CITY OF MABTON

YAKIMA COUNTY **WASHINGTON**

WATER SYSTEM IMPROVEMENTS
PROJECT REPORT

G&O #14062
MARCH 2015

Gray & Osborne, Inc.
CONSULTING ENGINEERS

CITY OF MABTON

YAKIMA COUNTY **WASHINGTON**

WATER SYSTEM IMPROVEMENTS
PROJECT REPORT

DAVID VAN CLEVE
STATE OF WASHINGTON
30789
REGISTERED
PROFESSIONAL ENGINEER

4-6-2015

G&O #14062
MARCH 2015

Gray & Osborne, Inc.
CONSULTING ENGINEERS

TABLE OF CONTENTS

CITY OF MABTON

WATER SYSTEM IMPROVEMENTS PROJECT REPORT

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDIX

CITY OF MABTON
WATER SYSTEM IMPROVEMENTS
PROJECT REPORT

INTRODUCTION

The City of Mabton has received project funding from DWSRF and CDBG for water system improvement projects. Table 1-1 presents the funding agency and the amount of funding available for each project. All of the projects included in Table 1-1 were included in the recently approved Water System Plan.

TABLE 1-1

Monthly Water Rates

Project	Funding Available	Funding Agency
Drill & Equip Well No. 6	$1,800,000	DWSRF DM13-952-181 Loan/Grant
New 1.0 Mgal Reservoir	$2,518,000	DWSRF 2014-065 Loan CDBG Grant
Chlorination System Improvements		
Diesel Generator Well No. 5		

This report will provide the equipment sizing for the proposed projects.

WATER USE

Since the 2013 Water System Plan, the City has repaired and installed a flow meter at Well No. 4. The water use projected in the 2013 Water System Plan was estimated from consumption records, whereas this report will utilize actual production records to adjust those projections with actual usage.

Table 1-2 presents the water production for 2013 and 2014 based on flow meter data from Well No. 4 and 5. Actual production shown in Table 1-2 is higher than the estimate production in the 2013 Water System Plan. The calculated average day demand (ADD) to maximum day demand (MDD) peaking factor in Table 1-2 is 2.38 versus the 2.1 peaking assumed for the 2013 Water System Plan.

FUTURE WATER USE

Table 1-3 projects the future water use for the 20-year planning period based on an annual population growth rate of 1.5 percent as utilized in the 2013 Water System Plan.

TABLE 1-2

Water Production

Year	Service Area Pop. (1)	Production (gal) (2)	ADD (gpd) (3)	ADD (gpm) (4)	MDD (gpm) (5)	PHD (gpm) (6)
2013	2,305	154,811,938	424,000	294	691	1,451
2014	2,310	165,502,645	453,000	315	761	1,597
Average		**160,157,292**	**438,500**	**305**	**726**	**1,524**

(1) Population data from the Office of Financial Management.
(2) Production based on Well No. 4 and 5 flow meters.
(3) ADD (gpd) = Production / 365 days.
(4) ADD (gpm) = ADD (gpd) / 1440 min.
(5) MDD based on Well No. 4 and 5 flow meter records.
(6) PHD = MDD x 2.1 peaking factor. 2.1 peaking factor as determined in the 2013 Water System Plan.

TABLE 1-3

Future Water Production

Year	Service Area Pop. (1)	Production (gal) (2)	ADD (gpd) (3)	ADD (gpm) (4)	MDD (gpm) (5)	PHD (gpm) (6)
2015	2,310	160,157,292	453,000	315	761	1,597
2021	2,564	177,768,000	487,000	338	805	1,690
2035	3,158	218,951,000	600,000	417	992	2,083

(1) Population is projected to grow at 1.5 percent per year.
(2) Production is projected to grow at 1.5 percent per year, the same as the population growth rate.
(3) ADD (gpd) = Production / 365 days.
(4) ADD (gpm) = ADD (gpd) / 1440 min.
(5) MDD (gpm) = ADD (gpm) x 2.38 peaking factor.
(6) PHD = MDD x 2.1 peaking factor. 2.1 peaking factor as determined in the 2013 Water System Plan.

WELL SIZING

The City completed a hydrogeological evaluation of the City's three existing wells. The results of the evaluation are presented in the 2015 Source Water Protection Project Report. The City has three existing wells as follows:

- Well No. 3 - 60 gpm. This well is high in nitrates and the 2015 Source Water Protection Project Report recommended that the well be decommissioned.
- Well No. 4 - 200 gpm
- Well No. 5 - 450 gpm

The City intends to drill a Well No. 6, and the 2015 Source Water Protection Project Report estimated that the new well would yield 1,000 gpm. To be conservative, this source analysis assumes that the actual production rate will be 700 gpm.

WAC 246-290-222 (4) requires total source capacity to be sufficient to provide a reliable supply of water equal to or exceeding the MDD at all times. Table 1-4 presents the source capacity analysis assuming the new Well No. 6 produces 700 gpm. Table 1-4 shows that the system did not have sufficient capacity in 2015 to meet MDD. In 2014, the water system operator reported that during the summer maintaining reservoir level was difficult, which indicates that MDD is slightly greater than current source production.

