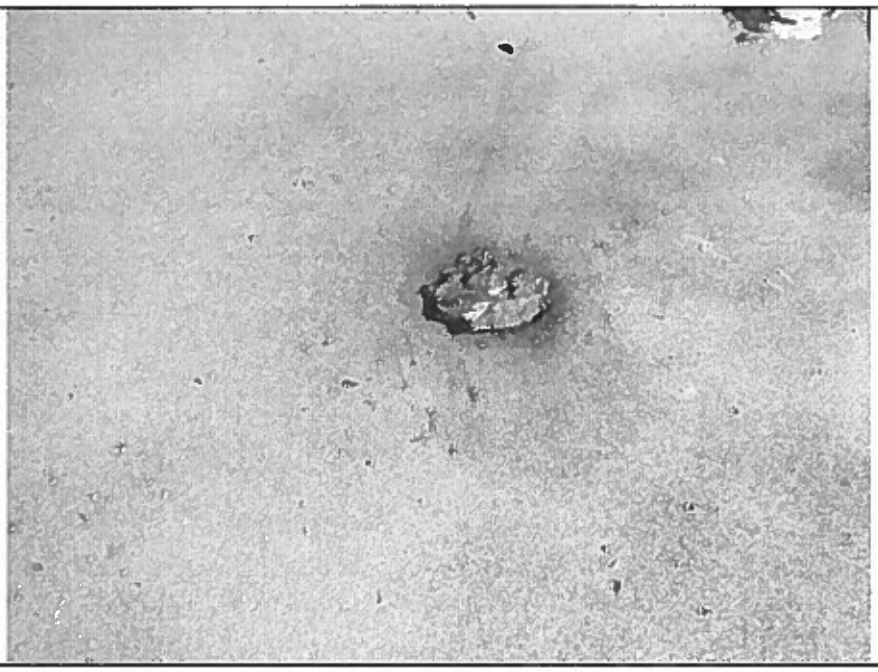


EXTERIOR	Many small abrasion and sites of coating damage.

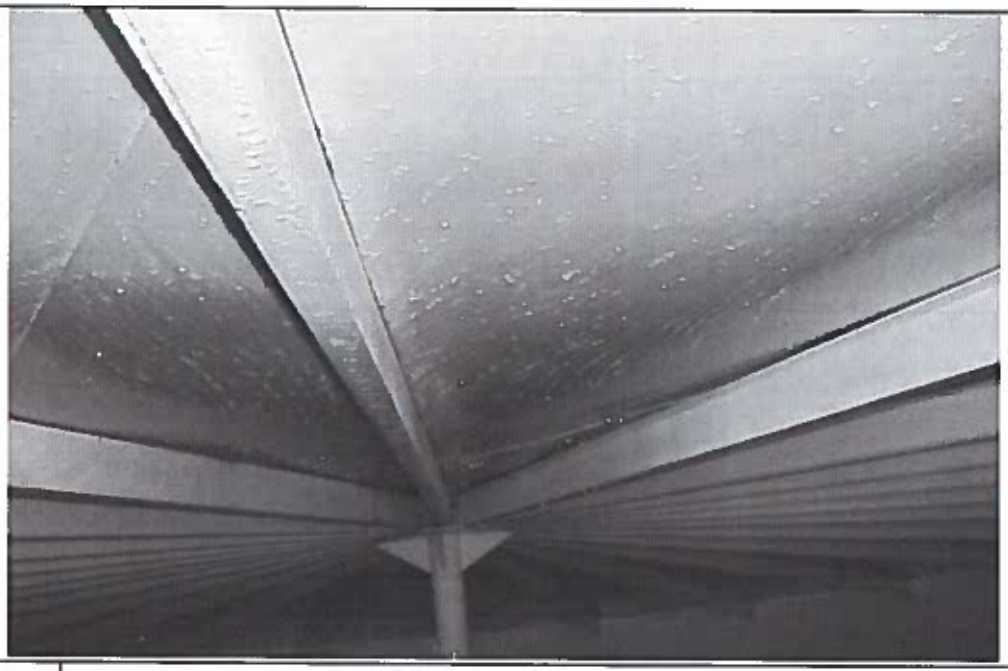


EXTERIOR	Prime coat exposed.

