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Task Order 0014

Final
Feasibility Study Update

U.S. Army Corps of Engineers
Kansas City District

Northwest Missouri Regional Water Supply Study – Phase IV

May 12, 2011

US Army Corps of Engineers
Kansas City District

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Missouri Department of Natural Resources

CDM

Northwest Missouri Regional Water Supply
Transmission System Study
Phase IV

Final
Feasibility Study Update

May 2011

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Acronyms/Abbreviations

ACWWC	Atchison County Wholesale Water Commission
CDM	CDM Federal Programs Corporation
Commission	Great Northwest Wholesale Water Commission
GPCD	gallons per capita per day
HP	horsepower
kwh	kilowatt-hours
M	million
MDNR	Missouri Department of Natural Resources
MGD	million gallons per day
O&M	operations and maintenance
OPC	opinion of probable cost
PAS	Planning Assistance to States
PER	Preliminary Engineering Report
psi	pounds per square inch
PWSD	Public Water Supply District
USACE	U.S. Army Corps of Engineers
WTP	water treatment plant

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Executive Summary

Under the July 15, 2010 Planning Assistance to States cost share agreement between the U.S. Army Corps of Engineers and the Missouri Department of Natural Resources Water Resources Center, CDM Federal Programs Corporation was requested to provide engineering and technical support services to the Kansas City District for Phase IV of the Northwest Missouri Regional Water Supply Study. The objective of Phase IV is to provide a Preliminary Engineering Report (PER) for the Stage 1 Pipeline and to provide an update to the 2009 *Phase II Feasibility Study* tailored for the current Great Northwest Wholesale Water Commission (Commission) membership. This report serves as the PER for the Stage 1 Pipeline. The Feasibility Study Update is a separate document, but relies heavily on the conclusions summarized herein.

The Feasibility Study Update has been completed as a follow-up to the Phase 1, 2, and 3 reports prepared for the Commission and builds heavily on the recommended improvements from the Stage 1 Pipeline PER completed concurrently with this report.

The conceptual design incorporates 240 miles of pipeline, three pump stations, four elevated storage tanks and two clearwells in total, including the pipelines proposed during the Stage 1 PER.

The opinion of probable cost was $124.5 million for this system. Operations and maintenance and replacement costs were determined as $660,000 and $1,100,000 respectively. The final major expense that the conceptual system would incur is purchasing water. Using the current average daily use of approximately 5.2 MGD, an average wholesale water rate to the system of $3.58 per 1,000 gallons a cost of $6.9M per year may be anticipated. Using these expenses and assuming an interest rate of 4.75-percent over 33 years, the estimated cost per 1,000 gallons with no grant funding is $8.82.

The commission was broken into four proposed stages of construction based on need and serving the largest number of customers as soon as possible. Table ES-1 summarizes the stages, utilities served, and cost components for each stage.

Table ES-1
Full Commission Alignment Summary

Stage	Utility in Each Stage	2030 Demands Avg. Day (MGD)/ Max Day (MGD)	2030 Population Served by Improvements	OPC of Proposed Improvements $ Million/ $/capita	Source of Supply
1	Andrew County PWSD #1 Andrew County PWSD #4 City of Albany City of Barnard City of Bolckow City of King City City of Stanberry DeKalb County PWSD #1 Gentry County #1 Gentry County #2 Nodaway County #1	1.9/3.7	26,700	$49.9 M/$1,900/cap	Varies
1a	Davies County PWSD #1	0.16/0.32	2,700	$7.9M/$2,900/cap	Pattonsburg
2	Andrew County PWSD #2 Buchannan County PWSD #1 City of Cameron City of Maysville City of Stewartsville Clinton County PWSD #1 DeKalb County PWSD #1	3.31/6.62	33,800	$46.9M/$1,390/cap	Varies
3a	City of Gallatin	0.38/0.75	1,900	$6.9M/$,3600/cap	Groundwater
3b	City of Maitland	0.03/0.05	340	$1.5M/$4,400/cap	Groundwater
3c	City of Ravenwood	0.03/0.06	510	$2.6M/$5,100/cap	Groundwater
4	City of Grant City	0.13/0.25	1,400	$5.3M/$3,800/cap	Middle Fork Water Co.

This report also suggested a series of "Next Steps" for the Commission to proceed with in order to move forward with this project. Three of the most major of those items are identified below:

- Establish a contractual mechanism as to how to administer water sales to the customers and select a method of equitable payment for the Commission members.
- Directly negotiate with those Commission members that can be served by the Stage 2 Alignment towards determining the actual water demands the utilities would wish to purchase from Stage 2.
- Conduct a PER for the Stage 2 Pipeline alignment towards pursuing funding for future work.

Section 1
Introduction

Under U.S. Army Corps of Engineers (USACE) contract W912DQ-08-D-0048 Task Order 0014, CDM Federal Programs Corporation (CDM) was requested to provide engineering and technical support services to the Kansas City District for Phase IV of the Northwest Missouri Regional Water Supply Study. The objective of Phase IV is to provide a Preliminary Engineering Report (PER) for the Stage 1 Pipeline and to provide an update to the *2009 Phase II Feasibility Study* tailored for the current Great Northwest Wholesale Water Commission (Commission) membership. This report serves as the Feasibility Study Update.

The Missouri Department of Natural Resources (MDNR) Water Resources Center and the USACE were requested to provide the Commission with this study. Funding for this study was provided through the USACE Planning Assistance to States (PAS) Program, Section 22 of the Water Resources Development Act of 1974 (Public Law 93-251) as amended to assist the States in the preparation of comprehensive plans for the development, utilization and conservation of water and related land resources, and Section 319 of the Water Resources Development Act of 1990 (Public Law 101-640). The Missouri Department of Natural Resources (MDNR), as the non-Federal sponsor of the PAS agreement, utilized State general revenue funds for 50-percent of this study's cost. CDM and Bartlett & West completed the work on both documents under this agreement. Special consideration should also be to the important role the Northwest Regional Council of Governments made by supporting communication with the Commission over the course of the project.

The PER and Feasibility Study Update also rely heavily on the data from previous studies and information provided by MDNR, the Commission and its membership and specific non-member water utilities that were identified as potential water supply options.

1.1 Stage 1 Pipeline Project Description

At the time this project was initiated, the Commission included 24 water utilities as shown in Table 1-1.

Table 1-1
October 2010 GNWWWC Membership

Andrew County Public Water Supply District (PWSD) #1
Andrew County PWSD #2
Andrew County PWSD #4
Buchannan County PWSD #1
City of Albany
City of Barnard
City of Bolckow
City of Cameron
City of Gallatin
City of Grant City
City of King City
City of Maitland
City of Maysville
City of Plattsburg
City of Ravenwood
City of Savannah
City of Stanberry
City of Stewarstville
Clinton County PWSD #1
Davies County PWSD #1
DeKalb County PWSD #1
Gentry County #1
Gentry County #2
Nodaway County #1

The Commission Strategic Planning Sub-Committee, along with MDNR and USACE assistance, identified the initial Stage 1 Pipeline alignment shown as Figure 1-1. This report assumes that the Phase 1 work is completed and in use. The report builds upon that foundation to determine the impacts to the full system based on the entire Commission membership.

There are four potential water suppliers identified as alternatives for evaluation: Missouri-American (located in St. Joseph, Missouri), City of Savannah, City of Plattsburg and the Atchison County Wholesale Water Commission (ACWWC).

The intent of this report is to determine the potential water demand for the full build out, evaluate the water supply options, provide a recommendation as to the lowest cost source, and provide construction cost information to the Commission to pursue funding.

The standard Missouri PER/Facility Plan guidelines also include tasks for public involvement and environmental review that are not included in this report or in the current scope of work.

1.2 Project Background

A group of interested parties and stakeholders from Northwest Missouri established a Water Partnership Planning Group (Water Partnership) consisting of representatives from each of the 12 counties in Northwest Missouri. The 12 counties are Andrew, Atchison, Buchanan, Caldwell, Clinton, Davies, DeKalb, Gentry, Harrison, Holt, Nodaway, and Worth. The goal of the Water Partnership was to explore options for a regional plan that provides a long-term, affordable, high-quality water supply.

During the 2007 Phase I study, 83 public water systems in the 12 county area were evaluated with regards to their water supply capacity (including source capacity and treatment capacity), ability to withstand drought, and adequacy of water treatment facilities (including excess capacity, age of treatment facilities, and compliance with drinking water standards). Only 40 of the 83 systems had their own water supply sources. Other potential water supply sources for the 12 county area were identified and evaluated. These sources included aquifers, potential reservoir sites, off stream diversions, and other suppliers (City of Kansas City, Missouri, Rathburn Reservoir in Iowa, and Missouri-American Water Company of St. Joseph). The water supply demands were identified, including the existing unserved population, anticipated population growth, and other needs including commercial and industrial projections. The initial studies identified seven of the current water systems that could serve as hubs in a more comprehensive, long-range plan. These systems have the capacity to continue meeting the needs of their current service area while providing additional water to a regional system. The Water Partnership and an appointed engineering/technical subcommittee were assigned responsibility for identifying and evaluating alternative solutions to address the water supply needs for the 12 county area. The subcommittee identified and evaluated several alternatives, and provided the Water Partnership with a recommended water supply transmission system plan. The recommendation was adopted by the Water Partnership as the best alternative to evaluate for implementation in Phase II of the study.

The Phase II study, completed March 6, 2009, provided the preliminary planning report with cost estimates for the regional water supply transmission system and a framework for implementing the regional water supply system outlined in Phase 1.

The Water Partnership eventually formed the Commission that has 24 member utilities as of the beginning of 2011. The Commission, along with the USACE and MDNR, also produced a Phase III study in 2010. This Phase III provided a methodology for water supply facilities to compare cost, a discussion of how current and future regulatory issues may impact groundwater and surface water supplies, and an analysis of the availability, reliability, and quality of current groundwater and surface water supplies.

As the follow on to the previous work, CDM and Bartlett & West were retained to complete that Phase IV work described above.

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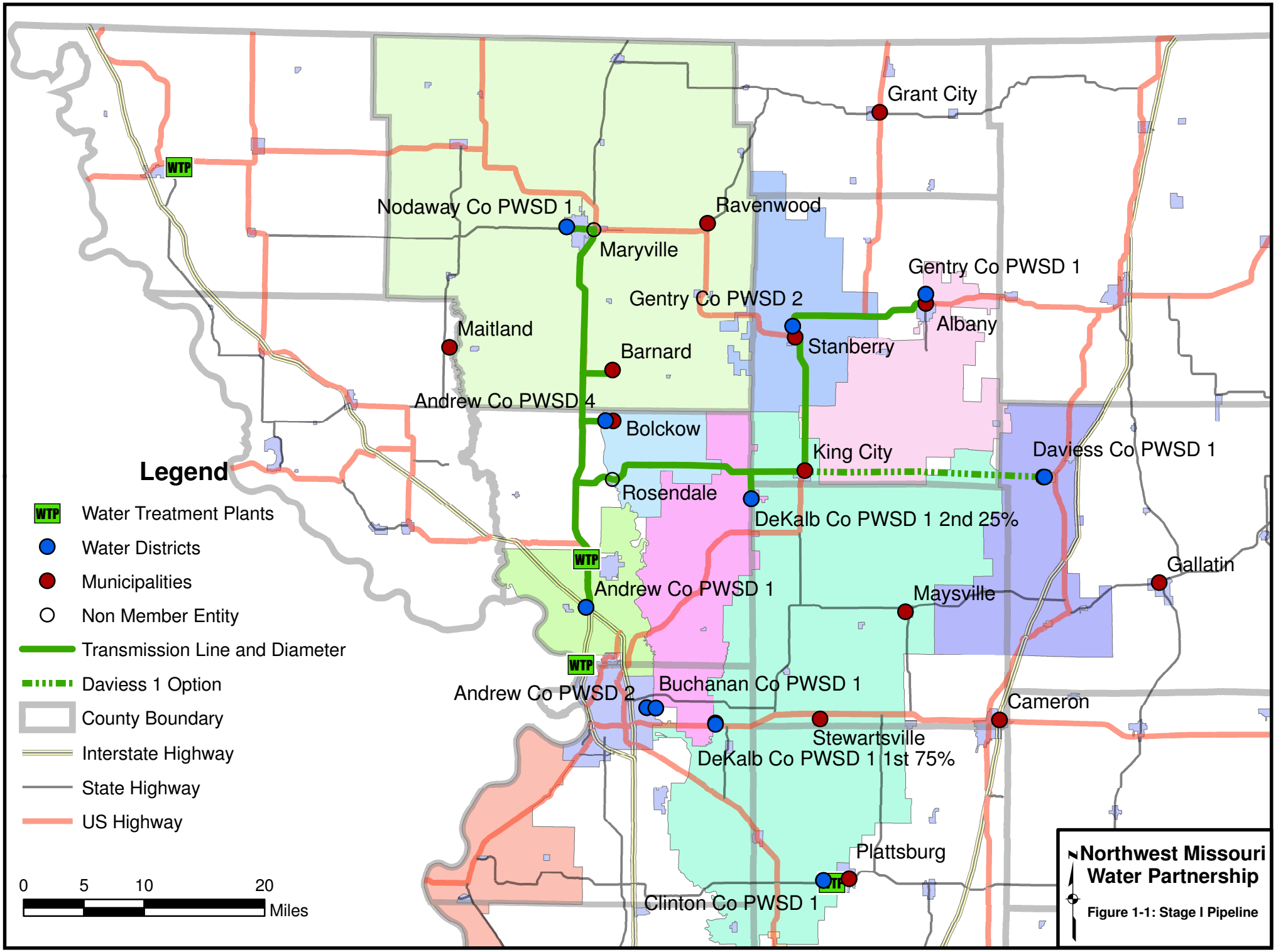
Grant City
WTP
Nodaway Co PWSD 1
Ravenwood
Maryville
Gentry Co PWSD 1
Gentry Co PWSD 2
Albany
Maitland
Stanberry
Barnard
Andrew Co PWSD 4
Bolckow
King City
Daviess Co PWSD 1
Legend
Rosendale
DeKalb Co PWSD 1 2nd 25%
Water Treatment Plants
Water Districts
Municipalities
Non Member Entity
Transmission Line and Diameter
Daviess 1 Option
County Boundary
Interstate Highway
State Highway
US Highway
WTP
Andrew Co PWSD 1
Gallatin
Maysville
WTP
Andrew Co PWSD 2
Buchanan Co PWSD 1
Cameron
Stewartsville
DeKalb Co PWSD 1 1st 75%
Plattsburg
WTP
Clinton Co PWSD 1
0
5
10
20
Miles
Northwest Missouri Water Partnership
Figure 1-1: Stage I Pipeline

Section 2
Description of Existing Facilities

2.1 Description of Need

Water has long been identified as a key driver in the success and stability of population trends. In northwest Missouri, many communities depend on access to the Missouri River and its alluvial aquifers or reservoirs for water supply. Those without access to these sources purchase water from a wholesale supplier. The *Northwest Missouri Regional Water Supply Transmission System Study Phase III Report* dated May 2010 provides a summary of water supply issues in the northwest region of Missouri. This report discusses four primary topics: formation of the Commission, cost of water, current and future regulatory issues, and drinking water sources within the region and on a county-by-county basis.

The goal of this report is to provide pipeline sizing and cost information specifically for the 24 current Commission members individually, rather than analyzing the entire 12 county area. The methodology, assumptions, and projected demands are summarized below.

2.2 Future Water Need Projections

Historical growth trends and water usage surveys for the 24 Commission members were compiled and studied and from that, projections extending to year 2030 were completed. Water demands are projected to the year 2030, which is anticipated to be the first year that all phases of the conceptual system would be built and in operation. This work was performed under the *2007 Phase 1 Report* and modified in the *2009 Phase II Report*, but have been updated as part of this work. The objective was to determine the overall amount of water demand required by the Commission members when all phases of the project would be constructed and in operation.

The 1950 through 2000 city and county population data was provided by the Missouri Census Data Center. The 2006 population data was also used if available from the 2007 *Phase I Report*. The historic population trend and population projections through 2030 are shown in Appendix A. Six utilities have a negative population growth since 1950. For those utilities, it was assumed that the current water demands would remain as is without any decline in the future.

Historical water demand data was requested from each Commission member. If data was available provided by a Commission member, the data from the *2007 Phase I Report* was used. In certain cases, the water demand and sales numbers were modified due to one Commission member selling water to a second member. These changes were made to provide a more realistic view of the water demands for the membership and not to double count water needs.

Similar to the methodology used in the *2007 Phase 1 Report* and in the modified *2009 Phase II Report*, the entire water usage for selected communities has been included in the wholesale supply system. This acknowledges that most of these supplies are aging beyond their expected service life, or suffer from water quality or quantity issues. An important trend identified in the Phase I effort is that of the 83 systems in the region, 43 purchase water from a neighboring community.

At one time, 24 of those 43 systems had their own source supply. Since many aging and degrading supplies remain, regionalization and consolidation of water suppliers will likely continue, even in absence of a regional comprehensive system. The assumption that a majority of communities will have abandoned their water supplies within the next 20 years is validated by the trends seen in the area.

2.2.1 Calculation Methodology

The calculations are presented in Appendix A of this report. The 2009 water demand data were divided by the 2009 utility population projections to determine a gallon per capita day (GPCD). The GPCD was then multiplied by the 2030 projected population to determine the annual water demand and average day water demand. Consistent with the *2009 Phase II Report*, a conservative peaking factor of 2.0 was multiplied by the average day water demand to estimate the maximum day demands.

Population data specific to water districts was projected from the data included in the *2007 Phase I Report*. This was based on determining the percentage of population each water district served within the County in 2006. That percentage was assumed to remain constant and multiplied by the individual County growth projections to determine the District population growth.

Table 2-1 summarizes the water demand results of the Commission.

Table 2-1
Summary of Commission Demands

District/City	Water Demands (MGD)	
	Current Max. Day	2030 Max. Day
Andrew County PWSD #1	1.02	1.17
Andrew County PWSD #2	0.73	0.84
Andrew County PWSD #4	0.07	0.09
Buchannan County PWSD #1	0.35	0.35
City of Albany	0.44	0.50
City of Barnard	0.04	0.05
City of Bolckow	0.10	0.10
City of Cameron	2.68	3.33
City of Gallatin	0.75	0.78
City of Grant City	0.25	0.25
City of King City	0.20	0.20
City of Maitland	0.05	0.05
City of Maysville	0.17	0.19
City of Ravenwood	0.06	0.07
City of Stanberry	0.23	0.23

Table 2-1 (Continued)

District/City	Water Demands (MGD)	
	Current Max. Day	2030 Max. Day
City of Stewarstville	0.10	0.13
Clinton County PWSD #1	0.12	0.16
Davies County PWSD #1	0.31	0.32
DeKalb County PWSD #1	1.41	1.62
Gentry County #1	0.25	0.25
Gentry County #2	0.10	0.10
Nodaway County #1 (1)	0.60	0.60
City of Plattsburg	1.8	2.1
City of Savannah	0.9	1.1
Total (Excluding Plattsburg & Savannah)	10.1	11.4
Total w/ 15% Additional Growth Included	11.6	13.1

Note 1: Assumes only another 0.6 MGD purchased not full system demand
MGD = million gallons per day

The resulting total annual percentage change was 0.61-percent per decade as opposed to 0.26-percent per decade presented in the *2007 Phase I Report*. However, the *2007 Phase I Report* analyzed 80 utilities over 12 counties and was a much broader assessment of the area. These projections are tailored specifically to the utilities shown.

This methodology does not account for any future water demands beside the current customer base. The overall water demand was increased by 15-percent to allow for some future water sales or supply to water utilities near the transmission mains that are not current Commission members.

Nodaway County PWSD No. 1 currently purchases all of its water from the City of Maryville and has a long term water purchase contract with that supply. The 0.6 MGD maximum day demand is an estimate of the demands for the unserved areas within Nodaway County that could be served by the Commission supply rather than the Maryville Supply.

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Section 3
Conceptual Design Criteria

3.1 Model Criteria and Pipeline Sizing

The hydraulic criteria used in the model are indicated in Table 3-1. These criteria were chosen to minimize energy costs while optimizing storage and pumping facilities. A maximum pressure was selected to reduce the need for energy dissipation at delivery points. Most Commission members should be able to accept incoming water at this selected pressure without the need for throttling or higher pressure class pipelines. Members have a minimum pressure of 35 pounds per square inch (psi) at their connection points. Some member may need booster pump stations to serve their individual water systems.

Table 3-1
Model Development Criteria

Model Constraint	Value
Allowable Friction Headloss Range	5.3 - 15.8 feet per mile
Target Pressure Range	40 - 150 PSI
Allowable Pressure Range	20 - 200 PSI
Maximum Transmission Velocity	3.5 feet per second
Equalization Storage Tank Volume	10% transmission flow
Maximum Horsepower (HP) per Pump	300 HP
Hazen-Williams Roughness Coefficient	140

PSI = pounds per square inch
HP = horsepower

3.2 Pumping Facilities

Pump stations are located in areas where free-flowing pressures from elevated storage or other pump stations would drop the pressure below 20 psi. The pump stations are sized to provide flow for peak daily demands in a 24-hour delivery period. Individual pumps were limited to 300-HP to allow for low voltage (480 volt or less) motors and variable frequency drives while keeping conductor sizes within a reasonable and economical range.

3.3 Water Storage Facilities

Storage facilities, elevated, and standpipes are located where the combination of elevation and pipeline friction losses caused pipeline pressure upstream of the pump station to exceed 200 psi. Storage facilities were sized in the transmission system for pump station equalization only. Each member of the Commission will be responsible for their own internal storage needs. The inlet and outlet piping to each tank will be configured to promote recirculation within the tanks.

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Section 4
Resource Alternatives Considered

4.1 Water Supply Alternatives

There were four potential wholesale water suppliers that were considered. These suppliers include the emerging ACWWC, Missouri-American Water Company in St. Joseph, City of Plattsburg, and the City of Savannah. There are additional supply hubs in the area, Middlefork Water Company being one example, that do have the capability of providing minor quantities of potable water as compared to the four major suppliers named above. These additional local contributors may be considered in the preparation of a final design but are not further evaluated as part of the preparation of this PER.

A survey of the four suppliers was completed as an initial task of the *Phase II Feasibility Report* and was updated again as a portion of this PER. In the survey, the suppliers were asked to define their current capacity and explain plans in place for expansion. They were also asked to report their current wholesale water rates. Copies of the correspondence with the suppliers are provided in Appendix C.

4.1.1 Atchison County Wholesale Water Commission

Bartlett & West is the engineer for the ACWWC and provided the requested information. The ACWWC is currently under design and is scheduled to go online in mid 2013. The initial construction will include a 2.5 million gallons per day (MGD) groundwater treatment facility and well field. This facility will not have excess treatment or transmission capacity, but the site was selected to allow for future expansions up to 10 MGD. ACWWC has not set a wholesale water rate, but the 2008 facility plan indicates that it will be approximately $4.00 per 1,000 gallons sold. Projecting the 2008 number to 2013, it was inflated at 5-percent per year to $5.11 per 1,000 gallons of water sold. ACWWC will provide chloramines as the residual disinfectant. ACWWC will provide up to 6 MGD with the current site selection to the Commission.

