



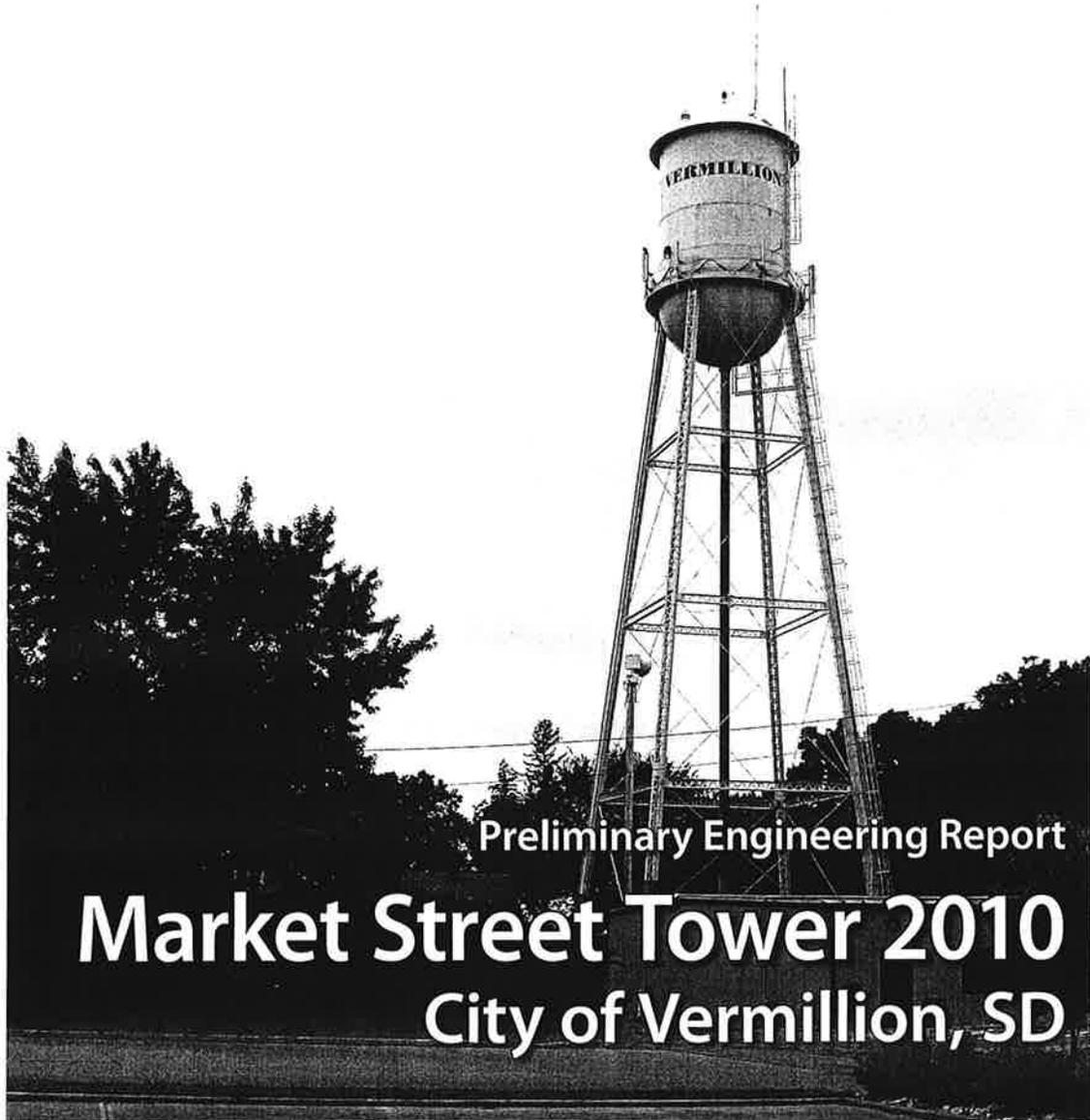
Preliminary Engineering Report
Market Street Tower 2010
City of Vermillion, SD

Prepared By
Banner Associates, Inc.
Brookings, South Dakota

August 2010

BANNER

BAI No. 08115.00.03



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*MARKET STREET TOWER IMPROVEMENTS
PRELIMINARY ENGINEERING REPORT-2010
CITY OF VERMILLION
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SECTION 1

INTRODUCTION, AUTHORIZATION, AND PURPOSE

SECTION 1: INTRODUCTION, AUTHORIZATION, AND PURPOSE

1.1 INTRODUCTION

The City of Vermillion is located in the southeastern portion of South Dakota, approximately 3.7 miles from the Nebraska border and in the Vermillion and Missouri River Valleys. The City of Vermillion is located in Sections 13, 14, 23, and 24 of Township 92 North, Range 52 West and Sections 18, 19, and 20 of Township 92 North, Range 51 West within Clay County, South Dakota.

The City of Vermillion, South Dakota, has 2,751 meters that provide water to approximately 11,848¹ people within the city limits, as based on historical census data. Water is pumped from the five production wells through a series of 6-inch and 8-inch lines to a 16-inch intake line into the water treatment plant, treated using conventional lime softening, then pumped from a 1.5 MG ground storage reservoir into the distribution system. Water is conveyed from the water treatment plant to the Market Tower through a 12-inch transmission main and to the Prentis Park Tower through a 12-inch transmission main. The two water towers provide a total of 0.60 MG of elevated water storage for the City.

Improvements to the Market Street Tower are needed because the tower is approximately 100 years old and a previous inspection report notes that the Market Street Tower needs to have upgrades to meet OSHA safety standards. The proposed improvements include recoating the inside and outside of the tank, removing and replacing the frost jacket, railings, ladders and safety climb devices with OSHA approved systems, removing the spider rods and securing roof, installing an air gap in overflow and plumbing the drain line to overflow, and installing an AWWA compliant air vent. The inspection report also suggests the City determine the cost effectiveness of repairing versus replacing the 100-year old tank.

1.2 AUTHORIZATION

This study was authorized under an engineering services agreement between Banner Associates, Inc. and the City of Vermillion dated May 25, 2010.

1.3 PURPOSE

The purpose of this report is to:

- Document the need for improvements to the Market Street Tower
- Identify alternatives and scope of improvements to be considered for the Market Street Tower
- Present an estimate of probable costs for improvements to the Market Street Tower and replacement of the existing tower
- Provide an implementation plan for the design and construction of those improvements

1.4 ORGANIZATION OF REPORT

This report is organized into a total of four sections. The topics covered in each of the sections are summarized as follows:

SECTION 1	INTRODUCTION, AUTHORIZATION, AND PURPOSE
SECTION 2	NEED FOR PROJECT
SECTION 3	EVALUATION OF ALTERNATIVES
SECTION 4	CONCLUSIONS AND RECOMMENDATIONS

1.5 PREVIOUS REPORTS

The following reports were reviewed during this study:

- Preliminary Engineering Report, Water Distribution System Analysis 2000 for Vermillion, South Dakota, Banner Associates, Inc, April 2000.

¹ The population of the City of Vermillion based on the year 2000 census was 9765 and adjusted to 10,276. 11,848 is the projected current population.

- Facility Plan for Vermillion Sanitary Sewer Improvements- 2009, Banner Associates, Inc, April 2009.
- Capital Improvements Plan 2009, City of Vermillion, Banner Associates, Inc. May 2010

1.6 ABBREVIATIONS

fps	feet per second
gpcd	gallons per capita per day
gpm	gallons per minute
HGL	hydraulic grade line
hp	horsepower
MG	million gallons
MGD	million gallons per day
psi	pounds per square inch
rpm	revolutions per minute
VFD	variable frequency drive
GSR	ground storage reservoir

1.7 ELEVATION DATUM

All elevations in this report are based on NAD83 datum (UTM with NAD83 datum, Zone 14, Meter; Central Meridian 99dW Meter).

END OF SECTION 1

SECTION 2

NEED FOR THE PROJECT

SECTION 2: NEED FOR THE PROJECT

2.1 SUMMARY OF THE EXISTING SYSTEM

The system consists of five (5) wells, a lime softening plant, a 1.5 MG ground storage reservoir, two elevated towers, and water distribution system with 48 miles of pipe ranging from 4" through 16" water main with smaller service connections. The City of Vermillion water treatment plant is located in the northeast quarter of Section 24, Township 92 North, Range 52 West within Clay County, South Dakota. The layout of the existing water distribution system is shown in Figure 2.1.

Total well production is approximately 2,635 gpm (3.79 MGD). Total well capacity is the flow with all pumps in service. Firm capacity is defined as the flow without the largest pump in service. Therefore, the firm capacity of the well pumps is 2,080 gpm (2.99 MGD).

The City of Vermillion currently operates a conventional lime softening plant that was originally constructed in 1972 and recently renovated to provide a capacity of approximately 4.6 MGD. Basin design and equipment were sized around dual 3.0 MGD process trains for a total future treatment capacity of 6.0 MGD. However, two additional filters and associated equipment would be needed to treat 6.0 MGD of water. Current population projections and associated water demands do not approach the existing treatment capacity of 4.6 MGD. The design of the 6.0 MGD facility was needed to be able to take the existing process train out of service and still deliver water to existing customers.