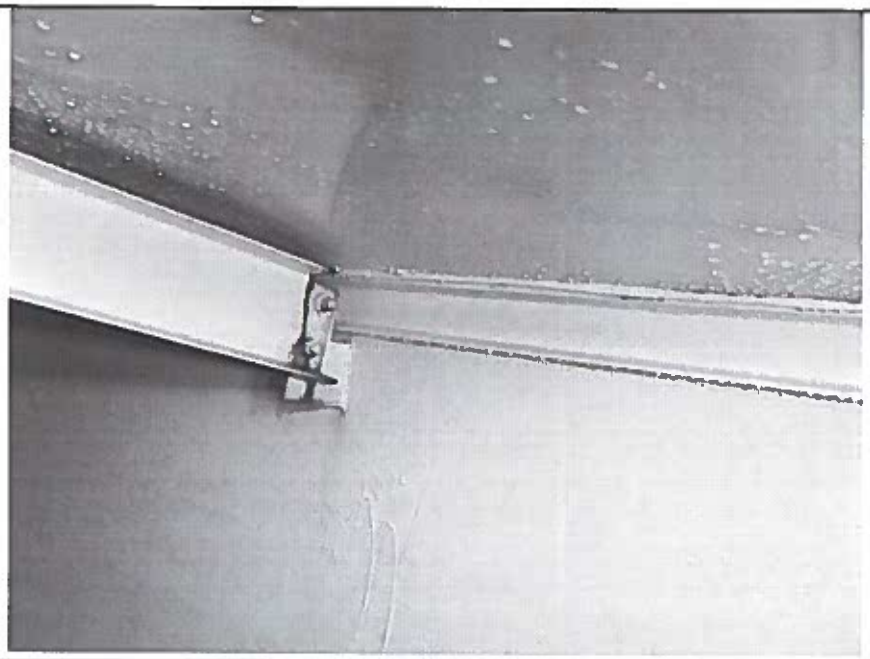
EXTERIOR	Exposed primer on roof.



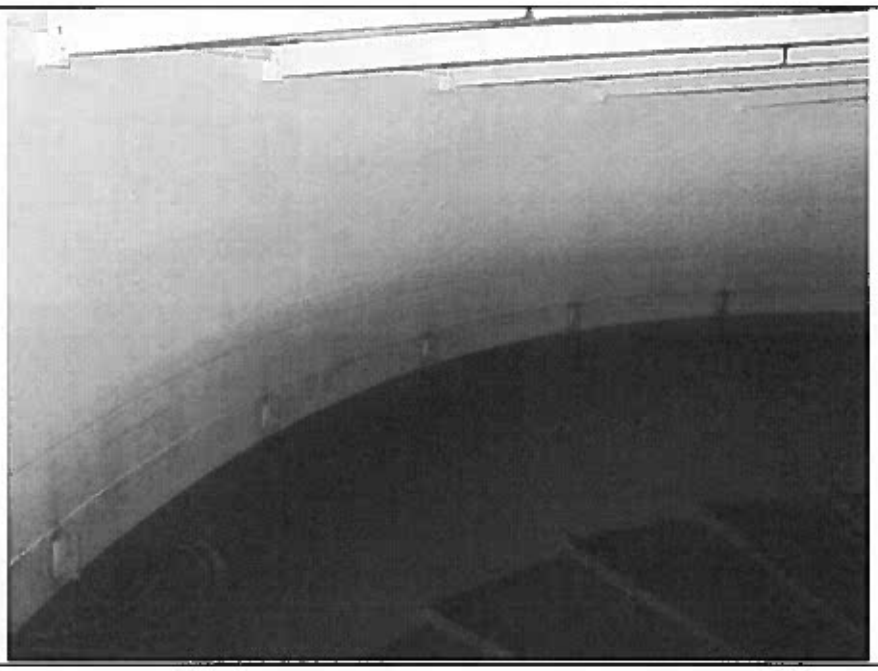
EXTERIOR	Poorly filled in hole.