4.1.2 Missouri-American Water Company

Missouri-American Water Company owns and operates the 30 MGD groundwater treatment municipal water system in St. Joseph, Missouri. The water treatment plant (WTP) has at least an additional 8 MGD of capacity to serve the Commission. Missouri-American also uses chloramines as the residual disinfectant. The 2010 wholesale water rate structure includes a minimum charge and a water charge per 1,000 gallons as outlined in Table 4-1 below. The projected 2013 rates were inflated at 5-percent per year from the published 2010 numbers.

Table 4-1
Missouri-American Rate Schedule

Rate Class	2010 Rate ($/kgal)	2013 Projected Rate ($/kgal)
Monthly Minimum Charge (12-inch meter)	$1,124.62	$1,301.89
For the first 100,000 gallons	$4.2794	$4.95
For the next 1.9 million (M) gallons	$3.3234	$3.85
For the next 3.0M gallons	$2.7691	$3.21
For all over 5.0M gallons	$1.8886	$2.19

4.1.3 City of Savannah

The City of Savannah currently operates a 2.0 MGD municipal groundwater treatment plant that completed construction in 2008. In 2010, Bartlett & West completed a *Drinking Water Facilities Plan* that addressed possible plant expansions and provided some projected water rates based on different purchasing scenarios.

The Savannah WTP has free chlorine as its residual disinfectant. All of the other major sources of water are providing chloramines as the residual disinfectant in the system. Purchasing water from the City of Savannah would require the Commission to invest in an ammonia feed facility to convert the residual disinfectant to chloramines to match the other supplies. This cost is estimated as $70,000 for the initial construction cost and will add an additional operation and maintenance (O&M) expense to the Commission that is not incurred with the other alternatives. It is possible that the Commission could negotiate with the City to add this at their existing WTP, but that would need to be negotiated between the two parties as part of a supply agreement between the Commission and the City.

Based on the report assumptions, the plant could be expanded to 5.0 MGD allowing for between 3 to 3.5 MGD being available for Commission use. It is assumed that Andrew County PWSD No. 1 is part of the general Commission demand and not an individual purchaser for this capacity. The study does note that it may be feasible to expand the plant capacity beyond this amount, but further information is needed regarding the well field yield and evaluation of the plant site and lime sludge lagoon layout to make that determination.

An estimated production cost was provided in the report indicating the cost of water would be $3.77 per 1,000 gallons, but this did not include city administration and billing costs. For this PER, it was assumed to add an additional 20-percent to this number to account for costs not covered in the *Drinking Water Facilities Plan*. The rates were then inflated at 5-percent per year to a projected 2013 rate of $5.24 per 1,000 gallons.

4.1.4 City of Plattsburg

The City of Plattsburg currently operates a 1.3 MGD municipal WTP treating surface water from Smithville Lake. The City of Plattsburg provides chloramines as the residual disinfectant. No excess production or transportation capacity is currently available, but raw water rights are available to expand production up to 10 MGD as needed. A plant expansion would be required to supply the Commission with water. It is projected that this could take up to 4 years to accomplish. The City of Plattsburg has indicated that their current wholesale water rate is $2.95 per 1,000 gallons sold. When adding in 5-percent inflation over the next 3 years (similar to the adjustments made for the other suppliers) and adding on the debt service expectations for a 4 MGD plant expansion to serve the additional flowrate, the estimated wholesale water rate is approximately $6.05 per 1,000 gallons.

4.1.5 Water Supply Selected Alternatives

Based on the analysis performed during Stage 1 PER of the report, Missouri-American is the least expensive water supplier to serve the Stage 1 Pipeline and the proposed future phases north of St. Joseph. In addition, the City of Plattsburg was also selected to provide up to another 4 MGD, specifically dedicated to the southern portion of the Commission expansion zone. The City of Plattsburg was selected due to proximity to the southern Commission members and allowing the Commission to include multiple water supplies for redundancy rather than assuming all flows were from one source.

The Commission has placed a priority on purchasing water from a variety of water sources. Smaller water utilities, such as Middle Fork Water Company and the City of Savannah, could also be a system supplier, but the overall water supplied by these sources will be limited with a small impact on the overall system design. Water quality from these smaller sources should also be investigated and confirmed to be compatible with the primary source. All sources should have chloramines as the residual disinfectant and be of similar water hardness and pH.

4.2 General Alignment and System Description

Figure 4-1 shows the overall system map. To create the overall system model, points were assigned for each utility to determine where they would receive water from the Commission. The actual connection points were selected by referencing the water distribution and transmission system maps provided by the individual utility and referencing the knowledge of wholesale water suppliers to current membership. For example, Andrew County PWSD No. 4 receives its water supply from the City of Bolckow. Therefore, it is assumed that the water district has a connection point within Bolckow's city limits.

The full transmission system consists of approximately 230 miles of 4-inch to 30-inch diameter piping. The overall system consists of four storage tanks, three pump stations, and a flow control structure. The tanks are located in Stewartsville, King City, Maryville, and near Grant City. Tank sizing and overflow information is provided in Table 4-2 below.

Table 4-2
Water Storage Tanks

Tank ID	Overflow Elevation (height above grad)	Volume (gallons)
1	140	400,000
2	63	200,000
3	50	30,000
4	100	750,000
5	NA	900,000 clearwell
6	NA	600,000 clearwell

Pump stations are located at the Missouri-American source, the Plattsburg source, and near Grant City. Flow control valves are included in the overall system to allow for tank cycling. More specifics on the pump stations can be seen in Table 4-3.

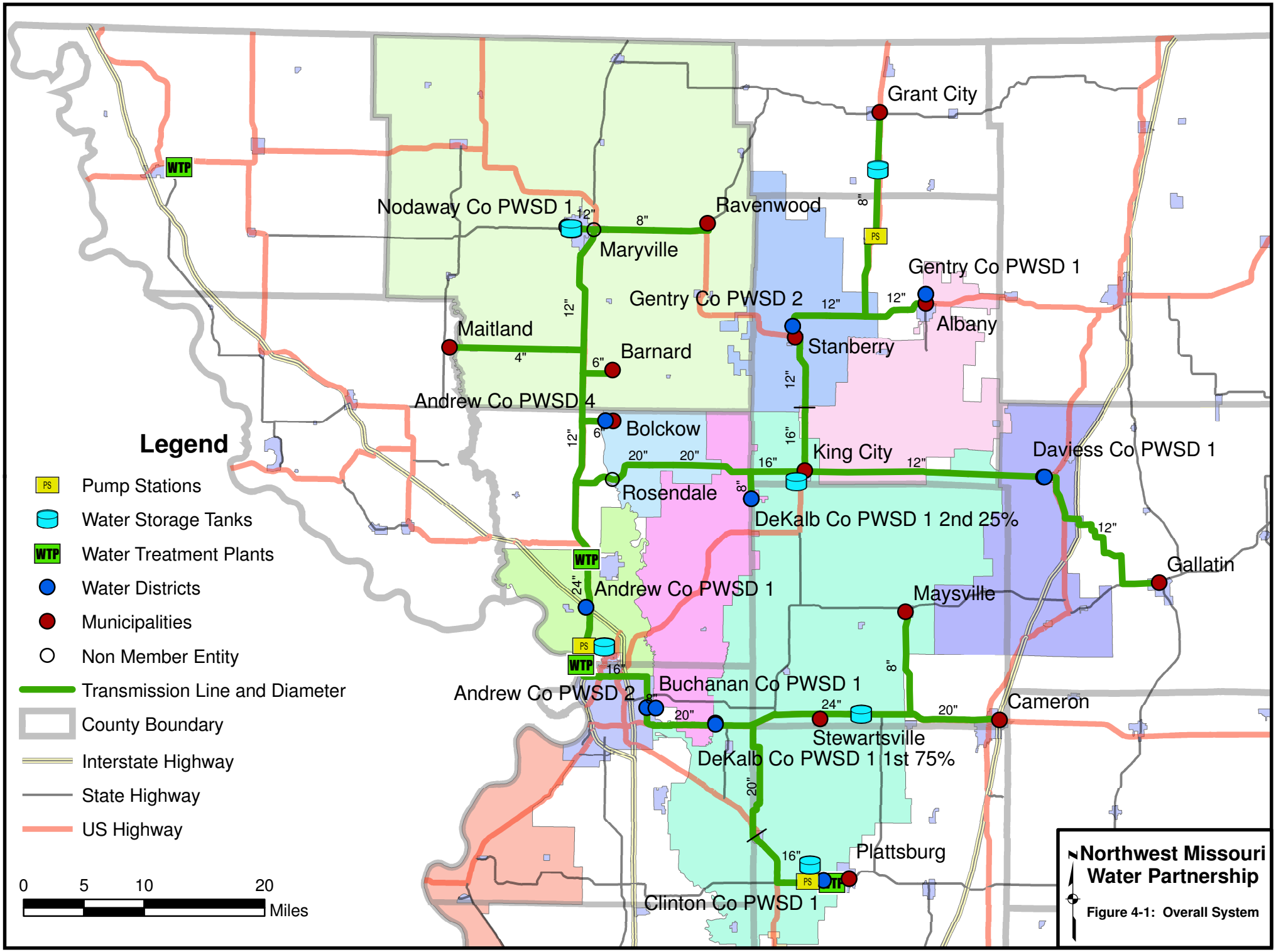
Table 4-3
Pump Stations

Pump Station ID	Flow (gal/min)	Flow (MGD)	Head	Total HP	Number of Pumps
1	6945	13.50	430	1150	5
2	2775	4.00	362	400	3
3	350	0.50	143	50	2

Table 4-4 below provides the range of system pressures available to each of the commission members. The maximum pressure was found using 50-percent of peak day supply and zero demand. It was assumed that pump speed will be controlled so the critical node does not exceed 200 psi. Appendix B includes more complete hydraulic information.

Table 4-4
Pressure Ranges for Each Water Utility

Water Utility	Pressure Range (psi)
Albany	35 - 123
Andrew Co PWSD # 1	72 - 106
Andrew Co PWSD #2	91 - 132
Andrew Co PWSD #4	73 - 104
Barnard	73 - 104
Bolckow	102 - 133
Buchanan Co PWSD #1	114 - 158
Cameron	60 - 98
Clinton Co PWSD #1	62 - 112
Daviess Co PWSD #1	111 - 197
DeKalb Co PWSD #1 - 1st Pt (75%)	126 - 159
DeKalb Co PWSD #1 - 2nd Pt (25%)	55 - 83
Gallatin	54 - 176
Gentry Co PWSD #1	35 - 123
Gentry Co PWSD #2	67 - 124
Grant City	40 - 56
King City	60 - 67
Maitland	77 - 130
Maysville	66 - 95
Nodaway Co PWSD #1	37 - 45
Ravenwood	79 - 91
Stanberry	87 - 143
Stewartsville	68 - 82


Legend
Pump Stations
Water Storage Tanks
Water Treatment Plants
Water Districts
Municipalities
Non Member Entity
Transmission Line and Diameter
County Boundary
Interstate Highway
State Highway
US Highway
0 5 10 20
Miles
Grant City
Nodaway Co PWSD 1
Ravenwood
Maryville
Gentry Co PWSD 1
Gentry Co PWSD 2
Albany
Maitland
Stanberry
Barnard
Andrew Co PWSD 4
Bolckow
King City
Daviess Co PWSD 1
Rosendale
DeKalb Co PWSD 1 2nd 25%
Gallatin
Andrew Co PWSD 1
Maysville
Buchanan Co PWSD 1
Andrew Co PWSD 2
Cameron
Stewartsville
DeKalb Co PWSD 1 1st 75%
Plattsburg
Clinton Co PWSD 1
Northwest Missouri Water Partnership
Figure 4-1: Overall System

Section 5
Conceptual Plan Preliminary Cost Opinion

This section presents the underlying information required for a water rate analysis, including initial construction costs, system replacement cost, and annual O&M costs.

5.1 Opinion on Probable Cost

The cost opinion of the initial construction cost for the conceptual overall system has been developed based on actual prices from recent similar rural water projects. Facilities are divided into three categories: pipelines, pump stations, and water storage tanks.

A cost opinion has been developed for the overall system. Pipeline costs were estimated by assuming a unit price per foot for each size of pipe. These prices ranged from $27 per linear foot for a 6-inch diameter pipe up to $150 per linear foot for a 30-inch diameter pipe. Pipeline unit prices include design, material, installation, and easement acquisition.

Pump station costs have been estimated by assuming a fixed cost for a pump station, which includes design, land structure, power, and instrumentation. Additional cost is then added per pump and per HP for additional building footprint, power, and equipment costs. Estimated pump station costs range from $1.25 million for a 450 HP station with 3 pumps to $2.85 million for an 1150 HP station with 5 pumps.

Water storage tank costs have been estimated assuming a fixed cost for a basic installation, which includes cost for land acquisition, design, and basic structure. Additional cost is then added per foot of height and per 1,000 gallons of volume. Estimated storage tank costs range from $330,000 for a 50 foot. Standpipe with 30,000 gallons of capacity to $1.8 million for a 900,000 gallon clearwell.

From the transmission lines, pump station, and water storage tank costs, the opinion of probable costs (OPC) was calculated. From this OPC, a 5-percent increase was added for legal and financial costs and a 20-percent contingency and inflation to the total cost summary. The overall total cost summary is provided in Table 5-1. A more detailed list of the costs can be seen in the Appendix D.

Table 5-1
Total Cost Summary

Item	Cost
Pump Stations	$4,400,000
Water Storage Facilities	$6,100,000
Pipelines	$89,100,000
Construction, Land, and Engineering	$99,600,000
Legal and Financial (5%)	$5,000,000
Contingency and Inflation (20%)	$19,900,000
Total	$124,500,000

5.2 Replacement Cost

System replacement costs are essential to managing a water system and are an important component in determining rates. This report assumes full replacement of each component at the end of its lifespan at the inflated initial construction cost, minus 40-percent for one-time project incidentals. These expenses, such as easement acquisition and some design costs, do not need to be paid again during a replacement project. Projected lifespan is assumed as 20 years for pump stations, 40 years for storage facilities, and 60 years for pipeline. When compensating for price inflation during the lifespan of the facilities, it is assumed that cash investments set aside for depreciation will gain interest at a rate equal to inflation.

Using this assumption, annualized replacement costs are approximately $130,000 for pump station replacement, $90,000 for storage tank replacement, and $900,000 for pipeline replacement, for a total of $1,120,000 per year in replacement costs. Most often, investments can be chosen which exceed the rate of price inflation. If this happens, the amount of cash needed to fund depreciation is reduced.

5.3 Annual Operation and Maintenance Cost

O&M costs were developed using similar data from comparable water systems. Although many different factors combine to make up a system's annual budget, often the bulk of the cost is represented in four components: staffing, energy (electricity) costs, storage repainting, and pipeline maintenance and repair. Costs for these four categories have been estimated and the total of these costs are represented as the estimated annual O&M cost for the system.

Staffing costs assume a staffing level of three full-time employees and one part-time employees, comprised of two administrative and two field employees. Estimated staffing costs including benefits and employer payroll contributions total $210,000.

Electrical costs are mostly derived from pumping operations. Assuming pumping operations are active approximately 25-percent of the total hours available in a year, the system would have an annual electrical demand of approximately 3,000,000 kilowatt-hours (kwh). Assuming a rate cost of $0.12 per kwh, the resultant annual energy cost is approximately $310,000 per year.

Storage tank recoating represents another significant maintenance cost on the conceptual system. To develop this cost estimate, it is assumed that the coating systems used require a full blast and recoat every 15 years. Recent recoating costs for similar size tanks indicate the present value cost of recoating is approximately $150,000 per tank. If this cost is annualized, the cost to recoat all six of the system's storage tanks is budgeted at approximately $60,000 per year.

The final component of the estimated O&M costs is pipeline maintenance. For this component, it is assumed that one break will occur for every 20 miles of pipeline each year. The present value repair cost represents the additional labor cost, equipment cost, and parts, and is estimated at $3,000 per repair. Multiplying those two factors show an estimated cost of upkeep for the 235-mile conceptual pipeline system is approximately $36,000 per year.

Combining these four factors provides a representation of annual O&M costs for the conceptual system, excluding depreciation as represented in the previous section. This annual cost totals approximately $620,000 per year.

5.4 Water Purchase Cost

Water purchase costs were calculated using data provided by the suppliers. Since there are no preexisting water purchase contracts, standard industry terms have been assumed. Although Missouri-American is capable of serving an entire average day alone, the split of supply on an average day is assumed to mirror the peak day allocations to each supplier. The allocations were described in Section 4 of this report. Based on these assumptions, the aggregate water supply cost per 1,000 gallons is approximately $3.61. Assuming a combined annual purchase of 1,926 million gallons, the annual water purchase costs total $6.95 million.

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Section 6
Summary of Wholesale Rate Requirements

This section of the report presents the results of financial analyzes required to provide a preliminary estimate of the wholesale rates applicable to this project. Rate requirements are composed of debt service on construction of facilities, O&M expenses of the facilities, and water cost purchased for resale. These costs are estimated under the following capital improvement financing scenarios:

- Scenario 1 assumes 100-percent revenue bond financing
- Scenario 2 assumes 80-percent revenue bond financing and 20-percent grant funding
- Scenario 3 assumes 50-percent revenue bond financing and 50-percent grant funding

Table 6-1
Summary of Wholesale Rate Requirements

	Scenario 1	Scenario 2	Scenario 3
Estimated Annual Debt Service	$7,500,000	$6,000,000	$3,800,000
Estimated O&M Expense	$620,000	$620,000	$620,000
Estimated Annual Renewal and Replacement	$1,100,000	$1,100,000	$1,100,000
Estimated Annual Water Purchase	$6,900,000	$6,900,000	$6,900,000
Total Estimated Annual Revenue Requirement	$16,200,000	$14,700,000	$12,500,000
Annual Est. Water Sales Volume (kgal/MGD)	1,830,000/5.0	1,830,000/5.0	1,830,000/5.0
Estimated Cost per 1,000 gallons	$8.83	$8.01	$6.81
Estimated Customer Monthly Wholesale Cost (5,000 gal)	$44.16	$40.07	$34.07

The necessity and amount of capital and operating reserves and bond issuance costs cannot be established at this time. The bond underwriter will determine the need for reserves to provide investor security based on the actual project phasing plan to be implemented. Typically, if these reserves are deemed necessary, they can be accumulated over a period of time by the entity. Bond issuance cost is directly related to the size of the bond issues. Without a phasing plan, bond issuance sizes cannot be determined along with bond issuance costs.

It is also important to note that additional cost savings would be possible by omitting the additional 15-percent service capacity added in Section 2 of this report. Scenario 2 and 3 illustrate the impacts to the overall rate structure should grant funds be made available for this project.

For purpose of these financial analyses, the following assumptions are used:

- Total estimated capital improvements will be $124.5 million for the entire project, including transmission mains, pumping stations, storage facilities, and expansion to existing water treatment plants.
- Annual water usage was calculated using 5.7 MGD average daily use assuming all wholesale customers are under contract for service.
- No phasing of the issuance of revenue bonds has been assumed. All revenue bonds are assumed to have been issued at a 4.75-percent interest rate, 33 year term, with equal annual debt service payments.
- All funding of any operating and capital reserves, which may be necessary for revenue bond issuance has been completed. Reserves may not be necessary should insurance be ultimately obtained.
- Estimated revenue bond issuance amounts do not reflect impact of any issuance costs nor any capitalized interest during construction.
- Water purchases as described in Section 4.
- Estimated annual renewal and replacement cost is based on straight-line depreciation projections for various facility types.

To refine the "Summary of Wholesale Rate Requirements" presented in Table 7-1, certain key activities must be initiated and completed in order to have an accurate representation of the project's long term financial requirements. The list below denotes key activities:

- Establishment of a political entity with rate setting, enforcement, and debt issuing authority.
- Legal commitment by community members to participate in the project during design, construction, and operation of the project facilities through take or pay agreement. Development and execution of take or pay agreements between the system and wholesale customers to establish rate stability and strengthen the financial viability of the system.
- Development of a project strategic financial plan that recognizes project "phasing" and changes in membership in order to determine the actual size of needed bond issues and timing. This will impact the need and level of "capitalized interest during construction" and reflect the financing scheme developed by the entity and its memberships for funding during construction.
- Hiring of bond council and underwriter to develop revenue bond ordinance; an official bond offering statement; projected debt service schedules; bond issuance cost; the need for amount timing of any necessary operation and capital reserves to provide investor security; bond issuance amount; interest rate; bond term; adequate level of "capitalized interest during construction"; and bond market timing.

Section 7
System Staging

The overall system map was presented in Section 4 of this report. Currently, it is the intent of the Commission to construct the full system build out in stages. The order, size, and priority of those stages is dependent on the Commission's preferences, but the following staging presents one recommended approach.

First, the overall system map was divided into individual projects based on a constructability review, which are illustrated in Figure 7-1.

The Commission selected the Stage 1 Pipeline alignment as the first construction project. As part of this, the Commission requested an alternative to providing a pipeline extension from King City to Daviess County PWSD No. 1. These are identified as Stage 1 and Stage 1a on Figure 7-1 and in Table 7-1.