TABLE 1-4

Source Capacity Analysis

Year	Source Capacity(gpm) (1)	MDD (gpm) (2)	(+ / -) (gpm) (3)
2015 (w/o new well)	650	761	-111
2021 (with new well)	1,350 (4)	805	545
2035 (with new well)	1,350 (4)	992	358

(1) Assuming a 700 gpm well drilled in 2015.
(2) From Table 1-3.
(3) (+ / -) (gpm) = Source Capacity - MDD.
(4) The City is in the process of buying additional water rights. This assumes that the instantaneous water rights would be increased to allow both Well No. 5 and 6 to operate.

In addition to meeting the requirements of WAC 246-290-222 (4), the WSDM recommends that systems wishing to provide a high level of reliability to their customers consider the following source criteria for emergency conditions:

1. Provide sufficient source capacity to meet the MDD and replenish fire suppression storage within 72 hours. The largest fire suppression storage requirement is 180,000 gallons (1,500 gpm for 2 hours).

2. Meet the MDD with 18 (rather than 24) hours of pumping.
3. Meet the ADD with the largest source out of service.

Table 1-5 presents the source reliability analysis assuming that the new Well No. 6 produces 700 gpm well. Table 1-5 shows that the City does not meet the reliability requirements without the new well, and it will meet the requirements for the 20-year planning period with the new well.

TABLE 1-5

Source Reliability Analysis

Condition	Q (avail.) (1) (gpm)	Q (req'd) (7) (gpm)	(+/-) (gpm)
2015 (w/o new well)			
1. Meet MDD & Replenish FSS w/in 72 hrs	650 (1)	802 (8)	-152
2. Meet MDD w/ 18 hrs Pumping	488 (2)	761	-273
3. Meet ADD w/o Largest Source	200 (3)	315	-115
2035 (with new well)			
1. Meet MDD & Replenish FSS w/in 72 hrs	1,350 (4)	1,033 (8)	317
2. Meet MDD w/ 18 hrs Pumping	1,013 (5)	992	21
3. Meet ADD w/o Largest Source	650 (6)	417	233

(1) Output of Well No. 4 and 5.
(2) Output of Well No. 4 and 5 times 0.75.
(3) Output of Well No. 4.
(4) Output of Well No 5 and 6.
(5) Output of Well No 5 and 6 times 0.75
(6) Output of Well No 6.
(7) From Table 1-3.
(8) From Table 1-3 plus 1,500 gpm x 120 min / (72 hrs x 60 min/hr).

As shown in the Table 1-4 and 1-5 a 700 gpm well is the minimum well size that will meet all of the source reliability criteria for the 20-year planning period. The City is hoping that the new well will actually provide a 1,000 gpm.

The distribution system leakage (DSL) for 2013 and 2014 is 15 percent and 13.5 percent respectively. If the City reduces its DSL, the new well will meet the source requirements for more than 20 years. In addition, conservation would reduce water use and allow the new well will meet the source requirements for more than 20 years.

WATER RIGHTS

The City currently has certificates for an instantaneous (Qi) water right of 1,000 gpm and an annual withdrawal (Qa) water right of 452.4 acre-feet. The City also has a right for a well for use at the wastewater treatment facility for Qi of 15 gpm and Qa of 2 acre-feet

per year (this right not included in Table 1-5). A summary of the City's water rights is presented in Table 1-6.

TABLE 1-6

City of Mabton Water Rights

Source	Water Right Number	Type	Priority Date	Maximum Instantaneous Withdrawal (gpm)	Annual Withdrawal (Acre-Feet)
Well Nos. 2 & 3	G3-00027C	Certificate	3/3/1971	1,400	280 (1)
Well No. 4	G4-29212C	Certificate	2/24/1987	1,000 (2)	452.4 (2)
Well Nos. 4 & 5	CG4-29212C	Change Cert./ROE (3)	4/27/2004	--	--
Subtotal (Sources used in City's water system):				1,000 (2)	452.4 (2)

(1) Total Qa capped at 280 acre-ft. Originally this right was for Wells No. 1 and 2, but Well No. 1 has been decommissioned.

(2) 280 acre-feet of this right are alternate, non-additive to Ground Water Certificate No. G3-00027C. CG4-29212C limits Qi to 1,000 gpm and Qa to 452.4 acre-ft.

(3) Water Right Change Application is approved to allow Well No. 4 and Well No. 5 as the points of withdrawal for this water right.

The new well will be considered an additional well per RCW 90.44.100. RCW 90.44.100 requires a showing of compliance for the new additional well for the following reasons:

- The well shall tap the same body of public groundwater as the original well or wells. The existing Well No. 4 is drawing water from the upper and lower Saddle Mountain Basalt. The new Well No. 6 will draw water from the lower Saddle Mountain Basalt.[1]
- As used in this section, the "location of the original well or wells" is the area described as the point of withdrawal in the original public notice published for the application for the water right for the well. The new Well No. 6 will be in the same quarter/quarter section identified in the original public notice for Well No. 4 and will be approximately halfway between Well No. 4 and 5.
- If an additional well is constructed, the original well or wells may continue to be used, but the combined total withdrawal from the original and additional well or wells shall not enlarge the right conveyed by the original water use permit or certificate. Certificate G4-29212C for Well No. 4 allows a withdrawal rate of 1,000 gpm. The maximum withdrawal rate of the new Well No. 6 will be 1,000 gpm. This will preclude Wells 4, 5 or 6 from operating simultaneously.