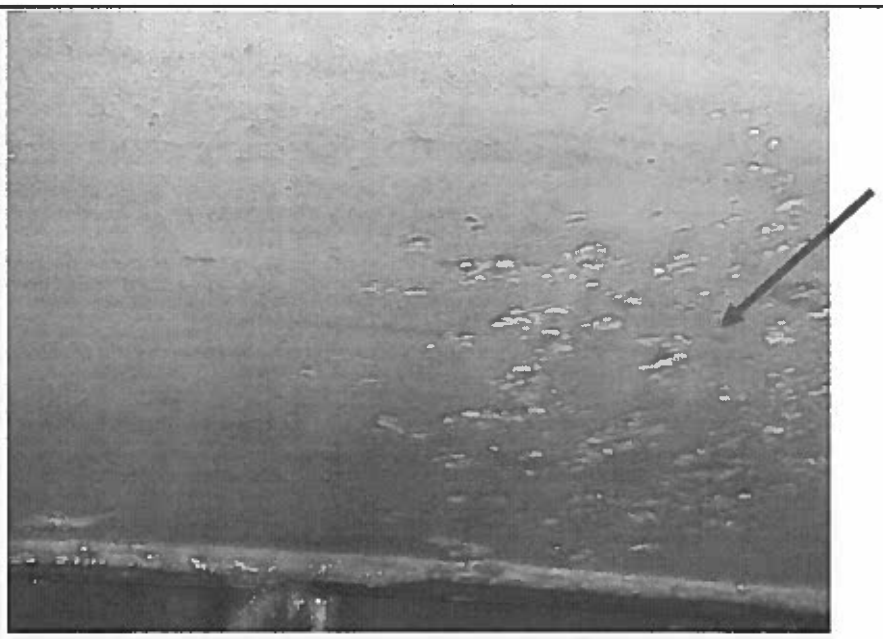
INTERIOR	Rafters and roof.



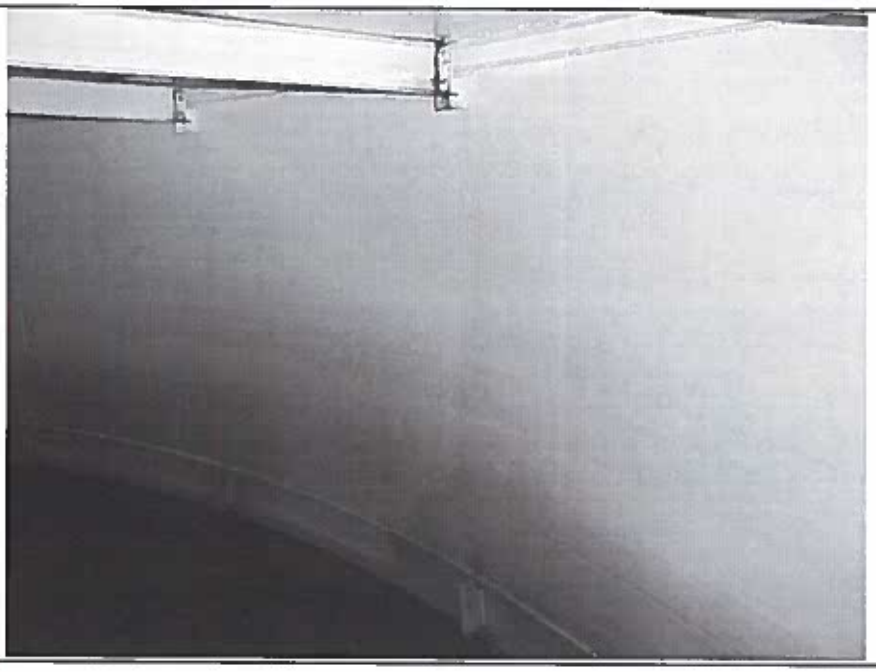
INTERIOR	Rusting at connection point and runs in existing coating.



INTERIOR	Staining on shell.

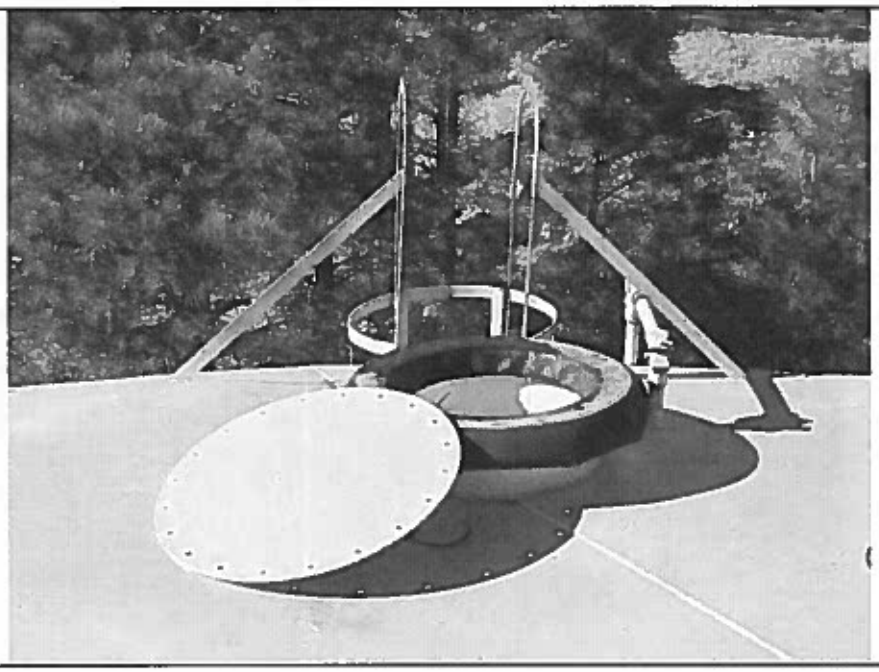


INTERIOR	Metal loss from corrosion prior to recoating.

