PROJECT PROPOSAL

Capital or O&M	**Capital**	**Project Manager**	**Ed Basquill**
Project Number		**Date**	**07/13/07**
		Cost Center	**222**
		Priority Code	

____ **Non-budgeted Project for current year**
X **Project to be considered for future Capital Plan**
____ **Budgeted in current Capital Program** *(provide parent program # if child project)*

Title of Project **BEPWTP Capacity Development Project**

Scope

Expand the capacity of BE Payne Water Treatment Plant to 90 MGD to service future growth and business development opportunities and ensure the production capacity reserve exceeds 15% of maximum day demands as recommended by KYDOW.

Project Justification: *(Please check all that apply and provide written summary of justification)*

Regulatory	X	Contract Commitment		Growth Related	X
Safety		Contributed Capital		Other *(attach explanation)*	
Security		Economic Benefit *(include NPV)*			
Operating Requirement	X	Improved Customer Service			

Project Estimate:

Total Cost excluding Noncash Contrib. Capital		*Activity (Preliminary design, land acquisition, construction, etc)*
2008		
2009	400,000	DESIGN
2010	2,500,000	CONSTRUCTION
2011	2,100,000 ~~2,500,000~~	CONSTRUCTION
Other		

Total Cost **$ 5,000,000**
Less Contrib
Net Cost **$ 5,000,000**

Noncash Contributed Capital:Labor and/or materials =
Total Asset Cost including Noncash Contrib. Capital : **$5,000,000**

Impact on Operating Revenues / Costs *(Detailed documentation included in Net Present Value calculation)*

Category	Annual amount *(dollars and description)*	Orgs affected

Make and Model of new asset ______ Serial Number ______

Depreciation Life **50 years**

Retirement : Does this replace an existing asset Y or N ? If yes, please provide detailed information on asset being retired, including undepreciated value, make, model, serial number, date placed in service, etc
N

Planning document(s) referenced Water Treatment Capacity Study
Future Planning / Design Support Required Y or N ? N

Attach business case and documentation to further explain scope and/or justification.
Capital Project Proposal form must be approved by the following for budget consideration.
"x" boxes for required approvals.

		Initial, Date and Forward			*Initial, Date and Forward*
1) Project Manager		TCS 8/20/07	5) CBSO		[initials] 8/22/07
2) Process Owner		TCS 8/20/07	6) CPAC		[initials] 8/22/07
3) BSO		TCS 8/20/07	7) President		
4) Planning		TCS 8/20/07	8) Project Accounting		

Original retained by Project Accounting. Copy returned to Project Manager.

PROJECT PROPOSAL (Continued)

Project # 00000 **Title** BEPWTP Capacity Development Project

Project(s) and task(s) to be transferred to new project	
Start date of project	1/1/2010
End date of project	12/31/2011
If plant project, list location (i.e. BEP, Allmond, etc)	BEP
Elevated or general service area	Elevated

KEY MEMBERS *(these employees will be given access to see all costs)*

Project Manager/Task Manager	**Ed Basquill**
Program Manager	**Jim Smith**
BSO	
Inspector	
Other	

PROJECT CATEGORY *(highlight / circle one)*

Distribution Storage Facility
Facilities Management
General Administrative
General (Furniture, Lab/Communication Equipment)
Information Technology
Meters, Services and Hydrants
Preliminary E/S
Supply and Pumping Facility
Transmission and Distribution
Vehicles/Power Operated Equipment
Water Treatment Facility

FUNDING SOURCE *(must = 100%; based on Total Cost excluding Noncash Contributed Capital)*

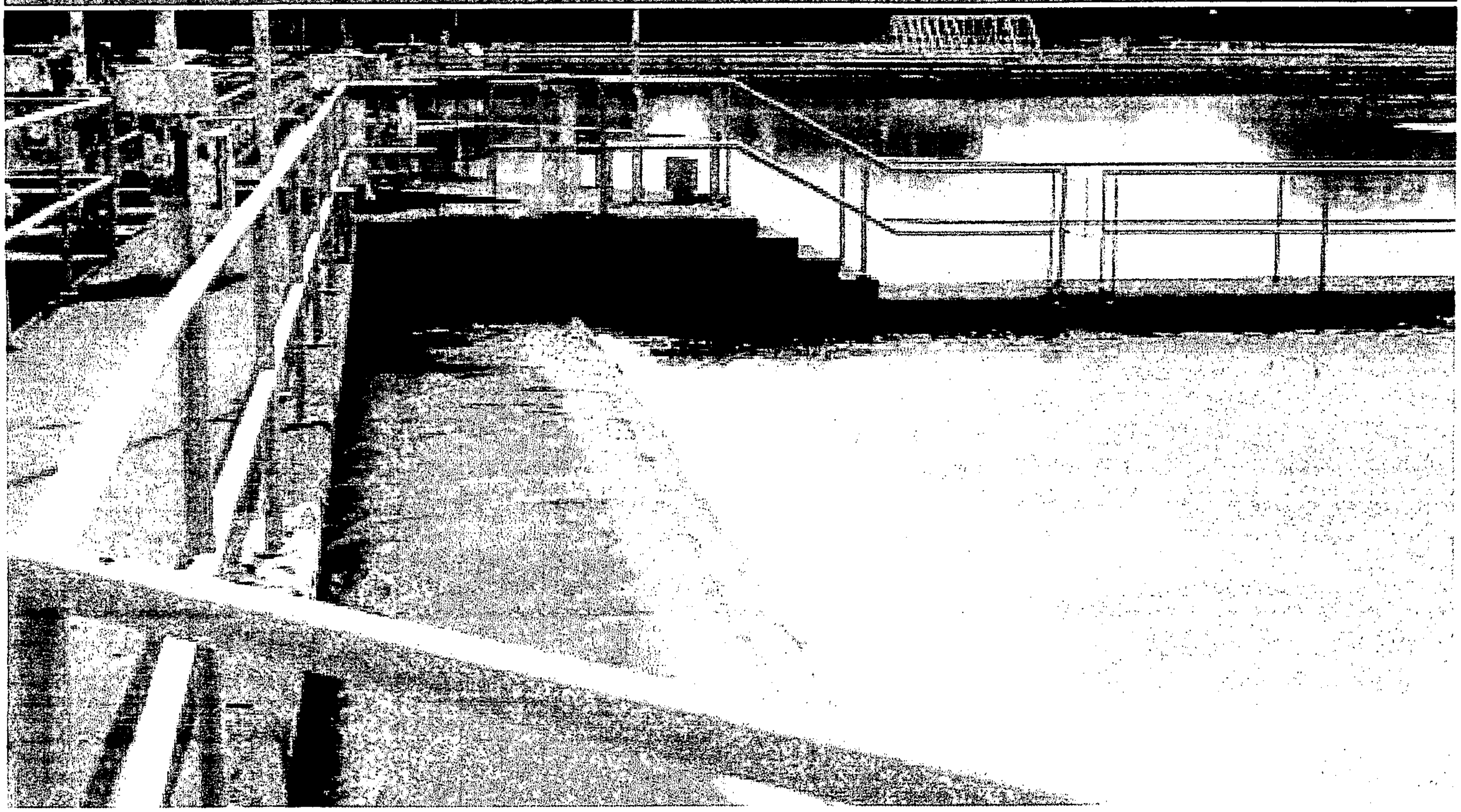
Agency *(be specific)*	
Bond Funds	
Bullitt County Water Reserve	
Customer	
Depreciation Fund	**100**
Developer	
Goshen Reserve	
Infrastructure Reserve	
Oldham County Fund	
Operating Fund *(for O&M only)*	
Shepherdsville Reserve	
System Development Fund	
	100