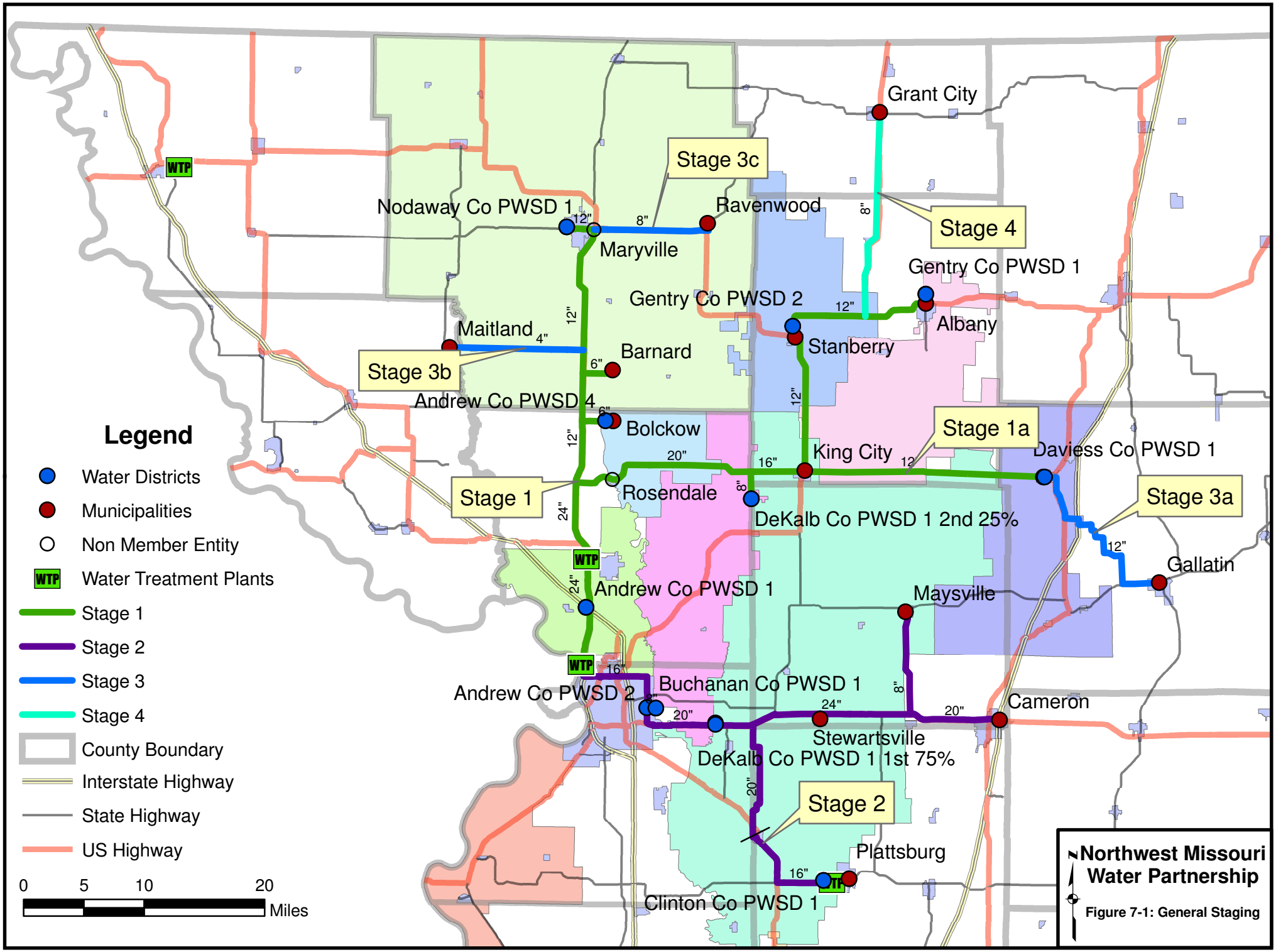
The Stage 2 Pipeline alignment was selected as the southern corridor, bringing in Plattsburg as an additional source of water. This pipeline alignment serves more customers than the Stage 1 and 1a Alignments and addresses some water concerns for the City of Cameron.

The Stage 3 Pipeline can be constructed as one project or in order from Stage 3a, 3b, and 3c. These pipelines serve the City of Gallatin, Maitland, and Ravenwood. The *2010 Phase III Report* identified all of these water utilities as reliant on groundwater sources for water and provided the following summarized information on these specific utilities. Groundwater in Daviess County has been found to have low to moderate potential of water production and well recharge. The City of Gallatin has closed four municipal wells due to low groundwater yields and as of the *2009 Phase III Report* the maximum daily treatment capacity is currently exceeded. City of Maitland has a groundwater treatment facility with wells located in the Nodaway River alluvium. Water samples of this water indicate high concentrations of iron and total dissolved solids and has closed two wells due to high nitrate. Finally, the City of Ravenwood has a groundwater treatment facility that has the capacity to treat up to 0.1 MGD. Its source of supply is the alluvium near Platte River that is assigned a moderate-high yield and recharge potential.

The last utility for Stage 4 is the City of Grant City. It currently purchases water from the Middle Fork Water Company that has a reliable source of surface water that is capable of meeting current demands during the drought of record. Grant City was identified as the lowest priority as is has the most reliable of the remaining four water utilities not served by Stage 1 or 2 in the current Commission membership.

Table 7-1
Full Commission Alignment Summary

Stage	Utility in each stage	2030 Demands	2030 Population Served by Improvements	OPC of Proposed Improvements $ Million/ $/capita	Source of Supply
		Avg. Day (MGD)/ Max Day (MGD)			
1	Andrew County PWSD #1 Andrew County PWSD #4 City of Albany City of Barnard City of Bolckow City of King City City of Stanberry DeKalb County PWSD #1 Gentry County #1 Gentry County #2 Nodaway County #1	1.9/3.7	26,700	$49.9 M/$1,900/cap	Varies
1a	Davies County PWSD #1	0.16/0.32	2,700	$7.9M/$2,900/cap	Pattonsburg
2	Andrew County PWSD #2 Buchannan County PWSD #1 City of Cameron City of Maysville City of Stewartsville Clinton County PWSD #1 DeKalb County PWSD #1	3.31/6.62	33,800	$46.9M/$1,390/cap	Varies
3a	City of Gallatin	0.38/0.75	1,900	$6.9M/$,3600/cap	Groundwater
3b	City of Maitland	0.03/0.05	340	$1.5M/$4,400/cap	Groundwater
3c	City of Ravenwood	0.03/0.06	510	$2.6M/$5,100/cap	Groundwater
4	City of Grant City	0.13/0.25	1,400	$5.3M/$3,800/cap	Middle Fork Water Co.


Grant City
Stage 3c
Nodaway Co PWSD 1
Ravenwood
Stage 4
Maryville
Gentry Co PWSD 1
Gentry Co PWSD 2
Albany
Maitland
Stanberry
Stage 3b
Barnard
Andrew Co PWSD 4
Bolckow
Stage 1a
King City
Daviess Co PWSD 1
Stage 1
Rosendale
Stage 3a
DeKalb Co PWSD 1 2nd 25%
Gallatin
Andrew Co PWSD 1
Maysville
Buchanan Co PWSD 1
Andrew Co PWSD 2
Cameron
Stewartsville
DeKalb Co PWSD 1 1st 75%
Stage 2
Plattsburg
Clinton Co PWSD 1
WTP
Legend
Water Districts
Municipalities
Non Member Entity
Water Treatment Plants
Stage 1
Stage 2
Stage 3
Stage 4
County Boundary
Interstate Highway
State Highway
US Highway
0 5 10 20
Miles
Northwest Missouri Water Partnership
Figure 7-1: General Staging

Section 8
Conclusions

An updated water demand projection and overall system plan was presented to serve the current Commission membership. An updated opinion of probable construction costs and estimated cost of water were also provided. A recommended staging plan was put forth, but this staging plan should be considered a living document that is updated based on the changing political environment, utility needs, and availability of adequate funding.

8.1 Recommended "Next Steps"

This Feasibility Study Update concludes, given the assumptions and conceptual design as presented, that the project may be feasible if the rate information produced is acceptable to the member entities. Before moving into final design and construction, the following summarizes the recommended "next steps" for this project:

- Establish a contractual mechanism as to how to administer water sales to the customers and select a method of equitable payment for the Commission members.
- Directly negotiate with those Commission members that can be served by the Stage 2 Alignment towards determining the actual water demands the utilities would wish to purchase from Stage 2.
- Conduct a PER for the Stage 2 Pipeline alignment towards pursuing funding for future work.

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Appendix A

Reference Calculations

CDM Calculation Form (Excel)		Job # 6198-78941		Calc. By: CSC	
Client:	Northwest Missouri Water Commision	Checked By:	SAS	Date:	12/08/10
Project:	NoWMo Water Study	Date:	12/10/10	Calc. No.:	
Detail:	Water Demand Projections	Reviewed By:	K. Rood	Revision#:	
		Date:	12/10/10	Date:	

Calculation Brief Title: Water Demand projections for the NWMo Commision members

1.0 Purpose/Objective

Calculate the water demand for 2030

2.0 Procedure

1. Identify population growth trends from the Census population data (1950 to 2000).
2. Estimate 2030 population and find a Population Change per year for each district and city.
3. Analyze 2005 to 2009 measured water demands from commision members, and correlate them with the projected population to estimate a per capita consumption
4. Apply the population change slopes to estimate 2030 population.
5. Estimate 2030 Demands from 2030 estimated population and average per capita per day estimations

3.0 References/Data Sources

1. Source 1950 - 1990 city population figures: http://mcdc.missouri.edu/trends/historical.shtml
2. Source 2000 city population figures: http://mcdc2.missouri.edu/websas/dp3_2kmenus/mo/Places/
3. Source of 1950 - 2000 counties population figures: http://mcdc.missouri.edu/trends/historical.shtml
4. Phase II Feasibility Study
5. Data provided by each commission member
6. Phase 1 Report, Appendix H

4.0 Assumptions and Limitations

1. Population growth changes are linear
2. Negative population growth trends will be taken as no growth (Population Change slope = 0)

5.0 Calculations

See attached tables

6.0 Conclusions/Results

See attached tables.

Population Analysis and Projections

County or City	City and County US Census Population Data (1) 1950	1960	1970	1980	1990	2000	(2) 2006	2030 Projected Population (3)	Annual Population Change (4)	Revised 2030 Projected Population (5)	Revised Annual Population Change (5)
Andrew County	11,727	11,062	11,913	13,980	14,632	16,492		19,600	105	19,600	105
Buchannan County	96,826	90,581	86,915	87,888	83,083	85,998		79,500	-216	86,000	0
City of Albany	1,850	1,662	1,804	2,152	1,958	1,937	3600	4,100	21	4,100	21
City of Barnard	275	237	206	234	234	257	300	310	0	310	0
City of Bolckow	250	232	225	245	253	234	240	240	0	240	0
City of Cameron	3,570	3,674	3,960	4,519	4,831	8,312	9788	12,300	105	12,300	105
City of Gallatin	1,634	1,658	1,833	2,063	1,864	1,789	1834	1,900	3	1,900	3
City of Grant City	1,184	1,061	1,095	1,068	998	926	1341	1,300	0	1,300	0
City of King City	1,031	1,009	1,023	1,063	986	1,012		1,000	0	1,020	0
City of Maitland	456	427	319	415	338	342	340	290	-2	340	0
City of Maysville	973	942	1,045	1,187	1,176	1,212		1,400	6	1,400	6
City of Plattsburg	1,655	1,663	1,832	2,095	2,248	2,354		2,800	16	2,800	16
City of Ravenwood	319	282	336	436	409	448	438	510	3	510	3
City of Savannah	2,332	2,455	3,324	4,184	4,352	4,762	5000	6,200	51	6,200	51
City of Stanberry	1,651	1,409	1,479	1,387	1,310	1,243		1,000	-7	1,250	0
City of Stewarstville	414	466	634	832	732	759		1,000	8	1,000	8
Clinton County	11,726	11,588	12,462	15,916	16,595	18,979		23,700	156	23,700	156
Davies County	11,180	9,502	8,420	8,905	7,865	8,016		6,300	-58	8,100	0
DeKalb County	8,047	7,226	7,305	8,222	9,967	11,597		13,900	77	13,900	77
Gentry County	11,036	8,793	8,060	7,887	6,848	6,861		4,600	-77	6,900	0
Nodaway County	24,033	22,215	22,467	21,996	21,709	21,912		20,800	-36	22,000	0

(1)

Source 1950 - 1990 city population figures: http://mcdc.missouri.edu/trends/historical.shtml

Source 2000 city population figures: http://mcdc2.missouri.edu/websas/dp3_2kmenus/mo/Places/

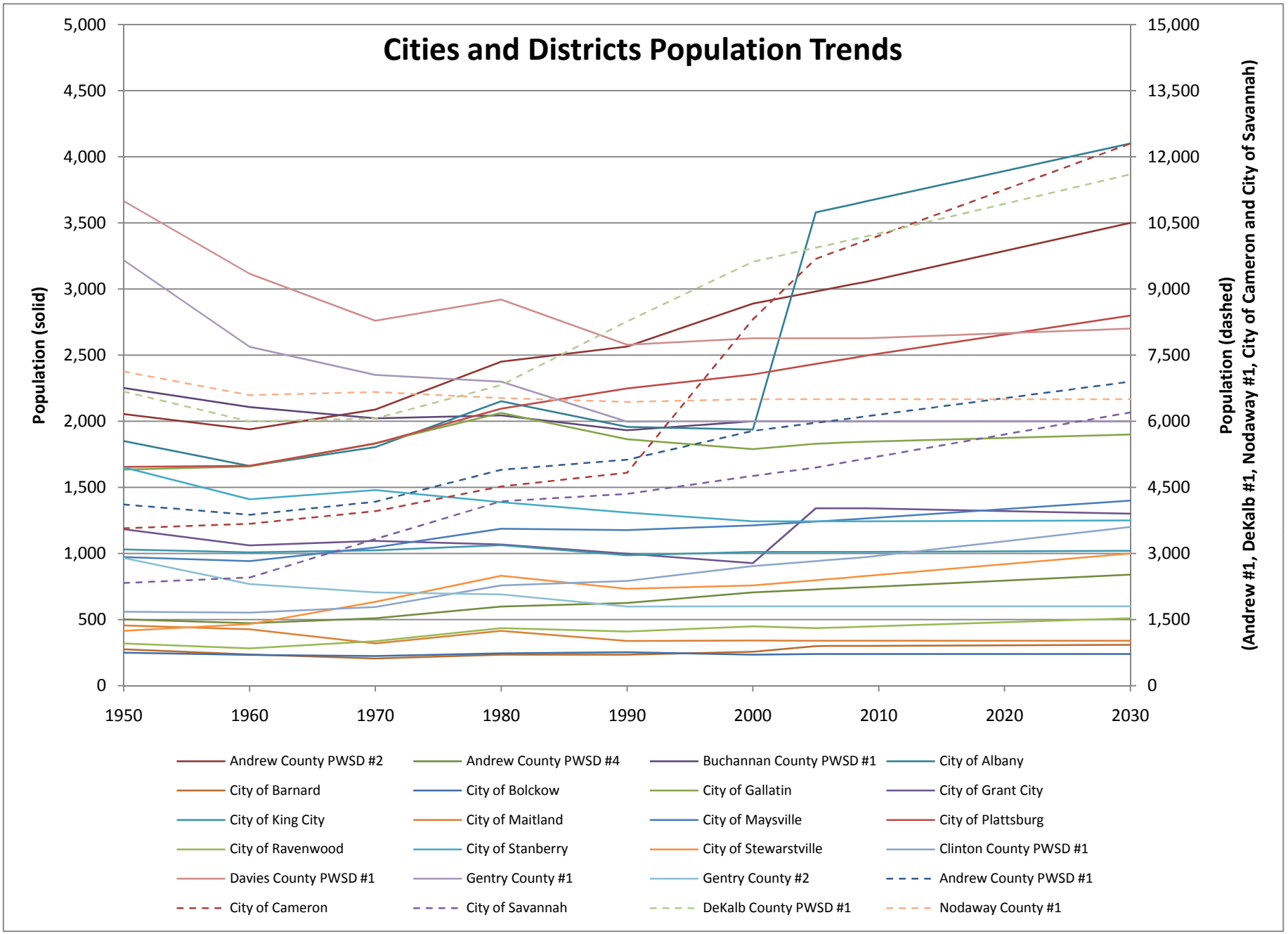
Source of 1950 - 2000 counties population figures: http://mcdc.missouri.edu/trends/historical.shtml

(2) Population in 2006, based on the Phase I report

(3) Estimated 2030 population by linear extrapolation of the 1950 to 2000 data, based in 2000 for the counties, and based in 2006 Phase I report for the cities

(4) Population Change per year based on linear interpolation (slope of the least squares regression line)

(5) Revised Projections to show no negative population growth. Areas showing negative are assumed to maintain current population and demands.


Cities and Districts Population Trends
Population (solid)
Population (dashed)
(Andrew #1, DeKalb #1, Nodaway #1, City of Cameron and City of Savannah)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
15,000
13,500
12,000
10,500
9,000
7,500
6,000
4,500
3,000
1,500
0
1950
1960
1970
1980
1990
2000
2010
2020
2030
Andrew County PWSD #2
Andrew County PWSD #4
Buchannan County PWSD #1
City of Albany
City of Barnard
City of Bolckow
City of Gallatin
City of Grant City
City of King City
City of Maitland
City of Maysville
City of Plattsburg
City of Ravenwood
City of Stanberry
City of Stewarstville
Clinton County PWSD #1
Davies County PWSD #1
Gentry County #1
Gentry County #2
Andrew County PWSD #1
City of Cameron
City of Savannah
DeKalb County PWSD #1
Nodaway County #1

Average Annual Water Demand for the Cities

District / City	Annual Water Production Purchased (gallons)						Average Annual Water Demand	Notes	Estimated Population (4)					Gallons Per Capita Daily Demand (GPCD) (5)					Average GPCD (6)	2030 Revised Projected Population (7)	2030 Water Demand (8)	
	2005	2006	2007	2008	2009	2010			2005	2006	2007	2008	2009	2005	2006	2007	2008	2009			Avg. Day (gpd)	Annual (gal)
City of Albany	83,818,400	79,669,320	78,676,180	82,507,830	79,907,480		80,916,000	(3), (9)	3,579	3,600	3,621	3,642	3,663	64	61	60	62	60	61	4,100	252,000	91,636,000
City of Barnard							8,030,000	(1)	300	300	300	301	301						73	310	23,000	8,259,000
City of Bolckow							18,250,000	(1)	240	240	240	240	240						208	240	50,000	18,250,000
City of Cameron	482,222,350	486,340,400	518,828,800	488,042,200	466,381,000		488,363,000	(3)	9,683	9,788	9,893	9,999	10,104	136	136	144	134	126	135	12,300	1,665,000	607,381,000
City of Gallatin							137,605,000	(1)	1,831	1,834	1,837	1,841	1,844						204	1,900	389,000	141,761,000
City of Grant City							45,625,000	(1)	1,341	1,341	1,341	1,341	1,341						93	1,300	125,000	45,625,000
City of King City	38,157,000	36,633,800	36,076,400	37,146,800	34,583,500		36,520,000	(3)	1,012	1,012	1,012	1,012	1,012	103	99	98	101	94	99	1,020	101,000	36,809,000
City of Maitland							9,125,000	(1)	340	340	340	340	340						74	340	25,000	9,125,000
City of Maysville						31,864,500	31,865,000	(2)	1,241	1,247	1,253	1,259	1,264						69	1,400	97,000	35,282,000
City of Plattsburg							336,895,000	(1)	2,433	2,449	2,464	2,480	2,496						370	2,800	1,036,000	377,963,000
City of Ravenwood	11,984,260	10,927,160	9,751,460	9,622,490	9,903,870		10,438,000	(3)	435	438	441	444	447	75	68	61	59	61	65	510	34,000	12,084,000
City of Savannah	158,365,285	172,504,100	178,491,415	165,427,000	164,486,390	171,309,286	167,855,000	(3)	4,949	5,000	5,051	5,102	5,153	88	95	97	89	87	91	6,200	565,000	206,062,000
City of Stanberry	42,500,240	43,055,770	41,581,660	39,688,370	39,024,980	35,029,216	41,171,000	(3), (10)	1,243	1,243	1,243	1,243	1,243	94	95	92	87	86	91	1,250	114,000	41,403,000
City of Stewarstville	21,737,900	18,812,500	17,782,300	17,542,200	17,587,800	14,156,300	18,693,000	(3)	798	806	813	821	829	75	64	60	59	58	63	1,000	64,000	23,008,000

Average Annual Water Demand for the Counties

District / City	Annual Water Production Purchased (gallons)						Average Annual Water Demand	% of County Pop. served by the PWSD	Estimated Population (4)					Gallons Per Capita Daily Demand (GPCD) (5)					Average GPCD (6)	2030 Revised Projected Population (7)	2030 Water Demand (8)	
	2005	2006	2007	2008	2009	2010			2005	2006	2007	2008	2009	2005	2006	2007	2008	2009			Avg. Day (gpd)	Annual (gal)
Andrew County PWSD #1	181,270,500	183,473,250	202,632,250	174,327,600	190,350,000		186,411,000	35%	5,963	6,000	6,037	6,073	6,110	83	84	92	79	85	85	6,900	584,000	213,074,000
Andrew County PWSD #2 (12)	122,664,650	138,888,150	136,832,236	141,590,675	123,494,400	137,286,900	132,695,000	18%	2,982	3,000	3,018	3,037	3,055	113	127	124	128	111	120	3,500	422,000	153,875,000
Andrew County PWSD #4		12,441,560	14,882,400	14,441,200	12,899,200	11,949,700	13,667,000	4%	728	732	736	741	745		47	55	53	47	51	840	43,000	15,540,000
Buchannan County PWSD #1	66,400,000	61,000,000	69,000,000	63,600,000	63,300,000	64,000,000	64,660,000	2%	2,000	2,000	2,000	2,000	2,000	91	84	95	87	87	89	2,000	178,000	64,660,000
Clinton County PWSD #1	20,648,000	22,497,600	22,618,400	23,083,300	24,410,400		22,652,000	5%	943	950	957	965	972	60	65	65	66	69	65	1,200	78,000	28,378,000
Davies County PWSD #1	59,663,030	57,334,750	60,619,300	53,994,030	54,343,310		57,191,000	33%	2,628	2,628	2,628	2,628	2,628	62	60	63	56	57	60	2,700	161,000	58,758,000
DeKalb County PWSD #1 (11)		255,953,566	256,983,766	257,223,866	257,178,266	260,609,766	256,835,000	83%	9,936	10,000	10,064	10,127	10,191		70	70	70	69	70	11,600	809,000	295,120,000
Gentry County #1	43,250,600	47,399,680	48,392,820	44,561,170	47,161,520		46,154,000	29%	2,000	2,000	2,000	2,000	2,000	59	65	66	61	65	63	2,000	127,000	46,154,000
Gentry County #2	13,732,000	17,574,000	19,404,000	21,325,000	19,028,000		18,213,000	9%	600	600	600	600	600	63	80	89	97	87	83	600	50,000	18,213,000
Nodaway County #1	162,240,050	157,646,980	171,892,620	164,911,713	164,590,140		164,257,000	30%	6,500	6,500	6,500	6,500	6,500	68	66	72	70	69	69	6,500	451,000	164,257,000

(1) Data from Phase II Feasibility Study
(2) Estimated data based on City reporting 87,300 average daily production for 2010.
(3) Data provided by utility
(4) Estimated Population by linear extrapolation of U.S. Census Data with revised projections
(5) Estimated Per Capita Daily Demand = Annual water demand / Estimated population / 365 days
(6) Average of GPCD (Gallons/Capita/Day)
(7) Areas showing neagtive population change are assumed to remain at the current population
(8) Average annual water demand = GPCD x 2030 Revised Projected Population x 365 days
(9) Albany Production data minus Gentry 1 purchased water
(10) Stanberry Purchased water minus water sold to Gentry 2
(11) DeKalb purchased water minus Stewartsville purchased water
(12) Andrew #2 Water Purchased minus water sold to DeKalb County #1

County population portions served by each PWSD

Public Water Supply District	District Population in 2006 (1)	County served by the PWSD (2)	2006 County Population (3)	% of County Population served by the PWSD (4)	District Annual Population Change (cap) (5)	District 2030 Projected Population (6)
Andrew County PWSD #1	6000	Andrew County	17,119	35%	37	6,900
Andrew County PWSD #2	3000	Andrew County	17,119	18%	18	3,500
Andrew County PWSD #4	732	Andrew County	17,119	4%	4	840
Buchannan County PWSD #1	2000	Buchanan County	85,998	2%	0	2,000
Clinton County PWSD #1	950	Clinton County	19,917	5%	7	1,200
Davies County PWSD #1	2628	Daviess County	8,016	33%	0	2,700
DeKalb County PWSD #1	10000	DeKalb County	12,058	83%	64	11,600
Gentry County #1	2000	Gentry County	6,861	29%	0	2,000
Gentry County #2	600	Gentry County	6,861	9%	0	600
Nodaway County #1	6500	Nodaway County	21,912	30%	0	6,500

(1) 2006 population from Ref No. 4; Phase I report

(2) County that consumes most of the Public Water District supply

(3) Entire County population in 2006, linear extrapolation of 2000 census data with revised projections

(4) PWSD Population / County Population

(5) District Annual Population Change (County Annual Population change times Percentage of County Population served by the PWSD)

(6) District 2030 Projected Population based on 2006 Phase I Report

Estimated Future Demands

District / City	Current Water Demands			2030 Future Projected Water Demand		
	Annual Demand (MG)	Avg. Day (MGD)	Max. Day (MGD) (1)	Annual Demand (MG)	Avg. Day (MGD)	Max. Day (MGD) (1)
Andrew County PWSD #1	186	0.51	1.02	213	0.58	1.17
Andrew County PWSD #2	133	0.36	0.73	154	0.42	0.84
Andrew County PWSD #4	14	0.04	0.07	16	0.04	0.09
Buchannan County PWSD #1	65	0.18	0.35	65	0.18	0.35
City of Albany	81	0.22	0.44	92	0.25	0.50
City of Barnard	8	0.02	0.04	8	0.02	0.05
City of Bolckow	18	0.05	0.10	18	0.05	0.10
City of Cameron	488	1.34	2.68	607	1.66	3.33
City of Gallatin	138	0.38	0.75	142	0.39	0.78
City of Grant City	46	0.13	0.25	46	0.13	0.25
City of King City	37	0.10	0.20	37	0.10	0.20
City of Maitland	9	0.03	0.05	9	0.03	0.05
City of Maysville	32	0.09	0.17	35	0.10	0.19
City of Ravenwood	10	0.03	0.06	12	0.03	0.07
City of Stanberry	41	0.11	0.23	41	0.11	0.23
City of Stewarstville	19	0.05	0.10	23	0.06	0.13
Clinton County PWSD #1	23	0.06	0.12	28	0.08	0.16
Davies County PWSD #1	57	0.16	0.31	59	0.16	0.32
DeKalb County PWSD #1	257	0.70	1.41	295	0.81	1.62
Gentry County #1	46	0.13	0.25	46	0.13	0.25
Gentry County #2	18	0.05	0.10	18	0.05	0.10
Nodaway County #1 (2)	164	0.45	0.90	110	0.30	0.60
TOTAL (MG)	1,889	5.18	10.35	2,074	5.68	11.36
			15% increase	2,385	6.53	13.07
			20% increase	2,489	6.82	13.64
				Annual Percentage Change:		*0.47%*
Phase I Totals (MG)	1,289	3.53	7.06	1,383	3.79	7.58
			15% increase	1,590	4.36	8.71
			20% increase	1,660	4.55	9.09
				Annual Percentage Change:		*0.35%*
City of Plattsburg	337	0.92	1.85	378	1.04	2.07
City of Savannah (2)	168	0.46	0.92	206	0.56	1.13
TOTAL (MG)	505	1	3	584	2	3
				Annual Percentage Change:		*0.75%*

(1) Max Day = Avg. Day (gpd) x 2.0

(2) Assumption: Nodaway will only purchase 0.3 MGD (Avg. Day) and 0.6 MGD (Max. Day) from the Commision to supply current unserved areas.