Four (4) high service pumps are used to pump the water from the water treatment facility and ground storage reservoir into the distribution system. Total pump capacity is the flow with all pumps in service. Firm capacity is defined as the flow without the largest pump in service. Therefore, the firm capacity of the high service pumps is 2,250 gpm (3.24 MGD). Based on information obtained from City of

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PROJECT TITLE:

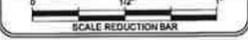
**MARKET STREET
TOWER
PRELIMINARY
ENGINEERING
REPORT-2010**

PROJECT LOCATION:

**VERMILLION
SD**

REV.	DATE	DESCRIPTION

DRAWN BY: CEB
 DESIGNED BY: JLP
 CHECKED BY: CEB
 JOB NO: 08115.00.03
 DATE: JUNE 2010

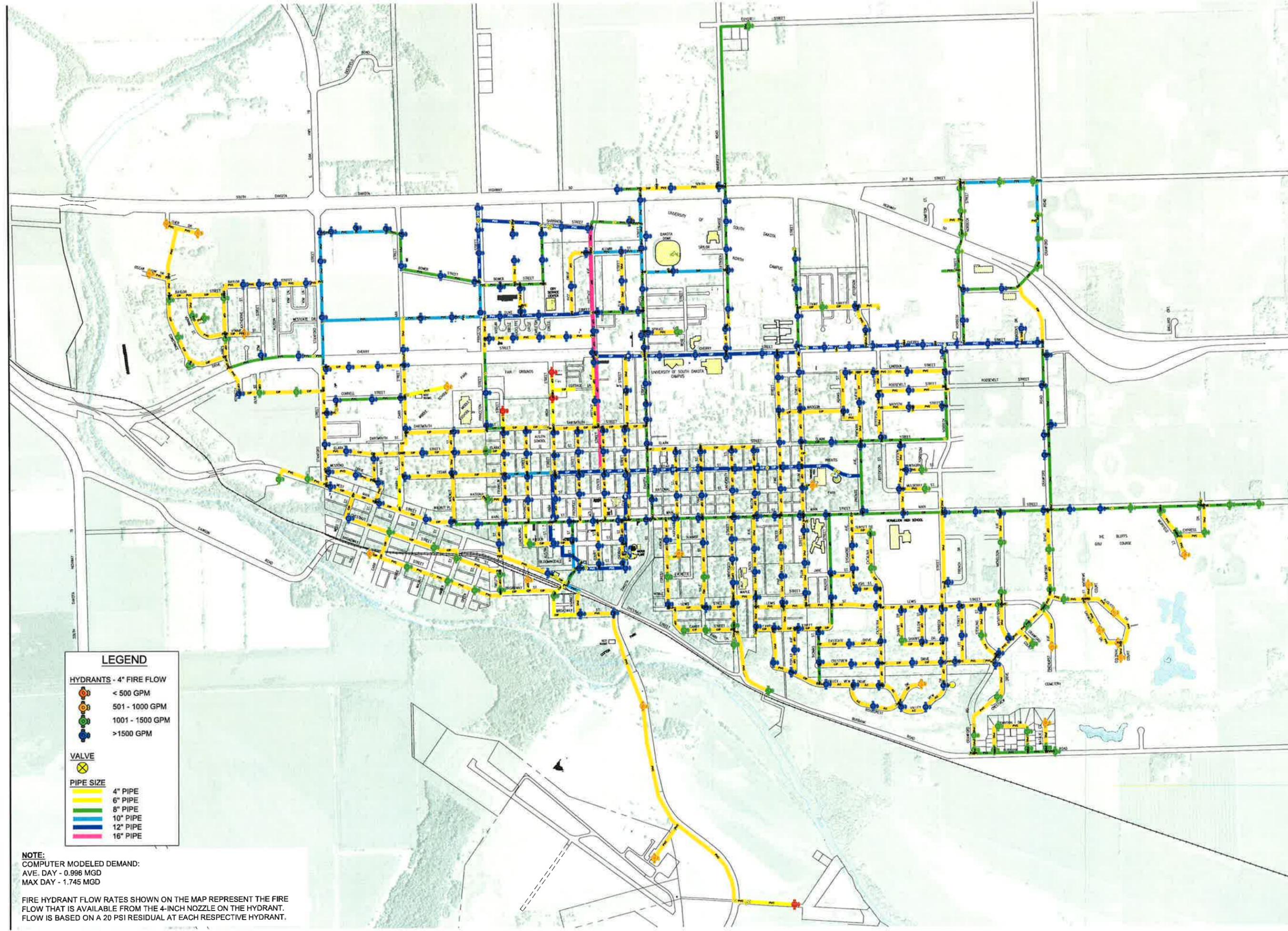


SHEET TITLE:

**EXISTING
WATER
DISTRIBUTION
SYSTEM**

FIGURE NO.:

FIGURE 2.1



LEGEND

HYDRANTS - 4" FIRE FLOW

- < 500 GPM
- 501 - 1000 GPM
- 1001 - 1500 GPM
- >1500 GPM

VALVE

- VALVE

PIPE SIZE

- 4" PIPE
- 6" PIPE
- 8" PIPE
- 10" PIPE
- 12" PIPE
- 16" PIPE

NOTE:
 COMPUTER MODELED DEMAND:
 AVE. DAY - 0.996 MGD
 MAX DAY - 1.745 MGD

FIRE HYDRANT FLOW RATES SHOWN ON THE MAP REPRESENT THE FIRE FLOW THAT IS AVAILABLE FROM THE 4-INCH NOZZLE ON THE HYDRANT. FLOW IS BASED ON A 20 PSI RESIDUAL AT EACH RESPECTIVE HYDRANT.

Vermillion staff and the computer model, it was determined that each pump contributes approximately 900 gpm when three pumps are operating; therefore, the actual firm capacity is approximately 2,700 gpm (3.90 MGD). Under normal operating conditions, one pump serves as a lead pump while one of the remaining pumps starts during high demand conditions. The third and fourth pump serves as standby pumps. In the summer, the high service pumps start when the Prentis Park Tower falls below a preset point and stop when the Prentis Park Tower fills above a preset point. The Market Street Tower has an altitude valve that closes when the Market Street Tower is full to avoid the tank from overflowing. In the winter time, the high service pumps are controlled based on the water level in the Market Street Tower. The pumps have VFDs to operate at variable speeds. Backup power from a generator is available at the plant to run the high service pumps and all plant equipment. Wire and conduit was installed between the water treatment plant and Wells 3A and 4A to be able to run these two well pumps off of the backup generator.

The City's distribution system is one pressure zone pressurized by two elevated steel water towers: the Prentis Park Tower and the Market Street Tower.

The smaller of the two towers is the Market Street Tower and is located near the downtown business district. The Market Street Tower is a 100,000 gallon capacity tower with an overflow elevation of 1367.0 ft. This 22 foot diameter tower has a 34 foot tall cylindrical shell with a hemispherical bottom and a cone roof. The base of the bowl of the tower is 104 feet above ground elevation. This tower was constructed in 1912.

The second elevated storage tank is the Prentis Park Tower. The Prentis Park Tower is a 500,000 gallon water tower with an overflow elevation of 1366.8 ft, located at Prentis Park near the City Swimming Pool, just east of Plum Street. This tower is a multi-leg torroid design with a bowl that is 55 ft in diameter and 30 ft tall. The base of the bowl of the tower is 98 feet above ground elevation. The

500,000 gal tower was constructed and placed into service in 1959. The interior and exterior of the 500,000 gal tank was completely sandblasted and repainted in 1998 and is in relatively good condition.

A 1.5 million gallon welded steel ground storage reservoir is located at the water treatment plant. Treated water is pumped from the clearwell to the ground storage reservoir by low service pumps. Water is pumped from the water treatment plant to both water towers through a 12-inch line.

Table 2.1: Existing Storage Facilities

Name	Type	Volume (MG)	Head Range (ft)	Overflow Elevation (ft)	Diameter (ft)
WTP GSR	Ground	1.50	32	1258.5	89
Market Street Tower	Elevated	0.10	34	1367.0	22
Prentis Park Tower	Elevated	0.50	30	1366.8	55
Total Storage Volume		2.10			

Although there are no hard and fast rules that govern how much storage is needed in a system, it is generally recommended to have at least one average day's demand in elevated storage and at least enough water in total storage to meet the peak day demand. This volume of storage is needed to provide service in the event of unforeseen events. The current average day demand is approximately 1.01 MGD versus 0.60 MG in elevated storage and the peak day demand is approximately 1.75 MGD versus 2.10 MG in total storage.

Based on the general rule of thumb, the volume of total storage is slightly more than the recommended amount, although the total elevated storage is slightly less than the recommended amount. Because of the age and condition of the Market Street Tower, it is recommended that a larger elevated tower replace the existing Market Street Tower. Generator backup at the water treatment plant will be considered when making a recommendation as to what size water tower shall be constructed. Essentially backup power can decrease the required elevated storage due to having a backup means of delivering water in the event of a power failure.

2.2 SUMMARY OF SYSTEM DEMANDS

2.2.1 General

The system demands for the Vermillion system are comprised of both domestic water use and required commercial and residential fire flow. Domestic water use was determined based on historical water use. Water billing records were obtained from the City for the commercial and residential water use over the last seven years (from 2003-2009). The following sub-section will discuss the historical water use and methodology used to project domestic water use in the future.

2.2.2 Domestic Water Usage

Historical water production and sales records were furnished by City for the years 2003 through 2009. USD is the largest water user for the City of Vermillion. In 2008, USD purchased approximately 43,725,000 gallons of water from the City of Vermillion.

2.2.2.1 Population Estimate

Establishing the current and future population will provide the basis for projecting future domestic water usage. The population estimate in the Facility Plan for Vermillion Sanitary Sewer Improvements- 2009, Banner Associates, Inc, April 2009 was used for the 30 year design period to the year 2040 for this report.

The population data was used in conjunction with three well known methods to perform population projections. The first method is an Arithmetic method which assumes the population increases at a constant rate. The second method is a Decreasing Rate of Increasing which assumes the population increases to a limiting value or saturation point. The final method is the Geometric Progression which places a line of best fit to data based

on historical population data using a compound interest equation. The population analysis is shown in Section 4.4 of the “*Facility Plan for Vermillion Sanitary Sewer Improvements- 2009, Banner Associates, Inc, April 2009*”.

The following table shows the resulting average projected population for the City of Vermillion.

Table 2.2: Population Projections

	2009	2019	2029	2039
Linear Regression Method	12,195	13,473	14,656	15,840
Arithmetic Method	11,231	12,292	13,353	14,413
Geometric Method	12,118	14,555	17,481	20,996
Average	11,848	13,440	15,163	17,083

The population of Vermillion for the year 2009 is estimated to be 11,848. The design population needs to be determined for the year 2040. The year 2040 design population is determined by using the averages of the population projections from the years 2019, 2029, and 2039.

2.2.2.2 Future Domestic Water Demands

The residential, commercial, and unaccounted for water use was evaluated in the “*Capital Improvement Plan 2009*”. Table 2.3 summarizes the past and projected water use as explained in the “*Capital Improvement Plan 2009*”.

Table 2.3: Existing and Projected Water Requirements

	2008	2010	2020	2030	2040
Population	10,969	12,029	13,604	15,346	17,287
Residential					
gpcd	60	58	58	58	58
Subtotal (gpd)	652,700	697,000	788,300	889,200	1,001,700
Residential %	69.3%	68.2%	68.2%	68.2%	68.2%
Commercial					
gpcd	26	27	27	27	27
Subtotal (gpd)	288,800	325,500	368,100	415,200	467,700
Commercial %	30.7%	31.8%	31.8%	31.8%	31.8%
Unaccounted For (gpd)	73,300	97,700	110,500	124,600	140,400
Unaccounted For %	7.2%	8.7%	8.7%	8.7%	8.7%
Average Day Demand (gpd)	1,014,900	1,120,200	1,266,800	1,429,100	1,609,800
Max Day Demand (gpd)	1,778,200	2,016,400	2,280,300	2,572,400	2,897,700

2.3 NEED FOR THE PROJECT

Improvements to the Market Street Tower are needed because of the age and condition of the Market Street Tower to upgrade the tower to meet OSHA safety standards and to provide additional storage to meet the current and future demands in the system.