If Billable or Agency/Developer project, billing party's name and address:

To be filled out by Project Accounting:

Project set up in Oracle by name/date	
Interest or Non-interest	
Template	

FINAL REPORT



SUBMITTED TO

Louisville Water Company

FOR

Water Treatment Plant Capacity Study

AUGUST 2007

SUBMITTED BY

CH2MHILL

Water Treatment Plant Capacity Study

Prepared for

Louisville Water Company

August 2007

CH2MHILL

Executive Summary

This study was conducted to identify current water production capacities at the BE Payne and Crescent Hill Water Treatment Plants (BEPWTP and CHWTP), and low cost improvements to expand production capacity production.

Each plant's capacity was evaluated according to the following three components:

1. Hydraulics by computer modeling, calibrated by surveying
2. Treatment facility loading rates as compared to industry and design standards
3. Chemical-handling facilities and pumping equipment

BEPWTP and CHWTP have nominal design capacities of 60 million gallons per day (mgd) and 240 mgd, respectively. These capacities are based on standard filtration rates at each plant and have been confirmed by sanitary surveys conducted by the Kentucky Division of Water (KY DOW) (see Appendix E). As a result of this study, it was determined that the current maximum production capabilities of BEPWTP and CHWTP are 60 mgd and 180 mgd, respectively, as shown in Table ES-1. These maximum capabilities are based on plant hydraulics, treatment facility loading rates, chemical-handling facilities, and pumping equipment. Currently, if either plant is operated above these maximum capacities, softening basin weirs will flood causing improper operation of the plant. Figures ES-1 and ES-2 show current maximum production capacities for each unit process at BEPWTP and CHWTP.

Higher production capacities were investigated for both plants. Hydraulic computer modeling was prepared, calibrated, and conducted to determine flow rate capacities and head losses through each component of the treatment plants. Options to allow increased flow rate were identified and tested.

For the BEPWTP, three hydraulic improvement options were identified to expand from the current capacity of 60 mgd to 90 mgd, and two hydraulic options were identified for an expansion to 120 mgd. Hydraulic improvements included raising weir elevations to eliminate downstream backwater effects, lowering weirs where excess freefall exists to eliminate upstream backwater effects, extending basin walls to attain adequate freeboard, and enlarging or creating new passageway openings in basin walls. Additional improvements are related to treatment processes and equipment and include clear well additions, retrofitting tube settlers in settling basins, high service pumps, and chemical storage and feed facilities.

For the CHWTP, one hydraulic improvement option was identified for an expansion from the current capacity of 180 mgd to 210 mgd, and two hydraulic options were identified for an expansion to 240 mgd. Hydraulic improvements included raising weir elevations to prevent downstream backwater effects, extending basin walls, enlarging or creating new passageway openings in basin walls, and strengthening the piping connections for the east filter influent. Additional improvements are related to treatment processes and equipment and include clear well additions, retrofitting tube settlers in settling basins, high service pumps, and chemical storage and feed facilities.

TABLE ES-1
Water Treatment Plant Capacities, Present and Future

Capacity	Crescent Hill WTP	BE Payne WTP	Total
Nominal Design, mgd	240	60	300
Current Maximum Production Capability, mgd	180	60	240
Phase 1 Expansion, mgd	210	90	300
Phase 2 Expansion, mgd	240	120	360

Presently, as of publication of this report, Louisville Water Company's (LWC) maximum daily production of 205 mgd occurred in June 2005. Based on the LWC's current maximum day production capacity of 240 mgd, LWC currently has a reserve system capacity of 35 mgd. Upon completion of the Phase 1 and Phase 2 expansions, LWC will increase its reserve capacity to 95 mgd and 155 mgd, respectively.

All capacity improvements were categorized as **Required** or **Discretionary**. Improvements were considered to be **Required** if the improvement would be needed to enable the WTP to: 1) meet KY DOW requirements consistently, and 2) maintain LWC's high standard of water quality. Improvements were considered to be **Discretionary** if their benefit would improve plant operations or redundancy. Some improvements that are based on KY DOW guidelines or recommendations, but are not requirements, would fall into the **Discretionary** category until further investigation is performed to indicate otherwise.