CDM **Calculation Form (Excel)**

Client:	GNWWC	**Job #**	78941	**Calc. By:**	SAS
Project:	Feasibility Study Update	**Checked By:**	Alex M. Szerwinski	**Date:**	05/09/11
Detail:	Cost Comparison	**Date:**	05/09/11	**Calc. No.:**	--
		Reviewed By:	Ann Casey	**Revision#:**	2
		Date:	05/09/11	**Date:**	05/09/11

Calculation Brief Title: Determine the Annual Cost for full build out.

1.0 Purpose/Objective

Determine the Annual Cost for full build out.

2.0 Procedure

1 Summarize OPCC data from Bartlett & West
2 Summarize water rate data from the various water suppliers and project 2013 costs.
3 Determine O&M, Debt Service, and Replacement Costs

3.0 References/Data Sources

1 2010 Water Rates from Missouri American date July 1, 2010.
2 "Section 8 Conceptual Plan Preliminary Cost Estimate" from Phase II Feasibility Study dated March 6, 2009.
3 CDM Water Demand Statistics.xlsx
4 OPCCs provided by Bartlett & West
5 Plattsburg Letter dated 1-31-11

4.0 Assumptions and Limitations

1 Assumptions are summarized throughout the document.

5.0 Calculations

Full Buildout for Current Demand
(*i.e.* Est. Annual Water Purchased) 1,926 MG/year *(Ref. 3)*

Est. Annual = (Avg. Day Water Demand = Max. Day/2.0) * 365 days/year *1.05 (5% unaccounted for water)

Annual Water Sales 1,834,579 kgal/year Full Build Out

Water Sales = Water Purchased/(1+Percentage of unaccounted for water [assumed to be 5%])

1. See the following sheets.

Full Build Out Summary

Summary Table	
	Full Build Out
Annual Est. Water Purchase Volume (kgal) (1)	1,926,000
Annual Est. Water Sales Volume (kgal)	1,835,000
Cost of Water Per Year (2)	$6,945,000
OPCC	$124,500,000
Est. Annual Debt Service (3)	$7,500,000
Est. Annual O&M Costs	$620,000
Est. Annual Replacement Costs	$1,120,000
Estimated Annual Costs	$16,185,000
Cost per kgal (4)	$8.82

(Ref. 4)

(1) Current Avg. Day for Stage 1 Pipeline Customers x 1.05 to account for system water loss x 365 days/year
(2) Calculated on "Background Calculations" worksheet.
(3) Estimated based on 33 years at 4.75% interest, assuming even payments
(4) Cost per kgal = Estimated Annual Costs/(Annual Est. Water Purchase Volume x 1.05)

6.0 Conclusions/Results

	100% Loan Money	80% Loan/20% Grant	50% Grant/Loan
OPC	$124,500,000	$99,600,000	$62,250,000
Est. Annual Debt Service (3)	$7,500,000	$6,000,000	$3,800,000
Est. Annual O&M Costs	$620,000	$620,000	$620,000
Est. Annual Replacement Costs	$1,120,000	$1,120,000	$1,120,000
Est. Annual Water Purchase	$6,945,000	$6,945,000	$6,945,000
Estimated Annual Costs	$16,200,000	$14,700,000	$12,500,000
Est. Cost per 1,000 gallons	$8.83	$8.01	$6.81
Customer Monthly Wholesale Cost (5,000 gal)	$44.16	$40.07	$34.07

CDM

PROJECT: GNW Stage 1 PER	COMPUTED BY : SAS	CHECKED BY/DATE: AMS - 3/3/2011; 5/9/11
JOB NO.: 78941	DATE : 3/2/2011 v2. 5-9-2011	REVIEWED BY/DATE: AC - 5/10/11
CLIENT: USACE KC District	REVISION NO.: 2	PAGE NO. : 2 of 2

Description:

Background Calculations

Cost of Service Number

Missouri- American (1)

	Gallons/Month	Sale for Resale Current Rates ($/kgal)	2013 Projection (2) ($/kgal)	Cost to Purchase Water ($/yr)	
Monthly Minimum Charge		$1,124.62	$1,301.89	$15,623	(3)
For the first	100,000	$4.2794	$4.95	$5,945	(4)
For the next	1,900,000	$3.3234	$3.85	$87,717	(4)
For the next	3,000,000	$2.7691	$3.21	$115,401	(4)
For everything over	5,000,000	$1.8886	$2.19	$2,483,626	(5)
			Total Cost supply/yr from MoAm	$2,708,312	

(1): Cost per table provided by Missouri American dated July 1, 2010. Charges are assessed monthly.
(2): Inflated cost by 5% per year to 2013 numbers: = 2010 Rate*(1.05)^3
(3): 2" meter size was chosen for the monthly charge.

(4): Cost to Purchase Water: 2013 Projection ($/kgal) * Gallons/Month (kgal) *12 months/year
(5): Cost to Purchase Water: 2013 Projection ($/kgal) * (Total Water Purchased-kgal/yr - (5,000 kgal/mo*12/yr)-(Plattsburg Annual Sales kgal/yr))

City of Plattsburg Data

	Sale for Resale Current Rates ($/kgal)	2013 Projection (1) ($/kgal)	Cost to Purchase Water ($/yr)	Plattsburg supply		
Cost/1,000 gallons	$2.9500	$3.41	2,492,945	4	MGD Max. Day	(Report Assumption)
Cost/1,000 gallons to cover Debt Service (4):		$2.39	1,744,000	2	MGD Avg. Day	(Report Assumption)
Total Wholseale Cost/kgal		$5.80		730,000	kgal/year	(Avg. Day * 365 days)
		Total Cost supply from Plattsburg	4,236,945			

(1): Inflated cost by 5% per year to 2013 numbers: = 2010 Rate*(1.05)^3
(2): Avg. Day (MGD) = Max. Day (MGD) / 2
(3): Cost to Purchase Water: 2013 Projection ($/kgal) * Water Supply (kgal/Year)
(4): Plattsburg Debt Service Numbers: (Ref. 5)
4 MGD Capacity @ $6.00/gallon estimated expansion cost $24,000,000 (See Plattsburg Letter)
Annual Debt Service $1,744,000 Estimated based on 30 years at 6% interest, assuming even payments

Replacement Costs

OPCC Break Down - Provided by B&West (w/o Davies 1 Extension)

	Current Costs	Replacement Costs per year	(Assumed Values) Proposed Life Span (yrs.)
Transmission Lines	$89,080,000	$891,000	60
Water Storage	$6,090,000	$92,000	40
Pump Stations	$4,430,000	$133,000	20
Total	$99,600,000	$1,116,000	$/year

Replacement Cost = 2013 OPCC Value * (1-0.4) / Proposed Life Span; 40% of initial OPCC is assumed as a one time expense
Proposed lifespan (Ref. 2): 20 years for pump stations, 40 years for storage facilities, 60 years for pipelines

O&M Costs

O&M Cost Summary	
Staffing	$210,000
Electrical	$314,000
Storage Tanks	$60,000
Piping	$36,000
Total O&M	$620,000

Staffing Assumptions: 1 full time and 1 part time ADMIN and 2 full time field service employees, Employee cost is $60,000 per employee per year
$210,000

Electrical: Assume PS operates 25% of the time on an annual basis per Phase II O&M assumptions

HP	KW	KW*HR	Cost / KWH	Annual Cost
1600	1193.12	2612932.8	0.12	$314,000

(OPCC report from B&West)

No. of Tanks 6 (OPCC report from B&West)

Storage Tanks: Assumed $150K every 15 years for repainting and maintenance
$60,000

Pieplines: Assume 1 break every 20 miles and $3000 to fix each break (OPCC report from B&West)
Total Pipeline Mileage 236.80 miles
Total Breaks Per Year 12
Total Line O&M $36,000

Total OPCC Cost Summary

OPCC Break Down	---	$99,600,000	
Legal and Financial	5%	$4,980,000	
Contingency & Inflati	20%	$19,920,000	
	Total	$124,500,000	Ref 4

Appendix B

Modeling Results

Date: 10 May 2011
By: Molly Pesce
Checked By: Bruce Hattig
Re: Pressure Table for the Overall System

Community	Elevation (feet)	Minimum Pressure (psi)	Maximum Pressure (psi)	HGL_{Min} (feet) - Calculated	HGL_{Max} (feet) - Calculated	HGL_{Min} (feet) - Modeled	HGL_{Max} (feet) - Modeled
Albany	950	35	123	1030.85	1234.13	1032	1235
Andrew Co PWSD # 1	1020	72	106	1186.32	1264.86	1187	1264
Andrew Co PWSD #2	912	91	132	1122.21	1216.92	1121	1218
Andrew Co PWSD #4	1010	73	104	1178.63	1250.24	1179	1250
Barnard	1010	73	104	1178.63	1250.24	1179	1250
Bolckow	948	102	133	1183.62	1255.23	1183	1254
Buchanan Co PWSD #1	853	114	158	1116.34	1217.98	1115	1218
Cameron	952	60	98	1090.6	1178.38	1091	1179
Clinton Co PWSD #1	1002	62	112	1145.22	1260.72	1144	1261
Daviess Co PWSD #1	780	111	197	1036.41	1235.07	1036	1235
DeKalb Co PWSD #1 - 1st Pt (75%)	841	126	159	1132.06	1208.29	1131	1206
DeKalb Co PWSD #1 - 2nd Pt (25%)	1053	55	83	1180.05	1244.73	1180	1245
Gallatin	828	54	176	952.74	1234.56	952	1235
Gentry Co PWSD #1	950	35	123	1030.85	1234.13	1032	1235
Gentry Co PWSD #2	948	67	124	1102.77	1234.44	1102	1235
Grant City	1025	40	56	1117.4	1154.36	1118	1153
King City	1081	60	67	1219.6	1235.77	1219	1235
Maitland	948	77	130	1125.87	1248.3	1126	1248
Maysville	961	66	95	1113.46	1180.45	1113	1179
Nodaway Co PWSD #1	1131	37	45	1216.47	1234.95	1217	1235
Ravenwood	1028	79	91	1210.49	1238.21	1210	1237
Stanberry	904	87	143	1104.97	1234.33	1105	1235
Stewartsville	998	68	82	1155.08	1187.42	1156	1187

*Max Pressure was found using 50% peak day supply and zero demand. It was assumed that pump speed will be controlled so the critical node does not exceed 200 psi.

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******************************************************************
*                          E P A N E T                           *
*                   Hydraulic and Water Quality                  *
*                   Analysis for Pipe Networks                   *
*                         Version 2.0                            *
******************************************************************
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Input File: MOAm gfd.net

Link - Node Table:

Link ID	Start Node	End Node	Length ft	Diameter in
109	32	34	25889.584309	24
115	42	32	28628.27	24
117	44	46	24186.604064	12
119	48	44	5259.850703	12
123	54	56	18459.301865	12
125	58	60	3823.306885	12
127	62	64	13013.826416	12
129	66	68	25353.873685	12
139	78	80	11571.705202	6
141	44	82	9084.235681	6
143	84	62	10111.368967	12
145	86	88	951.294959	12
147	90	92	15446.070030	12
155	12	102	23242.244643	16
157	104	106	25129.350635	20
159	108	110	21670.464670	20
161	48	78	15924.247181	12
163	112	68	4396.201801	12
165	114	116	41715.258354	4
167	118	120	53895.626546	12
169	102	104	9735.164451	16
171	122	102	12017.922714	8
173	124	126	8498.010350	8
175	12	128	72241.288684	12
187	34	50	2763.671968	24
189	132	42	24016.78	24
191	134	132	5272.301439	24
193	46	134	3225.361603	12
195	78	112	10166.340821	12
197	80	136	1991.774638	6
199	138	112	7242.862487	4
201	116	138	7019.142244	4
203	140	114	2718.890522	4
205	142	66	11822.619789	12
207	64	142	1346.075690	12
209	86	84	2063.121682	12
211	62	144	6025.010030	8

Link - Node Table: (continued)

Link ID	Start Node	End Node	Length ft	Diameter in
213	144	146	20119.608793	8

215	146	124	11968.320398	8
217	126	148	6806.791630	8
219	82	150	4630.219333	6
221	110	134	15674.961160	20
223	152	108	1519.641879	20
225	106	152	9040.789911	20
229	128	154	14806.835473	12
231	156	158	696.853118	12
233	154	156	18054.998208	12
235	158	118	37390.425439	12
237	58	160	1536.532116	12
239	160	10	6239.234188	12
241	56	60	524.540342	12
243	92	54	1569.151793	12
245	162	90	6489.571040	12
247	164	162	7219.68	12
251	90	94	36600.129687	8
253	96	166	12574.225393	8
255	166	168	12642.977728	8
1	1	12	1000	24
2	2	84	1000	12
3	12	3	20000	16
4	3	10	35008.020082	12
6	4	96	100	8
8	5	96	29725.922466	8
9	94	5	#N/A	#N/A Pump

Energy Usage:

Pump	Usage Factor	Avg. Effic.	Kw-hr /Mgal	Avg. Kw	Peak Kw	Cost /day
9	0.00	0.00	0.00	0.00	0.00	0.00
				Demand Charge:		0.00
				Total Cost:		0.00

Page 3
Node Results:

Node ID	Demand GPM	Head ft	Pressure psi	Quality
10	0.00	1152.24	127.58	0.00
102	0.00	1203.29	68.90	0.00
104	0.00	1199.65	45.17	0.00
106	0.00	1196.48	127.14	0.00
108	0.00	1195.15	52.50	0.00
110	0.00	1192.41	124.18	0.00
112	0.00	1196.44	65.09	0.00
114	0.00	1129.24	113.65	0.00
116	0.00	1179.32	31.80	0.00
118	0.00	1001.49	26.76	0.00
12	160.00	1219.41	59.87	0.00
120	623.00	951.92	53.55	0.00
122	323.00	1179.69	54.95	0.00
124	0.00	1211.13	29.66	0.00
126	0.00	1210.48	105.64	0.00
128	0.00	1093.70	51.69	0.00
132	0.00	1190.08	43.40	0.00
134	0.00	1190.43	45.49	0.00

136	112.00	1178.68	73.10	0.00
138	0.00	1187.75	94.81	0.00
140	40.00	1125.98	76.93	0.00
142	0.00	1209.53	29.17	0.00
144	0.00	1213.59	105.10	0.00
146	0.00	1212.05	25.40	0.00
148	56.00	1209.96	78.97	0.00
150	80.00	1183.33	102.17	0.00
152	0.00	1195.34	59.06	0.00
154	0.00	1067.94	127.67	0.00
156	256.00	1036.52	110.98	0.00
158	0.00	1035.88	111.04	0.00
160	184.00	1141.75	102.83	0.00
162	0.00	1100.49	114.65	0.00
164	599.00	1094.31	62.45	0.00
166	0.00	1127.76	86.66	0.00
168	200.00	1117.54	40.25	0.00
32	934.00	1186.58	72.16	0.00
34	0.00	1186.58	66.53	0.00
42	0.00	1188.48	28.44	0.00
44	0.00	1191.58	64.52	0.00
46	0.00	1190.57	38.61	0.00
48	0.00	1192.15	84.16	0.00
50	0.00	1186.58	36.00	0.00
54	0.00	1120.59	115.55	0.00
56	0.00	1136.38	84.98	0.00
58	80.00	1140.09	83.07	0.00
60	0.00	1136.82	79.00	0.00
62	0.00	1214.05	84.42	0.00

Page 4

Node Results: (continued)

Node ID	Demand GPM	Head ft	Pressure psi	Quality	
64	0.00	1209.95	40.22	0.00	
66	0.00	1205.81	27.95	0.00	
68	0.00	1197.83	37.42	0.00	
78	0.00	1193.89	71.27	0.00	
80	0.00	1180.91	113.53	0.00	
82	0.00	1186.11	115.76	0.00	
84	0.00	1218.24	26.67	0.00	
86	0.00	1217.07	33.21	0.00	
88	479.00	1216.54	37.27	0.00	
90	0.00	1106.04	86.52	0.00	
92	0.00	1119.25	110.37	0.00	
94	0.00	1106.04	101.56	0.00	
96	0.00	1137.92	21.78	0.00	
3	0.00	1211.12	48.15	0.00	
5	0.00	1137.92	115.22	0.00	
1	-3041.84	1220.00	60.23	0.00	Tank
2	-884.16	1220.00	27.30	0.00	Tank
4	-200.00	1138.00	21.67	0.00	Tank

Link Results:

Link ID	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Status
109	0.00	0.00	0.00	Open
115	934.00	0.66	0.07	Open

117	117.16	0.33	0.04	Open
119	197.16	0.56	0.11	Open
123	-599.00	1.70	0.86	Open
125	599.00	1.70	0.86	Open
127	349.16	0.99	0.31	Open
129	349.16	0.99	0.31	Open
139	112.00	1.27	1.12	Open
141	80.00	0.91	0.60	Open
143	405.16	1.15	0.41	Open
145	479.00	1.36	0.57	Open
147	-599.00	1.70	0.86	Open
155	1139.84	1.82	0.69	Open
157	816.84	0.83	0.13	Open
159	816.84	0.83	0.13	Open
161	-197.16	0.56	0.11	Open
163	-349.16	0.99	0.31	Open
165	-40.00	1.02	1.20	Open
167	623.00	1.77	0.92	Open
169	816.84	1.30	0.37	Open
171	-323.00	2.06	1.96	Open
173	56.00	0.36	0.08	Open

Page 5
Link Results: (continued)

Link ID	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Status
175	879.00	2.49	1.74	Open
187	0.00	0.00	0.00	Open
189	934.00	0.66	0.07	Open
191	934.00	0.66	0.07	Open
193	117.16	0.33	0.04	Open
195	-309.16	0.88	0.25	Open
197	112.00	1.27	1.12	Open
199	-40.00	1.02	1.20	Open
201	-40.00	1.02	1.20	Open
203	-40.00	1.02	1.20	Open
205	349.16	0.99	0.31	Open
207	349.16	0.99	0.31	Open
209	-479.00	1.36	0.57	Open
211	56.00	0.36	0.08	Open
213	56.00	0.36	0.08	Open
215	56.00	0.36	0.08	Open
217	56.00	0.36	0.08	Open
219	80.00	0.91	0.60	Open
221	816.84	0.83	0.13	Open
223	816.84	0.83	0.13	Open
225	816.84	0.83	0.13	Open
229	879.00	2.49	1.74	Open
231	623.00	1.77	0.92	Open
233	879.00	2.49	1.74	Open
235	623.00	1.77	0.92	Open
237	-679.00	1.93	1.08	Open
239	-863.00	2.45	1.68	Open
241	-599.00	1.70	0.86	Open
243	-599.00	1.70	0.86	Open
245	-599.00	1.70	0.86	Open
247	-599.00	1.70	0.86	Open
251	0.00	0.00	0.00	Open
253	200.00	1.28	0.81	Open
255	200.00	1.28	0.81	Open

1	3041.84	2.16	0.59	Open
2	884.16	2.51	1.76	Open
3	863.00	1.38	0.41	Open
4	863.00	2.45	1.68	Open
6	200.00	1.28	0.81	Open
8	0.00	0.00	0.00	Open
9	0.00	0.00	0.00	Closed Pump

[TITLE]

[JUNCTIONS]

