

**City of St. Joseph, Missouri**  
**Facilities Plan**

**Technical Memorandum No. TM-WW-9**  
**Site Considerations, Utility**  
**Improvements, and Ancillary Facilities**



**By**



Work Order No. 09-001  
B&V Project 163509

July 12, 2010

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## **Site Considerations, Utility Improvements, and Ancillary Facilities**

### **1.0 Executive Summary**

This technical memorandum documents work performed under Phase 330G of the Wastewater Facilities Plan – Site Considerations, Utility Improvements, and Ancillary Facilities. The objectives of this memorandum include:

- Develop an overall site figure that shows the footprint of proposed and future facilities based on recommendations in the technical memoranda.
- Conceptually evaluate existing utilities including power feeds, site power distribution, backup power, gas, water, nonpotable water, fiber, and telephone to support recommended facilities.
- Provide conceptual costs for any necessary upgrades to existing utility systems.
- Review with City staff the condition and capacity of support facilities including the administration and maintenance buildings.
- Provide conceptual costs for any necessary upgrades to support facilities.

Improvements are recommended within the Facilities Plan to upgrade the existing Water Protection Facility (WPF) treatment capabilities and reduce combined sewer overflows (CSOs) from the combined sewer system. The following projects were recommended at the WPF as part of the Wastewater Facilities Assessment or Phase IA of the CSO Control Facilities Assessment:

- 88 million gallons per day (mgd) screening and grit removal facility
- Ammonia removal facilities (new industrial clarifier, new waste activated sludge (WAS)/returned activated sludge (RAS) pump station, and addition of diffusers to domestic activated sludge basins)
- 61 mgd high rate treatment (HRT) facility (compressible media filter building and blower building)
- 108 mgd ultraviolet (UV) disinfection facility

- 108 mgd effluent pump station and outfall

The following projects were recommended at the WPF as part of Phase II of the CSO Control Facilities Assessment:

- Deep tunnel screening and grit shaft for 20 foot diameter, 23,000 foot long, 54 million gallon (MG) deep storage tunnel
- 61 mgd deep tunnel pump station

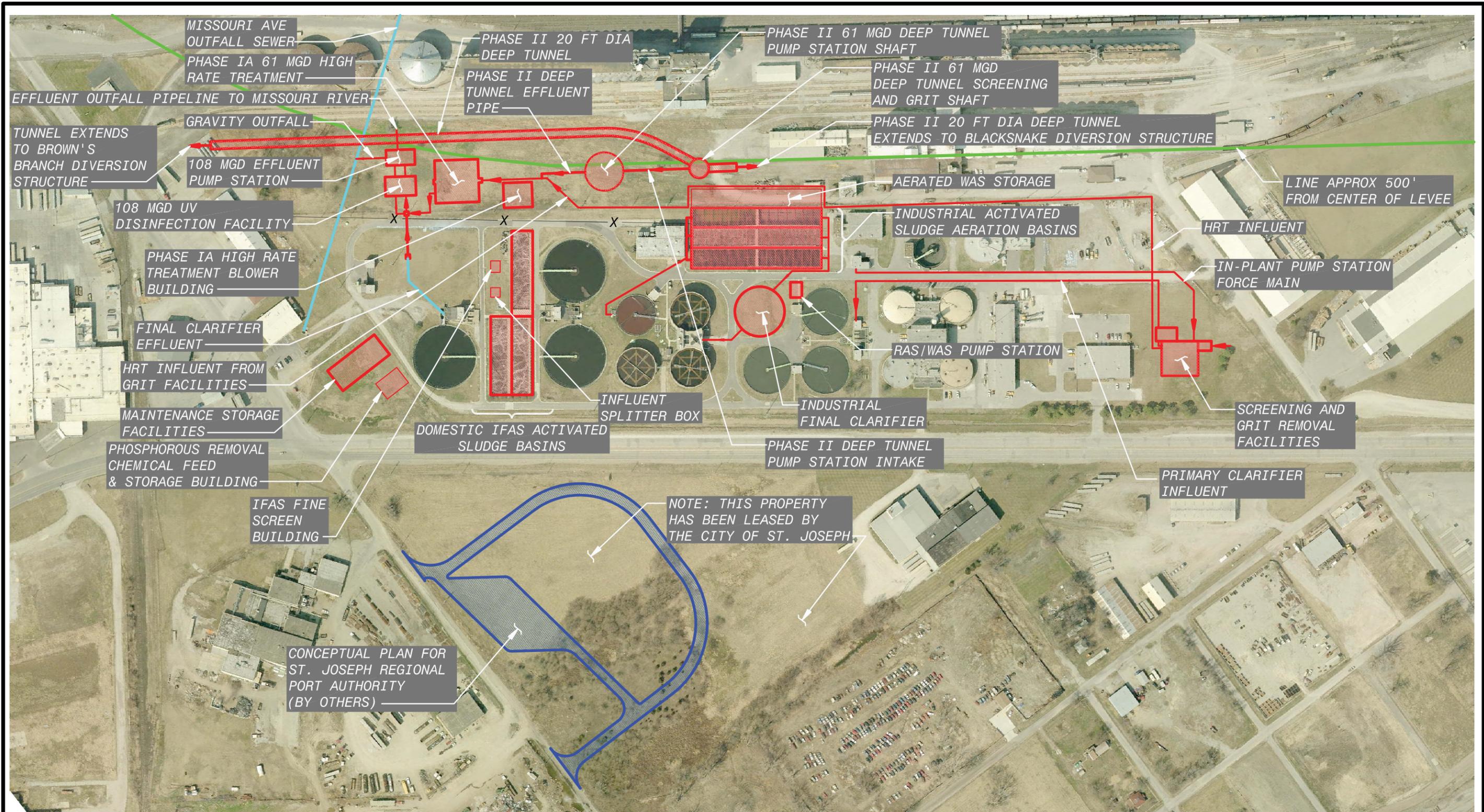
Figure ES-1 presents a conceptual layout of the aforementioned facilities at the WPF as recommended within the Facilities Plan.