Improvements to eliminate hydraulic bottlenecks are relatively minor with respect to costs for both plants; other improvements for treatment processes and equipment are more costly, as shown in Table ES-2. The total estimated construction costs for expanding the capacity at each plant are presented in this table.

TABLE ES-2
Construction Cost Estimate Summary

WTP	Phase 1 Expansion		Phase 2 Expansion	
	Required	_Discretionary_	_Required_	_Discretionary_
BEPWTP	90 mgd $5.0 million	90 mgd $16.9 million	120 mgd $8.6 million	120 mgd $26.3 million
CHWTP	210 mgd $1.6 million	210 mgd $20.6 million	240 mgd $14.7 million	240 mgd $23.6 million

Because of the lack of scope development at this conceptual stage of engineering analysis, these estimates would be considered rough, order-of-magnitude level. The expected accuracy range would be -50/+50 percent. The final cost of the recommended improvements will depend on actual labor and material costs, competitive market conditions, final project scope, schedule, detailed design documents, and other variable

conditions. As a result, the final cost of the recommended improvements will vary from these estimates.

Sections 2 and 3 of this report identify hydraulic, process, and equipment deficiencies that will result if the WTP capacities are increased. The identification of these deficiencies, and improvement options that were developed to correct them, were based on industry and Kentucky DOW standards and evaluation criteria developed during this project with LWC staff. Prior to designing any improvements to correct the deficiencies the criteria should be revisited in more detail. Example criteria that should be revisited or other issues to investigate are clear well volume requirements, future high service pumping capacities, tube settler feasibility and cost comparisons to new high-rate clarification technologies, future chemical feed rates, and filter high-rate performance testing.

PROJECT PROPOSAL

Capital or O&M	**Capital**	**Project Manager**	**Ed Basquill**
Project Number		**Date**	**07/13/07**
	Non-budgeted Project for current year	**Cost Center**	**222**
X	**Project to be considered for future Capital Plan**	**Priority Code**	
	Budgeted in current Capital Program *(provide parent program # if child project)*		

Title of Project **CHFP Capacity Development Project**

Scope

Expand the capacity of Crescent Hill Filter Plant (CHFP) to 210 MGD to service future growth and business development opportunities and ensure the production capacity reserve exceeds 15% of maximum day demands as recommended by KYDOW.

Project Justification: *(Please check all that apply and provide written summary of justification)*

Regulatory	X	Contract Commitment		Growth Related	X
Safety		Contributed Capital		Other *(attach explanation)*	
Security		Economic Benefit *(include NPV)*			
Operating Requirement	X	Improved Customer Service			

Project Estimate:

Total Cost excluding Noncash Contrib. Capital		*Activity (Preliminary design, land acquisition, construction, etc)*
2008		
2009		
2010		
2011	800,000	DESIGN & CONSTRUCTION
Other	800,000	FINAL CONSTRUCTION
Total Cost	$ **1,600,000**	Noncash Contributed Capital:Labor and/or materials =
Less Contrib		Total Asset Cost including Noncash Contrib. Capital = **$1,600,000**
Net Cost	$ **1,600,000**	

Impact on Operating Revenues / Costs *(Detailed documentation included in Net Present Value calculation)*

Category	Annual amount *(dollars and description)*	Orgs affected

Make and Model of new asset ______ Serial Number ______

Depreciation Life **50 years**

Retirement : Does this replace an existing asset Y or N ? If yes, please provide detailed information on asset being retired, including undepreciated value, make, model, serial number, date placed in service, etc

N

Planning document(s) referenced Water Treatment Capacity Study

Future Planning / Design Support Required Y or N ? **N**

Attach business case and documentation to further explain scope and/or justification.

Capital Project Proposal form must be approved by the following for budget consideration.

"x" boxes for required approvals.

		Initial, Date and Forward			*Initial, Date and Forward*
1) Project Manager		JCS 8/20/07	5) CBSO		[illegible] 8/22/07
2) Process Owner		JCS 8/20/07	6) CPAC		[illegible] 8/22/07
3) BSO		JCS 8/20/07	7) President		
4) Planning		JCS 8/20/07	8) Project Accounting		

Original retained by Project Accounting. Copy returned to Project Manager.

PROJECT PROPOSAL (Continued)

Project # 00000 **Title** CHFP Capacity Development Project

Project(s) and task(s) to be transferred to new project	
Start date of project	1/1/2011
End date of project	12/31/2012
If plant project, list location (i.e. BEP, Allmond, etc)	
Elevated or general service area	

KEY MEMBERS *(these employees will be given access to see all costs)*

Project Manager/Task Manager	**TBD**
Program Manager	**Carl Fautz**
BSO	
Inspector	
Other	

PROJECT CATEGORY *(highlight / circle one)*

Distribution Storage Facility
Facilities Management
General Administrative
General (Furniture, Lab/Communication Equipment)
Information Technology
Meters, Services and Hydrants
Preliminary E/S
Supply and Pumping Facility
Transmission and Distribution
Vehicles/Power Operated Equipment
Water Treatment Facility

FUNDING SOURCE *(must = 100%; based on Total Cost excluding Noncash Contributed Capital)*