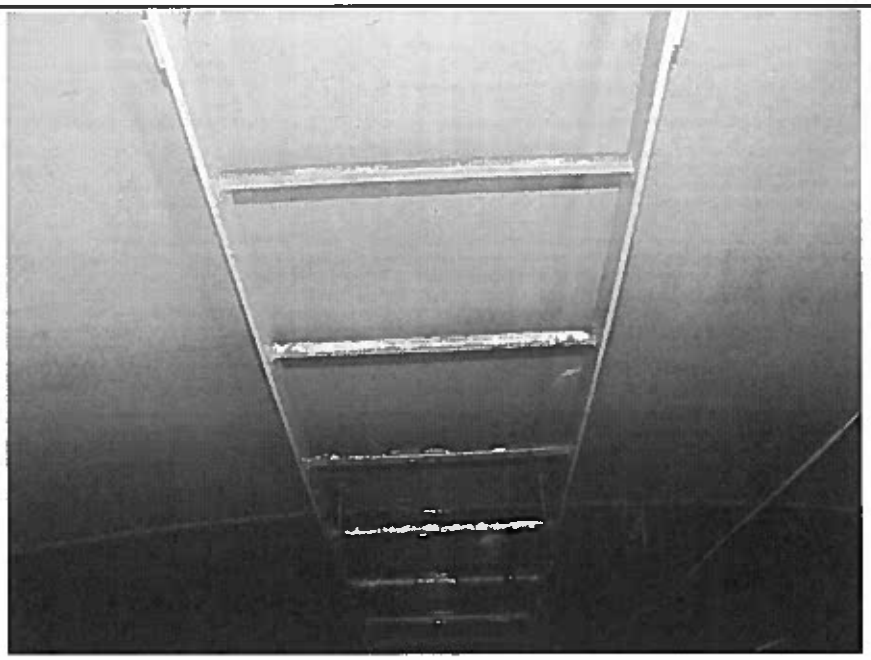


INTERIOR	Staining on shell.

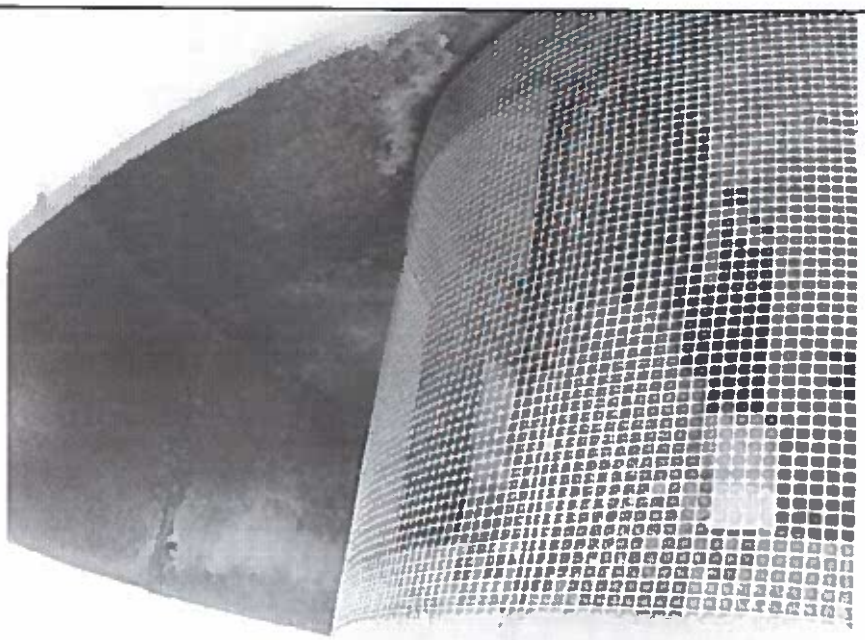
INTERIOR	Sediment on tank floor.