[1] City of Mabton Source Water Protection Project Report Feb 2015 Appendix A and D.

- The construction and use of the well shall not interfere with or impair water rights with an earlier date of priority than the water right or rights for the original well or wells. An impairment analysis was performed for Well No. 5 in 2004.[2] This impairment analysis determined that Well No. 5 pumping at 1,000 gpm would not impair any nearby wells. Either Well No. 5 or the new Well No. 6 will operate at maximum rate of 1,000 gpm. The impairment analysis determine that the nearest well to Well No. 4 is 1.4 miles away. The new Well No. 6 is further away from the nearby wells than Well No. 4. Well No. 6 or combination of Well No. 6, Well No. 4 and 5 as long as the maximum pumping rate is 1,000 gpm will not impair nearby wells.
- The replacement or additional well shall be located no closer than the original well to a well it might interfere with. As discussed in the previous bullet the new well will not be closer to the nearby wells than the original Well No. 4.
- The department may specify an approved manner of construction of the well. According to the 2015 Source Water Protection Project Report, the new well will be constructed as follows:

    - Drilling for a 20-inch surface seal with a 16-inch surface seal casing to 350 feet by rotary air method.
    - Drilling a 15.25-inch open hole to approximately 720 feet by rotary air method.
    - If required by the conditions in the open hole install a 12-inch liner to 720 feet with a stainless steel screen from 470 to 500 feet and 680 to 720 feet.

As discussed above, the new Well No. 6 will meet the requirements for an additional well. The Department of Ecology form showing of compliance with RCW 90.44.100 will be submitted to Ecology prior to drilling the well.

EQUIPPING WELL NO. 6

The equipping of Well No. 6 will be included in a project report after the well is drilled and the output of the well is known. The Well No. 6 as a minimum will be equipped with the following:

- Well house
- Emergency generator
- Variable frequency drive
- Vertical turbine pump
- Flow meter
- Water level sensing device

[2] City of Mabton Source Water Protection Project Report Feb 2015 Appendix E Well No. 5 Impairment Analysis

- Chlorination for the well will be provide by the chlorination system in the City Park. The City chlorinates all water before it enters the reservoir.

RESEVOIR

WAC 246-290 and the WSDM define the following storage volumes for reservoirs.

- *Operational Storage (OS)*: Operational storage is the volume at the top of the reservoir that is used to control the well pumps. The City uses the top 5 feet, or approximately 35,000 gallons, for this purpose.

- *Equalizing Storage (ES)*: This storage component consists of the amount of storage needed to make up the difference between the PHD and the source capacity of the water system. The WSDM requires sufficient ES to make up this difference for 150 minutes, i.e.,

  $$ES = (PHD - Q_S)(150 \text{ min}),$$

  Where, Q_S = the sum of all well capacities (in gpm) in the zone supplying the reservoir. WAC 246-290-230 (5) requires a minimum pressure of 30 psi at the bottom of ES.

- *Fire Suppression Storage (FSS)*: Fire suppression storage is the amount of storage required to fight a fire. WAC 246-290-230 (6) requires a minimum pressure of 20 psi when the system is simultaneously providing MDD plus the required fire flow. The required FSS is determined to be the amount of required fire flow multiplied by the fire flow duration. The City's largest maximum fire flow storage requirement is 1,500 gpm × 120 min = 180,000 gallons.

- *Standby Storage (SB)*: The purpose of standby storage is to provide a measure of reliability when sources fail, power outages occur, or another emergency places the burden of water system supply solely on storage. With the approval of the local fire authority (which the City's Fire Chief has granted), WAC 246-290-235 allows fire suppression and standby storage to be nested, with the larger of the two volumes being the minimum required. Section 9.0.4 of the WSDM indicates that SB should provide for two days of ADD assuming the largest water source is out of service, i.e.,

  $$SB1 = (2\ days)(ADD) - t_m(Q_S - Q_L)$$

  Where, Q_L = the capacity of the largest source, and t_m is the time that the sources are pumped during the two-day outage. The WSDM suggests using t_m = 1,440 minutes, or one day of pumping.

Alternatively, the WSDM recommends that SB be no less than 200 gallons times the number of ERUs being served by the reservoir.

Table 1-7 presents the required minimum storage required for the City assuming the new Well No. 6 is a 700 gpm well.

TABLE 1-7

Storage Volumes without Nesting
Assuming Well No. 6 is 700 GPM Well (1)

Year	Storage Component (Amounts in gal)				
	OS	ES	FSS (2)	SB	Total
2015	35,000	142,000	180,000	618,000 (3)	975,000
2021	35,000	51,000	180,000	157,400 (4)	423,400
2035	35,000	110,000	180,000	264,000 (4)	589,000

(1) In 2015, storage volumes calculated with existing wells only. The for 2021 and 2035, the storage volume calculated with the existing wells and new Well No. 6 with a 700 GPM output.
(2) Fire Suppression Storage of 1,500 gpm for 2 hours.
(3) 2015 SB storage based on the 2 days of ADD storage requirement.
(4) 2021 and 2035 SB storage based on 200 gallons x Number of ERUs.