Owens Inspection Services inspected the Market Street Tank in June 2007 and reported the results in a report titled “*City of Vermillion, South Dakota, 100,000 Gallon Elevated Water Storage Tank Cleaning, Inspection, and Touch-up Report*”. This report highlights rehabilitation improvements totaling approximately \$300,000, which includes recoating the inside and outside of the tank, removing and replacing the frost jacket, railings, ladders and safety climb devices with OSHA approved systems, removing the spider rods and securing roof, installing an air gap in overflow and plumbing the drain line to overflow, and installing an AWWA compliant air vent. The report also suggests the City determine the cost effectiveness of repairing or replacing the tank and recommends the tank be cleaned

every two years to monitor the corrosion condition of the tank. The entire report can be found in Appendix A.

END OF SECTION 2

SECTION 3

EVALUATION OF ALTERNATIVES

SECTION 3: EVALUATION OF ALTERNATIVES

3.1 DEVELOPMENT OF ALTERNATIVES

The major purposes of this report are to assess improvements to the Market Street Tower to protect water quality, minimize water loss, and to meet the minimum criteria set in the Recommended Standards for Water Works published by the Great Lakes Upper Mississippi River Board of State Public Health & Environmental Managers. The following alternatives were considered to maintain the existing fire flows while protecting the quality of the water.

1. Repair the existing water tower.
2. Replace the existing water tower.
3. No action alternative.

Capital costs were estimated for each of the improvements. The cost estimates include 10 percent (10%) contingencies and 14 percent (14%) engineering, legal, and administrative fees. Detailed cost estimates for each of the alternatives can be found in Appendix B.

3.1.1 Alternative 1: Repair of Existing Market Street Tower:

During cleaning of the Market Street Tower, Owens Inspection Services inspected and made a list of necessary repairs that would bring the tower up to OSHA standards for safety and Ten State Standards for protection of water quality. The repairs include recoating the inside and outside of the tank, removing and replacing the frost jacket, railings, ladders and safety climb devices with OSHA approved systems, removing the spider rods and securing roof, installing an air gap in overflow and plumbing the drain line to overflow, and installing an AWWA compliant air vent. The estimate for costs is approximately \$300,000. Including contingencies and engineering, the estimated project cost for Alternative 1 is \$383,100.

3.1.2 Alternative 2: Replacement of Market Street Tower:

This option would require removal of the existing 100,000 gallon Market Street Tower and replacement with a new larger water tower at a different location. It is proposed that a new 500,000 gallon tower be constructed on Shriner Street near the Walmart with an overflow elevation of approximately 1367 feet (equal to the overflow elevation of the existing Prentis Park Tower). The proposed 500,000 gallon storage tank will approximately meet the current storage needs of the City for the year 2010 average day demands, be located in the area projected for the most growth, and address water quality and access safety issues. The estimated cost of this alternative is approximately \$1,600,000 including contingencies and engineering.

As noted in Section 2, the rule of thumb is to have at least one average day's demand in elevated storage and at least enough water in total storage to meet the peak day demand. The average day demand for Year 2040 is 1.61 MGD and the maximum day demand is 2.90 MGD. With the proposed tower, the total elevated storage will be 1 MG and the total storage will be 2.5 MG. Although both are less than the rule of thumb, generator backup at the water treatment plant allows a decrease in storage due to having a backup means of delivering water in the event of a power failure. Therefore, Banner Associates, Inc. recommends a 500,000 gallon elevated tower to be constructed.

The City of Vermillion has indicated a preference for a composite water tower. The composite water tower is preferred because the O&M costs for painting and repairs are less than either a fluted column or spheroid, which is primarily due to the lower surface area required to be painted. The capital costs for either type of tower is approximately the same. The base of the composite tower also offers more storage and floor space than either a fluted column or spheroid. Figure 3.1 shows a typical elevation for a composite water tower.

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PROJECT TITLE:
MARKET STREET TOWER PRELIMINARY ENGINEERING REPORT-2010

PROJECT LOCATION:
VERMILLION SD

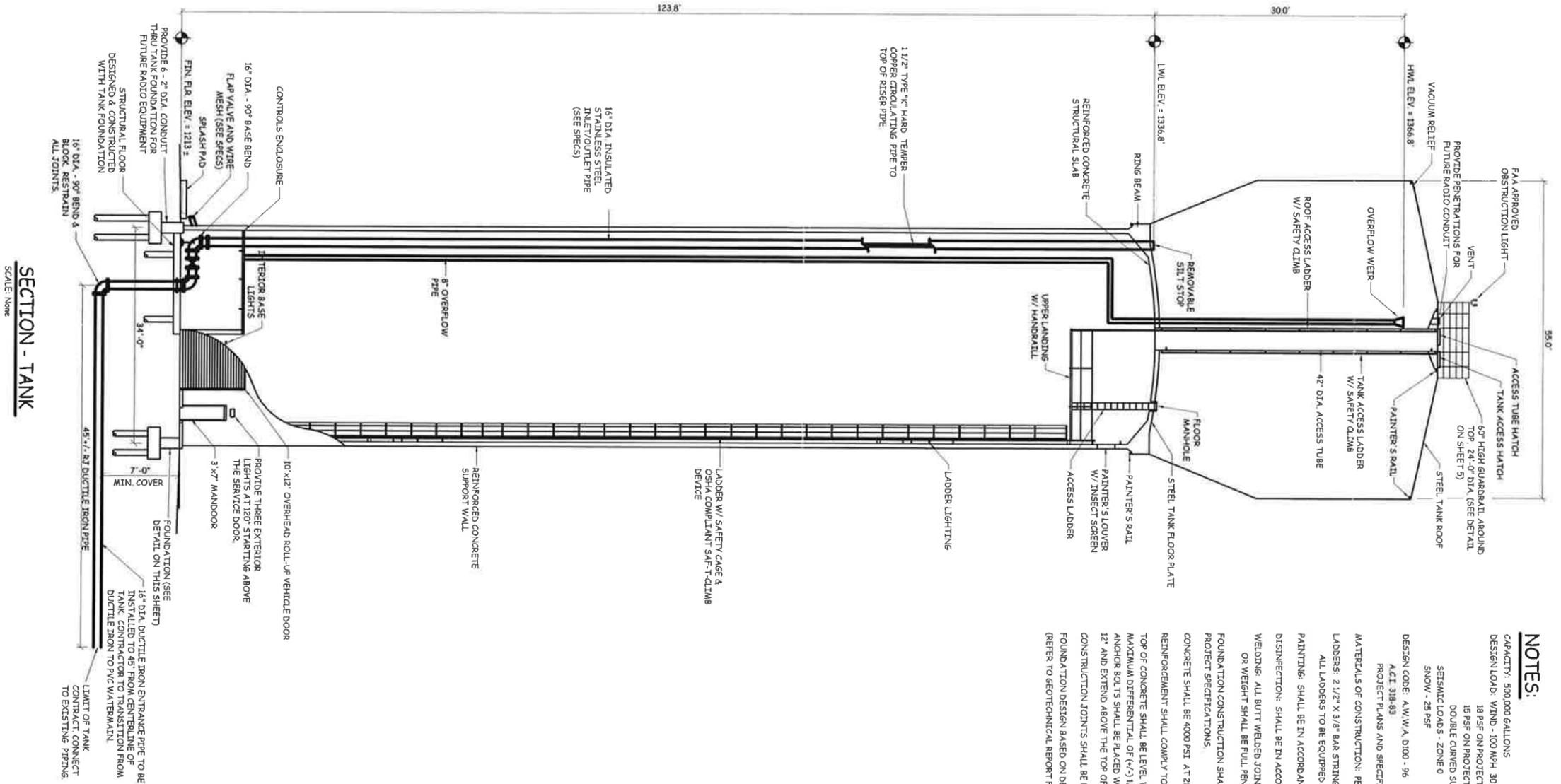
REV	DATE	DESCRIPTION

DRAWN BY: CEB
DESIGNED BY: JLP
CHECKED BY: CEB
JOB NO: 08115.00.03
DATE: JUNE 2010

SCALE: REDUCTION BAR

SHEET TITLE:
COMPOSITE STYLE WATER STORAGE TANK

FIGURE NO.:
FIGURE 3.1



SECTION - TANK
SCALE: NONE

NOTES:

CAPACITY: 500,000 GALLONS

DESIGN LOAD: WIND - 100 MPH 30 PSF OF PLANE SURFACES
18 PSF ON PROTECTED AREAS OF CYLINDERS
15 PSF ON PROTECTED AREAS OF CONICAL OR DOUBLE CURVED SURFACES

SEISMIC LOADS - ZONE 0
SNOW - 25 PSF

DESIGN CODE: A.W.W.A. D100 - 96
A.C.I. 318-03

PROJECT PLANS AND SPECIFICATIONS

MATERIALS OF CONSTRUCTION: PER A.W.W.A. SPECIFICATIONS

LADDERS: 2 1/2" X 3/8" BAR STRINGERS - 3/4" DIA. RINGS AT 12" O.C.
ALL LADDERS TO BE EQUIPPED WITH SAFETY CLIMBING DEVICES

PAINTING: SHALL BE IN ACCORDANCE WITH AWWA D102.

DISINFECTION: SHALL BE IN ACCORDANCE WITH AWWA C682.

WELDING: ALL BUTT WELDED JOINTS SUBJECT TO PRIMARY STRESS DUE TO WATER PRESSURE OR WEIGHT SHALL BE FULL PENETRATION AND FULL FUSION WELDS.

FOUNDATION CONSTRUCTION SHALL COMPLY WITH A.C.I. 318-03 AND APPLICABLE SECTIONS OF THE PROJECT SPECIFICATIONS.

CONCRETE SHALL BE 4000 PSI AT 28 DAYS.

REINFORCEMENT SHALL COMPLY TO A.S.T.M. A-615, GR 60

TOP OF CONCRETE SHALL BE LEVEL WITHIN (+/-) 1/8" AND SHALL BE THE SAME ELEVATION WITH A MAXIMUM DIFFERENTIAL OF (+/-) 1/4".