Necessary ancillary facility improvements are also required at the WPF. Table ES-1 summarizes the ancillary improvements and the opinion of probable project costs.

<b>Table ES-1 Summary of Opinion of Probable Project Costs for Ancillary Facility Improvements <sup>1</sup></b>		
<b>Item</b>	<b>Description</b>	<b>Cost, \$</b>
Maintenance Building	Two staff offices constructed within existing Maintenance Building and a 10,000 square foot spare parts/rolling stock maintenance storage facility.	1,625,000
Laboratory Expansion	Remodel of Administration Building to expand existing laboratory.	882,000
Power Upgrades	Redundancy upgrades to WPF power system to meet USEPA design criteria for critical facilities.	2,089,000
Nonpotable Water System Upgrades	Relocation of influent line to downstream of proposed UV facility.	136,000
SCADA Backbone	Installation of SCADA backbone to support WPF automation and remote sensing (see TM-WW-8 for details).	462,000
<b>Total</b>		<b>5,194,000</b>
1. All costs presented in May 2009 dollars (ENR BCI = 4773).		

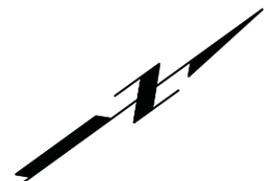
The only regulatory mandated improvements included within the ancillary facility recommendations are the power redundancy upgrades. It is anticipated that the power redundancy upgrades will be incorporated as part of larger proposed WPF projects. The

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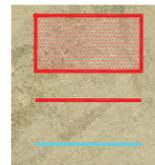


250' 125' 0 250' 500'

SCALE IN FEET



**LEGEND**



PROPOSED FACILITIES

PROPOSED PIPELINES

EXISTING PIPELINES

**ST. JOSEPH, MISSOURI  
FACILITIES PLAN**

PN 163509  
CONCEPTUAL LAYOUT OF  
WATER PROTECTION FACILITY  
RECOMMENDED FACILITIES

OCTOBER 2010

Figure ES-1

other ancillary improvement projects address specific needs stated by City staff or identified within the Facilities Plan. Upon review of the costs, City staff will determine the need and timing to incorporate the ancillary facility improvements.

## **2.0 Purpose of Study**

This technical memorandum documents work performed under Phase 330G of the Wastewater Facilities Plan – Site Considerations, Utility Improvements, and Ancillary Facilities. The objectives of this memorandum include:

- Develop an overall site figure that shows the footprint of proposed and future facilities based on recommendations in the technical memoranda.
- Conceptually evaluate existing utilities including power feeds, site power distribution, backup power, gas, water, nonpotable water, fiber, and telephone to support recommended facilities.
- Provide conceptual costs for any necessary upgrades to existing utility systems.
- Review with City staff the condition and capacity of support facilities including the administration and maintenance buildings.
- Provide conceptual costs for any necessary upgrades to support facilities.

## **3.0 Evaluation of Support Facilities**

### **3.1 Maintenance Facility**

Within TM-WW-10 – Staffing Analysis, several recommendations are made to refocus the maintenance staff effort to provide preventative (scheduled maintenance tasks such as routine oil changes and filter replacement) and predictive (utilizing vibration, ultrasonic testing, etc. to predict maintenance needs) maintenance rather than performing larger long-term capital improvement projects. In TM-WW-10, larger capital improvement projects are recommended to be performed by outside contractors. Based upon review of the existing WPF maintenance facility, the facility appears to be adequate if the maintenance staff is focused only on preventative and predictive maintenance

activities. If the City prefers to direct maintenance workers to continue to have significant involvement in future capital improvements, providing additional space to the existing 15,000 square foot maintenance facility could be necessary. The improvements presented herein for the maintenance facility assume that the recommendations presented in TM-WW-10 are adopted and no additional space is required within the existing maintenance facility specifically dedicated for “maintenance activities.”

Based upon interviews with City staff as well as a review of the maintenance facility, there are additional modifications that could be made to help streamline the maintenance efforts. City staff noted that they currently do not have a dedicated place to store spare parts or rolling stock. Furthermore, the addition of two 12 foot by 12 foot offices within the existing facility (or within an addition to the building) would allow the maintenance supervisor office and maintenance planner office to be located within the maintenance facility rather than in the administration building as they currently reside.

To address these concerns, a 10,000 square foot storage facility (20 foot tall Morton building) is recommended to provide a dedicated space for spare parts and rolling stock storage. Table 1 summarizes the cost for the proposed storage facility as well as the cost for the addition of two office spaces into the existing maintenance building. If the City is able to acquire additional space through the acquisition of existing facilities, the recommendation and costs associated with Table 1 may not be needed.

<b>Table 1</b>	
<b>Summary of Opinion of Probable Project Costs for Addition of Maintenance Storage and Offices <sup>1</sup></b>	
<b>Item</b>	<b>Cost, \$</b>
Rolling Stock Storage Building	
10,000 square foot Storage Building (Morton Building)	693,000
Two Maintenance Staff Offices	10,080
Flood Protection/Fill (placeholder) <sup>2</sup>	0
Site Remediation (placeholder) <sup>2</sup>	0
<i>Subtotal</i>	<i>703,000</i>
Electrical, I&C, Sitework, Contractor General Requirements <sup>3</sup>	380,000
<i>Subtotal</i>	<i>1,083,000</i>