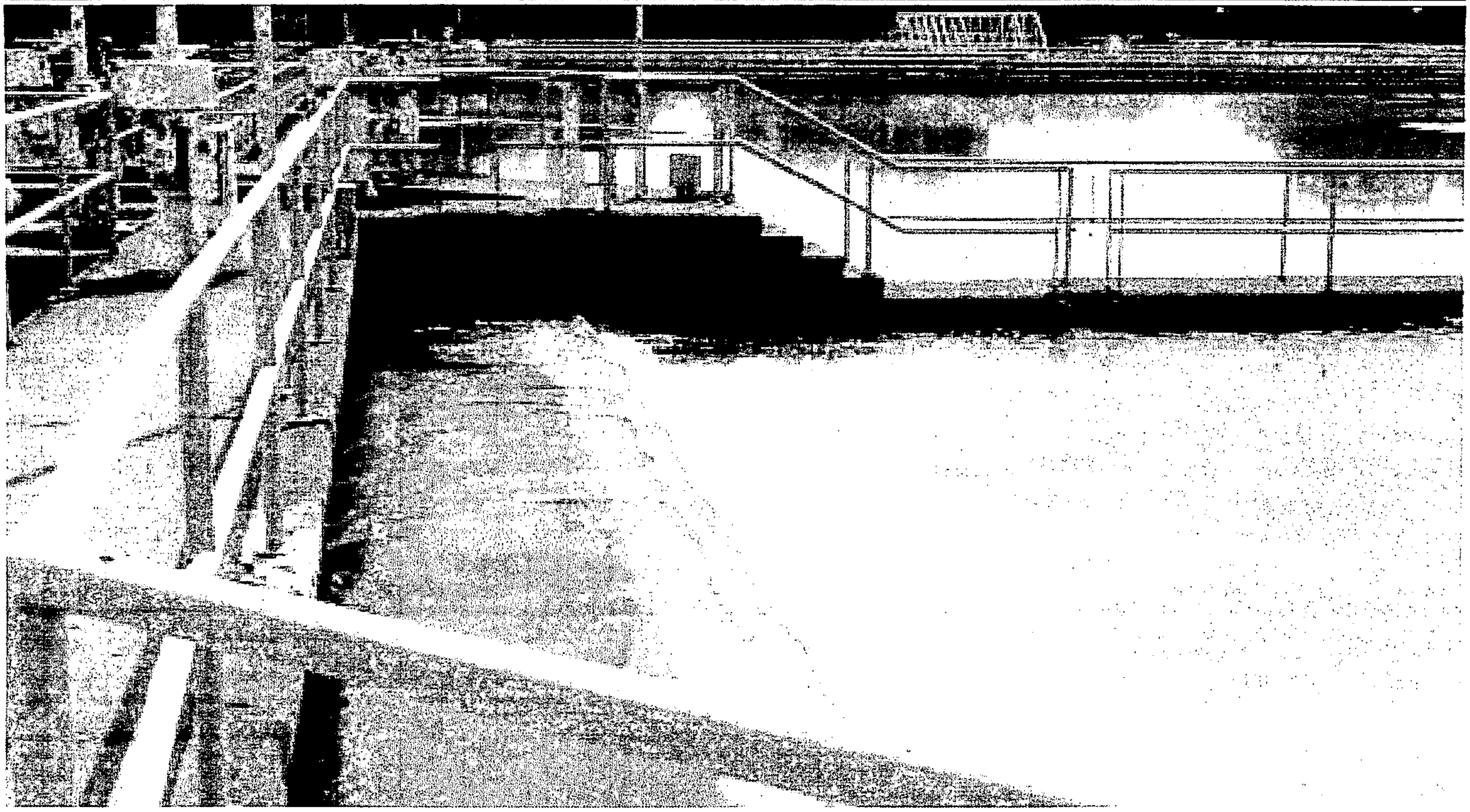
Agency *(be specific)*	
Bond Funds	
Bullitt County Water Reserve	
Customer	
Depreciation Fund	**100**
Developer	
Goshen Reserve	
Infrastructure Reserve	
Oldham County Fund	
Operating Fund *(for O&M only)*	
Shepherdsville Reserve	
System Development Fund	
	100

If Billable or Agency/Developer project, billing party's name and address:

To be filled out by Project Accounting:

Project set up in Oracle by name/date	
Interest or Non-interest	
Template	

FINAL REPORT



SUBMITTED TO

Louisville Water Company

FOR

Water Treatment Plant Capacity Study

AUGUST 2007

SUBMITTED BY

CH2MHILL

Water Treatment Plant Capacity Study

Prepared for

Louisville Water Company

August 2007

CH2MHILL

Executive Summary

This study was conducted to identify current water production capacities at the BE Payne and Crescent Hill Water Treatment Plants (BEPWTP and CHWTP), and low cost improvements to expand production capacity production.

Each plant's capacity was evaluated according to the following three components:

1. Hydraulics by computer modeling, calibrated by surveying
2. Treatment facility loading rates as compared to industry and design standards
3. Chemical-handling facilities and pumping equipment

BEPWTP and CHWTP have nominal design capacities of 60 million gallons per day (mgd) and 240 mgd, respectively. These capacities are based on standard filtration rates at each plant and have been confirmed by sanitary surveys conducted by the Kentucky Division of Water (KY DOW) (see Appendix E). As a result of this study, it was determined that the current maximum production capabilities of BEPWTP and CHWTP are 60 mgd and 180 mgd, respectively, as shown in Table ES-1. These maximum capabilities are based on plant hydraulics, treatment facility loading rates, chemical-handling facilities, and pumping equipment. Currently, if either plant is operated above these maximum capacities, softening basin weirs will flood causing improper operation of the plant. Figures ES-1 and ES-2 show current maximum production capacities for each unit process at BEPWTP and CHWTP.

Higher production capacities were investigated for both plants. Hydraulic computer modeling was prepared, calibrated, and conducted to determine flow rate capacities and head losses through each component of the treatment plants. Options to allow increased flow rate were identified and tested.

For the BEPWTP, three hydraulic improvement options were identified to expand from the current capacity of 60 mgd to 90 mgd, and two hydraulic options were identified for an expansion to 120 mgd. Hydraulic improvements included raising weir elevations to eliminate downstream backwater effects, lowering weirs where excess freefall exists to eliminate upstream backwater effects, extending basin walls to attain adequate freeboard, and enlarging or creating new passageway openings in basin walls. Additional improvements are related to treatment processes and equipment and include clear well additions, retrofitting tube settlers in settling basins, high service pumps, and chemical storage and feed facilities.