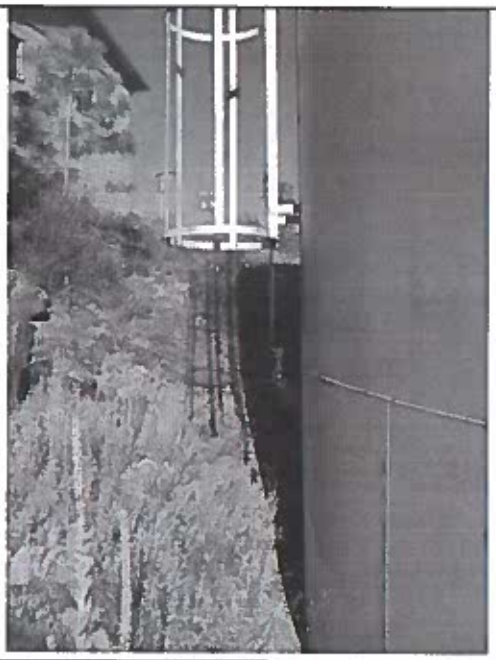
Roof Access and roof hatch.



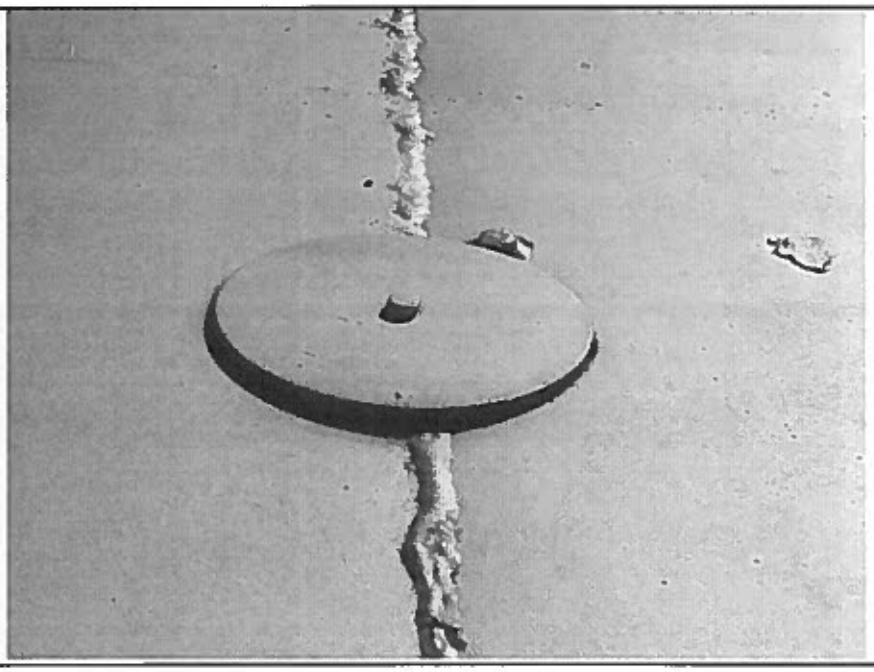
Interior ladder.



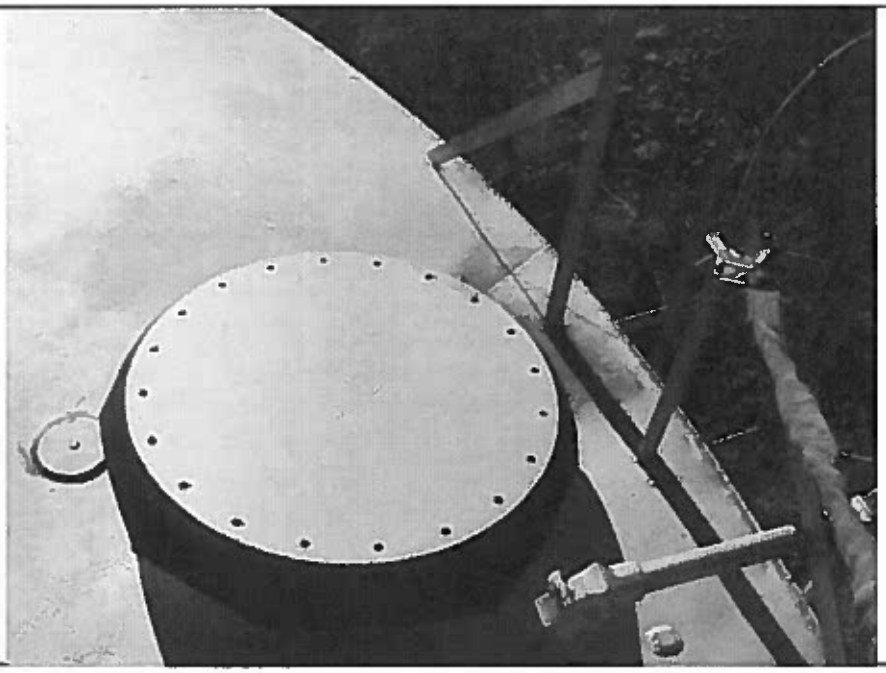
Vent screen.