ANCHOR BOLTS SHALL BE PLACED WITHIN 1/16" OF THE PLAN DIMENSIONS, BE PLUMB WITHIN 1/8" IN 12" AND EXTEND ABOVE THE TOP OF THE CONCRETE TO WITHIN 1/2" (+/-) OF THE SPECIFIED PROTECTION.

CONSTRUCTION JOINTS SHALL BE ROUGHED ACROSS THE ENTIRE FACE WITH 1/4" MIN. DEPTH INDENTATIONS.

FOUNDATION DESIGN BASED ON DEEP PILE FOUNDATION WITH A WORKING CAPACITY OF 100 TON. (REFER TO GEOTECHNICAL REPORT FOR MORE DETAILED INFORMATION)

3.1.3 Alternative 3- No Action Alternative:

The existing 100,000 gallon Market Street Tower was installed in 1912 and last renovated in 1985. Extensive maintenance and overhaul would be required to renovate the tower to current standards and no action would cause the problems to increase over time. Possible problems with no action include contamination of the water supply, continued violation of safety standards, and loss of structural integrity. The no action alternative would abandon the existing Market Street Tower. However, the City of Vermillion is not able to meet existing storage requirements as calculated in Section 2 of this report; therefore, no action was not considered a viable alternative.

3.2 OPERATIONAL AND MAINTENANCE COSTS

The annual operation and maintenance (O&M) costs were calculated for the three different alternatives. O&M costs were only calculated for the proposed infrastructure to help compare the life cycle costs of the three alternatives. O&M costs associated with any of the existing infrastructure (water distributions system, staff salaries, etc.) were not used in determining the annual O&M costs. It was determined that these costs would be incurred by the City regardless of which alternate was selected and therefore not considered when selecting an alternative. Pumping costs for all alternatives are expected to be the same; therefore the only O&M cost compared was tower maintenance. O&M costs for Alternative 1 includes the cost to paint the 100,000 gallon tower every 7 years and the cost to inspect the tower every two years (\$3000/2 years) and make repairs. The cost of the repairs was estimated to be the cost of repairs in the Owens Inspection Report (\$65,000) every 25 years (Year 2010 – Year 1985), which is \$2,600 each year. The O&M costs for Alternative 2 includes the cost to paint the 500,000 gallon tower every 10 years and the cost to inspect the tower every 5 years (\$3000/5 years). No repairs were assumed for the new tower. The Market Street Tower is abandoned in Alternative 3, so no O&M costs would be associated with the no action alternative. The following table is a summary of the O&M costs associated with the three alternatives. Additional information is included in Appendix B.

Table 3.1: Annual O&M Costs for Developed Alternatives

	Alternate No. 1	Alternate No. 2	Alternate No. 3
Tower Inspection	\$1,500	\$600	\$0
Tower Painting	\$8,400	\$8,600	\$0
Tower Repairs	\$2,600	\$0	\$0
Total Annual O&M Costs	\$12,500	\$9,200	\$0

END OF SECTION 3

SECTION 4

CONCLUSIONS AND RECOMMENDATIONS

SECTION 4: CONCLUSIONS AND RECOMMENDATIONS

4.1 RECOMMENDED IMPROVEMENTS

Capital costs were estimated for each of the improvements. The cost estimates include 10 percent contingencies and 14 percent engineering, legal, and administrative fees. Detailed cost estimates for each of the alternatives can be found in Appendix B. Although the cost for Alternative 1- Repair Existing Market Street Tower is approximately 25 percent (25%) of the cost for Alternative 2- Replace Market Street Tower with New Tower, the new tower would provide five times more storage in the area of expected development. In addition, the Market Street Tank is almost 100 years old and is beyond its useful life. Therefore, Banner Associates, Inc. recommends Alternative 2- Replace Market Street Tower with New Tower to correct the existing Market Street Tower deficiencies and to provide additional storage for average day system demands.

4.1.1 Alternative 2 – Replacement of Market Street Tower:

Banner Associates, Inc. recommends that the existing 100,000 gallon tower be retired and a new larger tower be erected at a different location. It is proposed that a new 500,000 gallon tower be constructed on Shriner Street near the Walmart with an overflow elevation of 1367 feet (equal to the overflow elevation of the existing Prentis Park Tower). The proposed 500,000 gallon storage tank will meet the storage needs of the City for the current average day demands and be located in the area projected for the most growth. Figure 4.1 shows the location of the proposed tower.

Figure 4.2 shows that the water levels in both the Prentis Park Tower and the new Shriner Street Tower cycle together. Adding the tower to the north part of town creates better hydraulic connection between the two water towers. Available fire flow rates were also checked to verify what effect moving the water tower would have on existing levels of fire protection. Available fire flows were greater than the existing fire flows in the north area of town.

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PROJECT TITLE:

**MARKET STREET
 TOWER
 PRELIMINARY
 ENGINEERING
 REPORT-2010**

PROJECT LOCATION:
 VERMILLION
 SD

REV.	DATE	DESCRIPTION

DRAWN BY: JLP
 DESIGNED BY: JLP
 CHECKED BY: CEB
 JOB NO: 08115.00.03
 DATE: JUNE 2010
 SCALE REDUCTION BAR

SHEET TITLE:

**PROPOSED
 WATER TOWER
 IMPROVEMENTS**

FIGURE NO.:
FIGURE 4.1

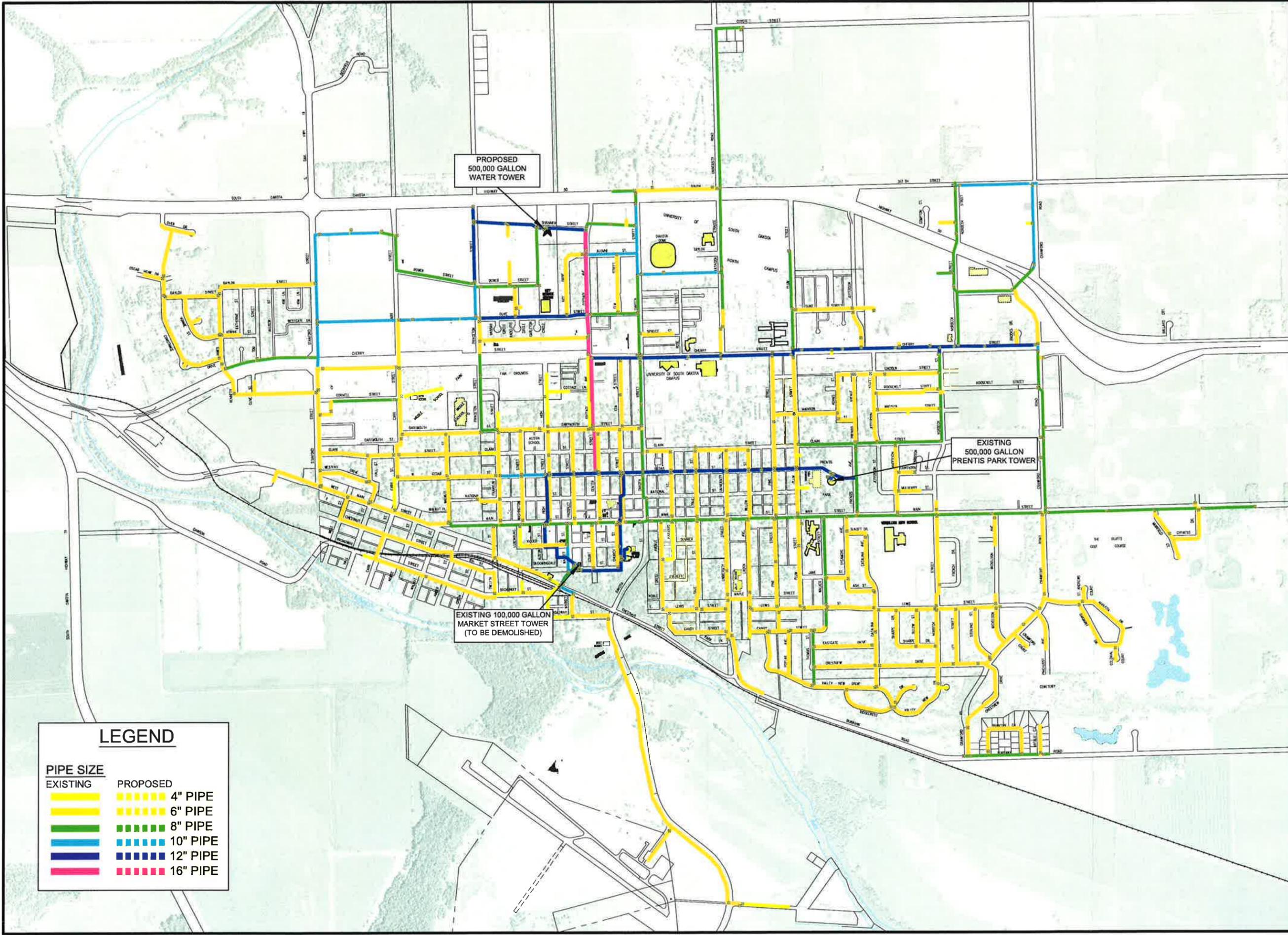
PROPOSED
 500,000 GALLON
 WATER TOWER

EXISTING
 500,000 GALLON
 PRENTIS PARK TOWER

EXISTING 100,000 GALLON
 MARKET STREET TOWER
 (TO BE DEMOLISHED)

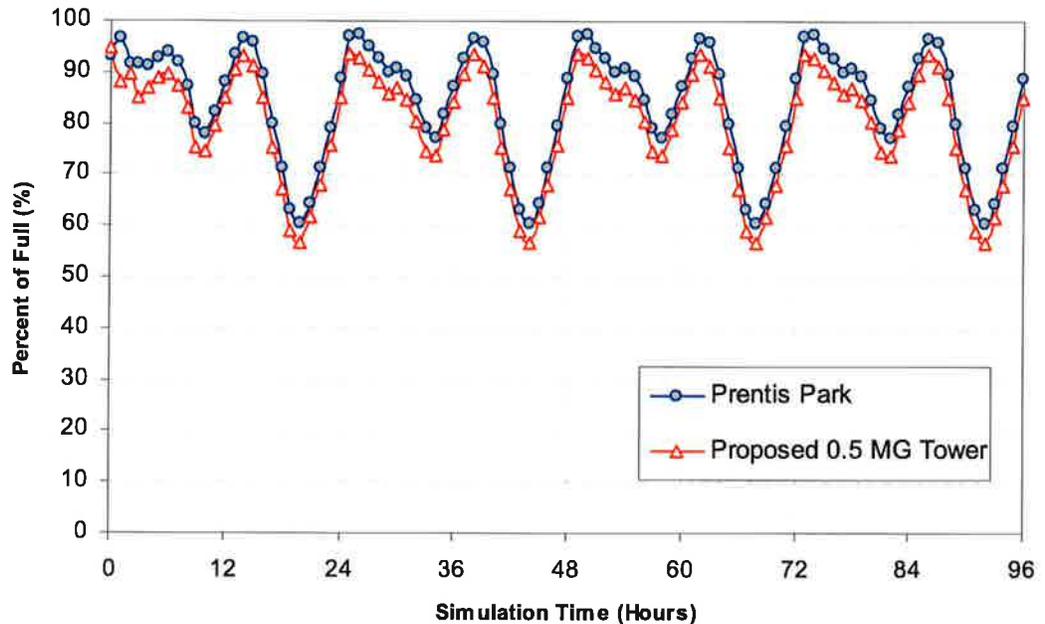
LEGEND

PIPE SIZE	
EXISTING	PROPOSED
	4" PIPE
	6" PIPE
	8" PIPE
	10" PIPE
	12" PIPE
	16" PIPE



Based on this information, it is recommended that the Market Street Tower be replaced with a new tower at this location.