For the CHWTP, one hydraulic improvement option was identified for an expansion from the current capacity of 180 mgd to 210 mgd, and two hydraulic options were identified for an expansion to 240 mgd. Hydraulic improvements included raising weir elevations to prevent downstream backwater effects, extending basin walls, enlarging or creating new passageway openings in basin walls, and strengthening the piping connections for the east filter influent. Additional improvements are related to treatment processes and equipment and include clear well additions, retrofitting tube settlers in settling basins, high service pumps, and chemical storage and feed facilities.

TABLE ES-1
Water Treatment Plant Capacities, Present and Future

Capacity	Crescent Hill WTP	BE Payne WTP	Total
Nominal Design, mgd	240	60	300
Current Maximum Production Capability, mgd	180	60	240
Phase 1 Expansion, mgd	210	90	300
Phase 2 Expansion, mgd	240	120	360

Presently, as of publication of this report, Louisville Water Company's (LWC) maximum daily production of 205 mgd occurred in June 2005. Based on the LWC's current maximum day production capacity of 240 mgd, LWC currently has a reserve system capacity of 35 mgd. Upon completion of the Phase 1 and Phase 2 expansions, LWC will increase its reserve capacity to 95 mgd and 155 mgd, respectively.

All capacity improvements were categorized as **Required** or **Discretionary**. Improvements were considered to be **Required** if the improvement would be needed to enable the WTP to: 1) meet KY DOW requirements consistently, and 2) maintain LWC's high standard of water quality. Improvements were considered to be **Discretionary** if their benefit would improve plant operations or redundancy. Some improvements that are based on KY DOW guidelines or recommendations, but are not requirements, would fall into the **Discretionary** category until further investigation is performed to indicate otherwise.

Improvements to eliminate hydraulic bottlenecks are relatively minor with respect to costs for both plants; other improvements for treatment processes and equipment are more costly, as shown in Table ES-2. The total estimated construction costs for expanding the capacity at each plant are presented in this table.

TABLE ES-2
Construction Cost Estimate Summary

WTP	Phase 1 Expansion		Phase 2 Expansion	
	Required	Discretionary	Required	Discretionary
BEPWTP	90 mgd $5.0 million	90 mgd $16.9 million	120 mgd $8.6 million	120 mgd $26.3 million
CHWTP	210 mgd $1.6 million	210 mgd $20.6 million	240 mgd $14.7 million	240 mgd $23.6 million

Because of the lack of scope development at this conceptual stage of engineering analysis, these estimates would be considered rough, order-of-magnitude level. The expected accuracy range would be -50/+50 percent. The final cost of the recommended improvements will depend on actual labor and material costs, competitive market conditions, final project scope, schedule, detailed design documents, and other variable

conditions. As a result, the final cost of the recommended improvements will vary from these estimates.

Sections 2 and 3 of this report identify hydraulic, process, and equipment deficiencies that will result if the WTP capacities are increased. The identification of these deficiencies, and improvement options that were developed to correct them, were based on industry and Kentucky DOW standards and evaluation criteria developed during this project with LWC staff. Prior to designing any improvements to correct the deficiencies the criteria should be revisited in more detail. Example criteria that should be revisited or other issues to investigate are clear well volume requirements, future high service pumping capacities, tube settler feasibility and cost comparisons to new high-rate clarification technologies, future chemical feed rates, and filter high-rate performance testing.

FINAL REPORT

SUBMITTED TO

Louisville Water Company

FOR

Water Treatment Plant Capacity Study

AUGUST 2007

SUBMITTED BY

CH2MHILL

Water Treatment Plant Capacity Study

Prepared for

Louisville Water Company

August 2007

CH2MHILL

Executive Summary

This study was conducted to identify current water production capacities at the BE Payne and Crescent Hill Water Treatment Plants (BEPWTP and CHWTP), and low cost improvements to expand production capacity production.

Each plant's capacity was evaluated according to the following three components:

1. Hydraulics by computer modeling, calibrated by surveying
2. Treatment facility loading rates as compared to industry and design standards
3. Chemical-handling facilities and pumping equipment

BEPWTP and CHWTP have nominal design capacities of 60 million gallons per day (mgd) and 240 mgd, respectively. These capacities are based on standard filtration rates at each plant and have been confirmed by sanitary surveys conducted by the Kentucky Division of Water (KY DOW) (see Appendix E). As a result of this study, it was determined that the current maximum production capabilities of BEPWTP and CHWTP are 60 mgd and 180 mgd, respectively, as shown in Table ES-1. These maximum capabilities are based on plant hydraulics, treatment facility loading rates, chemical-handling facilities, and pumping equipment. Currently, if either plant is operated above these maximum capacities, softening basin weirs will flood causing improper operation of the plant. Figures ES-1 and ES-2 show current maximum production capacities for each unit process at BEPWTP and CHWTP.

Higher production capacities were investigated for both plants. Hydraulic computer modeling was prepared, calibrated, and conducted to determine flow rate capacities and head losses through each component of the treatment plants. Options to allow increased flow rate were identified and tested.

For the BEPWTP, three hydraulic improvement options were identified to expand from the current capacity of 60 mgd to 90 mgd, and two hydraulic options were identified for an expansion to 120 mgd. Hydraulic improvements included raising weir elevations to eliminate downstream backwater effects, lowering weirs where excess freefall exists to eliminate upstream backwater effects, extending basin walls to attain adequate freeboard, and enlarging or creating new passageway openings in basin walls. Additional improvements are related to treatment processes and equipment and include clear well additions, retrofitting tube settlers in settling basins, high service pumps, and chemical storage and feed facilities.