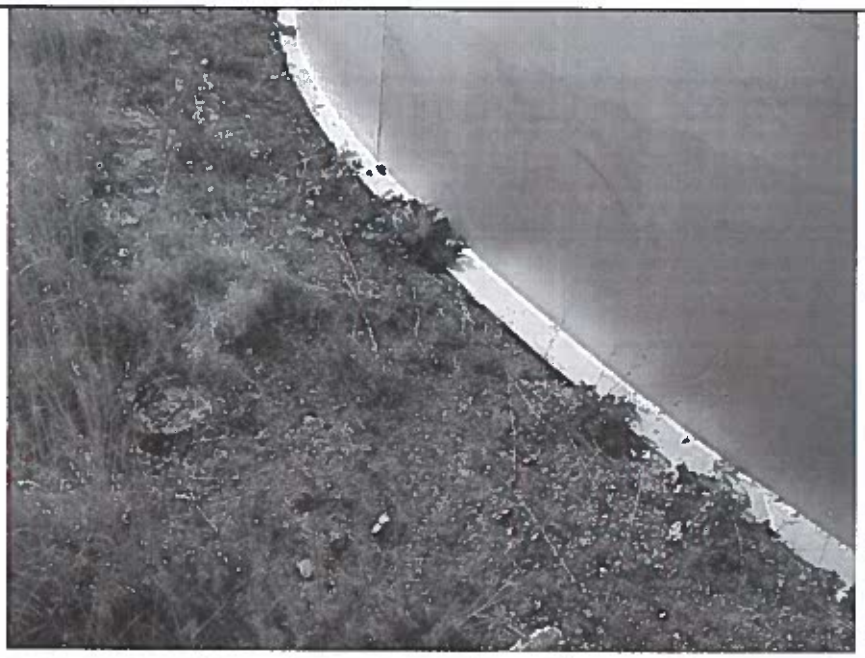
Access Ladder



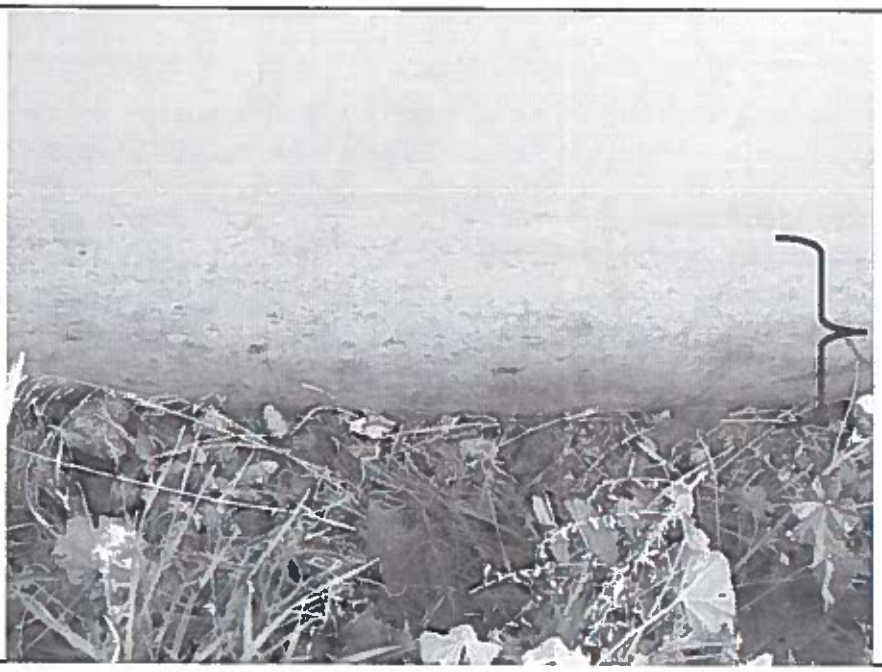
CP handholds.



Flanged roof hatch.



Buried foundation.



Water line on lower shell due to poor site drainage.