Figure 4.2: Water Levels in Prentis Park and Proposed 500,000 gal Towers



4.2 FINANCIAL PLAN AND IMPACT ON USER RATES

It was assumed for purposes of rate calculations that the project will be financed with a combination of grants and loans. The total probable project costs for the recommended improvements totals \$1,600,000. Calculation of annual debt service cost has been completed based on a 20%, 40% and 60% grant and prevailing interest rates for loans. Grant funding will be awarded by the State and will be based on the needs of the community and the improvements recommended. It is assumed that the City of Vermillion will be eligible for a State Revolving Fund (SRF) loan with a 20-yr or 30-yr term at 2.25% interest. The following table contains a breakdown of costs associated with the proposed project.

APPENDIX A:

TANK INSPECTION REPORT

City of Vermillion, South Dakota
100,000 Gallon Elevated Water Storage Tank
Cleaning, Inspection, and Touch-Up Report

Prepared For:

City of Vermillion, South Dakota

Prepared By:

Donald Owens
NACE Certified Coating Inspector



598 2nd Street Southeast
Sioux Center, Iowa 51250
Office: (712) 722-3972

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GENERAL INFORMATION

Introduction

In Accordance with AWWA Standards, water storage tanks should be cleaned and inspected on a regular basis for two reasons. First, as water is held in the container, suspended solids settle out of the water into the bottom of the container. Sediment and deposits on container walls decrease the effectiveness of disinfectants, which may compromise the container's sanitary integrity. Secondly, water storage tank maintenance is becoming more costly and complex. The coating system inside your container was costly to install and will only reach its full life expectancy if it is properly maintained. Preventative maintenance is therefore the key to saving money by ensuring that the interior coating system reaches its full potential. AWWA M42 – Steel Water Storage Tanks Standard states, "Tanks should be washed out and inspected at least once every two years, and where water supplies have sediment problems, annual wash outs are recommended."

An inspection and wash out of the City of Vermillion, South Dakota's 100,000 gallon elevated water storage tank was conducted on May 21, 2009. This inspection was authorized by City of Vermillion as part of the Owens Inspection Services, LLC Cleaning, Inspection, and Touch-up program. This elevated water storage tank was cleaned, rigged and inspected by Mr. Michael Engelstad and Mr. Donald Owens.

Information obtained during the inspection is compiled in this report and includes a professional inspection of the exterior and interior coating systems, foundations, structural members, and appurtenances.

These areas were inspected with respect to current AWWA, OSHA and Homeland Security requirements to prepare the recommendations, cost estimate of needed repairs, and ongoing annual budget bound within this report.



598 2nd Street Southeast
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GENERAL INFORMATION

Tank Information

CLIENT: City of Vermillion, South Dakota
CONTACT PERSON: Mr. Harold Holoch, City Engineer
TELEPHONE #: (605)677-7084
DATE ERECTED: 1912
STYLE: Riveted Steel, spherical bottom with a conical top
CAPACITY: 100,000 Gallons
ERECTED BY: Chicago Bridge and Iron Works, Inc.
HEIGHT: 120 ft. 0 in. to high water level
HEADRANGE: 45 ft. 0 in

Coating System

EXTERIOR COATING SYSTEM: A hydrophobic acrylic coating system applied in 2004 by K & W Coatings, LLC of Elkader, Iowa.

INTERIOR COATING SYSTEM: A polyamide epoxy coating system of unknown origins.

Historical Information

This elevated water storage tank has been cleaned and inspected on a regular basis by DeWild Grant Reckert and Associates Company of Rock Rapids, Iowa. This tank was last cleaned and inspected on June 11, 2007.



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INSPECTION REPORT

Exterior And Interior Coating Conditions

Exterior Coating System

The exterior coating system is in fair condition with light mildew present on the underside of the container. The Dry Film Thickness (DFT) of the exterior coating system was measured in accordance with SSPC-PA2 "Measurement of Dry Paint Thickness with Magnetic Gages", and an average DFT of 22.0 mils was recorded on the elevated water storage tank supporting tower and an average DFT of 12.4 mils was recorded on the container above the balcony. In accordance with ASTM D610-85 "Evaluating Degree of Rusting on Painted Surfaces", a rust grade of 10 was recorded, which indicates that less than 1% of the surface is rusted.

Interior Coating System

The interior coating system is in poor condition with iron and manganese staining with large failed areas and active corrosion noted below high water level. Approximately 1" of settled solids was removed from the container during the cleaning process. No signs of animal, insect or plant debris were observed on the interior of the container. The Dry Film Thickness (DFT) of the interior coating system was measured in accordance with SSPC-PA2 and an average DFT of 15.7 mils was recorded. In accordance with ASTM D610-85 "Evaluating Degree of Rusting on Painted Surfaces", a rust grade of 2 was recorded, which indicates that approximately 33% of the surface is rusted.



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INSPECTION REPORT

Appurtenances

Exterior Ladder

This elevated water storage tank does not have an exterior ladder. The lattice leg of the supporting tower is utilized as a makeshift ladder, which is not compliant with current OSHA requirements for fall protection.

Roof Shell Ladder

The roof ladder is a rolling ladder with 1" of toe space and undersized side rails. The vertical shell ladder is also undersized without any type of safety climb device. The roof shell ladder is not compliant with current OSHA requirements.

Hatches

This elevated water storage tank has three access hatches; one 18" diameter bolt flange hatch in the bowl of the tank, One 24" diameter access hatch with a 4" curb and a 2" overhang located on the northwest quarter of the roof, and one 24" bolt flange hatch located on the north east quarter of the roof. All of the access hatches seal properly and are compliant with current AWWA and OSHA requirement.

Exterior Overflow

A 4" diameter overflow pipe exits the container at high water level, runs through the balcony and discharges below grade into a storm drain. The overflow pipe is cracked above the balcony floor. The overflow is not compliant with current AWWA requirements.

INSPECTION REPORT

Inlet Pipe

A 10" diameter inlet pipe with insulation and metal frost jacket delivers the water approximately 12" above the base of the container. The inlet pipe appears to be in fair operational condition, with some rust tubercles observed during this inspection on the interior of the pipe.

Balcony

The balcony is riveted securely to the elevated water storage tank container. The balcony measures 18" wide with a top rail measurement of 35", and a 3" toe kick. The exterior ladder runs to the top of the railing system which impedes easy access onto the balcony by the climber. The balcony and railing system are not compliant with current OSHA requirements.

Roof Vent

A 16" diameter mushroom style vent and screen are located on the center of the roof. The roof vent and screen are in good operational condition however, a fail safe type vent is required to meet current AWWA standards.

Drain

A 3" diameter drain plug is located in the bottom of the elevated water storage tank. The drain plug needs to be replaced and should be plumbed into the overflow to divert settled solids down to the ground during the cleaning process.

INSPECTION REPORT

Result And Summary

Remedial Action

At the conclusion of the inspection, the elevated water storage tank was disinfected in accordance with AWWA C652-92 "Disinfection of Water Storage Facilities", Method 3.

Executive Summary

It is our opinion that this elevated water storage tank will require vast amounts of AWWA and OSHA upgrades along with exterior lead abatement procedures on the next exterior coating project to bring it back into compliance. For these reasons the City of Vermillion should conduct a study to determine if it would be cost effective to repair this elevated water storage tank or to vacate it and construct a new tank in the near future. However, we do recommend that the elevated water storage tank be cleaned and inspected every two years to monitor the corrosion condition of the interior and exterior coating systems.

Recommendations

1. Abrasive blast and recoat exterior of elevated water storage tank with a zinc/epoxy urethane coating system utilizing lead abatement containment procedures.
2. Abrasive blast and coat interior with solvent free polyurethane coating system.
3. Remove and replace existing ladders with OSHA compliant ladders and safety climb system.
4. Install air gap at discharge point of overflow with concrete sump pit to divert water into storm sewer.
5. Install 3" diameter drain line from drain to existing overflow to divert settled solids during cleaning process.
6. Remove and Replace 4" insulation and metal frost jacket on existing riser pipe.
7. Raise existing balcony railing system to meet current OSHA requirements for fall protection.
8. Remove and replace existing roof vent with AWWA compliant roof vent with fail- safe vent.



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INSPECTION REPORT

Structural Members

Foundations

The foundations, grout, and anchor bolts are in good condition with no spalling, cracking, or exposed aggregate observed during the inspection.

Tower Posts/Columns

The elevated water storage tank is supported by four lattice work columns which are satisfactorily aligned with no settling observed during the inspection.