;ID	Elev	Demand	Pattern	
10	857.809601	0		;
102	1044.269305	0		;
104	1095.411482	0		;New Junction
106	903.047204	0		;New Junction
108	1073.979188	0		;New Junction
110	905.820219	0		;New Junction
112	1046.223409	0		;New Junction
114	866.960169	0		;New Junction
116	1105.922624	0		;New Junction
118	939.736083	0		;New Junction
12	1081.236626	160		;King City
120	828.322389	623		;Gallatin
122	1052.862488	323		;DeKalb (25%)
124	1142.690699	0		;New Junction
126	966.687472	0		;New Junction
128	974.419391	0		;New Junction
132	1089.919218	0		;New Junction
134	1085.452118	0		;New Junction
136	1009.968566	112		;Barnard & Andrew 4
138	968.939746	0		;New Junction
140	948.421877	40		;Maitland
142	1142.219321	0		;New Junction
144	971.030920	0		;New Junction
146	1153.426120	0		;New Junction
148	1027.710715	56		;Ravenwood
150	947.524072	80		;Bolckow
152	1059.031783	0		;New Junction
154	773.299736	0		;
156	780.384461	256		;Davies 1
158	779.610107	0		;New Junction
160	904.443523	184		

```
;Stanberry
 162                    835.894863      0                                       ;New
Junction
 164                    950.172635      599
;Albany & Gentry 1
 166                    927.761637      0                                       ;New
Junction
 168                    1024.644839     200
;Grant City
 32                     1020.039770     934
;Andrew 1
 34                     1033.037074     0                                       ;New
Junction
 42                     1122.846663     0                                       ;
 44                     1042.668734     0                                       ;New
Junction
 46                     1101.459428     0                                       ;New
Junction
 48                     997.923834      0                                       ;
 50                     1103.505249     0
;-4125
 54                     853.906592      0                                       ;
 56                     940.257727      0                                       ;New
Junction
 58                     948.381330      80
;Gentry 2
 60                     954.501766      0                                       ;New
Junction
 62                     1019.226867     0                                       ;New
Junction
 64                     1117.131729     0                                       ;New
Junction
 66                     1141.306697     0                                       ;New
Junction
 68                     1111.461243     0                                       ;New
Junction
 78                     1029.407103     0                                       ;New
Junction
 80                     918.907434      0                                       ;New
Junction
 82                     918.943579      0                                       ;New
Junction
 84                     1156.700050     0                                       ;
 86                     1140.430515     0                                       ;New
Junction
 88                     1130.523219     479
;Nodaway 1
 90                     906.351272      0                                       ;New
Junction
 92                     864.535480      0                                       ;New
Junction
 94                     871.651245      0                                       ;New
Junction
 96                     1087.661239     0                                       ;New
Junction
 3                      1100            0                                       ;
 5                      872             0                                       ;

[RESERVOIRS]
;ID                     Head            Pattern

[TANKS]
;ID                     Elevation       InitLevel       MinLevel        MaxLevel
```

```
Diameter        MinVol          VolCurve
 1                      1081            139             0               160
50              0
 2                      1157            63              0               130
50              0                                       ;Maryville Tank
 4                      1088            50              0               70
10              0                                       ;

[PIPES]
;ID                    Node1                   Node2                   Length
Diameter        Roughness       MinorLoss       Status
 109                    32                      34                      25889.584309
24              140.000000      0.000000        Open    ;New Pipe
 115                    42                      32                      28628.27
24              140.000000      0.000000        Open    ;New Pipe
 117                    44                      46                      24186.604064
12              140.000000      0.000000        Open    ;New Pipe
 119                    48                      44                      5259.850703
12              140.000000      0.000000        Open    ;New Pipe
 123                    54                      56                      18459.301865
12              140.000000      0.000000        Open    ;New Pipe
 125                    58                      60                      3823.306885
12              140.000000      0.000000        Open    ;New Pipe
 127                    62                      64                      13013.826416
12              140.000000      0.000000        Open    ;New Pipe
 129                    66                      68                      25353.873685
12              140.000000      0.000000        Open    ;New Pipe
 139                    78                      80                      11571.705202
6               140.000000      0.000000        Open    ;New Pipe
 141                    44                      82                      9084.235681
6               140.000000      0.000000        Open    ;New Pipe
 143                    84                      62                      10111.368967
12              140.000000      0.000000        Open    ;New Pipe
 145                    86                      88                      951.294959
12              140.000000      0.000000        Open    ;New Pipe
 147                    90                      92                      15446.070030
12              140.000000      0.000000        Open    ;New Pipe
 155                    12                      102                     23242.244643
16              140.000000      0.000000        Open    ;New Pipe
 157                    104                     106                     25129.350635
20              140.000000      0.000000        Open    ;New Pipe
 159                    108                     110                     21670.464670
20              140.000000      0.000000        Open    ;New Pipe
 161                    48                      78                      15924.247181
12              140.000000      0.000000        Open    ;New Pipe
 163                    112                     68                      4396.201801
12              140.000000      0.000000        Open    ;New Pipe
 165                    114                     116                     41715.258354
4               140.000000      0.000000        Open    ;New Pipe
 167                    118                     120                     53895.626546
12              140.000000      0.000000        Open    ;New Pipe
 169                    102                     104                     9735.164451
16              140.000000      0.000000        Open    ;New Pipe
 171                    122                     102                     12017.922714
8               140.000000      0.000000        Open    ;New Pipe
 173                    124                     126                     8498.010350
8               140.000000      0.000000        Open    ;New Pipe
 175                    12                      128                     72241.288684
12              140.000000      0.000000        Open    ;New Pipe
 187                    34                      50                      2763.671968
24              140.000000      0.000000        Open    ;New Pipe
 189                    132                     42                      24016.78
24              140.000000      0.000000        Open    ;New Pipe
```

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 191                134                132                5272.301439
24          140.000000      0.000000        Open    ;New Pipe
 193                46                 134                3225.361603
12          140.000000      0.000000        Open    ;New Pipe
 195                78                 112                10166.340821
12          140.000000      0.000000        Open    ;New Pipe
 197                80                 136                1991.774638
6           140.000000      0.000000        Open    ;New Pipe
 199                138                112                7242.862487
4           140.000000      0.000000        Open    ;New Pipe
 201                116                138                7019.142244
4           140.000000      0.000000        Open    ;New Pipe
 203                140                114                2718.890522
4           140.000000      0.000000        Open    ;New Pipe
 205                142                66                 11822.619789
12          140.000000      0.000000        Open    ;New Pipe
 207                64                 142                1346.075690
12          140.000000      0.000000        Open    ;New Pipe
 209                86                 84                 2063.121682
12          140.000000      0.000000        Open    ;New Pipe
 211                62                 144                6025.010030
8           140.000000      0.000000        Open    ;New Pipe
 213                144                146                20119.608793
8           140.000000      0.000000        Open    ;New Pipe
 215                146                124                11968.320398
8           140.000000      0.000000        Open    ;New Pipe
 217                126                148                6806.791630
8           140.000000      0.000000        Open    ;New Pipe
 219                82                 150                4630.219333
6           140.000000      0.000000        Open    ;New Pipe
 221                110                134                15674.961160
20          140.000000      0.000000        Open    ;New Pipe
 223                152                108                1519.641879
20          140.000000      0.000000        Open    ;New Pipe
 225                106                152                9040.789911
20          140.000000      0.000000        Open    ;New Pipe
 229                128                154                14806.835473
12          140.000000      0.000000        Open    ;New Pipe
 231                156                158                696.853118
12          140.000000      0.000000        Open    ;New Pipe
 233                154                156                18054.998208
12          140.000000      0.000000        Open    ;New Pipe
 235                158                118                37390.425439
12          140.000000      0.000000        Open    ;New Pipe
 237                58                 160                1536.532116
12          140.000000      0.000000        Open    ;New Pipe
 239                160                10                 6239.234188
12          140.000000      0.000000        Open    ;New Pipe
 241                56                 60                 524.540342
12          140.000000      0.000000        Open    ;New Pipe
 243                92                 54                 1569.151793
12          140.000000      0.000000        Open    ;New Pipe
 245                162                90                 6489.571040
12          140.000000      0.000000        Open    ;New Pipe
 247                164                162                7219.68
12          140.000000      0.000000        Open    ;New Pipe
 251                90                 94                 36600.129687
8           140.000000      0.000000        Open    ;New Pipe
 253                96                 166                12574.225393
8           140.000000      0.000000        Open    ;New Pipe
 255                166                168                12642.977728
8           140.000000      0.000000        Open    ;New Pipe
 1                  1                  12                 1000
```

```
24              140             0               Open    ;
 2                      2                       84                      1000
12              140             0               Open    ;
 3                      12                      3                       20000
16              140             0               Open    ;
 4                      3                       10                      35008.020082
12              140             0               Open    ;
 6                      4                       96                      100
8               140             0               Open    ;
 8                      5                       96                      29725.922466
8               140             0               Open    ;

[PUMPS]
;ID                     Node1                   Node2                   Parameters
 9                      94                      5                       HEAD 2  ;

[VALVES]
;ID                     Node1                   Node2                   Diameter
Type    Setting         MinorLoss

[TAGS]

[DEMANDS]
;Junction               Demand          Pattern                 Category

[STATUS]
;ID                     Status/Setting
 9                      Closed

[PATTERNS]
;ID                     Multipliers

[CURVES]
;ID                     X-Value         Y-Value
;PUMP: PUMP:
 1                      0               2000
 1                      3000            500
 1                      3200            10
;PUMP: PUMP:
 2                      0               2000
 2                      180             500
 2                      210             10

[CONTROLS]


[RULES]


[ENERGY]
 Global Efficiency      70.000000
 Global Price           0
 Demand Charge          0.000000

[EMITTERS]
;Junction               Coefficient

[QUALITY]
;Node                   InitQual

[SOURCES]
;Node                   Type            Quality         Pattern
```

```
[REACTIONS]
;Type           Pipe/Tank               Coefficient


[REACTIONS]
 Order Bulk             1.000000
 Order Tank             1.000000
 Order Wall             1
 Global Bulk            0.000000
 Global Wall            0.000000
 Limiting Potential     0
 Roughness Correlation  0

[MIXING]
;Tank                   Model

[TIMES]
 Duration               0:00
 Hydraulic Timestep     1:00
 Quality Timestep       0:05
 Pattern Timestep       1:00
 Pattern Start          0:00
 Report Timestep        1:00
 Report Start           0:00
 Start ClockTime        12 am
 Statistic              NONE

[REPORT]
 Status                 Yes
 Summary                No
 Page                   0

[OPTIONS]
 Units                  GPM
 Headloss               H-W
 Specific Gravity       1.000000
 Viscosity              1
 Trials                 40
 Accuracy               0.001
 CHECKFREQ              2
 MAXCHECK               10
 DAMPLIMIT              0
 Unbalanced             Stop
 Pattern                1
 Demand Multiplier      1.000000
 Emitter Exponent       0.500000
 Quality                None mg/L
 Diffusivity            1
 Tolerance              0.001000

[COORDINATES]
;Node                   X-Coord                 Y-Coord
 10                     2780454.89              1469510.73
 102                    2758855.25              1415487.11
 104                    2749550.50              1416474.04
 106                    2723973.99              1418435.66
 108                    2714517.67              1418813.91
 110                    2696280.95              1412932.18
 112                    2685645.66              1468909.31
 114                    2629679.73              1470035.78
 116                    2671386.54              1469196.31
 118                    2907800.85              1392181.46
```

12	2781446.58	1415881.53
120	2936642.36	1368195.83
122	2758291.93	1403351.44
124	2728398.36	1521190.79
126	2736884.73	1521398.55
128	2854296.86	1414561.68
132	2682202.70	1405422.22
134	2682333.00	1410762.56
136	2698631.04	1461178.24
138	2678404.26	1469055.06
140	2626672.75	1469804.13
142	2684216.82	1509395.43
144	2696316.10	1521755.47
146	2716433.19	1521465.22
148	2740687.24	1524151.91
150	2698757.93	1439201.27
152	2715948.84	1418462.53
154	2868903.49	1415355.80
156	2887130.29	1413195.54
158	2887826.54	1413166.58
160	2777682.03	1473146.63
162	2815686.98	1483549.80
164	2821774.87	1486461.79
166	2815057.93	1560610.38
168	2815537.69	1573244.25
32	2686592.79	1355843.19
34	2685559.31	1330855.90
42	2686526.95	1382879.89
44	2685032.30	1437572.32
46	2683063.92	1413803.70
48	2684979.62	1443223.05
50	2685650.86	1328101.48
54	2792060.71	1483964.98
56	2777975.02	1479337.24
58	2777892.87	1474990.17
60	2777965.11	1478812.79
62	2690291.36	1521812.16
64	2684321.60	1510552.18
66	2683883.74	1497590.61
68	2685780.51	1473303.44
78	2685343.99	1458750.75
80	2696769.35	1459040.35
82	2694111.67	1437726.71
84	2680596.70	1522064.72
86	2677448.88	1522076.96
88	2678340.36	1523110.32
90	2809198.39	1483633.21
92	2793758.24	1483910.74
94	2813748.25	1518368.96
96	2814621.91	1548043.88
3	2782927.32	1442033.13
5	2813812.26	1519169.65
1	2780711.92	1415031.39
2	2680474.91	1522455.21
4	2812810.11	1547949.72

[VERTICES]

;Link	X-Coord	Y-Coord
109	2687445.31	1355401.85
109	2687636.79	1355120.86
109	2687780.11	1354806.59
109	2687964.63	1353973.32
109	2688242.66	1352889.91

109	2688331.61	1352428.56
109	2688327.06	1349797.60
109	2688254.06	1349309.17
109	2688255.04	1346832.58
109	2688229.65	1346409.92
109	2688147.04	1346010.65
109	2687948.51	1345260.27
109	2687666.69	1344151.22
109	2687169.69	1342315.88
109	2686738.25	1340928.24
109	2686530.38	1340250.79
109	2686462.77	1339924.85
109	2686326.24	1338866.96
109	2686190.80	1337744.13
109	2686085.33	1337255.16
109	2685883.06	1337211.16
109	2685768.62	1335804.49
109	2685730.46	1334691.41
109	2685572.89	1332951.08
115	2686924.81	1382209.92
115	2687120.92	1381948.85
115	2687589.85	1381104.14
115	2687575.85	1376142.57
115	2687518.17	1370879.82
115	2687535.91	1368858.24
115	2687437.40	1367955.26
115	2687374.51	1367832.40
115	2687411.35	1367573.18
115	2687474.10	1367062.63
115	2687510.74	1366007.69
115	2687488.08	1364456.38
115	2687511.28	1364042.65
115	2687608.48	1363573.32
115	2687837.55	1362505.33
115	2687987.55	1361793.29
115	2688232.10	1360287.07
115	2688324.80	1360085.63
115	2688345.05	1358397.00
115	2688321.50	1357381.61
115	2688224.70	1356860.30
115	2687951.35	1356214.23
115	2687758.16	1356113.54
115	2687547.92	1356061.29
115	2687116.04	1356151.48
117	2685040.28	1435197.07
117	2685048.35	1434720.81
117	2685175.75	1434226.72
117	2685205.42	1433644.96
117	2685175.52	1432671.81
117	2685122.66	1430705.78
117	2685136.24	1429508.40
117	2685082.27	1427608.53
117	2685027.82	1424166.97
117	2684941.44	1419871.33
117	2684918.33	1418494.69
117	2684859.43	1418063.62
117	2684760.17	1417671.56
117	2684538.13	1417105.41
117	2683989.67	1415885.33
117	2683423.92	1414512.77
119	2685083.33	1439195.00
119	2685042.92	1438961.97
119	2685021.34	1438280.10

119	2685032.06	1437645.08
123	2791464.54	1483988.64
123	2787235.74	1484034.78
123	2783292.84	1484045.39
123	2778731.66	1484045.53
123	2778273.17	1483728.55
123	2778049.16	1483260.91
127	2690228.30	1520424.81
127	2690152.40	1520008.77
127	2690022.67	1519342.96
127	2689855.84	1518419.38
127	2689774.18	1517853.94
127	2689621.40	1517569.31
127	2689253.23	1517029.19
127	2688867.61	1516527.95
127	2688510.84	1515940.06
127	2687928.57	1515159.94
127	2687208.65	1514077.68
127	2686898.45	1513782.10
127	2686590.64	1513345.54
127	2685659.61	1511994.26
127	2685223.05	1511323.27
127	2684624.01	1510939.84
127	2684378.46	1510744.89
129	2683899.04	1497471.34
129	2685701.52	1495845.24
129	2686303.02	1495263.77
129	2686278.83	1489701.85
129	2686030.03	1483426.15
129	2685774.11	1475492.08
139	2687472.32	1458642.38
139	2694859.37	1458613.29
139	2696014.50	1458555.86
141	2688056.34	1437723.71
143	2681037.19	1522079.56
143	2681563.12	1522067.50
143	2681672.54	1522076.35
143	2681765.57	1522089.58
143	2681892.17	1522116.21
143	2681981.59	1522136.38
143	2682109.16	1522174.67
143	2682228.82	1522198.85
143	2682380.29	1522202.58
143	2682739.55	1522188.86
143	2683327.32	1522173.18
143	2684076.02	1522153.24
143	2685051.05	1522121.97
143	2685365.85	1522117.99
143	2685403.50	1522097.64
143	2685450.21	1522023.83
143	2685486.02	1521974.31
143	2685528.33	1521954.05
143	2686421.61	1521931.89
143	2687253.15	1521907.52
143	2688102.13	1521885.78
143	2688970.96	1521862.05
143	2689866.78	1521828.28
147	2804324.03	1483860.00
147	2793925.19	1483896.89
157	2748214.30	1417816.72
157	2732851.51	1418376.64
159	2704855.40	1418518.89
159	2703839.07	1418092.35

159	2703556.25	1416654.66
159	2703080.84	1414497.25
159	2701672.46	1413040.59
159	2700357.78	1412097.28
159	2698311.33	1412062.79
167	2908251.50	1392192.04
167	2908378.34	1389655.28
167	2909773.56	1389528.44
167	2910027.23	1386738.00
167	2913451.86	1386484.32
167	2913832.38	1379761.90
167	2915861.79	1379761.90
167	2918525.39	1378366.68
167	2921442.67	1378620.36
167	2921950.02	1366190.21
167	2927277.23	1366190.21
167	2934690.39	1366518.13
169	2750535.56	1415457.64
173	2732543.97	1521095.70
175	2801410.81	1415284.68
175	2834619.28	1415591.92
175	2835884.87	1415360.90
187	2685536.08	1330065.47
187	2685524.15	1329241.60
187	2685640.03	1328471.35
189	2681953.20	1390355.43
189	2682511.04	1388570.30
189	2682986.53	1387335.94
189	2683156.12	1386908.44
189	2683382.40	1386490.01
189	2684284.85	1385457.71
189	2686543.73	1382954.15
191	2682285.14	1410629.49
193	2683053.31	1413732.38
193	2682359.95	1412079.79
195	2685334.34	1458764.71
205	2684197.70	1509174.07
205	2684066.40	1506641.87
205	2683985.99	1505022.98
205	2683762.72	1498534.00
207	2684301.72	1510378.61
209	2678529.91	1522006.75
209	2679033.63	1521997.80
209	2679177.46	1522039.87
209	2679319.08	1522074.91
209	2679465.57	1522097.21
209	2679618.13	1522105.63
209	2680085.69	1522098.40
213	2708969.21	1521636.41
217	2737194.04	1521420.13
217	2740438.28	1521311.98
219	2696061.37	1437551.01
221	2695940.68	1413046.36
221	2694502.99	1413329.19
221	2693179.70	1412897.49
221	2691563.24	1411642.04
221	2690864.23	1410606.76
221	2688921.84	1410471.68
229	2854729.67	1414542.89
235	2892904.08	1412993.51
235	2892904.08	1406905.27
235	2894299.30	1404749.02
235	2896709.22	1397138.73

```
 235                    2896709.22              1394982.48
 235                    2902797.46              1394601.97
 235                    2902926.11              1392067.00
 239                    2777864.95              1473452.89
 239                    2778915.77              1473431.75
 239                    2779398.22              1473430.57
 239                    2779723.72              1473415.85
 239                    2779835.84              1473411.52
 239                    2779924.73              1473400.57
 239                    2780004.52              1473375.46
 239                    2780095.37              1473341.20
 239                    2780178.51              1473302.15
 239                    2780236.81              1473259.56
 239                    2780293.74              1473206.05
 239                    2780341.46              1473144.61
 239                    2780378.24              1473086.10
 239                    2780413.63              1473018.22
 239                    2780435.99              1472984.36
 239                    2780475.78              1472932.12
 239                    2780496.42              1472815.75
 239                    2780497.01              1472730.19
 239                    2780484.92              1472667.72
 239                    2780482.44              1472169.68
 239                    2780478.91              1471642.06
 239                    2780470.09              1470782.87
 239                    2780460.33              1470163.32
 245                    2813142.71              1483545.31
 247                    2821521.41              1486392.93
 247                    2820831.04              1486072.01
 247                    2820223.19              1485443.24
 247                    2819010.10              1484031.12
 247                    2818245.06              1483554.31
 251                    2808930.92              1501635.49
 251                    2810304.27              1505696.71
 251                    2810143.07              1515212.05
 253                    2814716.96              1551631.46
 3                      2782316.20              1416026.33
 3                      2782757.56              1441557.81
 4                      2783007.84              1461937.82
 4                      2782269.05              1463292.27
 4                      2780483.64              1465816.47

[LABELS]
;X-Coord           Y-Coord          Label & Anchor Node
 2660805.75       1385527.66       "Savannah"
 2705131.92       1460854.07       "Andrew 4"
 2702444.52       1443881.44       "Bolckow"
 2621467.45       1478956.13       "Maitland"
 2702444.52       1467030.20       "Barnard"
 2737969.35       1532668.04       "Ravenwood"
 2672531.59       1532289.78       "Nodaway 1"
 2819428.44       1579467.04       "Grant City"
 2785629.21       1422596.44       "King City"
 2837828.11       1492573.23       "Gentry 1"
 2813241.67       1496355.76       "Albany"
 2784494.45       1492194.98       "Gentry 2"
 2749982.15       1483978.40       "Stanberry"
 2745534.40       1396875.25       "DeKalb (25%)"
 2884025.85       1422818.73       "Davies 1"
 2927852.30       1377206.10       "Gallatin"
 2691065.99       1359428.21       "Andrew 1"
 2625144.19       1417839.08       "Flow Control Structure"
```

```
[BACKDROP]
 DIMENSIONS             2486665.00              1314604.00              2958321.00
       1585560.00
 UNITS                  None
 FILE
 OFFSET                 0.00                    0.00