<b>Table 1</b>	
<b>Summary of Opinion of Probable Project Costs for Addition of Maintenance Storage and Offices <sup>1</sup></b>	
<b>Item</b>	<b>Cost, \$</b>
Contingency <sup>4</sup>	271,000
Land Acquisition (placeholder) <sup>2,5</sup>	0
<b>Opinion of Probable Construction Cost</b>	<b>1,354,000</b>
Engineering, Legal, and Administration <sup>6</sup>	271,000
<b>Opinion of Total Project Cost</b>	<b>1,625,000</b>
1. All costs presented in May 2009 dollars (ENR BCI = 4773). 2. Site related costs are placeholders and must be revised following final siting of the facilities. 3. Electrical and instrumentation and controls (I&C) projected at 25% of the total of all equipment and structure costs. Sitework projected at 10% of the total of equipment, structures, electrical, and I&C costs. Contractor general requirements projected at 12% of the total of equipment, structures, electrical, I&C, and sitework costs. 4. Project contingency is projected at 25% of the total of all equipment, structures, electrical, I&C, sitework, contractor general requirements, flood protection/fill, and site remediation costs. 5. Land acquisition is not included for the maintenance storage improvements. 6. Engineering, legal, and administration (ELA) costs are projected at 20% of the total of all equipment, structures, electrical, I&C, sitework, contractor general requirements, flood protection/fill, site remediation costs, contingency, and land acquisition.	

### 3.2 Administration and Laboratory Facility

The WPF staff currently performs and/or is scheduled to perform the following laboratory sampling and analysis services:

- National Pollutant Discharge Elimination System (NPDES) permit compliance (including Industrial Pretreatment Program (IPP) oversight) – primary responsibility.
- IPP surcharge program – primary responsibility.
- CSO and stormwater sampling – regulatory requirements.
- River monitoring and sampling – new regulatory requirement as of 2010.
- Landfill monitoring – new regulatory requirement as of 2010.
- Process control samples for operations staff.

The WPF laboratory occupies approximately 2,300 square feet with approximately 400 square feet for storage/service for monitoring equipment. Based on records at the plant, approximately 400 samples are processed per month. Approximately

50 percent of the sample load comes from industrial users in surcharge (excess fee for high strength waste). The 400 samples per month do not include any conventional analysis for residuals that is sent to off-site laboratories.

Currently all of the laboratory space has been fully utilized leaving no additional room for future analytical requirements. The current NPDES permit will require that both bacteria (disinfection) and ammonia analysis be completed. These two parameters will result in more than 100 additional analyses per month (total of 500). This also does not include data from seven additional CSO monitoring locations. In addition, the laboratory is currently running fecal coliform analysis on the biosolids without being in a clean room. This may result in cross contamination of the bacteriological samples.

The sample preparation area (400 square feet) was originally designed to service only eight samplers, but is now servicing 11 samplers not including the five CSO samplers (future total of 12 CSO samplers). This results in the need to service 23 samplers in an area that was originally designed for eight units.

Furthermore, upon review of the existing laboratory facility located in the administration building, the following observations were made:

- The laboratory staff needs dedicated office space and filing cabinet space.
- The counter space appears to be adequate for the existing range of laboratory analyses.
- The chemical hazardous storage should be reviewed to ensure adequate storage and ventilation are provided.
- The heating, ventilating, and air conditioning (HVAC) system should be evaluated to ensure that proper ventilation and treatment (if required) is provided.
- The electrical power supply and outlets should be evaluated to ensure that expensive laboratory equipment has “clean” power to minimize power related problems. Installation of surge protectors and backup power supplies (where appropriate) is recommended.
- If sampling is expanded, as planned, to include stormwater and Missouri River analyses, the sampling space is likely to be inadequate.

To provide laboratory staff dedicated office and storage space, City staff was consulted for input. Based upon this consultation, City staff recommended that the existing administration building be remodeled to provide additional laboratory space to support the additional laboratory duties. The maintenance staff offices that currently reside in the administration building would then be moved into the remodeled maintenance facility. Table 2 summarizes the cost for the proposed laboratory expansion within the existing administration building. An additional study (laboratory audit) and evaluation of the laboratory space needs and laboratory support apparatus are planned to better refine the issues and costs for the administration and laboratory building remodel presented herein. Laboratory benchmarking against other Midwest utilities has not occurred to date, but the majority of major utilities which participate in the American Water Works Association (AWWA)/Water Environment Federation (WEF) annual reviews have laboratories and perform monitoring and analytical tests similar to the City of St. Joseph. Specific details of the other facilities will be confirmed during the additional laboratory audit. Table 2 does not include a cost for the proposed laboratory audit.

<b>Table 2</b>	
<b>Summary of Opinion of Probable Project Costs for Laboratory Additions to Administration Building <sup>1</sup></b>	
<b>Item</b>	<b>Cost, \$</b>
Laboratory Modifications to Administration Building	
12,000 square foot Remodel of Administration Building	420,000
Flood Protection/Fill (placeholder) <sup>2</sup>	0
Site Remediation (placeholder) <sup>2</sup>	0
<i>Subtotal</i>	<i>420,000</i>
Electrical, I&C, Sitework, Contractor General Requirements <sup>3</sup>	168,000
<i>Subtotal</i>	<i>588,000</i>
Contingency <sup>4</sup>	147,000
Land Acquisition (placeholder) <sup>2,5</sup>	0
<b>Opinion of Probable Construction Cost</b>	<b>735,000</b>
Engineering, Legal, and Administration <sup>6</sup>	147,000
<b>Opinion of Total Project Cost</b>	<b>882,000</b>

<b>Table 2</b>	
<b>Summary of Opinion of Probable Project Costs for Laboratory Additions to Administration Building <sup>1</sup></b>	
<b>Item</b>	<b>Cost, \$</b>
1. All costs presented in May 2009 dollars (ENR BCI = 4773). 2. Site related costs are placeholders and must be revised following final siting of the facilities. 3. Electrical and instrumentation and controls (I&C) projected at 25% of the total of all equipment and structure costs. Sitework projected at 10% of the total of equipment, structures, electrical, and I&C costs. Contractor general requirements projected at 12% of the total of equipment, structures, electrical, I&C, and sitework costs. 4. Project contingency is projected at 25% of the total of all equipment, structures, electrical, I&C, sitework, contractor general requirements, flood protection/fill, and site remediation costs. 5. Land acquisition is not included for the laboratory expansion within the administration building 6. Engineering, legal, and administration (ELA) costs are projected at 20% of the total of all equipment, structures, electrical, I&C, sitework, contractor general requirements, flood protection/fill, site remediation costs, contingency, and land acquisition.	