INSPECTION REPORT

9. Remove existing spider rods and center hub from interior of tank and weld existing roof to tank sidewalls.



Submitted By:

Donald P. Owens
NACE Certification Coating Inspector No. 6374



598 2nd Street Southeast
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Cost Estimate of Needed Repairs

**City of Vermillion, South Dakota
100,000 Gallon Elevated Water Storage Tank**

Item No.	No. of Units	Description	Unit Price	Total Cost
1	9200 SF	Abrasive blast and and recoat Using class A containment	\$ 19.00	\$ 174,800
2	4730 SF	Abrasive blast and recoat with solvent free polyurethane	\$ 13.00	\$ 61,490
3	130 LF	Remove all ladders and replace with OSHA approved ladder and safety climb device	\$ 125.00	\$ 16,250
4	1 ea	Install air gap in overflow and plumb drain line to overflow	\$ 3,500.00	\$ 3,500
5	95 LF	Remove and replace frost jacket	\$ 65.00	\$ 6,175
6	80 LF	Install OSHA approved railing system	\$ 120.00	\$ 9,600
7	1 ea	Install AWWA compliant vent	\$ 2,500.00	\$ 2,500
8	Job	Remove spider rods and secure roof	\$ 5,500.00	\$ 5,500
Total				\$ 279,815

Budget Analysis Report

City of Vermillion, South Dakota
 50 Year Coating Cost Projections
 100,000 Gallon Elevated Water Storage Tank

Recoating Frequency:

Inside Wet: 20

Outside: 15

Inflation Rate: 3%

Interest Rate: 8%

Tank Capacity: 100,000 Gallons

Tank Style: Riveted Steel

Current Costs:

Inside Wet \$42,570

Outside: \$50,600

Washout: \$1,000

Year	Future Cost			Present Worth			
	Wash Out	Inside Wet	Outside	Wash Out	Inside Wet	Outside	Total
2009	\$0	\$0	\$0	\$0	\$0	\$0	\$0
2010	\$0	\$43,847	\$0	\$0	\$40,599	\$0	\$40,599
2011	\$1,000	\$0	\$0	\$857	\$0	\$0	\$857
2013	\$1,000	\$0	\$0	\$735	\$0	\$0	\$735
2015	\$1,000	\$0	\$0	\$630	\$0	\$0	\$630
2017	\$1,000	\$0	\$0	\$540	\$0	\$0	\$540
2019	\$0	\$0	\$68,002	\$0	\$0	\$31,498	\$31,498
2021	\$1,000	\$0	\$0	\$397	\$0	\$0	\$397
2023	\$1,000	\$0	\$0	\$340	\$0	\$0	\$340
2025	\$1,000	\$0	\$0	\$292	\$0	\$0	\$292
2027	\$1,000	\$0	\$0	\$250	\$0	\$0	\$250
2029	\$1,000	\$0	\$0	\$215	\$0	\$0	\$215
2030	\$0	\$79,193	\$0	\$0	\$15,732	\$0	\$15,732
2031	\$1,000	\$0	\$0	\$184	\$0	\$0	\$184
2033	\$1,000	\$0	\$0	\$158	\$0	\$0	\$158
2034	\$0	\$0	\$105,945	\$0	\$0	\$15,470	\$15,470
2035	\$1,000	\$0	\$0	\$135	\$0	\$0	\$135
2037	\$1,000	\$0	\$0	\$116	\$0	\$0	\$116
2039	\$1,000	\$0	\$0	\$99	\$0	\$0	\$99

2041	\$1,000	\$0	\$0	\$85	\$0	\$0	\$85
2043	\$1,000	\$0	\$0	\$73	\$0	\$0	\$73
2045	\$1,000	\$0	\$0	\$63	\$0	\$0	\$63
2047	\$1,000	\$0	\$0	\$54	\$0	\$0	\$54
2049	\$0	\$0	\$165,059	\$0	\$0	\$7,598	\$7,598
2050	\$0	\$143,031	\$0	\$0	\$6,096	\$0	\$6,096
2051	\$1,000	\$0	\$0	\$39	\$0	\$0	\$39
2053	\$1,000	\$0	\$0	\$34	\$0	\$0	\$34
2055	\$1,000	\$0	\$0	\$29	\$0	\$0	\$29
2057	\$1,000	\$0	\$0	\$25	\$0	\$0	\$25
2059	\$1,000	\$0	\$0	\$21	\$0	\$0	\$21
	\$23,000	\$266,071	\$339,006	\$5,372	\$62,427	\$54,566	\$122,366

Total Estimated Cost over 50 years: \$628,077

Present Worth (investment needed today to pay for costs over the next 50 years) \$122,366

Annual Budget \$10,003

APPENDIX B:

PROBABLE CONSTRUCTION COSTS

Market Street Tower Preliminary Engineering Report-2010
 Vermillion, South Dakota
 BAI No. 08115.00.03

Alternative 1 - Repair Existing 100,000 gallon Market Street Tower

SPEC. REF. NO.	DESCRIPTION OF WORK AND MATERIALS	QUAN.	UNIT	UNIT PRICE	TOTAL
Div. 1	GENERAL CONDITIONS	1	LS	\$20,000	\$20,000
Div. 2	SITE CONSTRUCTION				
	Abrasive Blast and Recoat (Class A)	9,200	SF	\$19	\$174,800
	Abasive Blast and Recoat (Polyurethane)	4,730	SF	\$13	\$61,490
	Remove and Replace Ladders and Safety Climb Device	130	LF	\$125	\$16,250
	Install Air Gap in Overflow and Plum Drain line to Overflow	1	LS	\$3,500	\$3,500
	Remove and Replace Frost Jacket	95	LF	\$65	\$6,175
	Install OSHA-approved Railing System	80	LF	\$120	\$9,600
	Install AWWA compliant vent	1	LS	\$2,500	\$2,500
	Remove spider rods and secure roof	1	LS	\$5,500	\$5,500
	PROBABLE CONSTRUCTION COSTS				\$300,000
	- Contingencies (10% of Construction Cost)				\$30,000
	- Basic Engineering Services - Design, Bidding, and Prelim Report				\$19,800
	- Construction Phase Services - Admin and final inspection				\$6,900
	- Construction Inspection and Staking				\$26,400
	Total Engineering and Contingencies				\$83,100
	PROBABLE PROJECT COST				\$383,100

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	
55	NPV Summary of Future Maintenance Costs															
56																
57	Project Location- Vermillion Market Street Tower- 2010															
58																
59	Elevated Tank Type	Legged Tank				Spheroid				Composite				Other		
60																
61	Exterior															
62	Year	Repaint	Repair													
63	10		X	27,600												
64	15		X	27,600												
65	20	X		55,200												
66	27		X	27,600												
67	32		X	27,600												
68	37	X		55,200												
69	44		X	27,600												
70	49		X	27,600												
71																
72																
73																
74																
75	Total				276,000											
76																
77	Interior Wet															
78	Year	Repaint	Repair													
79	10		X	14,190												
80	15		X	14,190												
81	20	X		28,380												
82	27		X	14,190												
83	32		X	14,190												
84	37	X		28,380												
85	44		X	14,190												
86	49		X	14,190												
87																
88																
89																
90																
91	Total				141,900											
92																
93	Interior Dry															
94	Year	Repaint	Repair													
95	10		X	300												
96	15		X	300												
97	20	X		600												
98	27		X	300												
99	32		X	300												
100	37	X		600												
101	44		X	300												
102	49		X	300												
103																
104																
105																
106	Total				3,000											
107																
108	Total NPV				420,900											

Market Street Tower Preliminary Engineering Report-2010
 Vermillion, South Dakota
 BAI No. 08115.00.03

Alternative 2 - Replace Market Street Tower with New 500,000 gallon Water Tower

SPEC. REF. NO.	DESCRIPTION OF WORK AND MATERIALS	QUAN.	UNIT	UNIT PRICE	TOTAL
Div. 1	GENERAL CONDITIONS	1	LS	\$83,000	\$83,000
Div. 2	SITE CONSTRUCTION				
	16" PVC	200	LF	\$45	\$9,000
	500,000 gal Elevated Tank	1	LS	\$1,100,000	\$1,100,000
	Demolition Existing 100,000 gal Elevated Tank	1	LS	\$65,000	\$65,000
	PROBABLE CONSTRUCTION COSTS				\$1,260,000
	- Contingencies (10% of Construction Cost)				\$126,000
	- Basic Engineering Services - Design, Bidding, and Prelim Report				\$83,160
	- Construction Phase Services - Admin and final inspection				\$19,600
	- Construction Inspection and Staking				\$110,880
	Total Engineering and Contingencies				\$339,640
	PROBABLE PROJECT COST				\$1,600,000

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
--	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

ELEVATED TANK LIFE CYCLE COST - COMPARATIVE ANALYSIS PROGRAM

6	Project Location-	Vermillion Market Street Tower- 2010	Alt. No. -	2
7		Construct New 500,000 gallon Tower	Date -	14-Jun-10

10	Estimated Elevated Tank Life (Yrs) -	50	Interest Rate (%)-	4.50
11			Inflation Rate (%)-	4.50

14	Coatings Schedule	No. Repairs Per Repair (0,1,2 or 3)	Coatings Life (Years)		
			Original	Repair	Repaint
16	Exterior	2	15	5	10
17	Interior Wet	2	15	5	10
18	Interior Dry	2	15	5	10

21	Elevated Tank Type	Composite	Spheroid	Fluted Column	Other
23	Capacity (Gal X1000)	500			
24	Height To HWL (ft.)	123.7			
25	Operating Range (ft.)	30.0			
26	Coatings Areas (s.ft.)				
27	-Exterior	8,400			
28	-Interior Wet	9,400			
29	-Interior Dry	100			
30	-Total	17,900			