For the CHWTP, one hydraulic improvement option was identified for an expansion from the current capacity of 180 mgd to 210 mgd, and two hydraulic options were identified for an expansion to 240 mgd. Hydraulic improvements included raising weir elevations to prevent downstream backwater effects, extending basin walls, enlarging or creating new passageway openings in basin walls, and strengthening the piping connections for the east filter influent. Additional improvements are related to treatment processes and equipment and include clear well additions, retrofitting tube settlers in settling basins, high service pumps, and chemical storage and feed facilities.

TABLE ES-1
Water Treatment Plant Capacities, Present and Future

Capacity	Crescent Hill WTP	BE Payne WTP	Total
Nominal Design, mgd	240	60	300
Current Maximum Production Capability, mgd	180	60	240
Phase 1 Expansion, mgd	210	90	300
Phase 2 Expansion, mgd	240	120	360

Presently, as of publication of this report, Louisville Water Company's (LWC) maximum daily production of 205 mgd occurred in June 2005. Based on the LWC's current maximum day production capacity of 240 mgd, LWC currently has a reserve system capacity of 35 mgd. Upon completion of the Phase 1 and Phase 2 expansions, LWC will increase its reserve capacity to 95 mgd and 155 mgd, respectively.

All capacity improvements were categorized as **Required** or **Discretionary**. Improvements were considered to be **Required** if the improvement would be needed to enable the WTP to: 1) meet KY DOW requirements consistently, and 2) maintain LWC's high standard of water quality. Improvements were considered to be **Discretionary** if their benefit would improve plant operations or redundancy. Some improvements that are based on KY DOW guidelines or recommendations, but are not requirements, would fall into the **Discretionary** category until further investigation is performed to indicate otherwise.

Improvements to eliminate hydraulic bottlenecks are relatively minor with respect to costs for both plants; other improvements for treatment processes and equipment are more costly, as shown in Table ES-2. The total estimated construction costs for expanding the capacity at each plant are presented in this table.

TABLE ES-2
Construction Cost Estimate Summary

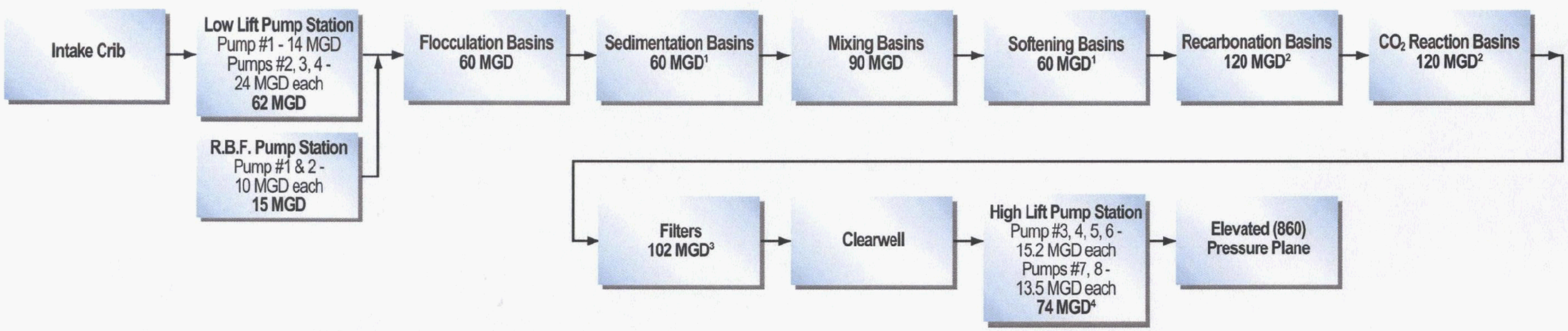
WTP	Phase 1 Expansion		Phase 2 Expansion	
	Required	Discretionary	Required	Discretionary
BEPWTP	90 mgd $5.0 million	90 mgd $16.9 million	120 mgd $8.6 million	120 mgd $26.3 million
CHWTP	210 mgd $1.6 million	210 mgd $20.6 million	240 mgd $14.7 million	240 mgd $23.6 million

Because of the lack of scope development at this conceptual stage of engineering analysis, these estimates would be considered rough, order-of-magnitude level. The expected accuracy range would be -50/+50 percent. The final cost of the recommended improvements will depend on actual labor and material costs, competitive market conditions, final project scope, schedule, detailed design documents, and other variable

conditions. As a result, the final cost of the recommended improvements will vary from these estimates.

Sections 2 and 3 of this report identify hydraulic, process, and equipment deficiencies that will result if the WTP capacities are increased. The identification of these deficiencies, and improvement options that were developed to correct them, were based on industry and Kentucky DOW standards and evaluation criteria developed during this project with LWC staff. Prior to designing any improvements to correct the deficiencies the criteria should be revisited in more detail. Example criteria that should be revisited or other issues to investigate are clear well volume requirements, future high service pumping capacities, tube settler feasibility and cost comparisons to new high-rate clarification technologies, future chemical feed rates, and filter high-rate performance testing.