The bottom of the Standby Storage should provide at least 20 psi at the highest service in the City. For Mabton the highest service in the UGA is at approximately elev. 737, putting the minimum allowable hydraulic gradient for standby storage at elev. 783 (737 + 20 x 2.31).

The bottom of Equalization Storage should provide at least 30 psi at the highest service in the City. For Mabton the highest service in the UGA is at approximately elev. 737, putting the minimum allowable hydraulic gradient for the equalization storage at elev. 806 (737 + 30 x 2.31).

The City's booster pump station typically provides 60 to 65 psi of pressure at the outlet of the booster pump station except during the summer months when it is typically lower. The City has decided to continue to provide this level of service to the City. The tank base is 723 feet in elevation. The minimum level for operational storage is 806 (861 + 60 x 2.31).

Figure 1-1 shows how the new reservoir and the existing reservoir meet these requirements. The new storage reservoir will be 145 feet high and 35 feet in diameter and will have a total storage volume of 1.0 million gallons (Mgal).

The new reservoir and existing reservoir will not have dead storage because the existing pump station (2,000 gpm @ 30 psi) will allow the City to utilize all of the storage in the reservoir.

The existing storage reservoir has aeration trays for methane removal. The only known methane producer was Well No. 2 and Well No. 2 is no longer in service. During well construction all three wells will be tested for methane and if required trays will be added. In any case, an explosion proof fan will be added to the new reservoir to ventilate the air space to remove the possibility of methane collecting.

The City's water system model was used to determine the pressures in the City with the new reservoir in operation. With the new reservoir, the pressures in the City are 53 psi (southeast corner of City) to 76 psi (wastewater treatment facility) at 2035 peak hour demands and operational and equalization storage depleted in the new reservoir.

Table 1-8 presents the results of the fire flow model with operational, equalization and fire suppression storage empty and 2035 maximum day demand. Table 1-7 also shows the improvement to fire flow with the water main improvements that are scheduled to be constructed with Rural Development (RD) funding in 2016.

Table 1-8

Fire Flow Results (1)

Fire Flow (gpm)	Existing System (%)	With RD Funded Water Main Improvements (%)
300-1,000	49%	21%
1,000-1,500	25%	14%
> 1,500	26%	64%

(1) Operational, equalization and fire suppression storage empty and 2035 maximum day demand

The reason the existing system cannot meet the City standard of 1,500 gpm fire flow is because the 75 percent of the City's water mains are six inches or less in diameter. After the proposed Rural Development (expected construction in 2016) funded water main improvements all of the remaining areas not meeting the 1,500 gpm fire flow requirement are on 4-inch mains or dead end 4-inch mains. The Water System Plan has future improvements to replace the remaining 4-inch mains. In addition, the 4 and 6-inch mains are cast-iron installed in 1936. These small, undersized water mains are reaching the end of their useful life.

EXISTING STORAGE RESERVOIR

The existing storage reservoir is 115 feet tall and 34.5 feet in diameter with a storage volume of 800,000 gallons. The reservoir was constructed in 1975. Last year, divers completed a condition assessment of the existing reservoir and reported the following conditions:

- The exterior paint top coat has deteriorated, and the primer coat is thin. Corrosion is currently minimal on the exterior shell walls, but the exterior will need to be recoated in the near future.
- The roof access hatch and pipe penetrations have corrosion holes. The roof is not presently water tight and needs immediate repairs.
- The interior shell coating is in poor condition, blistering, flaking, corrosion and pitting are prevalent in the lowest ring. Corrosion is also heavy above the water line. The interior of the reservoir needs to be recoated in the immediate future.
- The floor is in good condition.
- The outlet is in good condition. Other interior pipes show typical non-serious corrosion.
- No security fence surrounds the reservoir.
- The screens for the roof, side and outlet needs to be replaced.
- The interior ladder is in poor condition and needs replacement.
- The divers made epoxy repairs to the most severe interior wall corrosion areas.

In addition the design drawings show that the foundation is a 10" thick ring wall that is five feet in depth with anchor bolts. This foundation will not meet the current earthquake codes and will require upgrades.

Existing Reservoir Alternative Analysis

As shown in Figure 1-1, the existing reservoir is shorter than the proposed new reservoir. The following four options will allow the existing reservoir to be utilized with the new reservoir:

1. Exiting Reservoir Alternative 1 - Construct the new 1.0 Mgal reservoir as previously discussed. Repair the existing reservoir, recoat the existing reservoir (see condition assessment), upgrading the foundation for seismic requirements and utilize a small booster pump to provide water circulation in the new reservoir.

2. Existing Reservoir Alternative 2 - Construction the new 1.0 Mgal reservoir as previously discussed. Repair the existing reservoir, recoat the existing reservoir (see condition assessment), and upgrading the foundation for seismic requirements. Have the wells pump into the existing reservoir and utilize the existing booster pump station to pump water from the existing reservoir to the new reservoir.

3. Existing Reservoir Alternative 3 - Construct the new 1.0 Mgal reservoir as previously discussed. Raise the height of the existing reservoir, repair the existing reservoir (see condition assessment), recoat the existing reservoir, and upgrading the foundation for seismic requirements.

4. Existing Reservoir Alternative 4 - Construct the new reservoir at the same height as the existing reservoir and upgrade the existing booster pump station to provide the required pressure in the City. This alternative will also include repairing the existing reservoir (see condition assessment), recoating the existing reservoir, and upgrading the foundation for seismic requirements.