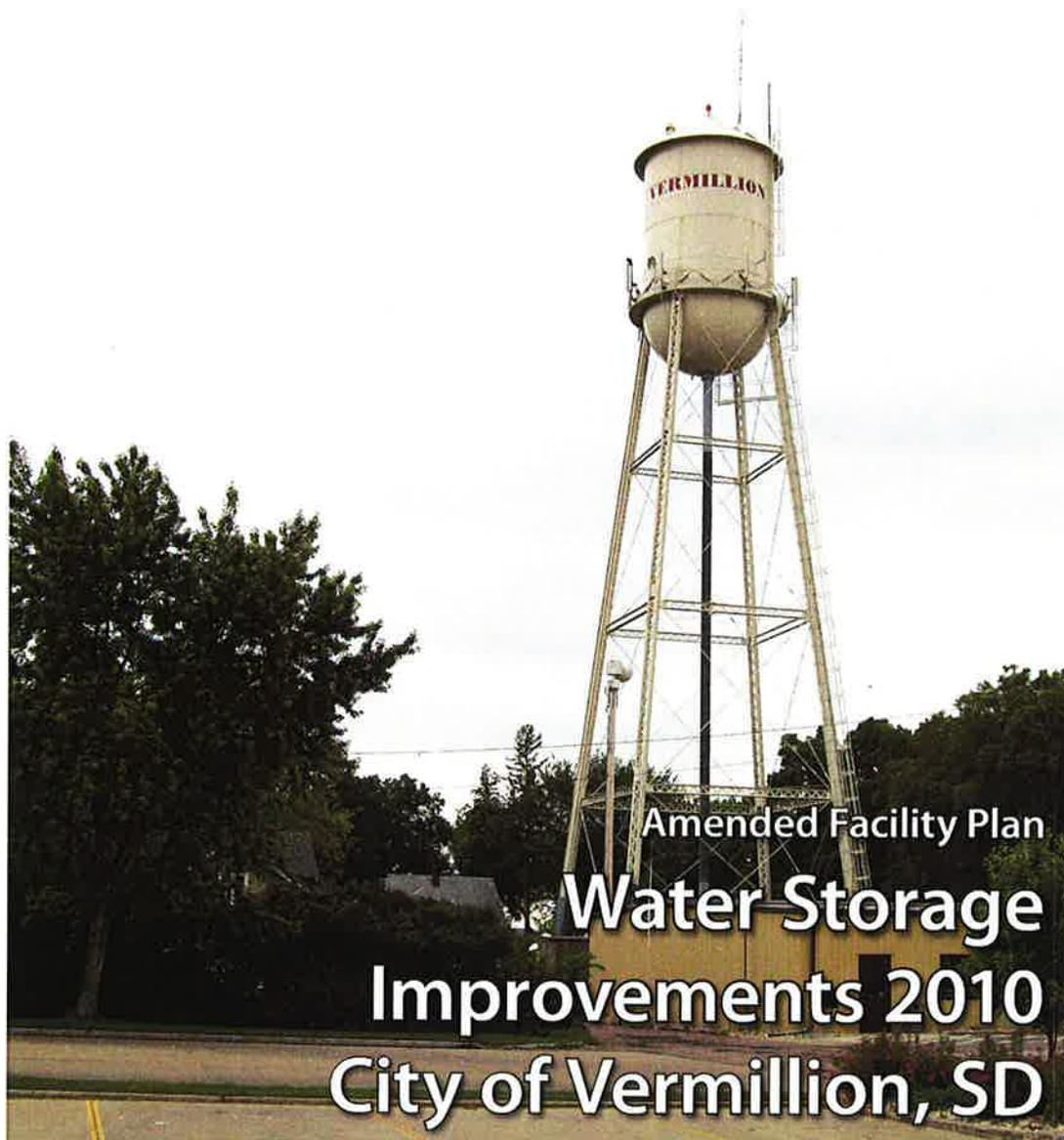
32	Coatings Cost (\$ per s.ft.)	Composite	Spheroid	Fluted Column	Other
		Repaint	Repair	Repaint	Repair
34	Exterior	6.00	3.00	6.00	3.00
35	Interior Wet	6.00	3.00	6.00	3.00
36	Interior Dry	6.00	3.00	6.00	3.00

38	Cost Summary (NPV X \$1,000)	Composite	Spheroid	Fluted Column	Other
40	Tank Cost				
41	Coatings Cost				
42	-Exterior	202			
43	-Interior Wet	226			
44	-Interior Dry	2			
45	-Total Coatings	430			
47	Total Cost	430			

49	Cost \$ Per Gallon	Composite	Spheroid	Fluted Column	Other					
		Tank	Maint.	Total	Tank	Maint.	Total	Tank	Maint.	Total
50			0.86	0.86						

NPV Summary of Future Maintenance Costs

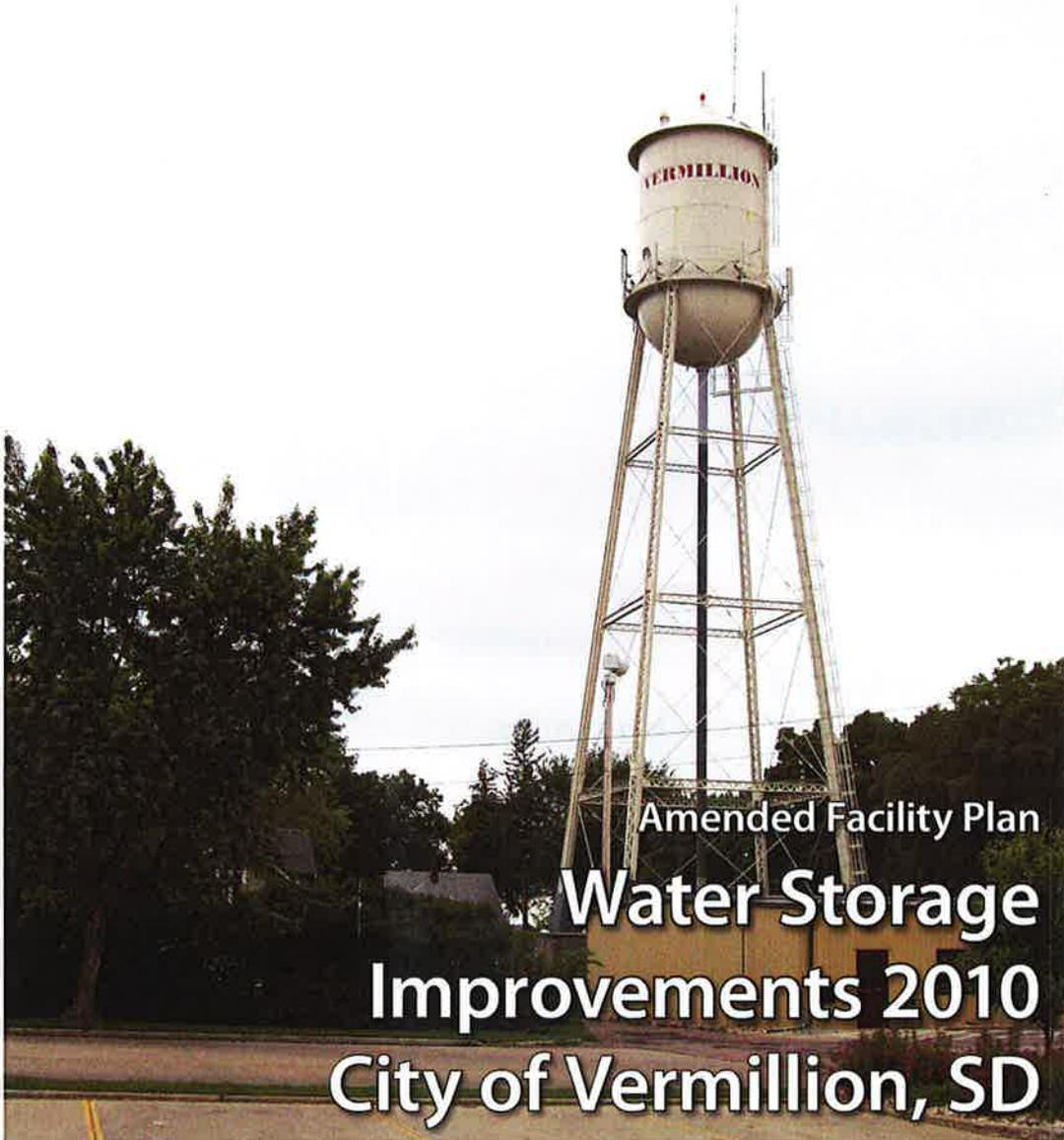
57	Project Location-	Vermillion Market Street Tower- 2010			
59	Elevated Tank Type	Composite	Spheroid	Fluted Column	Other



Prepared By
Banner Associates, Inc.
Brookings, South Dakota

September 2010
Amended March 2012

BANNER
BAI No. 08115.00.03



Prepared By
Banner Associates, Inc.
Brookings, South Dakota

September 2010
Amended March 2012

BANNER
BAI No. 08115.00.03

*WATER STORAGE IMPROVEMENTS 2010
 FACILITY PLAN-AMENDED MARCH 2012
 CITY OF VERMILLION
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SECTION 6: ADDITIONAL CONSIDERATIONS (AMENDMENT)

6.1 UPDATE TO ALTERNATIVE 2: TOWER REPLACEMENT

The original Water Storage Improvements Facility Plan was completed in September 2010. The Facility Plan recommended Alternative 2: Replacement of Market Street Tower with a 500,000 gallon composite tower, supported by O&M costs being less than a spheroid type tower. At the time of the Preliminary Engineering Report completed August 2010, Banner recently completed a comparable project where both composite and spheroid type were bid as alternatives and the bids showed the capital costs approximately the same. Subsequently, the spheroid alternate was not included in the Facility Plan as an alternate due to the recent bidding results showing capital costs approximately the same and known higher O&M costs, resulting in overall higher life cycle costs. The Facility Plan included an Opinion of Probable Project Cost of a 500,000 gallon composite water tower initially at \$1,600,000 then subsequently reduced by omitting the Market Street Tower demolition per DENR to \$1,524,000 including contingencies and engineering. The City following award of SRF funding pursued additional funding sources and were informed recently additional monies were not available. Banner updated the Alternative 2: Opinion of Probable Project cost by contacting tower contractors to investigate current budget pricing were advised composite tower costs have increased. Banner subsequently completed an Opinion of Probable Project Cost for a spheroid alternative as shown in Figure 6.1 by contacting tower contractors and being informed spheroid budget pricing is lower than the composite alternative. Recent tower construction has trended toward composite type towers and we believe the spheroid type towers have become more competitive in an effort to regain tower market share. The Updated Opinion of Probable Project Cost for the composite and spheroid water towers are \$1,766,000 and \$1,535,000 respectively, including contingencies and engineering, and are included in Appendix D. Therefore, Banner Associates, Inc. recommends the City bid both the composite and spheroid alternatives to compare bid pricing and analyze life cycle costs and allow the City to make the best informed decision.

6.2 UPDATE TO ALTERNATIVE 2: OPERATION AND MAINTENANCE COSTS

The original Facility Plan included operation and maintenance (O&M) costs for Alternative 2 –Replacement of Market Street Tower with a 500,000 gallon composite tower. The O&M costs for Alternative 2 were prepared for comparison to the Alternative 1-Repair of Existing Market Street Tower which the Owens Inspection Report shows an estimated 50 year life span with continued maintenance and extensive rehabilitation. The following Table 6.1 is a summary of the Annual O&M costs for the developed alternatives which illustrates Alternative 1 when compared to Alternative 2 has an approximately 8 times higher cost per gallon due to the initial rehabilitation work necessary to address deficiencies for a tank 20% the size of recommended elevated storage improvements.