**3.3 Overall Site Plan of Recommended Facilities**

Improvements are recommended within the Facilities Plan to upgrade the existing WPF treatment capabilities and reduce CSOs from the combined sewer system. The following projects were recommended at the WPF as part of the Wastewater Facilities Assessment or Phase IA of the CSO Control Facilities Assessment:

- 88 mgd screening and grit removal facility
- Ammonia removal facilities (new industrial clarifier, new WAS/RAS pump station, and addition of diffusers to domestic activated sludge basins)
- 61 mgd HRT facility (compressible media filter building and blower building)
- 108 mgd UV disinfection facility
- 108 mgd effluent pump station and outfall

The following projects were recommended at the WPF as part of Phase II of the CSO Control Facilities Assessment:

- Deep tunnel screening and grit shaft for 20 foot diameter, 23,000 foot long, 54 MG deep storage tunnel

- 61 mgd deep tunnel pump station

Figure 1 presents the conceptual layout of the aforementioned facilities. The final location of each facility will not be selected until detailed design. In addition, the opinions of probable project costs for these facilities are presented in other technical memoranda in Volumes 1 and 2 of the Facilities Plan. Only costs for recommended facilities not already discussed in other technical memoranda are presented herein.

## **4.0 Evaluation of Utility Improvements**

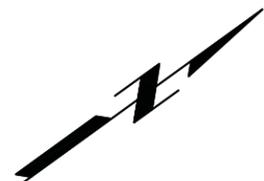
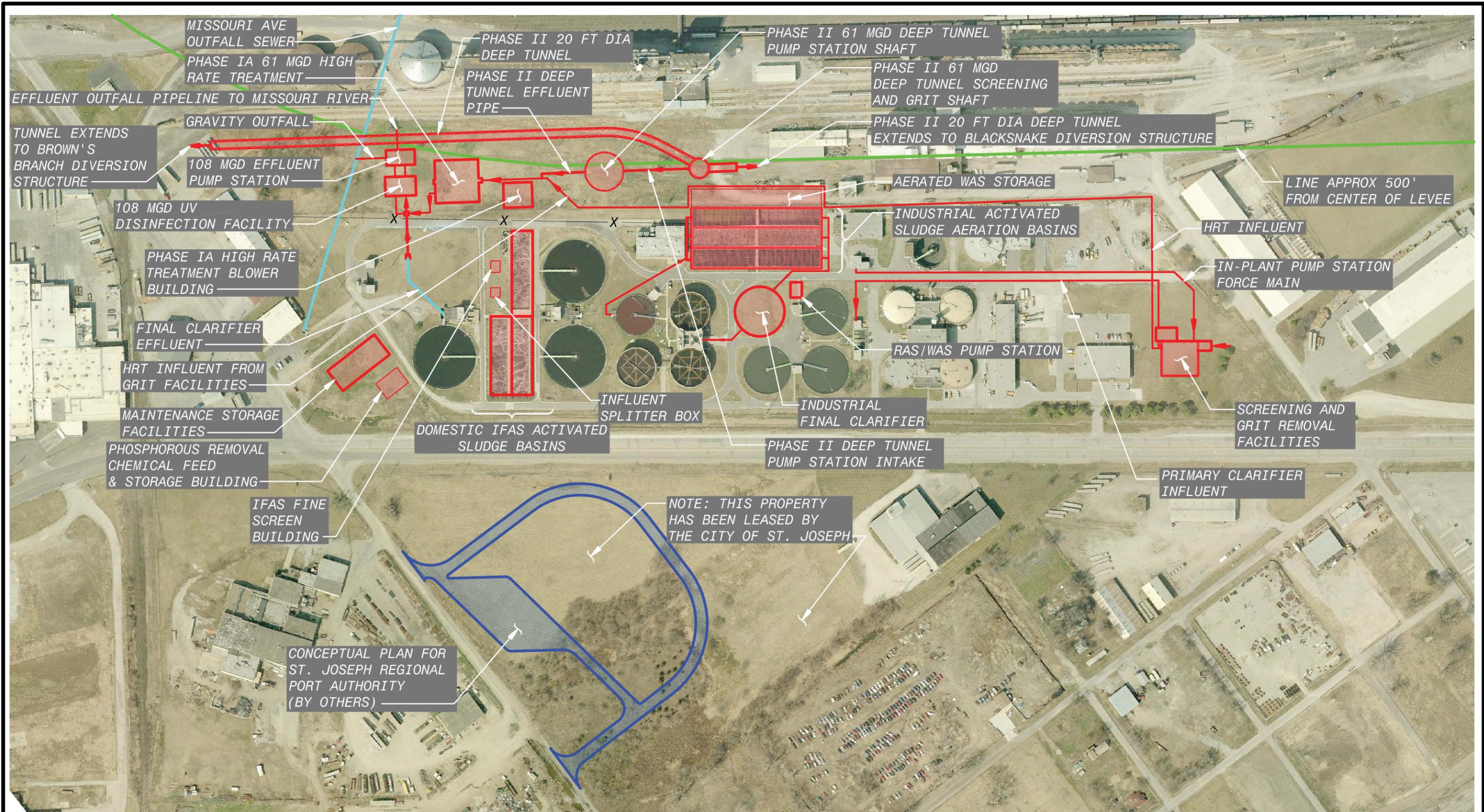
### **4.1 Power System**

The purpose of the power improvement evaluation is to address and satisfy the recommendations for backup power as set forth in the United States Environmental Protection Agency (USEPA) Technical Bulletin entitled “Design Criteria for Mechanical, Electric, and Fluid System and Component Reliability.” The determination of the reliability class and associated electrical recommendations applicable to the processes at the St. Joseph WPF are discussed in the following sections.