Table 1-9 presents the cost for the four alternatives.

Table 1-9

Existing Reservoir Alternatives

	Alternative 1	**Alternative 2**	**Alternative 3**	**Alternative 3**
New Reservoir	$2,311,000	$2,311,000	$2,311,000	$1,941,000
Alternative Construction Cost	$1,218,000	$1,191,000	$1,990,000	$1,521,000
Total Construction Cost	$3,529,000	$3,502,000	$4,301,000	$3,462,000
Annual O&M Cost	$1,400	$7,008	$0	$25,000
Present Worth Cost	**$3,549,828**	**$3,606,261**	**$4,301,000**	**$3,833,937**

Alternatives 1 and 2 have basically the present worth cost. Alternative 1 capital cost is slightly higher than Alternative 2 and its annual O&M cost is less expensive than Alternative 2. To minimize the annual O&M cost Alternative 2 is the preferred alternative.

Alternative No. 1 will require a small booster pump to allow turn over in the reservoir and an altitude valve to prevent from overfilling the existing reservoir. A turnover rate of one complete turnover in 5 days is required, which equals a flow rate of 110 gpm (800,000 gpd / 5 day / 1440 min/day). The head required is the difference in the height of the two reservoirs or 30 feet (145 feet -115 feet). The horsepower required is 2 hp.

Figure 1-2 presents the piping required for the new and existing reservoir. The new reservoir will be placed at the site of the abandon Well No. 2.

The grant/loan package for the new reservoir included some repairs to the existing reservoir, the new booster pump, and the altitude valve. It did not include the painting or the foundation upgrades of the existing reservoir. The new reservoir will provide the required storage for the next twenty years. The City will seek additional funding to repair, paint and upgrade the existing reservoir in the next water system plan.

CHLORINATION SYSTEM IMPROVEMENTS

The City has an existing gas chlorination system near the existing Reservoir. The Gas chlorination system is turned on when Well No. 4 is turned on and does not automatically start when Well No. 5 starts. The following improvements will be made to the chlorination system:

- Install new magnetic flow meter on the transmission main from the wells to the reservoirs. The new flow meter will provide the input to the chlorination system to control the injection rate of chlorine.
- Install a new chlorine injector before the new reservoirs that will allow the injection of chlorine at 1 to 2 mg/l for flow rates from 200 to 1,500 gpm.
- Install new chlorine equipment including, gas cabinet, scales, automatic shut off valves, chlorine detection equipment and new injector.

The estimate cost for this equipment is $55,000.

EMERGENCY GENERATOR AT WELL NO. 5

Well No. 5 does not have an emergency generator at Well No. 5. Well No. 5 has a 60 hp 480 volts 3 phase motor. The City has a 100 KW/125 KVA 480 volts 3-phase diesel generator at the WWTF that is being surplus. The following work will be completed to add an emergency generator to Well No. 5.

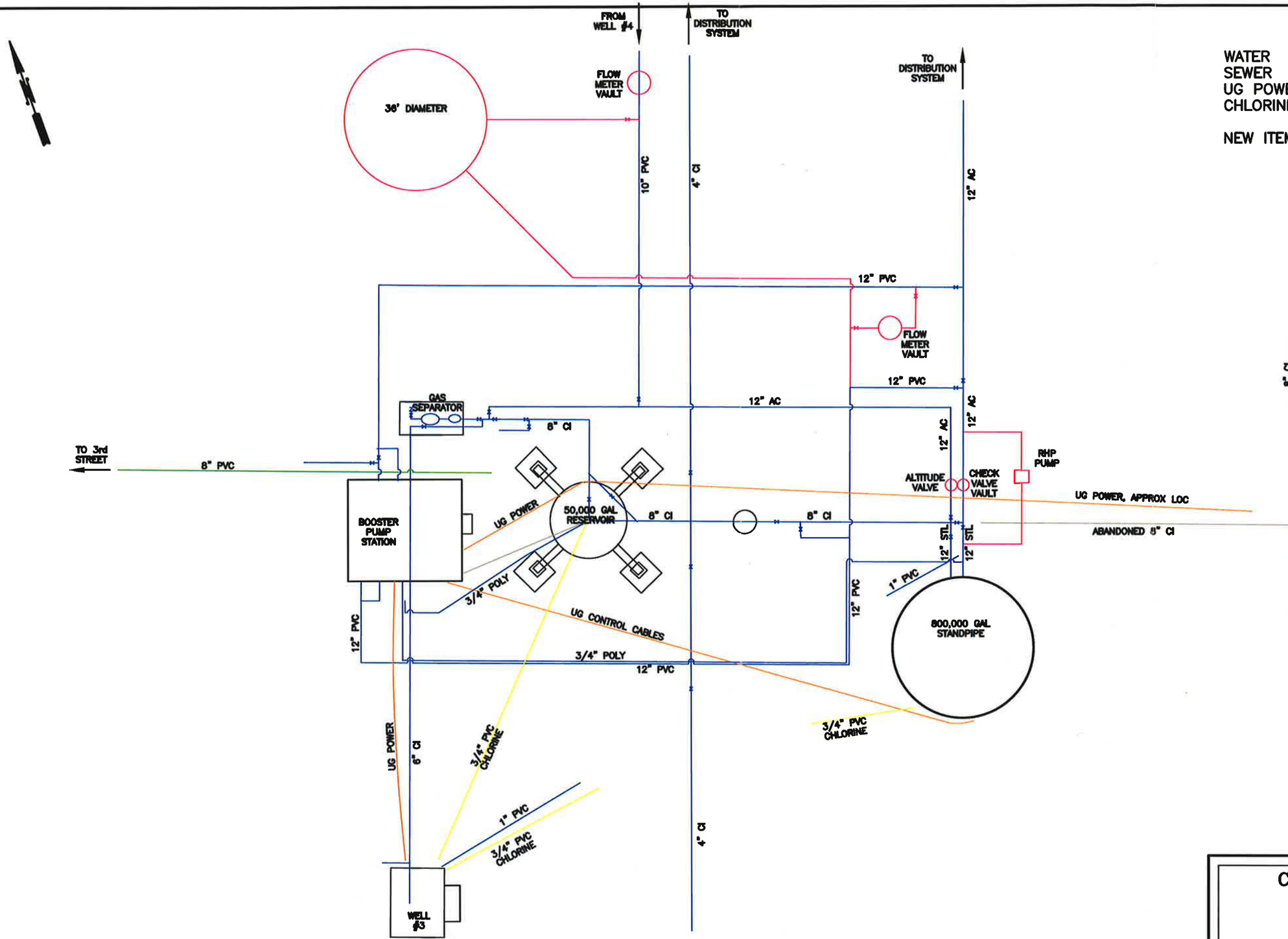
- Move the generator from the WWTF to Well No. 5.
- Install an automatic transfer switch at Well No. 5.