[END]
```

```
******************************************************************
*                          E P A N E T                           *
*                  Hydraulic and Water Quality                   *
*                  Analysis for Pipe Networks                    *
*                        Version 2.0                             *
******************************************************************
```

Input File: MoAm Platts 50-50 gfd.net

Link - Node Table:

Link ID	Start Node	End Node	Length ft	Diameter in
13	14	16	40379.84	20
15	18	20	10605.75	24
17	18	22	36131.790806	20
19	24	26	27223.229115	16
25	36	38	14340.724983	20
27	40	18	17473.63	20
35	50	52	44691.49	16
45	20	70	20094.43	24
47	72	70	2226.82	12.000000
49	52	74	9302.40	20
51	76	52	4000.62	8
65	98	14	21488.28	20
67	14	100	47316.68	8
91	70	98	17907.07	24
93	22	24	19441.994446	20
95	26	132	20352.13	16
97	38	40	3483.85	20
99	74	36	9768.684183	20
8	98	6	1866.53	30
9	7	50	2578.71	16
1	132	1	831.00	16

Node Results:

Node ID	Demand GPM	Head ft	Pressure psi	Quality
100	152.00	1113.23	65.93	0.00
132	128.00	1144.08	61.91	0.00
14	0.00	1136.24	54.50	0.00
16	2659.00	1090.90	60.09	0.00
18	0.00	1144.88	88.42	0.00
20	0.00	1148.71	74.92	0.00
22	0.00	1144.73	54.02	0.00
24	0.00	1144.65	87.92	0.00
26	0.00	1144.32	55.58	0.00
36	0.00	1126.27	127.42	0.00

Node Results: (continued)

Node ID	Demand GPM	Head ft	Pressure psi	Quality
38	0.00	1130.13	104.90	0.00

40	970.00	1131.07	125.87	0.00	
50	0.00	1121.13	7.64	0.00	
52	950.00	1121.13	90.61	0.00	
70	0.00	1155.97	58.18	0.00	
72	104.00	1155.89	68.30	0.00	
74	0.00	1123.64	103.33	0.00	
76	280.00	1115.10	113.72	0.00	
98	0.00	1162.98	43.17	0.00	
7	0.00	1121.13	38.19	0.00	
1	0.00	1144.08	62.00	0.00	
6	-5243.00	1164.00	43.33	0.00	Tank

Link Results:

Link ID	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Status
13	2659.00	2.72	1.12	Open
15	-2328.00	1.65	0.36	Open
17	128.00	0.13	0.00	Open
19	128.00	0.20	0.01	Open
25	-1230.00	1.26	0.27	Open
27	-2200.00	2.25	0.79	Open
35	0.00	0.00	0.00	Open
45	-2328.00	1.65	0.36	Open
47	-104.00	0.30	0.03	Open
49	-1230.00	1.26	0.27	Open
51	-280.00	1.79	1.51	Open
65	2811.00	2.87	1.24	Open
67	152.00	0.97	0.49	Open
91	-2432.00	1.72	0.39	Open
93	128.00	0.13	0.00	Open
95	128.00	0.20	0.01	Open
97	-1230.00	1.26	0.27	Open
99	-1230.00	1.26	0.27	Open
8	-5243.00	2.38	0.55	Open
9	0.00	0.00	0.00	Open
1	0.00	0.00	0.00	Open

```
[TITLE]


[JUNCTIONS]
;ID                     Elev            Demand          Pattern
 100                    961.084772      152
;Maysville
 132                    1001.189756     128
;Clinton 1
 14                     1010.447155     0                                       ;
 16                     952.214148      2659
;Cameron
 18                     940.826828      0                                       ;
 20                     975.809703      0                                       ;
 22                     1020.055889     0                                       ;
 24                     941.747560      0                                       ;
 26                     1016.047952     0                                       ;
 36                     832.193406      0                                       ;
 38                     888.045130      0                                       ;
 40                     840.574778      970
;DeKalb 1 (75%)
 50                     1103.505249     0                                       ;
 52                     912.018553      950
;Andrew 2
 70                     1021.689701     0                                       ;
 72                     998.268861      104
;Stewartsville
 74                     885.164786      0                                       ;
 76                     852.654752      280
;Buchanan 2
 98                     1063.337085     0                                       ;
 7                      1033            0
;Stage 2 Pump Station
 1                      1001            0                                       ;

[RESERVOIRS]
;ID                     Head            Pattern

[TANKS]
;ID                     Elevation       InitLevel       MinLevel        MaxLevel
Diameter        MinVol          VolCurve
 6                      1064            100             0               160
50              0                                       ;Stewartsville Tank

[PIPES]
;ID                     Node1                   Node2                   Length
Diameter        Roughness       MinorLoss       Status
 13                     14                      16                      40379.84
20              140.000000      0.000000        Open    ;New Pipe
 15                     18                      20                      10605.75
24              140.000000      0.000000        Open    ;New Pipe
 17                     18                      22                      36131.790806
20              140.000000      0.000000        Open    ;New Pipe
 19                     24                      26                      27223.229115
16              140.000000      0.000000        Open    ;New Pipe
 25                     36                      38                      14340.724983
20              140.000000      0.000000        Open    ;New Pipe
 27                     40                      18                      17473.63
20              140.000000      0.000000        Open    ;New Pipe
 35                     50                      52                      44691.49
16              140.000000      0.000000        Open    ;New Pipe
 45                     20                      70                      20094.43
24              140.000000      0.000000        Open    ;New Pipe
```

```
 47                     72                     70                     2226.82
12.000000       140.000000      0.000000        Open    ;New Pipe
 49                     52                     74                     9302.40
20                      140.000000      0.000000        Open    ;New Pipe
 51                     76                     52                     4000.62
8                       140.000000      0.000000        Open    ;New Pipe
 65                     98                     14                     21488.28
20                      140.000000      0.000000        Open    ;New Pipe
 67                     14                     100                    47316.68
8                       140.000000      0.000000        Open    ;New Pipe
 91                     70                     98                     17907.07
24                      140.000000      0.000000        Open    ;New Pipe
 93                     22                     24                     19441.994446
20                      140.000000      0.000000        Open    ;New Pipe
 95                     26                     132                    20352.13
16                      140.000000      0.000000        Open    ;New Pipe
 97                     38                     40                     3483.85
20                      140.000000      0.000000        Open    ;New Pipe
 99                     74                     36                     9768.684183
20                      140.000000      0.000000        Open    ;New Pipe
 8                      98                     6                      1866.53
30                      140             0               Open    ;
 9                      7                      50                     2578.71
16                      140             0               Open    ;
 1                      132                    1                      831.00
16                      140             0               Open    ;Plattsburg

[PUMPS]
;ID                    Node1                  Node2                  Parameters

[VALVES]
;ID                    Node1                  Node2                  Diameter
Type    Setting        MinorLoss

[TAGS]
 NODE   7                      -2622
 NODE   1                      -2622
 LINK   1                      -2622

[DEMANDS]
;Junction              Demand          Pattern                 Category

[STATUS]
;ID                    Status/Setting

[PATTERNS]
;ID                    Multipliers

[CURVES]
;ID                    X-Value         Y-Value
;PUMP: PUMP:
 1                     0               2000
 1                     198             500
 1                     202             10
;PUMP:
 2                     0               2000
 2                     3300            500
 2                     3500            10

[CONTROLS]
```

```
[RULES]


[ENERGY]
 Global Efficiency      70.000000
 Global Price           0
 Demand Charge          0.000000

[EMITTERS]
;Junction               Coefficient

[QUALITY]
;Node                   InitQual

[SOURCES]
;Node                   Type            Quality         Pattern

[REACTIONS]
;Type           Pipe/Tank               Coefficient


[REACTIONS]
 Order Bulk             1.000000
 Order Tank             1.000000
 Order Wall             1
 Global Bulk            0.000000
 Global Wall            0.000000
 Limiting Potential     0
 Roughness Correlation  0

[MIXING]
;Tank                   Model

[TIMES]
 Duration               0:00
 Hydraulic Timestep     1:00
 Quality Timestep       0:05
 Pattern Timestep       1:00
 Pattern Start          0:00
 Report Timestep        1:00
 Report Start           0:00
 Start ClockTime        12 am
 Statistic              NONE

[REPORT]
 Status                 Yes
 Summary                No
 Page                   0