There are three reliability classes that help to determine the level and necessity of providing backup power to a treatment facility and its processes. The classifications are defined as follows:

1. Reliability Classification I. Works which discharge into navigable waters that could be permanently or unacceptably damaged by effluent which was degraded in quality for only a few hours. Examples of Reliability Class I works might be those discharging near drinking water reservoirs, into shellfish waters, or in close proximity to areas used for water contact sports.
2. Reliability Classification II. Works which discharge into navigable waters that would not be permanently or unacceptably damaged by short-term effluent quality degradations, but could be damaged by continued (on the order of several days) effluent quality degradation. An example of a

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LEGEND	
	PROPOSED FACILITIES
	PROPOSED PIPELINES
	EXISTING PIPELINES

ST. JOSEPH, MISSOURI  
FACILITIES PLAN  
PN 163509  
CONCEPTUAL LAYOUT OF  
WATER PROTECTION FACILITY  
RECOMMENDED FACILITIES

OCTOBER 2010  
FIGURE 1

Reliability Class II works might be one which discharges into recreational waters.

3. Reliability Classification III. Works not otherwise classified as Reliability Class I or Class II.

Upon review of the reliability classifications, the WPF fits the Class II criteria. The Missouri River is a major river and has an assimilative capacity that can handle short-term WPF effluent quality degradation if it were to occur. Based upon the Reliability Classification II guidelines, the power system for the WPF should be:

*“Sufficient to operate all vital components during peak wastewater flow conditions, together with critical lighting and ventilation...except that vital components used to support the secondary processes (i.e., mechanical aerators or aeration basin compressors) need not be included as long as treatment equivalent and disinfection is provided.”*

The power, backup power, and power redundancy system improvements recommended for the WPF and discussed in the following sections follow the USEPA guidance.

#### **4.1.1 Existing System**

Site visits, data collection, investigation, and discussions with Kansas City Power & Light (KCP&L) staff were performed to better understand the existing power system feeding the WPF. The WPF site is fed power from KCP&L overhead sources at voltages of 34 kilovolts (kV) and 12 kV. The two overhead lines are installed along a north/south route on the west boundary of the WPF site. From the north, an overhead 12 kV line feeds the anaerobic digester’s 500 kilovolt-ampere (kVA) transformer that distributes 480 volt, 3 phase power to the thermophilic digester loads. From the south and northwest, an overhead 34 kV line feeds the rest of the WPF through two separate drops located just south of the blower building on the property line. At the two drop locations, there are three poles, owned by KCP&L, with pole mounted disconnects. The two outside disconnects are the plant 34 kV sources, and the center is an isolation disconnect

of the line. KCP&L staff indicated that the line disconnect is only used to isolate the line during an outage. The switch is otherwise not used as part of normal KCP&L or WPF operation. In addition, KCP&L staff stated that new remote switching units will be installed on the 34 kV lines to cut down on response time during outages. With these additions, the KCP&L monitoring office located in Kansas City, Missouri can remotely switch the loop to reroute power if required. Once the remote switches are installed, KCP&L staff stated that power service to the WPF could be restored within an hour if the problem can be addressed with switching.

The two 34 kV sources feed two pad mounted switches, owned by KCP&L, located just south of the blower building. Each pad mounted switch contains two switches, each feeding two pad mounted (substation) transformers. These transformers feed process areas as follows (from south to north): Utility Water Pump Station (Nonpotable Water Pump Station)/Transfer Pump Station (South St. Joseph Industrial Return Flow Pump Station), Intermediate Pump Station (IPS)/Return Sludge Pump Station, Blower Building, Filter Building/Solids Handling Facility, In-plant Influent Pump Station, and the Dissolved Air Flotation (DAF) Building .

Discussions with KCP&L staff clarified how the 34 kV line at the WPF is energized. The 34 kV line makes a loop in the downtown area with two substations providing service to the loop. On the south side of the downtown area, the Lake Road Substation feeds the 34 kV loop from the south and the Edmond Street Substation feeds the loop from the north. It is understood that the Edmond Street Substation does not have transformation, but merely passes 34 kV through from an upstream source. Lake Road is a major substation for the area and has transformation. According to KCP&L staff, the Edmond Street Substation will be expanded and transformation will be added during the summer of 2010. After the improvements, the Edmond Street Substation and the Lake Road Substation will be similar in scale and process. As it stands currently, the 34 kV loop has at least two power sources with additional feeder substation improvements to be constructed during the summer of 2010.

#### **4.1.2 Improvements and Power Redundancy**

As discussed previously, the USEPA Technical Bulletin entitled “Design Criteria for Mechanical, Electric, and Fluid System and Component Reliability” was referenced to determine the necessary WPF power upgrades. For critical components, backup power should adhere to the following USEPA design criteria:

- 231 Power Sources. “Two separate and independent sources of electric power shall be provided to the works from either two separate utility substations or from a single substation and a works based generator.”
- 234.1 Service to Motor Control Centers. “The internal power distribution system shall be designed such that no single fault or loss of a power source will result in disruption (i.e., extended, not momentary) of electric service to more than one motor control center...”

The 34 kV loop that feeds the WPF has two separate and independent sources of electrical power from two separate utility substations. The criterion does not say that the two sources must be separate and independent circuits that enter the WPF. The criterion requires that at least one of the power sources shall be a preferred source. In the case of the WPF, both sources are live (i.e., preferred) on the loop distribution configuration. Based on the information gathered from KCP&L, the service to the WPF meets the requirements of Article 231 of the System Design Criteria.