The estimate cost to compete this work is $50,000.

TELEMETRY AND CONTROLS

The basic flow path for the system is that the existing wells pump to the existing reservoir and the existing booster pump station pumps the water to the City from the reservoir. The existing controls for the wells and booster station consist of the following:

- Hard wires to Wells 3, 4 and 5 with a digital output to start and stop the wells.
- Pressure switches at the existing Reservoir to create the digital output to start and stop the wells.
- The digital output to Well No. 4 also starts the chlorination system.
- Pressure switches and flow meter to start and stop the existing booster pumps. However, a large portion of this functionality is inoperable and the City mostly operates the booster pumps in manual.
- The City manually records the flow meters at the well and booster pump.
- The City manually records the chlorination system usage.



CITY OF MABTON

FIGURE 1-2
RESERVOIR SITE PLAN

Gray & Osborne, Inc.
CONSULTING ENGINEERS

A new PLC based control system will be installed to control the water system. The system will still use hard wires to start and stop the existing well pumps based on the reservoir levels. A new fiber optic cable would be installed between the PLC and the new Well No. 6. Well No. 6 would have a PLC to record and control the new well.

Table 1-10 presents the proposed inputs and outputs for the system.

Table 1-10

PLC Inputs and Outputs

Inputs	Outputs
Reservoir float switch (High Level Alarm) one for each reservoir	Well start stop digital output one for each well
Reservoir pressure switch (Low Level Alarm) one for each reservoir	Alarm outputs (digital outputs) to auto dialer
Pressure transducer (analog input) one for each reservoir	Chlorination system start/stop (digital output)
Well production meter (analog input)	Flow output (analog) to chlorination system to pace chlorination system
Pump station flow meter (analog input)	Booster pump station digital output to start/stop pumps one for each pump
Well No. 6 well meter (fiber optic input)	
Well No. 6 water level (fiber optic input)	
Well No. 6 Alarms (fiber optic input)	
Chlorination system scale (analog input)	
Chlorination system failure (digital input)	

The PLC would automatically record total well production, Well No. 6 well production, Well No. 6 water level, reservoir water levels and chlorination system usage. The City would still need to manually record the flow meters for Well No. 4 and 5.

The controls for the new reservoir estimated cost is $85,000.

COST SUMMARY NEW RESERVOIR

Table 1-11 summarizes the cost for the new reservoir.

TABLE 1-11

New Reservoir Cost Summary

Item	Cost
Reservoir	$2,311,000
Chlorination System	$55,000
Emergency Generator	$50,000
Controls	$85,000
Administration	$17,000
Total	$2,518,000

GROUND LEVEL RESERVOIR STORAGE OPTIONS

A 4.0 acre excavation pit is located at 330 Gulden Road to the east of the City. This excavation pit could be lined and covered to create a large storage reservoir for the City. The pit could create a storage with a water depth of approximately 15 feet deep.

The following improvements are required to create a storage reservoir at this site:

- Clearing and grubbing.
- Removing rubbish from the bottom of pit.
- Approximately 4,100 of 8-inch water main to connect the new storage reservoir to the City. The new storage reservoir elevation is below the City's hydraulic grade line, so therefore water will flow by gravity to the new storage reservoir.
- 1,000 gpm pump station that meets the 2035 maximum day demand, to pump the water into the City system.
- Approximately 5.0 acres of liner, floating cover and geotextile cushion under the liner.
- Purchase of approximately 10 acres of land.

This reservoir would store approximately 19.4 million gallons, which would equal 32 days of average day flows and 13 days of maximum day demands. The estimate cost of this ground level storage reservoir is $3.4 million.