[OPTIONS]
 Units                  GPM
 Headloss               H-W
 Specific Gravity       1.000000
 Viscosity              1
 Trials                 40
 Accuracy               0.001
 CHECKFREQ              2
 MAXCHECK               10
 DAMPLIMIT              0
 Unbalanced             Stop
 Pattern                1
 Demand Multiplier      1.000000
 Emitter Exponent       0.500000
```

Quality	None mg/L
Diffusivity	1
Tolerance	0.001000

[COORDINATES]

;Node	X-Coord	Y-Coord
100	2826836.56	1353883.12
132	2792717.99	1234891.24
14	2828824.94	1308883.91
16	2867955.62	1306419.17
18	2760008.72	1304507.66
20	2769610.03	1308975.65
22	2762927.00	1271314.50
24	2760914.41	1254971.02
26	2773526.92	1235032.88
36	2724987.66	1304294.37
38	2739177.89	1304133.42
40	2742661.33	1304095.23
50	2685650.86	1328101.48
52	2713401.93	1311802.47
70	2789478.39	1309136.83
72	2789373.30	1306912.49
74	2715981.28	1304383.92
76	2717400.45	1311672.83
98	2807337.51	1308970.70
7	2685554.81	1330671.10
1	2793548.35	1234858.60
6	2807288.67	1310836.59

[VERTICES]

;Link	X-Coord	Y-Coord
13	2829677.71	1308888.23
13	2829671.10	1309276.92
13	2829855.31	1309292.19
13	2830072.49	1309258.95
13	2830308.48	1309202.99
13	2830531.23	1309109.82
13	2830795.84	1308999.13
13	2831270.62	1308721.33
13	2831833.64	1308271.81
13	2832634.59	1307632.32
13	2833017.75	1307326.40
13	2833376.63	1307088.13
13	2833701.87	1306932.26
13	2833957.38	1306812.10
13	2834202.59	1306756.29
13	2834452.65	1306686.73
13	2834748.31	1306645.59
13	2835471.80	1306653.49
13	2836328.92	1306662.84
13	2837613.95	1306718.47
13	2838811.65	1306755.11
13	2839465.64	1306784.50
13	2839667.99	1306810.94
13	2841184.40	1306813.11
13	2842677.63	1306815.24
13	2844038.08	1306768.89
13	2845006.41	1306743.62
13	2846555.16	1306737.29
13	2848215.51	1306672.91
13	2850004.57	1306629.13
13	2850308.53	1306643.43
13	2851254.13	1306599.35

13	2852535.72	1306583.94
13	2853757.80	1306544.48
13	2854675.75	1306499.94
13	2855505.78	1306476.96
13	2856309.02	1306434.94
13	2857266.10	1306450.97
13	2858380.49	1306513.55
13	2860583.39	1306611.91
13	2861724.28	1306666.15
13	2862672.29	1306699.59
13	2863292.61	1306896.15
13	2863547.26	1306898.69
13	2864162.94	1306847.52
13	2864526.17	1306727.68
13	2864948.81	1306665.60
13	2865581.62	1306572.65
13	2866944.97	1306454.95
15	2761146.56	1305050.26
15	2762816.53	1305846.62
15	2764237.06	1306524.03
15	2765363.66	1307082.79
15	2766705.81	1307713.76
15	2768137.44	1308405.05
15	2768651.22	1308657.96
15	2769026.16	1308827.11
15	2769376.93	1308952.87
17	2760004.99	1303425.78
17	2760001.61	1302276.60
17	2759979.31	1300636.23
17	2759971.21	1299093.37
17	2759966.09	1297371.86
17	2759973.00	1296688.83
17	2759962.08	1295989.67
17	2759947.43	1294702.32
17	2759950.20	1294588.96
17	2760076.34	1294619.37
17	2760342.20	1294615.33
17	2760746.78	1294608.90
17	2761295.35	1294600.18
17	2762016.81	1294587.91
17	2762887.73	1294573.10
17	2762885.46	1294256.56
17	2762878.74	1293320.44
17	2762874.15	1292681.22
17	2762877.10	1291977.21
17	2762880.41	1291188.42
17	2762882.66	1290651.16
17	2762843.63	1288758.86
17	2762840.12	1288461.91
17	2762854.59	1288272.70
17	2762897.15	1288095.27
17	2762936.69	1287929.11
17	2762933.91	1287080.79
17	2762948.92	1286690.83
17	2762948.70	1285689.87
17	2762947.79	1285067.78
17	2762945.68	1284010.23
17	2762962.33	1283691.00
17	2762956.72	1283012.28
17	2762952.31	1282599.38
17	2762917.81	1281281.15
17	2762913.35	1280025.63
17	2762919.32	1278654.36

17	2762913.01	1277678.74
17	2762909.14	1276895.43
17	2762917.22	1276412.05
17	2762910.33	1275640.01
17	2762901.61	1274808.55
17	2762901.64	1274129.94
17	2762910.91	1273406.23
17	2762937.12	1272176.67
19	2761542.52	1254947.58
19	2761546.36	1254209.64
19	2761594.04	1254063.40
19	2761652.46	1253951.28
19	2761842.29	1253759.34
19	2762250.11	1253381.60
19	2762968.74	1252847.88
19	2763283.75	1252609.97
19	2763593.29	1252360.65
19	2763880.64	1252085.52
19	2764942.41	1250983.52
19	2765355.84	1250557.00
19	2766102.05	1249787.16
19	2766562.07	1249322.49
19	2767272.70	1248590.69
19	2768167.02	1247695.14
19	2768918.08	1246913.12
19	2769401.23	1246426.35
19	2769662.32	1246150.01
19	2769798.53	1246005.83
19	2769931.04	1245855.54
19	2770093.63	1245600.94
19	2770244.59	1245365.94
19	2770393.85	1245063.05
19	2770468.01	1244855.04
19	2770534.26	1244612.98
19	2770580.15	1244404.50
19	2770607.81	1244102.41
19	2770609.81	1242965.75
19	2770593.53	1241738.30
19	2770574.99	1240646.54
19	2770559.40	1239885.65
19	2770568.32	1239181.73
19	2770572.48	1238254.35
19	2770550.73	1237015.50
19	2770552.48	1236401.94
19	2770546.79	1235726.05
19	2770530.16	1235027.36
19	2771064.67	1235022.13
19	2772113.70	1235022.66
19	2773244.56	1235033.04
25	2725153.10	1304292.17
25	2726449.42	1304279.94
25	2727944.82	1304266.06
25	2729053.08	1304273.78
25	2729441.92	1304287.08
25	2730248.92	1304318.68
25	2730968.18	1304321.68
25	2731326.69	1304255.30
25	2732559.62	1304246.54
25	2732656.98	1304241.38
25	2732714.34	1304192.58
25	2732892.99	1304195.57
25	2732942.03	1304239.58
25	2733530.32	1304228.86

25	2733594.35	1304322.68
25	2733987.90	1304324.74
25	2734080.36	1304206.41
25	2734483.15	1304194.97
25	2736163.84	1304196.05
25	2736971.72	1304175.65
25	2737399.57	1304155.67
25	2738109.99	1304147.21
27	2743999.28	1304071.65
27	2745184.71	1304064.35
27	2745656.66	1304112.97
27	2746147.53	1304112.14
27	2746489.91	1304063.58
27	2746867.87	1304051.82
27	2747659.69	1304044.72
27	2748485.45	1304038.19
27	2748588.98	1304069.33
27	2749021.21	1304058.47
27	2749209.47	1304027.69
27	2750381.37	1304017.90
27	2751680.23	1303994.70
27	2752960.59	1303988.71
27	2753922.14	1303977.66
27	2754849.55	1303979.62
27	2756313.59	1303949.22
27	2758046.52	1303938.14
27	2758697.47	1303969.40
27	2758857.65	1303994.70
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Appendix C

Supplier Information

Celebrating 175 Years 1833-2008

City of Plattsburg
114 W Maple Street
Plattsburg, Missouri 64477

January 31, 2011

Sara Stewart
CDM, Inc.
9200 Ward Parkway, Ste. 500
Kansas City, Missouri 64114

Dear Sara,

In response to your letter dated January 6, 2011.

Our current firm water treatment capacity is 1.3 million gallons per day which is also our peak hour demand. Our residual disinfectant is chloramines.

Our water supply is Smithville Lake. Our treatment process is as follows;

- Injection of sodium permanganate at the raw water pump station
- Injection of chlorine dioxide prior to the primary coagulants
- Injection of sternpac 70 and mozo floc prior to a static mixer and the primary basins
- The water than passes through two primary upflow basins where carbon is added
- The water than passes through a secondary rapid mix chamber where caustic and fluoride are added
- The water than passes through two secondary settling basins
- Chlorine is then injected to prevent bacteria growth in the filters
- Water passes through gravity flow filters
- Chlorine is injected prior to the water entering clearwell 1
- Water is pumped to larger clearwell that provide additional storage and contact time prior to entering clearwell 2 ammonia is injected
- Water is transferred to the customer by high service pumps

The allocated water supply from Smithville Lake is 10.27 MGD. This would create our ceiling for capacity. There is adequate area to expand the Plant to meet this capacity. It is safe to say the Plant could be expanded to meet 3.7 MGD average and peak 7.4 MGD.

The preferred connection point would be at the intersection of 116 highway and Shaver Road located at the City Limits of Plattsburg.

816-539-2148 Office **816-930-3260 Fax**

The capital improvements required to increase capacity to 7.4 MGD would include all facets of the plant with the exception of the intake structure and the transmission line from the raw water pump station to the plant. Based on an estimated $6.00 per gallons expansion cost the expansion to 7.4 MGD would cost $36,000,000.

We currently have the ability to barrow 4.5 million dollars from the USDA at 4% for thirty-five years. There is a one million dollar grant associated with this loan. We have an additional two million dollar bonding capacity.

The estimate cost of 1000 gallons with no capital recovery is $2.25.

The five year average for wholesale customers is $2.95 per 1000 gallons.

The time table to do the mentioned expansion would be four years.

Future rate adjustments are tied to increases and/or decreases in production cost, lake storage fees, debt service, and replacement, recovery, and capital improvement cost.

If you have other questions please call.

Thanks,

Joe Trotter
City Administrator

Stewart, Sarah

From: Michael.Wood@amwater.com
Sent: Friday, January 28, 2011 11:53 AM
To: Stewart, Sarah
Cc: Bernard.Meyer@amwater.com; Derek.Linam@amwater.com; Christopher.Parrish@amwater.com
Subject: Great Northwest Wholesale Water Commission
Attachments: 2009 WQ Report.pdf; 2982_001.pdf

Sarah:

I promised you a response today. I can write a letter next week addressing everything if this is not adequate but wanted to pass along what I have to date. I will address each of your bullet points below.

There have been no significant changes in operations or water treatment from our last update provided. Majority of that information can be utilized for this update.

1) We do utilize chloramines for disinfection and the plant is rated at 30 mgd.

2) The Missouri American Water Company's St. Joseph District owns and operates a well field and treatment plant in southwestern Andrew County.
Raw water is taken from the Missouri River alluvium by seven, 3 MGD vertical-drilled wells and/or one collector well consisting of seven horizontal-drilled wells, and containing three pumping units rated at 6 MGD each. The raw water travels from the well field to the 30mgd ground water treatment plant through two, 36-inch raw water lines.

The raw water enters the plant and an initial dose of chlorine is added for disinfection/oxidation. The water then moves through two mixing chambers where ferric, polymer, and carbon can be added to condition the water for removal of excess iron and manganese. The water then flows to any of 3 process clarifiers. At the point the water enters the clarifiers, slaked lime is added to raise the pH and reduce hardness. The clarifiers allow the precipitated minerals to settle for removal to lagoons located on the plant property. Prior to filtration, polyphosphate is added to sequester the remaining minerals. The water then proceeds to any of 6 dual-media filters, which have a rating of six MGD each. After filtration, additional chlorine is added with ammonia to create a chloramine for disinfection purposes. The water is then fluoridated and stored in a 1.5 mg below ground concrete clear well.

Meeting Phase 1 Demand - should not be a major issue if current demands do not change.
Meeting Total Commission Demand - I will have our Engineering Department evaluate and provide comments.

Preferred connection point would be at our Treatment Plant.

I am attaching a copy (pdf) of our most recent Consumer Confidence Report.
(See attached file: 2009 WQ Report.pdf)

Necessary Capital Improvements - requires further review

Capability to finance - May not be applicable depending upon Engineering comments from bullet point above.

Cost of water - See attached pdf of current rates.

(See attached file: 2982_001.pdf)

5 Year average of Wholesale Customers - not readily available.

Timeline to construct improvements - May not be applicable depending upon Engineering comments from bullet point above.

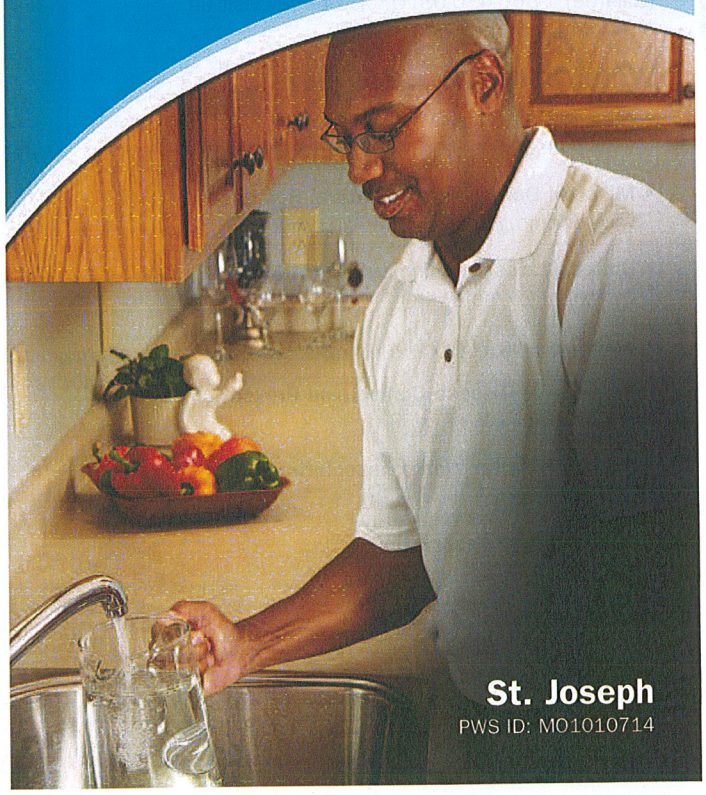
I hope this supplies you with enough information to proceed with study. If you need anything additional, please advise.

Thanks

Michael Wood
Operations Manager
Missouri American Water Company
Northwest Operations
3901 Beck Road, Suite B
St. Joseph, MO 64506
Office (816) 233-4000 Ext. 2222
Internal 7-412-2222
Cell (816) 262-5246
Home (816) 689-6306

2009 Annual Water Quality Report

MISSOURI AMERICAN WATER



St. Joseph
PWS ID: MO1010714

Este informe contiene información muy importante sobre su agua potable. Tradúzcalo o hable con alguien que lo entienda bien.

A Message from the Missouri American Water President

Missouri American Water is proud to be your local water company. Our lives revolve around water. It's in everything we do, everything we use. That's why it's important that we share with our customers information about our commitment to providing high-quality water service – a service you enjoy at about a penny a gallon.

I am pleased to provide you with the 2009 Annual Water Quality Report with detailed information about the source and quality of your drinking water. We have prepared this report using the data from water quality testing conducted for your local water system from January through December 2009. You'll find that we supply water that surpasses or meets all federal and state water quality regulations.

Just as important, we place a strong focus on acting as stewards of our environment. In Missouri, we participate in activities that help communities protect the watershed and educate customers on how to use water wisely. You can learn more about these programs on our website at www.missouriamwater.com.

Also in 2009, RWE Group sold its remaining shares of American Water stock, completing the divestiture of American Water from RWE Group. As a subsidiary of American Water, we are proud to celebrate this milestone.

At Missouri American Water, we deliver more than just water. We deliver a key resource for public health, fire protection, economic opportunity and the overall quality of life we enjoy. We also deliver value – our water service costs about a penny a gallon! It's part of our commitment to serve you and everyone in the community. For more information or for additional copies of this report, visit us online at www.missouriamwater.com or contact our Customer Service Center at 1-866-430-0820.

Sincerely,

Frank Kartmann
President
Missouri American Water

A+ WATER QUALITY FOR LESS THAN A PENNY

Did you know that you pay less than a penny for a gallon of your tap water?

Providing high-quality water service is our business. Our team of water quality experts and certified operators monitor your water from source to tap, and we have an exceptional track record when it comes to water quality. **Our compliance record for meeting or surpassing state and federal drinking water standards was 100 percent last year.** That beats the national average.

Tap water: an exceptional value!

WE CARE ABOUT WATER. IT'S WHAT WE DO.

What is a Water Quality Report?

To comply with state and U.S. Environmental Protection Agency (USEPA) regulations, Missouri American Water issues a report annually describing the quality of your drinking water. The purpose of this report is to raise your understanding of drinking water and awareness of the need to protect drinking water sources. In 2009, we conducted tests for hundreds of contaminants, all of which were below state and federal maximum allowable levels. This report provides an overview of last year's (2009) water quality. It includes details about where your water comes from and what it contains.

If you have any questions about this report or your drinking water, please call our Customer Service Center at (toll-free) 1-866-430-0820.

About Missouri American Water

Founded in 1886, American Water is the largest investor-owned U.S. water and wastewater utility company. With headquarters in Voorhees, N.J., the company employs more than 7,000 dedicated professionals who provide drinking water, wastewater and other related services to approximately 15 million people in 32 states and Ontario, Canada.

At Missouri American Water, and all of American Water, we work hard everyday to provide our customers with water they can enjoy and use with confidence.

Source Water Information

Missouri American Water supplies quality drinking water to more than 32,000 residential, commercial and industrial customers in the City of St. Joseph. The St. Joseph District also supplies water to four water districts and the neighboring cities of Elwood and Wathena, Kansas. The St. Joseph water treatment plant uses groundwater taken from numerous vertical wells and a horizontal collector well.

How to Contact Us

For more information regarding this report or any of the other services provided by Missouri American Water, please call our Customer Service Center at (toll-free) 1-866-430-0820, or you may visit us at www.missouriamwater.com.

Water Information Sources

- **Missouri American Water**
  www.missouriamwater.com
- **Missouri Department of Natural Resources**
  www.dnr.mo.gov
- **United States Environmental Protection Agency**
  www.epa.gov/safewater
- **Safe Drinking Water Hotline:** (800) 426-4791
- **Centers for Disease Control and Prevention**
  www.cdc.gov
- **American Water Works Association**
  www.awwa.org
- **Water Quality Association**
  www.wqa.org
- **National Library of Medicine/ National Institute of Health**
  www.nlm.nih.gov/medlineplus

Substances Expected to be in Drinking Water

The sources of drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs, and groundwater wells. As water travels over the surface of the land or through the ground, it dissolves naturally occurring minerals and, in some cases, radioactive material, and can pick up substances resulting from the presence of animals or from human activity.

Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk.

Contaminants that may be present in source water include:

Microbial Contaminants, such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife.

Inorganic Contaminants, such as salts and metals, which can be naturally occurring or may result from urban stormwater runoff, industrial or domestic wastewater discharges, oil and gas production, mining, or farming.

Pesticides and Herbicides, which may come from a variety of sources, such as agriculture, urban stormwater runoff, and residential uses.

Organic Chemical Contaminants, including synthetic and volatile organic chemicals, which are by-products of industrial processes and petroleum production, and can also come from gas stations, urban stormwater runoff, and septic systems.

Radioactive Contaminants, which can be naturally occurring or be the result of oil and gas production and mining activities.

For more information about the contaminants and potential health effects, call the USEPA's Safe Drinking Water Hotline at (800) 426-4791.

St. Joseph Water Treatment Facility Earns Special Recognition

The Missouri Department of Natural Resources honored Missouri American Water's St. Joseph Treatment Facility for successful completion of the Missouri Environmental Management Partnership Program (MEMP). The partnership encourages organizations to improve their environmental performance by developing and implementing an environmental management system (EMS). Missouri American Water is the first company in Missouri to receive this distinction. Environmental management is an integral part of Missouri American Water's operations. Achieving Advanced Partner status in the MEMP Program has allowed us to increase environmental awareness and reduce environmental risks. Missouri American Water's participation in this program is an example of the company's dedication to making environmental management a fundamental part of the business. As providers of high quality, affordable water, our responsibility is to not only protect one of our most precious resources but to improve the environment.

Special Health Information

Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants may be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. USEPA/CDC guidelines on appropriate means to lessen the risk of infection by *Cryptosporidium* and other microbial contaminants are available from the USEPA's Safe Drinking Water Hotline (800) 426-4791.

If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. Missouri American Water is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking. If you are concerned about lead in your water, you may wish to have your water tested. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline or at http://www.epa.gov/safewater/lead.

To ensure that tap water is of high quality, the USEPA prescribes regulations limiting the amount of certain substances in water provided by public water systems. U.S. Food and Drug Administration regulations establish limits for contaminants in bottled water, which must provide the same protection for public health. Missouri American Water's advanced water treatment processes are designed to reduce any such substances to levels well below any health concern.

How to Read This Table

Missouri American Water conducts extensive monitoring to ensure that your water meets all water quality standards. The results of our monitoring are reported in the following tables. While most monitoring was conducted in 2009, certain substances are monitored less than once per year because the levels do not change frequently. For help with interpreting this table, see the "Table Definitions" section.

Starting with a **Substance**, read across. **Year Sampled** is usually in 2009 or year prior. **MCL** shows the highest level of substance (contaminant) allowed. **MCLG** is the goal level for that substance (this may be lower than what is allowed). **Results** represents the measured amount (less is better). **Range** tells the highest and lowest amounts measured. A **Yes** under **Compliance Achieved** means the amount of the substance met government requirements. **Typical Source** tells where the substance usually originates.

Unregulated substances are measured, but maximum contaminant levels have not been established by the government.

Definitions of Terms Used in This Report

- **AL (Action Level)**: The concentration of a contaminant, which, if exceeded, triggers treatment or other requirements, which a water system must follow.
- **MCL (Maximum Contaminant Level)**: The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as feasible using the best available treatment technology.
- **MCLG (Maximum Contaminant Level Goal)**: The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety.
- **MRDL (Maximum Residual Disinfectant Level)**: The highest level of disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.
- **MRDLG (Maximum Residual Disinfectant Level Goal)**: The level of drinking water disinfectant below which there is no known or expected risk to health. MRDLGs do not reflect the benefits of the use of disinfectants to control microbial contamination.
- **NA**: Not applicable
- **ND**: Not detected
- **pCi/L (picocuries per liter)**: Measurement of the natural rate of disintegration of radioactive contaminants in water (also beta particles).
- **ppm (parts per million)**: One part substance per million parts water, or milligrams per liter.
- **ppb (parts per billion)**: One part substance per billion parts water, or micrograms per liter.

Water Quality Statement

We are pleased to report that during the past year, the water delivered to your home or business complied with all state and federal drinking water requirements. For your information, we have compiled a list in the table, showing what substances were detected in your drinking water during 2009. Although all of the substances listed below are under the Maximum Contaminant Level (MCL) set by the USEPA, we feel it is important that you know exactly what was detected and how much of the substance was present in the water. For additional information concerning our results, please contact our customer service department at (toll-free) 1-866-430-0820.

Monitoring was also done during 2008 and 2009 under the U.S. Environmental Protection Agency (USEPA) Unregulated Contaminant Monitoring Rule 2 (UCMR2). Data is available on the USEPA's web site (www.epa.gov/safewater/data/ucmrgetdata.html).

There are many unforeseen and unpredictable factors that may cause a source water to be contaminated. The Missouri Department of Natural Resources routinely monitors all public water supplies to ensure public health is protected. Source Water Assessments have been assembled by the Missouri Department of Natural Resources to evaluate the susceptibility of contamination to our drinking water sources. For more information about these assessments call the Missouri Department of Natural Resources at (800) 361-4827.

Water Quality Results

Regulated Substances (Measured on the Water Leaving the Treatment Facility)

Substance (units)	Year Sampled	MCL	MCLG	Results	Range Low-High	Compliance Achieved	Typical Source
Alpha emitters (pCi/L)	2008	15	0	2.4	1.5 - 3.9	Yes	Erosion of natural deposits
Barium (ppm)	2009	2	2	0.12	0.11 - 0.13	Yes	Discharge of drilling wastes; Discharge from metal refineries; Erosion of natural deposits
Chloramines (ppm)	2009	TT	NA	3.1	2.8 - 3.4	Yes	Water additive used to control microbes
Di(2-ethylhexyl)phthalate (ppb)	2009	6	0	0.4	ND - 1.1	Yes	Discharge from rubber and chemical factories
Fluoride (ppm)	2009	4	4	0.7	0.7 - 0.8	Yes	Erosion of natural deposits; Water additive which promotes strong teeth; Discharge from fertilizer and aluminum factories
Nitrate (as N) (ppm)	2009	10	10	0.05	0.03 - 0.07	Yes	Runoff from fertilizer use; Leaching from septic tanks, sewage; Erosion of natural deposits
Nitrite (as N) (ppm)	2009	1	1	0.01	0.01 - 0.01	Yes	Runoff from fertilizer use; Leaching from septic tanks, sewage; Erosion of natural deposits

Bacterial Results (from the Distribution System)

Substance (units)	Year Sampled	MCL	MCLG	Highest Percentage Detected	Compliance Achieved	Typical Source
Total Coliform Bacteria	2009	5% Pos. Samples	0	0	Yes	Naturally present in the environment

Other Compounds (Measured in the Distribution System)

Substance (units)	Year Sampled	MCL	MCLG	Results	Range Low-High	Compliance Achieved	Typical Source
Chloramines (ppm)	2009	MRDL = 4	MRDLG = 4	2.3	2.3 - 3.0	Yes	Water additive used to control microbes
TTHMs [Total trihalomethanes] (ppb)	2009	80	NA	4.1	2.0 - 4.9	Yes	By-product of drinking water disinfection
HAA5 [Haloacetic Acids] (ppb)	2009	60	NA	5.2	3.7 - 6.2	Yes	By-product of drinking water disinfection

Unregulated Substances (Measured on the Water Leaving the Treatment Facility)

Substance (units)	Year Sampled	Results	Range Low-High	Typical Source
Bromodichloromethane (ppb)	2009	1.1	ND - 1.8	By-product of disinfection
Chloroform (ppb)	2009	3.3	1.4 - 4.8	By-product of disinfection
Sulfate (ppm)	2009	112	94.2 - 145.7	Erosion of natural deposits

Tap Water Samples: Lead and Copper Results

Substance (units)	Year Sampled	Action Level	MCLG	Number of Samples	90th Percentile	Number of Samples Above Action Level	Typical Source
Copper (ppm)	2007	AL = 1.3	1.3	30	0.163	0	Corrosion of household plumbing systems; Erosion of natural deposits; Leaching from wood preservatives
Lead (ppb)	2007	AL = 15	0	30	4.0	0	Corrosion of household plumbing systems; Erosion of natural deposits

Missouri-American Water Company
Name of Issuing Corporation

For City of St. Joseph and Vicinity Areas Only
Community, Town or City

CLASSIFICATION OF SERVICE
GENERAL WATER SERVICE

Availability

Available for any metered customer located on Company mains suitable for supplying the service requested.

Rate

Billing Rate as follows:

Water Usage – 1,000 Gallons – Rate per 1,000 Gallons Per Month

		Residential	Commercial	Industrial	Public Authority	Sale For Resale	
For the first	100	$ 4.2705	$4.2794	$6.2732	$ 4.2794	$ 4.2794	+
For the next	1,900	4.2705	3.3234	3.5141	3.3234	3.3234	+
For the next	3,000	4.2705	2.7691	2.1196	2.7691	2.7691	+
For all over	5,000	4.2705	1.8886	1.7316	1.8886	1.8886	+

Water Usage – CCF – Rate per CCF

For the first	134	$ 3.2029	$ 3.2096	$4.7049	$3.2096	$3.2096	+
For the next	2,533	3.2029	2.4925	2.6356	2.4925	2.4925	+
For the next	4,000	3.2029	2.0768	1.5897	2.0768	2.0768	+
For all over	6,667	3.2029	1.4164	1.2987	1.4164	1.4164	+

Monthly Minimum Charge

Meter Size	Per Month	Meter Size	Per Month	
5/8"	$ 9.26	4"	$ 128.45	+
3/4"	11.85	6"	252.50	+
1"	16.80	8"	401.35	+
1 1/2"	29.22	10"	681.79	+
2"	44.11	12"	1,124.62	+
3"	78.85			+

These rates do not include any municipal, state or federal taxes computed on either billing or consumption basis. Any such taxes applicable shall be added as separate items in rendering each bill.

Billing

Bills for water service will be distributed on a monthly basis. The due date on the tariff shall be ten (10) days after the "date of rendition" of the bill to the customer. The customer's bill will be due and payable after this due date. The delinquent date printed on the bill will not be less than twenty-one (21) days after the date of the postmark of the bill. Any accounts remaining unpaid at the expiration of twenty-one (21) days shall be considered delinquent and the Company may take such action as specified in its filed rules and regulations.

* Indicates new rate or text
\+ Indicates change

DATE OF ISSUE: June 18, 2010

DATE OF EFFECTIVE: July 1, 2010

ISSUED BY: Frank Kartmann, President
727 Craig Road, St. Louis, MO 63141

BARTLETT & WEST

SERVICE. THE BARTLETT & WEST WAY.

January 24, 2011

Ms. Sarah A. Stewart, P.E.
CDM, Inc.
9200 Ward Parkway, Ste. 500
Kansas City, MO 64114

Subject: Re: Request for Proposals to Supply Potable Water to Great Northwest Wholesale Water Commission

Dear Ms. Stewart:

The following are responses to your January 6th, 2011, request:

- The initial phase of construction is under design and scheduled to go on line in mid 2013. The initial phase will have a firm capacity of 2.5 million gallons per day (MGD). The site was selected to allow for future expansions to a total capacity of 10 MGD. Of this total, approximately 4 MGD is planned to be held in reserve for the Atchison County area. The remaining 6 MGD is potentially available for sale to the Great Northwest Wholesale Water Commission.