The requirements for Article 234.1, “Service to Motor Control Centers”, as well as the USEPA ventilation criteria are not currently met for certain WPF critical process areas. Table 3 presents the existing facilities that require power redundancy and the basis for the requirement. The existing facilities that do not require power redundancy are presented in Table 4.

<b>Table 3</b>	
<b>Existing Facilities Requiring Redundant Power Feeds</b>	
<b>Facility</b>	<b>USEPA Criteria</b>
In-plant Influent Pump Station	Ventilation (NFPA) (For Screening Room) and Critical Flow Through Component
Grit Facility	Ventilation (NFPA)
Comminutors (Channel Monsters)	Critical Flow Through Component
Intermediate Pump Station	Critical Flow Through Component
Raw Sludge Pump Stations 1 and 2	Ventilation (NFPA)
Utility Water Pump Station (Nonpotable Water Pump Station), Transfer Pump Station (South St. Joseph Industrial Return Flow Pump Station)	Critical Support Facility
Blower Building	Process Required to Provide Adequate UV Disinfection
Return Sludge Pump Stations 1 and 2	Ventilation (NFPA)
Filter Building	Ventilation (NFPA)
DAF Building	Ventilation (NFPA)
Digester Building	Ventilation (NFPA)
NFPA – National Fire Protection Association	

<b>Table 4</b>	
<b>Existing Facilities Not Requiring Redundant Power Feeds</b>	
<b>Facility</b>	<b>Reason</b>
Administration Building	Not Classified as Critical Facility
Maintenance Building	Not Classified as Critical Facility

To provide power redundancy to the existing facilities listed in Table 3, the existing KCP&L pad mounted switches will need to be interconnected. With the interconnection, if one of the pole mounted switches or source feeders failed, the other source could feed the second pad mounted switch. KCP&L staff stated that the pad mounted switches are interconnected and that the addition of new switches and the possible need for a tie-switch will be incorporated. The cost and responsibility for providing this redundancy will need to be determined. To maintain conservatism in the power upgrade cost opinion, the costs associated with the pad mounted switch improvement are assumed to be the sole responsibility of the City. In addition, parallel power lines and transformers will need to be added so that each of the critical facilities listed in Table 3 would have power redundancy. The probable project costs for these

improvements are presented in Table 5. The comminutors (Channel Monsters) currently have a backup generator located in Raw Sludge Pump Station 1, and therefore no additional improvements are required for this equipment.

<b>Table 5</b>	
<b>Summary of Opinion of Probable Project Costs for KCP&amp;L Power Upgrades<sup>1</sup></b>	
<b>Item</b>	<b>Cost, \$</b>
KCP&L Power Upgrades and Power Redundancy	
New Switchgear	350,000
New Power Lines and Transformers	555,000
Flood Protection/Fill (placeholder) <sup>2</sup>	0
Site Remediation (placeholder) <sup>2</sup>	0
<i>Subtotal</i>	<i>905,000</i>
Electrical, I&C, Sitework, Contractor General Requirements <sup>3</sup>	488,000
<i>Subtotal</i>	<i>1,393,000</i>
Contingency <sup>4</sup>	348,000
Land Acquisition (placeholder) <sup>2, 5</sup>	0
<b>Opinion of Probable Construction Cost</b>	<b>1,741,000</b>
Engineering, Legal, and Administration <sup>6</sup>	348,000
<b>Opinion of Total Project Cost</b>	<b>2,089,000</b>
<ol style="list-style-type: none"> <li>1. All costs presented in May 2009 dollars (ENR BCI = 4773).</li> <li>2. Site related costs are placeholders and must be revised following final siting of the facilities.</li> <li>3. Electrical and instrumentation and controls (I&amp;C) projected at 25% of the total of all equipment and structure costs. Sitework projected at 10% of the total of equipment, structures, electrical, and I&amp;C costs. Contractor general requirements projected at 12% of the total of equipment, structures, electrical, I&amp;C, and sitework costs.</li> <li>4. Project contingency is projected at 25% of the total of all equipment, structures, electrical, I&amp;C, sitework, contractor general requirements, flood protection/fill, and site remediation costs.</li> <li>5. Land acquisition is not included for the KCP&amp;L power upgrades.</li> <li>6. Engineering, legal, and administration (ELA) costs are projected at 20% of the total of all equipment, structures, electrical, I&amp;C, sitework, contractor general requirements, flood protection/fill, site remediation costs, contingency, and land acquisition.</li> </ol>	

Critical facilities proposed as part of the Facilities Plan will also require power redundancy to meet the USEPA power criteria. Table 6 presents the proposed critical facilities that will require power redundancy and the basis for the requirement. Table 7 presents the proposed facilities that will not require power redundancy. Providing power redundancy to the proposed facilities will require the addition of dual transformers and power lines from the upgraded switchgear to each proposed facility. The costs associated with providing power redundancy are included in the multiplier for “Electrical,

Instrumentation and Controls” as presented in the various technical memoranda for the proposed facilities and are therefore not included herein.

<b>Table 6 Proposed Facilities Requiring Redundant Power Feeds</b>	
<b>Facility</b>	<b>USEPA Criteria</b>
Disinfection Facilities and Effluent Pump Station	Disinfection Requirements, Critical Flow Through Component
Grit and Screening Facility	Ventilation (NFPA)
Phosphorus and Total Nitrogen Removal Chemical Storage Building	Ventilation (NFPA)
High Rate Treatment Facility	Critical Flow Through Component
Deep Tunnel Pump Station	Ventilation (NFPA), Critical Flow Through Component
NFPA – National Fire Protection Association	

<b>Table 7 Proposed Facilities Not Requiring Redundant Power Feeds</b>	
<b>Facilities</b>	<b>USEPA Criteria</b>
Ammonia Removal Facilities	No Buildings Will Be Constructed

In summary, to meet the USEPA backup power criteria, the following power improvements are recommended at the WPF:

- Modify the KCP&L pad mounted switches for redundancy at the 34 kV level.
- Provide redundant transformer connections and power lines from the upgraded switchgear to the existing and proposed critical facilities.