As an alternative to the ground level storage reservoir, the City could drill an additional well beyond Well No. 6. The additional well would be a backup to the existing wells and would utilize the existing aquifer. The existing aquifer could be considered a large underground storage reservoir that would be accessed by the well. The City is in the process of drilling a new 700 to 1,000 gpm for a total construction cost of $1.8 million. A 700 to 1,000 gpm well will produce 1.0 to 1.4 million gallons of water per day or approximately equal to the maximum day demands in 2035.

The following are the advantages and disadvantages of the ground level storage reservoir:

Advantage

- Would allow the City to pump water in the winter to utilize the water during high peak demands during the summer.

Disadvantage

- The reservoir would have low turnover and high water age which could cause taste and odor issues.
- The ground level storage reservoir cost more than an additional well.
- Since all of the water in the City would still come from wells the water system would still be affected by declining aquifer water levels.

The following are the advantages and disadvantages of the additional well:

Advantage

- Less expensive than the ground level storage reservoir.

Disadvantage

- Since all of the water in the City would still come from wells the water system would still be affected by declining aquifer water levels.

Either of these options would provide additional long term reliability for the water system. Both of these options should be examined more fully in the next water system plan. The next water system plan would explore the methods and means to fund the additional reliability.

APPENDIX A

COST ESTIMATES

CITY OF MABTON
WATER IMPROVEMENT PROJECT REPORT
145' X 35' DIAMETER RESERVOIR
TOTAL ESTIMATED PROJECT COST
CONSTRUCTION COST INDEX ENR FEBRUARY 2015 - 10387

NO.	ITEM	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$124,000	$124,000
2	Trench Safety	1	LS	$5,000	$5,000
3	Reservoir	1	LS	$675,750	$675,750
4	Reservoir Painting	1	LS	$174,000	$174,000
5	Reservoir Foundation	1	LS	$218,250	$218,250
6	Reservoir Excavation	1	LS	$33,000	$33,000
7	Piping and Valves	1	LS	$83,000	$83,000
8	Fencing	500	LF	$35	$17,500
9	Electrical And Instrumentation	1	LS	$15,000	$15,000
10	Minor Changes	1	LS	$10,000	$10,000
11	Site Restoration	1	LS	$15,000	$15,000
				Subtotal:	$1,371,000
				Construction Contingency (25%):	$342,750
				Construction Subtotal	$1,714,000
				Washington State Sales Tax (7.9%)	$135,000
				Construction Total:	$1,849,000
				Engineering, Administration and Legal	$462,000
				Total Cost	$2,311,000

CITY OF MABTON
WATER IMPROVEMENT PROJECT REPORT
ALTERNATIVE 1 EXISTING RESERVOIR
TOTAL ESTIMATED PROJECT COST
CONSTRUCTION COST INDEX ENR FEBRUARY 2015 - 10387

NO.	ITEM	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$66,000	$66,000
2	Trench Safety	1	LS	$5,000	$5,000
3	Reservoir Painting	1	LS	$308,250	$308,250
4	Foundation Modifications	1	LS	$182,000	$182,000
5	Reservoir Improvements	1	LS	$44,000	$44,000
6	Piping Modifications	1	LS	$65,000	$65,000
7	Fencing	500	LF	$35	$17,500
8	Electrical And Instrumentation	1	LS	$10,000	$10,000
9	New Pump	1	LS	$15,000	$15,000
10	Minor Changes	1	LS	$15,000	$15,000
11	Site Restoration	1	LS	$5,000	$5,000
				Subtotal:	$733,000
				Construction Contingency (25%):	$183,250
				Construction Subtotal	$916,000
				Washington State Sales Tax (7.9%)	$72,000
				Construction Total:	$988,000
				Engineering, Administration and Legal	$247,000
				Total Cost	$1,235,000

CITY OF MABTON
WATER IMPROVEMENT PROJECT REPORT
ALTERNATIVE 2 EXISTING RESERVOIR
TOTAL ESTIMATED PROJECT COST
CONSTRUCTION COST INDEX ENR FEBRUARY 2015 - 10387

NO.	ITEM	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$64,000	$64,000
2	Trench Safety	1	LS	$5,000	$5,000
3	Reservoir Painting	1	LS	$308,250	$308,250
4	Foundation Modifications	1	LS	$182,000	$182,000
5	Reservoir Improvements	1	LS	$44,000	$44,000
6	Piping Modifications	1	LS	$55,000	$55,000
7	Fencing	500	LF	$35	$17,500
8	Electrical And Instrumentation	1	LS	$10,000	$10,000
9	Minor Changes	1	LS	$15,000	$15,000
10	Site Restoration	1	LS	$5,000	$5,000
				Subtotal:	$706,000
				Construction Contingency (25%):	$176,500
				Construction Subtotal	$883,000
				Washington State Sales Tax (7.9%)	$70,000
				Construction Total:	$953,000
				Engineering, Administration and Legal	$238,000
				Total Cost	$1,191,000

CITY OF MABTON
WATER IMPROVEMENT PROJECT REPORT
ALTERNATIVE 3 EXISTING RESERVOIR
TOTAL ESTIMATED PROJECT COST
CONSTRUCTION COST INDEX ENR FEBRUARY 2015 - 10387