- The residual disinfectant used by the plant will be chloramines.
- The supply will come from nearby alluvial wells and the treatment process will include aerations, lime softening, pH adjustment and filtration.
- All of the initial phase capacity is slated for existing members of the Atchison County Wholesale Water Commission (ACWWC). Providing water to the Great NW Wholesale Water Commission would require additional construction in well, treatment and transmission systems.
- A copy of the 2010 Community Confidence Report cannot be included since there was no water treatment conducted in 2010.
- Financing any future improvements will be considered on a case by case basis.
- The wholesale rate would depend on agreed upon financing terms, up front contributions and the level of grants available from the federal government. Following is an estimate using the November 2008 Facility Plant rate estimates (Table 9.5) and these assumptions:
    - No grant funds.
    - Construction of wells and treatment similar to the project under design.
    - Similar financing terms as indicated in Table 9.5.
    - Similar reserve practices as indicated in Table 9.5.
    - A population served that fully uses the contracted supply. The numbers shown in the first scenario of Table 9.5 anticipates expansion in the local water district and customers in Atchison County by a factor of 5,076/2,157 or 2.35. The resulting wholesale rate for 5,000 gallons is $64 per month or $12.80 per thousand gallons.
    - Total project costs for supply and plant, excluding transmission is 73% ((22-6)/22) of the loan indicated in Table 9.5.

250 NE TUDOR ROAD ■ LEE'S SUMMIT MO 64086-5696
816.525.3562 ■ FAX 816.525.9041 ■ 866.869.8030
WWW.BARTWEST.COM

- Maximum supply is 6 MGD.

The resulting calculation is: $12.80 per thousand gallons x 73% / 2.35 = $3.98 per thousand gallons or approximately $4.00 per thousand gallons. These numbers should be escalated to account for inflation since November 2008.

If you have any further questions, please contact me.

Sincerely,

Bruce Hattig, P.E.

cc: Kyra Mills, Chairperson, Atchison County Wholesale Water Commission

Drinking Water Facilities Plan

Water Treatment Plant Improvements

City of Savannah, Missouri

By

BARTLETT & WEST
SERVICE. THE BARTLETT & WEST WAY.
3110 KARNES ROAD • ST JOSEPH MO 64506
816.364.3551 • FAX 816.364.6548 • 888.863.5844
WWW.BARTWEST.COM

City Contact	Engineer Contact
Mike Fischer, City Administrator City Hall 402 Court Street Savannah, MO 64485 Ph 816-324-3315	Casey Patton Bartlett & West 3110 Karnes Rd, St Joseph, MO 64506 Ph 816-364-3551

Only relevant portions of this Drinking Water Facilities Plan are included for reference to the Stage 1 Pipeline PER.

Introduction

This study was commissioned by the City of Savannah, Missouri in an effort to develop a long-term plan for improving the efficient use and expansion of their water treatment plant and related facilities. Specifically the City identified three areas of concern for evaluation within the study to assist them in addressing their long-term planning needs. Those areas and their corresponding divisions within the study are as follows:

- **PART I - EXPANSION OF THE WATER TREATMENT FACILITY**

  Develop a facility plan for expansion of their water treatment plant (WTP) in order to provide future service to wholesale water customers and support growth of the City.

- **PART IIA - ALTERNATE WIND ENERGY SOURCE**

  Review the potential costs and related benefits for developing an alternate wind energy source.

- **PART IIB -METHODS OF ENERGY CONSERVATION**

  Review methods of energy conservation within current operations that would lower their electrical costs.

- **PART III - CHLORINE VERSUS CHLORAMINE**

  Address the issues related to the use of free chlorine versus chloramines as it relates to potential service to wholesale customers and the City service. Review the efficiencies of current disinfection operations and areas for improvement.

In each section of this study, a number of alternatives were considered and the benefits and costs evaluated. Upon evaluation, recommendations are made to assist the City in moving forward.

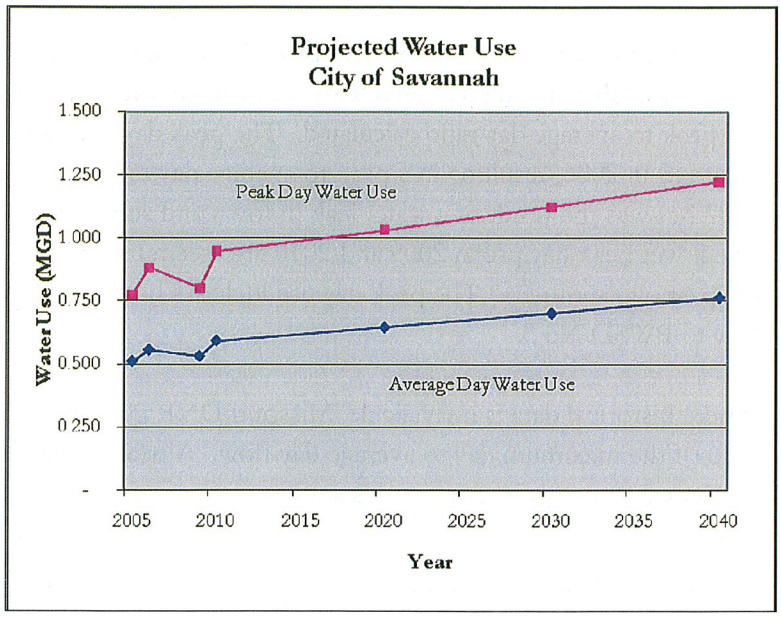
Year	Average Day Use *	Peak Day Use **	Ratio of Peak to Avg. Day Use
2004	412,816	620,000	1.50
2005	510,444	774,000	1.52
2006	556,016	881,000	1.58
2007	575,315	1,003,000	1.74
2008	533,205		
2009	530,174	800,000	1.51
2010	552,165	793,000	1.44

**Total water use and the peak to average day ratio includes both Savannah municipal water use and water sold to Public Water Supply District No.3 (PWSD No 3) of Andrew County.*
*** Peak Day in 2007 is high due to a leak in the system, no data is available for 2008.*

While the City meters water use at each household within town, this information was not readily available to compare with metered use at the water treatment plant. However the per capita-day water use is consistent with other towns the size of Savannah. As such, we would anticipate the unaccounted for water use, as a percent of the total demand to be approximately 10%. Unaccounted for water use reflects water loss due to backwashing, fighting fires, flushing mains and hydrants, system leaks and repairs, and unmetered parks, swimming pools, or other public facilities. There are 2,061 household meters within the City and the City is currently implementing a program to replace each meter with a wireless read system to further track and reduce water loss.

Water Use Projections

The following table and graph are provided showing the current and future water use projections for the City of Savannah and Andrew County PWS District No 3. As indicated, water use projections are determined using the estimates of population growth presented earlier in this study, a water use rate of 95 gallons per capita-day and a peaking factor of 1.60. Water use projections similar to population projections are for the 30-year study period.



Population and Water Use Projections City of Savannah, Missouri			
Year	City Population	Avg.Day Water Use MGD	Peak Day Water Use MGD
2005	4,812	0.510	0.77
2006	5,002	0.556	0.88
2009	5,107	0.530	0.80
2010	5,150	0.563	0.90
2020	5,605	0.612	0.98
2030	6,100	0.666	1.07
2040	6,639	0.725	1.16

Wholesale Water Use and Sales

As indicated, the City currently sells water to PWSD No 3 of Andrew County and has done so since November of 2004. The interconnection is located west of town near the old treatment plant and the intersection of highway 71 and County Road 427. Sales to their system are metered at the point of connection and for the purposes of this study will be estimated at about 15% of water used or 81,000 gallons per day. The City is currently renegotiating a new purchase agreement with PWSD No 3.

Informally, the City of Savannah has also discussed the potential of interconnection and selling water to Andrew County PWSD 1. Their estimated water use, as documented in a letter in 2007 (see Appendix), indicates a current peak day of 900,000 gallons per day and a future peak day of 1.4 MGD. In the fall of 2008, the City of Savannah also voted and agreed to join the Great Northwest Wholesale Water Commission (GNWWC) and has since been active in participating in planning sessions and hosting the regional meetings.

V. Discussion of Alternatives

For this study, three different WTP expansion levels or alternatives were considered and evaluated for feasibility and planning purposes. Depending on the growth and development of other regional systems in proximity to the City of Savannah, these expansion alternatives may also be considered in phases. A brief description of each alternative is provided below along with a comparison of the additional system capacity and demand.

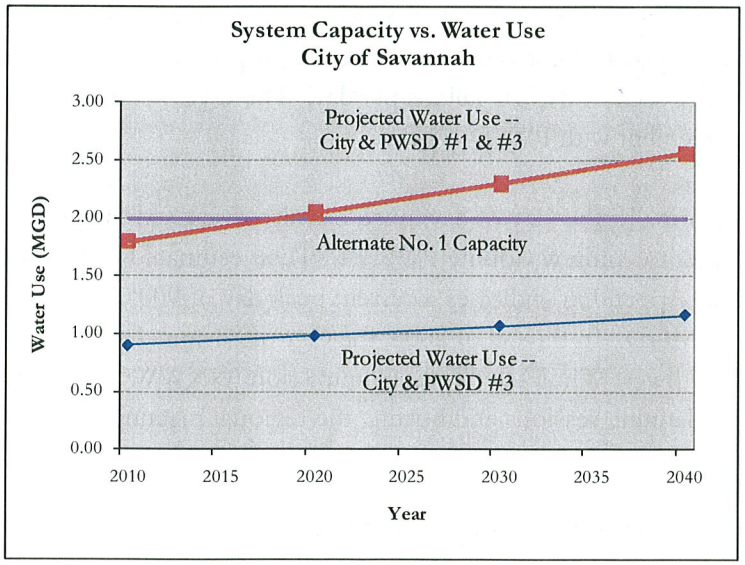
Alternate No. 1

This alternate considers the improvements needed within the system to maximize the use of their current treatment plant and related facilities with a minimum amount of capital expenditure. The improvements of this alternate requires increasing the system run time during peak conditions to 22 hours per day along with the following proposed capital improvements. The current treatment process, depending on water use and other system variables has a run time of 6-10 hours.

- Well Field/Raw Water Line --In an effort to increase the firm capacity at the well field and not to stress the existing wells which are all hydraulically connected, a third well in the area already test drilled is proposed along with the approximately one mile of connecting raw water line.

- WTP Improvements – Little physical expansion of the WTP is anticipated however the addition of a third high service pump (HSP) is proposed and added staff and maintenance expenses are anticipated with the added system run time.

As can be seen in the adjoining chart, the proposed improvements under Alternate No. 1 meet the current and future demand needs of the City and their current wholesale user PWSD No 3, to the year 2040 and beyond. In addition, the proposed improvements provide excess capacity of nearly 1.0 MGD and enable the City to add a large wholesale user with similar water use requirements of Andrew County PWSD #1. However, while initially meeting those demands, further expansion of the system would likely be required within a few years depending on growth and their final demand requirements.



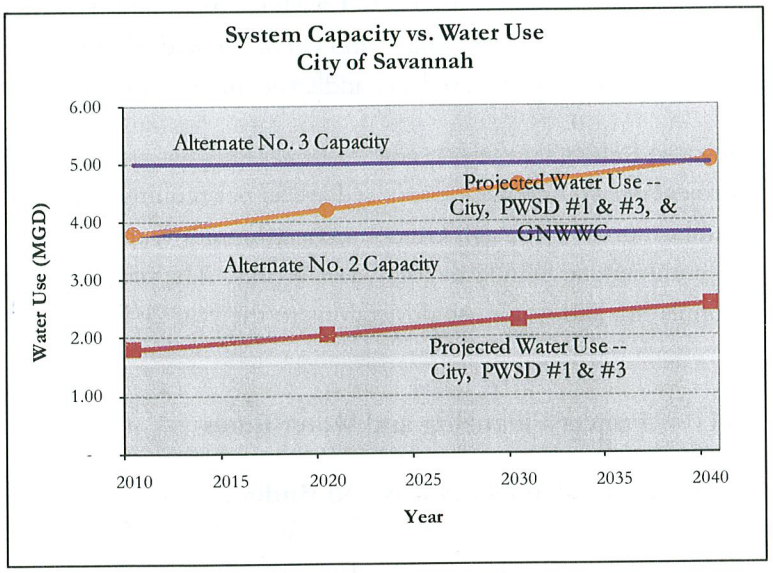
Alternate No. 2

This expansion alternative addresses the system improvements that are needed to meet the water use of a wholesale customer equivalent to the size of PWSD No 1 of Andrew County in the year 2040. Those demands are estimated at 900,000 gpd for their current peak day use and 1.4 MGD for future peak day demand. The expansion effort in this scenario will require increasing the size and capacity of the major system components to 3.5 to 4.0 MGD. Specifically the improvements needed are as follows.

- Well Field/Raw Water Line –In addition to adding a fourth well as indicated above, a fifth well is proposed such that the peak day demand can be met with the largest well of the five wells out of service.

- WTP /Clearwell Improvements – As indicated above, this alternative would require expansion of major system components. In addition to chemical feed expansions, a two new solids contact basins and three or four additional filter cells would be required, depending on filter arrangement and design criteria. Additionally, clearwell capacity would likely need to be doubled at this stage, resulting in an overall cost of WTP & clearwell improvements of approximately $4,060,000.

The adjoining chart compares the system capacity developed with Alternate No. 2 and Alternate No. 3 with potential water use.



Alternate No. 3

In this alternative, consideration was given to expansion of the treatment facilities and well field to meet a larger regional wholesale user such as the GNWWC. The projected system capacity for this alternate is estimated at 5.0 MGD. This is sufficient to meet projected water use needs for the City of Savannah and potential wholesale users Andrew County PWSD No. 1 and No. 3 with an additional 2.0 to 2.5 MGD dedicated to serving the regional needs of the Great Northwest Wholesale Water Commission GNWWC.

While it may be feasible to expand facilities beyond the limits of Alternate 3, additional effort beyond the scope of this study is needed to project that capacity. One constraint, without completing additional exploration and test pumping, is projecting the yield and development of new wells. For the purposes of this study, it is estimated that three new wells similar to the test well in 2004 can be developed. Other possible constraints include the availability of land at the WTP site for lime sludge lagoons and ready reconfiguration of the piping at the treatment facilities.

In addition to the three wells, the improvements of Alternate No. 3 include construction of new raw water pipeline, additional clearwell capacity, and a new 3.0 MGD treatment train; including solids contact basins, multi-media rapid rate filters, waste residuals handling and associated chemical feed equipment.

- Well Field/Raw Water Line – Approximately $1,680,000 of improvements, including construction of three new 1,200 gpm wells and approximately 5 miles of 18" diameter raw water transmission pipeline.

- WTP Improvements – Approximately $5,180,000 of improvements, including construction of two new 1.5 MGD treatment trains, each consisting of a solids contact basin, rapid rate filters, and chemical feed equipment. Also included are additional waste lagoons as required to handle the increased treatment residuals.

Project Criteria
Project design criteria as proposed are as per requirements for distribution systems, MoDNR Publication 417 -Design Guide for Community Water Systems and the 10 State Standards – Recommended Standards for Water Works. The project design period is 30 years with population and water use projections to the year 2040.

VI. Project Financing and Water Rates

City's Current Indebtedness and Budget
As part of the improvements in 2005 and 2006, the City issued 20-year revenue bonds for approximately 8 million in loans to construct the water system improvements. In 2009-2010, the debt service payment on the principle and interest of the bonds was $699,000 or about 45% of the City budget of approximately 1.5 million. The debt service is slated to increase by approximately $10,000 per year for the next 15 years before finally decreasing for eight years before the final two payments.

A summary of the current City water budget and an estimate of associated revenues from both bulk and metered sales are provided below.

VII. Project Budget with O & M Costs

Life Cycle Costs and Comparison of Alternatives

For each of the proposed alternates or level of expansion, capital costs were estimated and life cycle costs were developed. These life cycle costs are summarized below and include a comparison of the debt service, annual operating and maintenance (O & M) expenses, along with funds for long-term replacement and reserves. Annual operating costs include both the fixed and variable costs, the latter comprised of mostly chemical and electrical expenses.

Summary of Life Cycle Costs and Comparison of Alternatives	Current Budget	Alternate 1	Alternate 2	Alternate 3
Water Use and Plant Capacity				
Estimated Annual Water Use (X 1000gal)	197,465	410,692	410,692	866,942
City Annual Sales (X 1000gal)	167,845	174,572	174,572	174,572
Bulk Annual Sales (X 1000gal)	29,620	236,119	236,119	692,369
System Capacity	1.0 MGD	2.0 MGD	3.8 MGD	5.0 MGD
Capital Cost Summary				
Well Field/Raw Water Line	$0	$260,000	$490,000	$1,680,000
WTP Improvements	$0	$120,000	$4,060,000	$5,180,000
Total New Capital Costs	**$0**	**$380,000**	**$4,550,000**	**$6,860,000**
Annual Expenses & Production Costs				
Annual Debt Service				
New Improvements Debt Service	$0	$30,094	$360,336	$543,276
Current Annual Debt Service (P & I)	$699,000	$799,000	$799,000	$799,000
Total Annual Debt Service	$699,000	$829,094	$1,159,336	$1,342,276
Admin Costs				
City Annual Retail/Admin Costs	$220,800	$220,800	$220,800	$220,800
Annual Operating Costs				
Fixed Operating Costs	$337,200	$437,200	$660,000	$760,000
Variable Operating Costs, ($0.93/kgal)	$183,000	$382,000	$382,000	$806,000
Subtotal	$520,200	$819,200	$1,042,000	$1,566,000
Rehab/Reserve, Existiing Facilities	$92,000	$92,000	$92,000	$92,000
Rehab/Reserves, New Improvements	$0	$15,047	$180,168	$271,638
Annual Operating Costs	$612,200	$926,247	$1,314,168	$1,929,638
Total Annual Expenses	**$1,532,000**	**$1,976,141**	**$2,694,304**	**$3,492,713**
Unit Price Cost Comparison				
Cost of Debt Service ($/kgal)	$3.54	$2.02	$2.82	$1.55
Cost of Operation ($/kgal)	$3.10	$2.26	$3.20	$2.23
*Total Production Cost ($/kgal)	$6.64	$4.27	$6.02	$3.77
* Excludes City Admin Costs				

The production costs as tabulated above include both the debt service and operating costs divided by the projected annual water sales. It does not include the City administration and billing costs. The unit price cost comparison of production costs is intended as a tool to evaluate the economic feasibility of the different alternatives.

Capacity Charge

As an alternate to charging bulk users their debt service charge in their water bill, the City may consider providing bulk users the option of a lump sum capacity charge. This capacity charge allows the bulk user, based on their projected peak demand to "purchase" treatment and source capacity from the City. This defines the maximum allowable water use in their User Agreement and allows the bulk user to seek alternate forms of financing their share of the debt service.

The advantage of this approach is it recognizes that some bulk users may have access to better loan terms or even be able to secure grants for which the City of Savannah may not be eligible or be able to access. In this approach the basis for the bulk user's water rates are the operating costs and the perimeters for this calculation are mutually agreed upon prior to connection.

VIII. Conclusions and Recommendations

Maximize Existing Facility

As a first step in improving efficiencies, the City should consider maximizing the use of their existing treatment plant by increasing run times and securing additional bulk water sales. With rather small capital expenditures at the well field and high service pumps, the City could significantly increase production and sell the excess to a large wholesale user. This would spread the debt service and fixed operating costs over a larger number of users and resulting in lower production costs.

Important in adding a new large wholesale user will be the wording of the agreement to protect and enable the City to manage future system growth. As noted by the higher operating and debt service unit costs for Alternate No. 2, an expansion of facilities must be carefully phased with added demand to maintain these efficiencies and cost savings.

Expansion of the Treatment Plant

The efficiencies of expanding and operating a larger system will, in the long-term, have an impact on lowering the City's production costs on a unit price basis. This is due to the efficiencies of operating a larger treatment facility as well as having a larger number of users participating in the system operating costs and repayment of debt service. The most cost efficient expansion is the larger 5.0 MGD facility that allows Savannah to serve the local wholesale users as well as the Great Northwest Wholesale Water Commission (GNWWC).

Recover Production Costs

It is important to note that the success of any future expansion of facilities is contingent on the City negotiating a rate for their bulk water sales that covers their cost of production and debt service for capital expenses as well as contributing to the equipment reserve and replacement fund. In all of the alternates outlined in this study, the average water bill in the City would be negatively impacted if these costs are not shared by all the users.

the City. As such, the change from chlorine to chloramines to reduce DBPs provides little advantage for the City users. The change already outlined is also complex, with the potential for nitrification and biofilm formation. This would be true not only for the City distribution system but also for their current wholesale user Andrew County PWSD No. 3.

While switching to chloramines would extend the residual within the distribution system, the current use of free chlorine has worked well for the City, allowing them to maintain a consistent residual within their distribution system, despite the shorter residual time of free chlorine.

Finally, because the City must continue to use free chlorine as the primary disinfectant at their treatment plant the addition of another disinfectant at the treatment facility will add costs and complexity to the operation.

Recommended Alternative

It is recommended that the City consider each potential wholesale user on a case by case basis. If a new wholesale user requires the addition of chloramines for secondary disinfection in their system, the injection point can be provided at the master meter location. The cost increase for adding a liquid chlorine and ammonia injection system at a master meter pit location is estimated at about $70,000. This would include a 6 x 10 foot building, free and total chlorine analyzers, metering and chemical feed equipment, and a 100-200 gallon mixing tank with palletized dry chemical storage area. Depending on flows required, a gas chlorination system may prove to be more economical, though it would likely require a larger building and initial capital costs would be closer to $125,000. However depending on the chlorine residual and output requirements, chemical costs for a liquid chlorine system would be about $0.05 per thousand gallons while chemical costs for a gas system would be less than half that amount. The City could have the new wholesale user pay for this as part of the connection fee and also make them responsible of the operation and maintenance of the new facility.

VI. Secondary Disinfection's Point of Injection

Currently the third injection site for the chlorine gas is located between the filters and the clearwell. The purpose of this chlorine injection location is to provide both primary disinfection, 4-log virus removal/inactivation, and secondary disinfection, maintaining a residual in the distribution system. Typically, the primary disinfection is located downstream of the filters to help reduce DBP formation and the secondary disinfection would be provided as the water enters the distribution system, if needed. If a secondary disinfectant system is considered to be a benefit for the distribution system then the injection point should be located between the ground storage reservoir and the high service pumps.

VII. Conclusions

Appendix D

Cost Options

Date: 26 April 2011
By: Molly Pesce
Checked: Bruce Hattig
Re: 16164.010 Great NW Phase IV, Overall System Total Cost

Revised to add storage to the suction side of the Pump Station near Missouri American's WTP. One storage unit is assumed for Stage I and a second is assumed for Stage II.

Assumptions & Givens:

Kansas City Construction Cost Index (KC CCI) Value for Dec. 2010 =	10410.12
KC CCI Value for March 2009 =	9667.81
KC CCI Value for Dec. 2001 =	6477.21

Opinion of Probable Construction Costs (OPCC) Pipeline[2]

Diameter	Length (feet)	Unit Cost (per linear foot)[1]	Extension
4	58,700	$ 20.00	$ 1,180,000
6	27,300	$ 27.00	$ 740,000
8	208,300	$ 39.00	$ 8,130,000
12	424,400	$ 60.00	$ 25,470,000
16	148,700	$ 81.00	$ 12,050,000
20	244,800	$ 101.00	$ 24,730,000
24	136,200	$ 121.00	$ 16,490,000
30	1,900	$ 151.00	$ 286,900.00
		Total	$ 89,080,000

1) Notes: Unit prices include design, material, installation and land.

2) Notes: Pipe lengths were rounded to the nearest 100, unit cost per foot were rounded to nearest dollar and every subtotal was rounded up to the nearest $10,000.

Date: 26 April 2011
By: Molly Pesce
Checked: Bruce Hattig
Re: 16164.010 Great NW Phase IV, Overall System Total Cost

OPCC Elevated Water Storage Tanks/Stand Pipes			
Tank ID	Height (feet)	Volume (x1000 gal)	Extension[1]
1	140	400	$ 970,000
2	63	200	$ 550,000
3	50	30	$ 330,000
4	100	750	$ 1,240,000
Clearwell	**--**	***900***	***$ 1,800,000***
Clearwell	**--**	***600***	***$ 1,200,000***
		Total	$ 6,090,000

OPCC Pump Stations/Flow Control						
Pump Station ID	Flow (gal/min)	Flow (MGD)	Head	Total HP	Number of Pumps	Extension[1]
1	6,945	13.50	430	1150	5	$ 2,850,000
2	2,775	4.00	362	400	3	$ 1,150,000
3	350	0.50	143	50	2	$ 350,000
Flow Control Structure	--	--	--	--	--	$ 80,000
					Total	$ 4,430,000

Total Cost Summary	
Construction, Land & Engineering	$ 99,600,000
Legal & Financial (5%)	$ 4,980,000
Contingency & Inflation (20%)	$ 19,920,000
Total	$ 124,500,000

Date: 26 April 2011
By: Molly Pesce
Checked: Bruce Hattig
Re: 16164.010 Great NW Phase IV, Stage 2 Total Cost

Revised to add storage to the suction side of the Pump Station near Missouri American's WTP. One storage unit is assumed for Stage II.

Assumptions & Givens:

Kansas City Construction Cost Index (KC CCI) Value for Dec. 2010 =	10410.12
KC CCI Value for March 2009 =	9667.81
KC CCI Value for Dec. 2001 =	6477.21

Opinion of Probable Construction Costs (OPCC) Pipeline[2]

Diameter	Length (feet)	Unit Cost (per linear foot)[1]	Extension
8	51300	$ 39.00	$ 2,010,000
12	2200	$ 60.00	$ 140,000
16	95700	$ 81.00	$ 7,760,000
20	171800	$ 101.00	$ 17,360,000
24	48600	$ 121.00	$ 5,890,000
30	1900	$ 151.00	$ 286,900.00
		Total	$ 33,450,000

1) Notes: Unit prices include design, material, installation and land.

2) Notes: Pipe lengths were rounded to the nearest 100, unit cost per foot were rounded to nearest dollar and every subtotal was rounded up to the nearest $10,000.

OPCC Elevated Water Storage Tanks/Stand Pipes

Tank ID	Height (feet)	Volume (x1000 gal)	Extension[1]
Clearwell	--	***600***	***$ 1,200,000***
1	100	750	$ 1,240,000
		Total	$ 2,440,000

Date: 26 April 2011
By: Molly Pesce
Checked: Bruce Hattig
Re: 16164.010 Great NW Phase IV, Stage 2 Total Cost

OPCC Pump Stations/Flow Control						
Pump Station ID	Flow (gal/min)	Flow (MGD)	Head	Total HP	Number of Pumps	Extension[1]
1	2775	4.00	88	100	2	$ 460,000
2	2775	4.00	362	400	3	$ 1,150,000
					Total	$ 1,610,000

Total Cost Summary		
Construction, Land & Engineering	$	37,500,000
Legal & Financial (5%)	$	1,880,000
Contingency & Inflation (20%)	$	7,500,000
Total	$	46,880,000

Date: 7 March 2011
By: Molly Pesce
Checked: Bruce Hattig
Re: 16164.010 Great NW Phase IV, Stage 3a Total Cost

Assumptions & Givens:

Kansas City Construction Cost Index (KC CCI) Value for Dec. 2010 =	10410.12
KC CCI Value for March 2009 =	9667.81
KC CCI Value for Dec. 2001 =	6477.21

Opinion of Probable Construction Costs (OPCC) Pipeline[2]			
Diameter	Length (feet)	Unit Cost (per linear foot)[1]	Extension
12	91,300	$ 60.00	$ 5,480,000
		Total	$ 5,480,000

1) Notes: Unit prices include design, material, installation and land.

2) Notes: Pipe lengths were rounded to the nearest 100, unit cost per foot were rounded to nearest dollar and every subtotal was rounded up to the nearest $10,000.

Total Cost Summary	
Construction, Land & Engineering	$ 5,480,000
Legal & Financial (5%)	$ 280,000
Contingency & Inflation (20%)	$ 1,100,000
Total	$ 6,860,000

Date: 7 March 2011
By: Molly Pesce
Checked: Bruce Hattig
Re: 16164.010 Great NW Phase IV, Stage 3b Total Cost

Assumptions & Givens:

Kansas City Construction Cost Index (KC CCI) Value for Dec. 2010 =	10410.12
KC CCI Value for March 2009 =	9667.81
KC CCI Value for Dec. 2001 =	6477.21

Opinion of Probable Construction Costs (OPCC) Pipeline			
Diameter	Length (feet)	Unit Cost (per linear foot)[1]	Extension
4	58,700	$ 20.00	$ 1,180,000
		Total	$ 1,180,000

1) Notes: Unit prices include design, material, installation and land.

2) Notes: Pipe lengths were rounded to the nearest 100, unit cost per foot were rounded to nearest dollar and every subtotal was rounded up to the nearest $10,000.

Total Cost Summary	
Construction, Land & Engineering	$ 1,180,000
Legal & Financial (5%)	$ 60,000
Contingency & Inflation (20%)	$ 240,000
Total	$ 1,480,000

Date: 7 March 2011
By: Molly Pesce
Checked: Bruce Hattig
Re: 16164.010 Great NW Phase IV, Stage 3c Total Cost

Assumptions & Givens:

Kansas City Construction Cost Index (KC CCI) Value for Dec. 2010 =	10410.12
KC CCI Value for March 2009 =	9667.81
KC CCI Value for Dec. 2001 =	6477.21

Opinion of Probable Construction Costs (OPCC) Pipeline[2]			
Diameter	Length (feet)	Unit Cost (per linear foot)[1]	Extension
8	53,400	$ 39.00	$ 2,090,000
		Total	$ 2,090,000

1) Notes: Unit prices include design, material, installation and land.

2) Notes: Pipe lengths were rounded to the nearest 100, unit cost per foot were rounded to nearest dollar and every subtotal was rounded up to the nearest $10,000.

Total Cost Summary	
Construction, Land & Engineering	$ 2,090,000
Legal & Financial (5%)	$ 110,000
Contingency & Inflation (20%)	$ 420,000
Total	$ 2,620,000

Date: 7 March 2011
By: Molly Pesce
Checked: Bruce Hattig
Re: 16164.010 Great NW Phase IV, Stage 4 Total Cost

Assumptions & Givens:

Kansas City Construction Cost Index (KC CCI) Value for Dec. 2010 =	10410.12
KC CCI Value for March 2009 =	9667.81
KC CCI Value for Dec. 2001 =	6477.21

Opinion of Probable Construction Costs (OPCC) Pipeline[2]			
Diameter	Length (feet)	Unit Cost (per linear foot)[1]	Extension
8	91500	$ 39.00	$ 3,570,000
		Total	$ 3,570,000

1) Notes: Unit prices include design, material, installation and land.

2) Notes: Pipe lengths were rounded to the nearest 100, unit cost per foot were rounded to nearest dollar and every subtotal was rounded up to the nearest $10,000.

OPCC Elevated Water Storage Tanks/Stand Pipes			
Tank ID	Height (feet)	Volume (x1000 gal)	Extension[1]
1	50	30	$ 330,000
		Total	$ 330,000

OPCC Pump Stations/Flow Control						
Pump Station ID	Flow (gal/min)	Flow (MGD)	Head	Total HP	Number of Pumps	Extension[1]
1	350	0.50	143	50	2	$ 350,000
					Total	$ 350,000

Date: 7 March 2011
By: Molly Pesce
Checked: Bruce Hattig
Re: 16164.010 Great NW Phase IV, Stage 4 Total Cost

Total Cost Summary		
Construction, Land & Engineering	$	4,250,000
Legal & Financial (5%)	$	220,000
Contingency & Inflation (20%)	$	850,000
Total	$	5,320,000