## **4.2 Nonpotable Water**

### **4.2.1 Existing System**

The existing nonpotable water system provides service water to the entire WPF facility. The Nonpotable Water Pump Station (Utility Water Pump Station) is located at the south end of the WPF and pumps WPF effluent. The pump station’s wetwell is served by a 16 inch influent line. City staff noted that during extremely low WPF flows

(i.e., when the Intermediate Pump Station is down), the wetwell can run dry. The pump station's influent pipe is not located at the invert of the main plant effluent pipe and therefore does not deliver adequate flows to the wetwell during very low and inconsistent WPF flows. At the downstream end of the nonpotable water distribution system, located at the DAF Building, a 300 gallon hydropneumatic (pressure) tank with an attached compressor maintains the distribution pressure within the system. A programmable logic controller (PLC) and pressure relief valve were added to this tank to automatically control the volume of water stored in the tank and better regulate the distribution system.

City staff indicated that prior to the installation of the PLC and pressure relief valve, the nonpotable water system was difficult to operate. The system is now much more manageable, less reactive, and easier to control. The existing pump drives are still manually controlled and some oversight is required to ensure that during periods of high demand, additional pumps are turned on allowing enough utility water to be provided to the WPF.

In addition, the nonpotable water system provides a place for snails and other organisms to grow. Due to the upstream WPF trickling filter, there will always be a source of snails and snail eggs that will end up deposited in the nonpotable water wetwell and distribution system. Snails can plug up the distribution system and their shells are abrasive causing equipment wear.

#### **4.2.2 Improvements**

City staff stated a desire to re-plumb the nonpotable water system to use disinfected WPF effluent following construction of the UV disinfection facility. Therefore, the nonpotable water influent pipe will need to be relocated downstream of the UV disinfection facility that is currently under design. If located properly, the lack of nonpotable water during low WPF flows should be remedied.

Furthermore, several proposed processes will require additional nonpotable service water. Therefore the demand on the system will increase once the new facilities are commissioned. Table 8 presents the estimated nonpotable water demand for the proposed WPF facilities. Upon review of Table 8, the nonpotable water system will need

to provide an additional peak capacity of 340 gallons per minute (gpm) once the proposed facilities are in service.

<b>Table 8 Nonpotable Water Requirements for Proposed Facilities</b>		
<b>Facility</b>	<b>Average, gpm</b>	<b>Maximum, gpm</b>
88 mgd Screening and Grit Facility	65	190
108 mgd UV Disinfection Facility	minimal	minimal
61 mgd High Rate Treatment Facility	minimal	150
108 mgd Effluent Pump Station	minimal	minimal
Notes: 1. “Minimal” indicates providing a service connection for minimal miscellaneous usage only. 2. UV maximum usage is estimated at 10 gpm through hose connection for sleeve cleaning for 4 hours, once per quarter. 3. HRT maximum usage assumes use of Actiflo with liquid polymer.		

Based on the results of the financial capability analysis, improvements to the grit facility may be delayed or removed entirely from the 20-year capital improvements plan. The proposed HRT system is planned to be in service by the end of 2029. Therefore, although the new facilities could (depending upon the HRT technology selected) place an increased demand on the nonpotable water system, these improvements are far enough in the future that no capacity upgrades are being recommended to the nonpotable water system at this time.

The trickling filters are the source of snails and snail eggs within the WPF. To control the snail population within the overall WPF, they must be addressed at the trickling filters. Snails can be controlled within a trickling filter by raising the pH of the influent water which allows a short-term production of ammonia within the trickling filter process. Ammonia kills snails very effectively and thus can help control the snail population. If this control technique is used, the “control treatment” must be repeated every four to six months to control the snail population. If the trickling filter at the WPF is taken out of service to provide full nitrification and denitrification (as proposed in TM-WW-4 – Nutrient Removal Facilities), the snail population at the WPF will decrease significantly.

To kill snails within the nonpotable water system only, the most economical solution is to use chlorine in the form of sodium hypochlorite within the wetwell and

distribution system. Although City staff has relayed their aversion for using chlorine in the WPF processes, there are no comparable alternatives. If City staff prefers not to use chlorine to control the snail population in the nonpotable water system, the use of strainers on the distribution side of the nonpotable water system is the only viable method to keep snail shells from passing into the processes using nonpotable water. Based on discussions with City staff, they have elected to not address the snail issues until the denitrification process is constructed requiring the removal of the tricking filters.

Table 9 summarizes the opinion of probable project cost to relocate the influent line for the Nonpotable Water Pump Station downstream of the proposed UV facility.