NO.	ITEM	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$107,000	$107,000
2	Trench Safety	1	LS	$5,000	$5,000
3	Reservoir Painting	1	LS	$339,000	$339,000
4	Foundation Modifications	1	LS	$182,000	$182,000
5	Reservoir Improvements	1	LS	$44,000	$44,000
6	Reservoir Height Raise	1	LS	$400,000	$400,000
7	Piping Modifications	1	LS	$55,000	$55,000
8	Fencing	500	LF	$35	$17,500
9	Electrical And Instrumentation	1	LS	$10,000	$10,000
10	Minor Changes	1	LS	$15,000	$15,000
11	Site Restoration	1	LS	$5,000	$5,000
				Subtotal:	$1,180,000
				Construction Contingency (25%):	$295,000
				Construction Subtotal	$1,475,000
				Washington State Sales Tax (7.9%)	$117,000
				Construction Total:	$1,592,000
				Engineering, Administration and Legal	$398,000
				Total Cost	$1,990,000

CITY OF MABTON
WATER IMPROVEMENT PROJECT REPORT
ALTERNATIVE 4 EXISTING RESERVOIR
TOTAL ESTIMATED PROJECT COST
CONSTRUCTION COST INDEX ENR FEBRUARY 2015 - 10387

NO.	ITEM	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$90,000	$90,000
2	Trench Safety	1	LS	$5,000	$5,000
3	Reservoir Painting	1	LS	$308,250	$308,250
4	Foundation Modifications	1	LS	$182,000	$182,000
5	Reservoir Improvements	1	LS	$44,000	$44,000
6	Piping Modifications	1	LS	$55,000	$55,000
7	Fencing	500	LF	$35	$17,500
8	Additional Fire Pump	1	LS	$95,000	$95,000
9	Electrical And Instrumentation	1	LS	$100,000	$100,000
10	Diesel Generator	1	LS	$75,000	$75,000
11	Minor Changes	1	LS	$15,000	$15,000
12	Site Restoration	1	LS	$5,000	$5,000
				Subtotal:	$902,000
				Construction Contingency (25%):	$225,500
				Construction Subtotal	$1,128,000
				Washington State Sales Tax (7.9%)	$89,000
				Construction Total:	$1,217,000
				Engineering, Administration and Legal	$304,000
				Total Cost	$1,521,000

CITY OF MABTON
WATER IMPROVEMENT PROJECT REPORT
ALTERNATIVE 3 NEW RESERVOIR
TOTAL ESTIMATED PROJECT COST
CONSTRUCTION COST INDEX ENR FEBRUARY 2015 - 10387

NO.	ITEM	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$104,000	$104,000
2	Trench Safety	1	LS	$5,000	$5,000
3	Reservoir	1	LS	$551,250	$551,250
4	Reservoir Painting	1	LS	$141,750	$141,750
5	Reservoir Foundation	1	LS	$174,750	$174,750
6	Reservoir Excavation	1	LS	$13,500	$13,500
7	Piping, Valves and Apprutances	1	LS	$83,000	$83,000
8	Fencing	500	LF	$35	$17,500
9	Electrical And Instrumentation	1	LS	$15,000	$15,000
10	Minor Changes	1	LS	$30,000	$30,000
11	Site Restoration	1	LS	$15,000	$15,000
				Subtotal:	$1,151,000
				Construction Contingency (25%):	$287,750
				Construction Subtotal	$1,439,000
				Washington State Sales Tax (7.9%)	$114,000
				Construction Total:	$1,553,000
				Engineering, Administration and Legal	$388,000
				Total Cost	$1,941,000

CITY OF MABTON
WATER IMPROVEMENT PROJECT REPORT
GROUND-LEVEL STORAGE RESERVOIR
TOTAL ESTIMATED PROJECT COST
ENR CONSTRUCTION COST INDEX FEBRUARY 2015 - 10387

NO.	ITEM	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$181,000	$181,000
2	Trench Safety	1	LS	$5,000	$5,000
3	60-mil HDPE Liner	217,800	SF	$0.85	$185,130
4	60-mil LLDPE/HDPE Cover	217,800	SF	$2.50	$544,500
5	12-oz Geotextile	217,800	SF	$0.17	$37,026
6	Liner Subgrade (Sand)	2,760	CY	$15.00	$41,400
7	Dike Excavation/Construction	2,000	CY	$25	$50,000
8	Rubbish Removal	1	LS	$100,000	$100,000
9	Site Grading	1	LS	$50,000	$50,000
10	Pump Station	1	LS	$200,000	$200,000
11	8" Water Main	4,100	LF	$85	$348,500
12	Piping, Valves and Appurtenances	1	LS	$20,000	$20,000
13	Fencing	2,200	LF	$35	$77,000
14	Electrical And Instrumentation	1	LS	$50,000	$50,000
15	Diesel Generator	1	LS	$60,000	$60,000
16	Minor Changes	1	LS	$30,000	$30,000
17	Site Restoration	1	LS	$15,000	$15,000
				Subtotal:	$1,995,000
				Construction Contingency (25%):	$499,000
				Construction Subtotal	$2,494,000
				Washington State Sales Tax (7.9%)	$197,000
				Construction Total:	$2,691,000
				Land Purchase	$175,000
				Engineering, Administration and Legal	$538,000
				Total Cost	$3,404,000