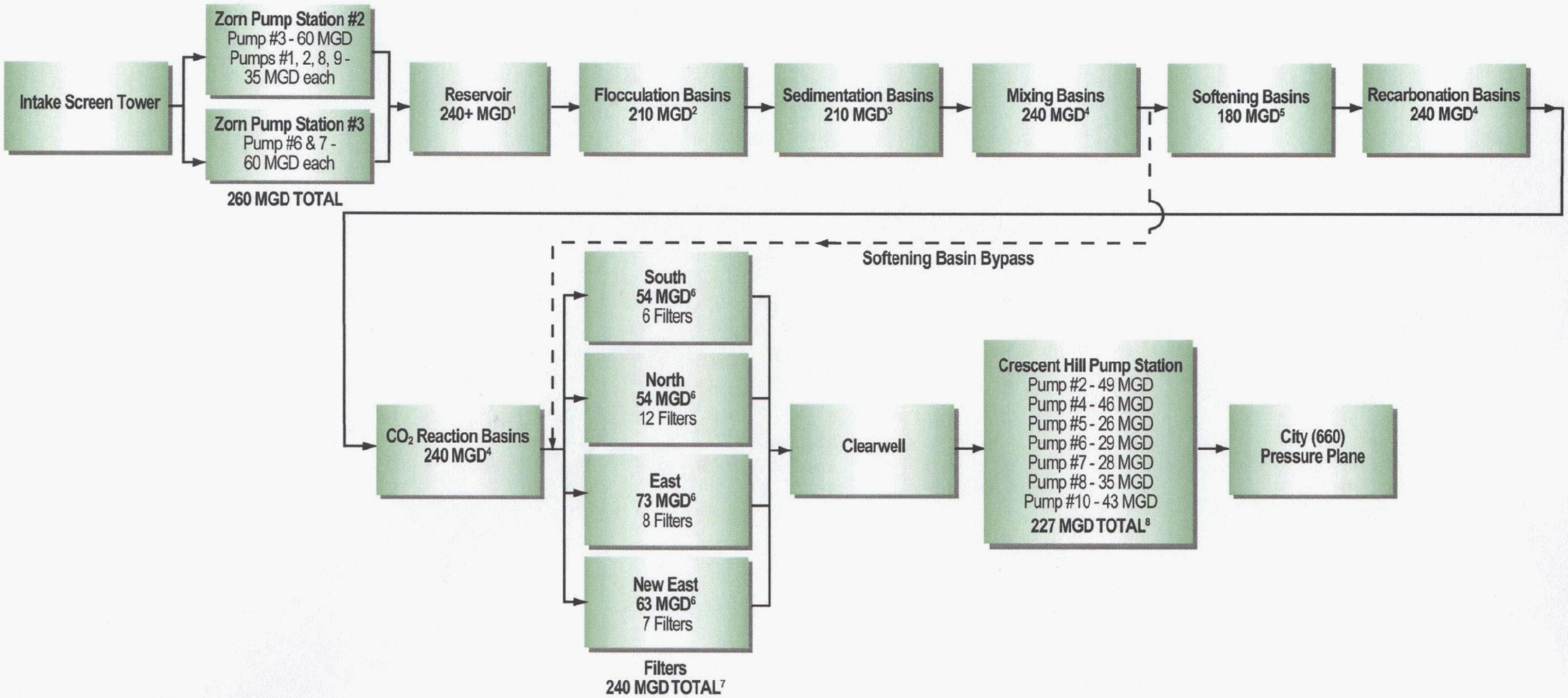
CURRENT PRODUCTION CAPABILITY: 60 MGD



[1] Based on surface loading rate criteria.
[2] No loading restrictions exist; however, inlet and outlet modifications may be required.
[3] Based on 8 filters at 5 gpm/sf.
[4] Pump #8 assumed to be in standby service.

FIGURE ES-1
Current Unit Process Capacities
B.E. Payne WTP

CURRENT PRODUCTION CAPABILITY: 180 MGD



1 Based on hydraulic modeling.
2 Based on detention time. Flocculation basins exceed max. flow-through velocity.
3 Based on surface loading rate. Weir overflow rate exceeded.
4 No loading restrictions exist; however, inlet and outlet modifications may be required.
5 Softening basins do not achieve 240 min. detention time.
6 Based on 3 gpm/sf filter rate. Inlet modifications may be required.
7 Total capacity was rounded down to be consistent with the sanitary survey.
8 Pump #6 assumed to be in standby service.

FIGURE ES-2
Current Unit Process Capacities
Crescent Hill WTP

CH2MHILL

WB072007004MKE Figure ES-2_v2.ai 08-08-07 sls/jls

Contents

Appendixes

Tables

Figures

SECTION 1

Introduction

This capacity study was conducted to identify current water production limitations and low-cost improvements to help determine whether the BE Payne and Crescent Hill Water Treatment Plants (BEPWTP and CHWTP) can be expanded to meet the following preselected capacities:

Capacity, Million Gallons per Day

WTP	Present Rating	First Potential Expansion	Second Potential Expansion
BEPWTP	60	90	120
CHWTP	180	210	240

A schematic view of current production capability by unit process for each plant is presented in Figures 1-1 and 1-2; however, the figures do not address the plants' capability to hydraulically transport water between processes. Specifically, the study identifies hydraulic bottlenecks, inadequate chemical storage and feed capacities, and high service–pumping capacities, which may prevent the facilities from meeting future water demands. Additionally, the treatment process loading rates were reviewed and compared to industry standards. Recommendations were made on the basis of hydraulic modeling and industry standard loading rates. This report presents the results of the study.

1.1 Approach

Each plant's capacity was evaluated according to the following three components:

1. Hydraulics—computer modeling of plant hydraulics to determine limitations, including high-service pumping, but not raw water pumping
2. Treatment facility loading rates—calculating loading rates for plant flows and comparing them to industry and design standards and requirements
3. Chemical-handling facilities—calculating chemical feed rates and storage required for plant flows to identify inadequate pumping or feeding equipment and inadequate storage

The available as-built water treatment plant (WTP) construction drawings for each plant were reviewed to identify facility dimensions, piping and conduit configurations, and hydraulic control points. A survey was also conducted at each treatment plant to verify elevations of the control points and other critical structures. Appendix A shows the locations of these points on site plans at both plants. The survey also included water surface elevations at specific flow rates to provide a baseline for calibration of the hydraulic model. CHWTP has been expanded or improved several times since the original treatment facilities were completed. The east filters were constructed in two phases, and the softening basins and associated conduits were constructed in three phases. The models were prepared using the most up-to-date record drawings of the facilities available. The CHWTP record drawings contain a different elevation datum for each expansion phase: The filter drawings and first- and second-phase softening basin drawings are based on the Louisville Water Company (LWC) Datum, whereas the third phase softening basin drawings use the National Geodetic Vertical Datum of 1929 (NGVD 29). This survey was conducted using the NGVD 29 Datum. The LWC Datum was translated to the NGVD 29 Datum by adding 404.14 feet to each elevation, per instructions provided by LWC staff.