<b>Table 9</b>	
<b>Summary of Opinion of Probable Project Costs for Nonpotable Water Upgrades <sup>1</sup></b>	
<b>Item</b>	<b>Cost, \$</b>
Nonpotable Water System	
Relocation of 16 inch Influent Pipe	64,000
Flood Protection/Fill (placeholder) <sup>2</sup>	0
Site Remediation (placeholder) <sup>2</sup>	0
<i>Subtotal</i>	<i>64,000</i>
Electrical, I&C, Sitework, Contractor General Requirements <sup>3</sup>	26,000
<i>Subtotal</i>	<i>90,000</i>
Contingency <sup>4</sup>	23,000
Land Acquisition (placeholder) <sup>2,5</sup>	0
<b>Opinion of Probable Construction Cost</b>	<b>113,000</b>
Engineering, Legal, and Administration <sup>6</sup>	23,000
<b>Opinion of Total Project Cost</b>	<b>136,000</b>
<ol style="list-style-type: none"> <li>1. All costs presented in May 2009 dollars (ENR BCI = 4773).</li> <li>2. Site related costs are placeholders and must be revised following final siting of the facilities.</li> <li>3. Electrical and instrumentation and controls (I&amp;C) projected at 25% of the total of all equipment and structure costs. Sitework projected at 10% of the total of equipment, structures, electrical, and I&amp;C costs. Contractor general requirements projected at 12% of the total of equipment, structures, electrical, I&amp;C, and sitework costs.</li> <li>4. Project contingency is projected at 25% of the total of all equipment, structures, electrical, I&amp;C, sitework, contractor general requirements, flood protection/fill, and site remediation costs.</li> <li>5. Land acquisition is not included for the non-potable water system upgrades.</li> <li>6. Engineering, legal, and administration (ELA) costs are projected at 20% of the total of all equipment, structures, electrical, I&amp;C, sitework, contractor general requirements, flood protection/fill, site remediation costs, contingency, and land acquisition.</li> </ol>	

### 4.3 Telephone and Data

Improvements to the telephone system as well as the WPF data network for the inclusion of a supervisory control and data acquisition (SCADA) system are detailed in TM-WW-8 – Instrumentation and Controls. Table 10 summarizes the opinion of probable project cost for the proposed SCADA backbone. Costs for connecting proposed projects to the SCADA backbone are included in the project associated instrumentation and controls costs.

<b>Table 10 Summary of Opinion of Probable Project Costs for SCADA Backbone <sup>1</sup></b>	
<b>Item</b>	<b>Cost, \$</b>
SCADA WPF Backbone	200,000
Flood Protection/Fill (placeholder) <sup>2</sup>	0
Site Remediation (placeholder) <sup>2</sup>	0
<i>Subtotal</i>	<i>200,000</i>
Electrical, I&C, Sitework, Contractor General Requirements <sup>3</sup>	108,000
<i>Subtotal</i>	<i>308,000</i>
Contingency <sup>4</sup>	77,000
Land Acquisition (placeholder) <sup>2, 5</sup>	0
<b>Opinion of Probable Construction Cost</b>	<b>385,000</b>
Engineering, Legal, and Administration <sup>6</sup>	77,000
<b>Opinion of Total Project Cost</b>	<b>462,000</b>
<ol style="list-style-type: none"> <li>1. All costs presented in May 2009 dollars (ENR BCI = 4773).</li> <li>2. Site related costs are placeholders and must be revised following final siting of the facilities.</li> <li>3. Electrical and instrumentation and controls (I&amp;C) projected at 25% of the total of all equipment and structure costs. Sitework projected at 10% of the total of equipment, structures, electrical, and I&amp;C costs. Contractor general requirements projected at 12% of the total of equipment, structures, electrical, I&amp;C, and sitework costs.</li> <li>4. Project contingency is projected at 25% of the total of all equipment, structures, electrical, I&amp;C, sitework, contractor general requirements, flood protection/fill, and site remediation costs.</li> <li>5. Land acquisition is not included for the non-potable water system upgrades.</li> <li>6. Engineering, legal, and administration (ELA) costs are projected at 20% of the total of all equipment, structures, electrical, I&amp;C, sitework, contractor general requirements, flood protection/fill, site remediation costs, contingency, and land acquisition.</li> </ol>	

#### 4.4 Natural Gas

None of the proposed processes at the WPF will require natural gas. Natural gas will only be needed to heat the facility buildings during cold weather. Therefore, significant and costly additions to the natural gas distribution system are not anticipated.

#### 4.5 Potable Water

The administration building, thermophilic digester building, control building, and blower building are served with potable water connections. None of the proposed processes at the WPF will require a substantial new potable water supply. A potable water supply may be needed at the new UV disinfection facility for UV module storage or at the new effluent pump station for pump seal lubrication. However, costs for the new water line and water meter would be covered in the sitework multiplier for this improvement. Therefore, significant and costly additions to the potable water system at the WPF are not anticipated.

#### 5.0 Conclusions

Necessary ancillary facility improvements are required at the WPF. Table 11 summarizes the identified ancillary improvements and the opinion of probable project cost for each.

<b>Table 11</b> <b>Summary of Opinion of Probable Project Costs for</b> <b>Ancillary Facility Improvements <sup>1</sup></b>		
<b>Item</b>	<b>Description</b>	<b>Cost, \$</b>
Maintenance Building	Two staff offices constructed within existing Maintenance Building and a 10,000 square foot spare parts/rolling stock maintenance storage facility.	1,625,000
Laboratory Expansion	Remodel of Administration Building to expand existing laboratory.	882,000
Power Upgrades	Redundancy upgrades to WPF power system to meet USEPA design criteria for critical facilities.	2,089,000
Nonpotable Water System Upgrades	Relocation of influent line to downstream of proposed UV facility.	136,000

<b>Table 11</b>		
<b>Summary of Opinion of Probable Project Costs for Ancillary Facility Improvements <sup>1</sup></b>		
<b>Item</b>	<b>Description</b>	<b>Cost, \$</b>
SCADA Backbone	Installation of SCADA backbone to support WPF automation and remote sensing (see TM-WW-8 for details).	462,000
<b>Total</b>		<b>5,194,000</b>
1. All costs presented in May 2009 dollars (ENR BCI = 4773).		

The only regulatory mandated improvements included within the ancillary facility recommendations are the power redundancy upgrades. It is anticipated that the power redundancy upgrades will be incorporated as part of larger proposed WPF projects. The other ancillary improvement projects address specific needs stated by City staff or identified within the Facilities Plan. Upon review of the costs, City staff will determine the need and timing to incorporate the ancillary improvements.

## 6.0 References

The following references were utilized in the preparation of this memorandum:

- Design Criteria for Mechanical, Electrical, Fluid System and Component Reliability (USEPA, 1973).