Table 6.1: Annual O&M Costs for Developed Alternates

	Alt. 1	Alt. 2 - Composite	Alt. 2 - Spheroid	Alt. 3
Tower Inspection	\$1,100	\$1,100	\$1,100	\$0
Tower Painting	\$5,300	\$9,700	\$10,200	\$0
Tower Rehabilitation	\$9,900	\$0	\$0	\$0
Total Annual O&M Costs	\$16,300	\$10,800	\$11,300	\$0
Annual O&M Cost/ Gallon	\$0.163	\$0.022	\$0.023	\$0

6.3 UPDATE TO RECOMMENDED ALTERNATIVES

The original Facility Plan recommended Alternative 2 over Alternative 1 which required extensive rehabilitation of the Market Street tower to address the age, condition, and OSHA safety standard deficiencies. An update to the previous life cycle (NPV) cost analysis with addition of the Alternative 2 - spheroid tower is included in Appendix D and summarized below in Table 6.2. The life cycle analysis or NPV values calculated in Table 6.2 show Alternative 1 has a higher cost of ownership compared to the next feasible alternative for the estimated 50 year remaining service life. The life cycle analysis supports Alternative 2 as a better use of funds as this is a lower investment in addition to Alternative 1 not attaining the recommend elevated water storage for increased redundancy for fire protection, power outages, and operational flexibility.

Table 6.2: NPV Costs for Developed Alternatives

	Alt. 1	Alt. 2 - Composite	Alt. 2 - Spheroid	Alt. 3
O&M NPV	\$459,000	\$304,000	\$318,000	\$0
Tower Replacement NPV	\$1,003,000*	\$1,200,000	\$1,003,000	\$0
Tower Demo. NPV	\$65,000	\$65,000	\$65,000	\$0
Total NPV Costs	\$1,527,000	\$1,569,000	\$1,386,000	\$0

*Alt. 1 - 50 yr service life remaining to be replaced with new tower at year 50

Banner Associates continues to recommend the City pursue Alternative 2 due to lower O&M costs shown in Table 6.1 and lower cost of ownership shown in Table 6.2 as a better use of funds and provide the recommended elevated storage.

6.4 UPDATE TO IMPLEMENTATION PLAN AND SCHEDULE

An updated implementation schedule for the Vermillion Water Tower Project is presented in Table 6.3: Amended Implementation Schedule. Some of the tasks listed in the schedule have been previously completed. The remaining tasks listed in the schedule are sequential in nature and not achieving deadline dates for tasks will result in the critical path being pushed back and following task completion dates being pushed back. Tasks completed or to be completed in order to move the project forward through the design and construction phases include the following:

Table 6.3: Amended Implementation Schedule

TASK	DATE
Presentation and Acceptance of PER	July, 2010
State Water Plan Application Acceptance	August, 2010
Consolidated Water Facilities Application Acceptance	March, 2011
DENR Approval for SRF Loan	March, 2011
Community Development Block Grant Application Denial	January, 2012
DENR Approval of Amended Facilities Plan	April, 2012
Notice to Proceed on Design of Improvements	April 2012
Submittal of Plans and Specifications	June, 2012
Open Bids for Construction	August, 2012
Complete Construction of Improvements	August, 2014
Complete One Year Warranty period	August, 2015

END OF SECTION 6

APPENDIX D:
AMENDED
PROBABLE CONSTRUCTION COSTS

Water Storage Improvements - 2012 Updated Opinion of Cost
 Vermillion, South Dakota
 BAI No. 08115.00.03 - AMENDED
 Date - 2/24/2012

Alternative 2 - Replace Market Street Tower with New 500,000 gallon Composite Water Tower

SPEC. REF. NO.	DESCRIPTION OF WORK AND MATERIALS	QUAN.	UNIT	UNIT PRICE	TOTAL
Div. 1	GENERAL CONDITIONS	1	LS	\$ 93,000	\$ 93,000
Div. 2	SITE CONSTRUCTION				
	16" PVC	250	LF	\$ 45	\$ 11,250
	16" 90 Deg Bend	3	EA	\$ 1,600	\$ 4,800
	500,000 gal Composite Tank	1	LS	\$ 1,200,000	\$ 1,200,000
	Interior Piping	1	LS	\$ 25,000	\$ 25,000
	Electrical and Controls	1	LS	\$ 85,000	\$ 85,000
	PROBABLE CONSTRUCTION COSTS				\$ 1,420,000
	- Contingencies (10% of Construction Cost)				\$ 142,000
	- Basic Engineering Services - Design, and Bidding				\$ 79,200
	- Construction Phase Services - Admin and final inspection				\$ 18,800
	- Construction Observation				\$ 105,600
	Total Engineering				\$ 203,600
	Total Engineering and Contingencies				\$ 345,600
	PROBABLE PROJECT COST				\$ 1,766,000

Water Storage Improvements - 2012 Updated Opinion of Cost
 Vermillion, South Dakota
 BAI No. 08115.00.03 - AMENDED
 Date - 2/24/2012

Alternative 2 - Replace Market Street Tower with New 500,000 gallon Spheroid Water Tower

SPEC. REF. NO.	DESCRIPTION OF WORK AND MATERIALS	QUAN.	UNIT	UNIT PRICE	TOTAL
Div. 1	GENERAL CONDITIONS	1	LS	\$ 80,000	\$ 80,000
Div. 2	SITE CONSTRUCTION				
	16" PVC	250	LF	\$ 45	\$ 11,250
	16" 90 Deg Bend	3	EA	\$ 1,600	\$ 4,800
	500,000 gal Spheroid Tank	1	LS	\$ 1,003,000	\$ 1,003,000
	Interior Piping	1	LS	\$ 25,000	\$ 25,000
	Electrical and Controls	1	LS	\$ 85,000	\$ 85,000
	PROBABLE CONSTRUCTION COSTS				\$ 1,210,000
	- Contingencies (10% of Construction Cost)				\$ 121,000
	- Basic Engineering Services - Design, and Bidding				\$ 79,200
	- Construction Phase Services - Admin and final inspection				\$ 18,800
	- Construction Observation				\$ 105,600
	Total Engineering				\$ 203,600
	Total Engineering and Contingencies				\$ 324,600
	PROBABLE PROJECT COST				\$ 1,535,000

	A	B	C	D	E	F	G	H	I	J	K	L	M
2	ELEVATED TANK LIFE CYCLE COST - COMPARATIVE ANALYSIS PROGRAM												
3													
5													
6	Project Location- Vermillion Water Storage Improvements										Date -	06-Mar-12	
7													
8													
9													
10	Estimated Elevated Tank Life (Yrs) -				50		Interest Rate (%) -				2.50		
11							Inflation Rate (%) -				2.50		
12													
13													
14	Coatings Schedule		No. Repairs Per Repaint							Coatings Life (Years)			
15			(0,1,2 or 3)				Original			Repair		Repair	
16	Exterior		3				20			5		15	
17	Interior Wet		2				15			3		10	
18	Interior Dry		3				25			10		20	
19													
20													
21	Elevated Tank Type		Repair Market St Tower				Composite			Spheriod			
22													
23	Capacity (Gal X1000)		100				500			500			
24	Height To HWL (ft.)		123.7				120.0			120.0			
25	Operating Range (ft.)		30.0				35.0			37.5			
26	Coatings Areas (s.ft.)												
27	-Exterior		9,200				9,600			12,400			
28	-Interior Wet		4,730				11,000			9,700			
29	-Interior Dry		538				1,400			5,400			
30	-Total		14,468				22,000			27,500			
31													
32	Coatings Cost												
33	(\$ per s.ft.)		Repaint		Repair		Repaint		Repair		Repaint		Repair
34	Exterior		5.70		0.90		5.70		0.90		5.70		0.90
35	Interior Wet		5.75		0.83		5.75		0.83		5.75		0.83
36	Interior Dry		3.60		0.75		3.60		0.75		3.60		0.75
37													
54													
58	NPV Summary of Future Maintenance Costs												
59	Elevated Tank Type		Repair Market St Tower				Composite			Spheriod			
60													
61	Exterior												
62	Year Repaint Repair												
63	20	X	8,280				8,640			11,160			
64	25	X	8,280				8,640			11,160			
65	30	X	8,280				8,640			11,160			
66	35	X	52,440				54,720			70,680			
67	50	X					8,640			11,160			
75	Total		77,280				89,280			115,320			
76													
77	Interior Wet												
78	Year Repaint Repair												
79	15	X	3,926				9,130			8,051			
80	18	X	3,926				9,130			8,051			
81	21	X	27,198				63,250			55,775			
82	31	X	3,926				9,130			8,051			
83	34	X	3,926				9,130			8,051			
84	37	X	27,198				63,250			55,775			
85	47	X					9,130			8,051			
86	50	X					9,130			8,051			
91	Total		70,099				181,280			159,856			
92													
93	Interior Dry												
94	Year Repaint Repair												
95	25	X	403				1,050			4,050			
96	35	X	403				1,050			4,050			
97	45	X					1,050			4,050			
106	Total		806				3,150			12,150			
107	Paint NPV		149,000				274,000			288,000			
108													
109	Tower Inspection NPV		30,000		Tower Inspection NPV		30,000		Tower Inspection NPV		30,000		
110	Paint NPV		149,000		Paint NPV		274,000		Paint NPV		288,000		
111	Rehab. NPV		280,000		Rehab. NPV				Rehab. NPV				
112	O&M NPV		459,000		O&M NPV		304,000		O&M NPV		318,000		
113													
114	Annual O&M Tower Insp.		1,100		Annual O&M Tower Insp.		1,100		Annual O&M Tower Insp.		1,100		
115	Annual O&M Paint		5,300		Annual O&M Paint		9,700		Annual O&M Paint		10,200		
116	Annual O&M Rehab.		9,900		Annual O&M Rehab.				Annual O&M Rehab.				
117	Total Annual O&M		16,300		Total Annual O&M		10,800		Total Annual O&M		11,300		
118	Annual O&M Cost \$/gallon		0.163		Annual O&M Cost \$/gallon		0.022		Annual O&M Cost \$/gallon		0.023		
119													
120	O&M NPV		459,000		O&M NPV		304,000		O&M NPV		318,000		
121	NPV Spheriod Tower		1,003,000		Composite Tower		1,200,000		Spheriod Tower		1,003,000		
122	NPV Market Tower Demo		65,000		Market Tower Demo.		65,000		Market Tower Demo		65,000		
123	Total NPV		1,527,000				1,569,000			1,386,000			
124													