The modeling was conducted using HYDRO, a CH2M HILL modeling software package. Each plant model starts at a specified downstream condition (typically the highest clear well water surface level) entered by the user and calculates head losses backwards through the treatment plant. The model results have been inverted for presentation in this memorandum so that results start at the head of the plant and end at the clear well. A single flow path is selected and entered into the model by building a scenario consisting of model elements that represent treatment plant structures (weirs, channels, circular or rectangular conduits, orifices, etc.). Each element is populated with appropriate attributes such as length, width, friction coefficient, and percent of base flow. The model is then run, and an output file is produced that consists of the hydraulic and energy grade lines (HGL and EGL) upstream and downstream of each element in the model.

Two water surface surveys were performed at CHWTP to establish a baseline for calibrating the model. The surveys were conducted at plant flows of 103 million gallons per day (mgd) and 151 mgd. Two water surface surveys were conducted at BEPWTP as well; however, the flow difference between the two surveys was very small, and little additional information was gathered from the second survey. As a result, the BEPWTP model was calibrated using the 35.6-mgd plant flow survey results. Treatment flow-tracking data from the LWC supervisory control and data acquisition (SCADA) systems at both plants were provided to verify that flows were consistent for the duration of the water surface surveys. Minor losses and friction factors were adjusted in each model until the HGL results from the model reflected the results of the surveyed water surface elevations. The calibration goal was to have a 0.04-foot (0.5-inch) maximum difference between the model and the actual surveyed water surfaces. The surveyed water surface elevations are not precise owing to the difficulty in measuring moving and sometimes turbulent water surfaces.

BEPWTP was much less complicated to model than CHWTP. BEPWTP consists of identical parallel treatment trains, each containing an approximately even flow split as well as a single filter bank. CHWTP treatment trains are not identical, and the flow downstream of the reaction basins must split to three different filter banks (north, south, and east filters) as well as enter two of the three banks from both ends of the influent channel. To establish the estimated flow split going to each filter bank, a network model was created using EPANET software. The EPANET model was prepared starting at the common reaction basin effluent conduit at the northeast corner of reaction basin 1 and ending at each filter influent channel. Each filter bank influent channel was assumed to be a demand node with the appropriate total filter flow, as measured by the SCADA system during the day of surveying, entered as the demand for each node. The starting point in the network model was assumed to be a supply reservoir with the actual surveyed water surface elevation of the reaction basin effluent channel at the northeast corner of reaction basin 1 entered as the reservoir water surface elevation. Some assumptions were made about whether certain buried valves were open or closed owing to LWC staff not knowing the current valve positions. The EPANET model produced the approximate flow split in each conduit branch feeding the three filter banks. The flow percentages calculated by the EPANET program were then entered into the appropriate element in the HYDRO model.

After model calibration, the first task was to establish the maximum hydraulic capacity of the existing treatment facilities without any modifications. During the survey of CHWTP, only four of six softening treatment trains were in service. To establish the maximum hydraulic capacity, flow percentages were adjusted in the model to assume that all eight coagulation basins and the six softening trains were in service and that each train was receiving a proportionate amount of flow on the basis of its size. One filter in each filter group was assumed to be out of service. Likewise, during the BEPWTP survey, only two of the three pretreatment trains were in service. The BEPWTP model flow percentages were adjusted after calibration to simulate conditions with all three pretreatment trains and seven of the eight filters being in service to establish the maximum hydraulic capacity.

After the maximum hydraulic capacity was established for each WTP, the model flow rates were adjusted to simulate specified future conditions for each plant. Modifications in each plant were identified to maintain a realistic hydraulic profile as well as adequate freeboard in basins and channels.

The loading rates of the treatment processes for each plant were examined and compared to Kentucky Division of Water (KY DOW) requirements and industry guidelines (for example, recommended standards for waterworks) for current and future flow conditions. The north and south coagulation basins at CHWTP are different sizes. The flow split between the basins was assumed to provide equal surface loading for each group of basins. Likewise, the filtration bed loading was assumed to be equal between each bank of filters. Loading rates were examined for current capacity and for two proposed capacities for each WTP.

Each chemical feed system was examined for dosage capacity as well as required storage. Required dosing capacity and recommended storage were calculated for current and proposed future capacities and compared to existing dosing equipment and storage.

1.2 Assumptions for Modeling

1.2.1 CHWTP

During peak flows, all four south coagulation basins, all four north coagulation basins, and all six softening basins are in service. Flocculation, sedimentation, and softening basin outages usually can be scheduled to occur during off-peak-demand seasons.

In operation are 14 of 15 east filters. (It is good practice to assume one filter will always be in standby service owing to increased frequency of backwashing.) The north filter bank is decommissioned for future capacity analysis.

Flow is split equally among the six slow mix and softening basins. The slow mix basin influent gates are partially closed to help distribute flow equally to slow mix basins 1–4.

Flow around reaction basins 1 and 2 is split 80 percent in the north channel and 20 percent in the south channel, with reaction basin 3 out of service. Flow split is 75 percent in the north channel and 25 percent in the south channel with reaction basin 3 in service. The 80 percent of flow in the north channel is the amount required for calibration with reaction basin 3 out of service. With reaction basin 3 in service, the additional flow splits proportionately to the north and south channels on the basis of channel section area.

1.2.2 BEPWTP

During peak flows, the process basins (flocculation, coagulation, slow mix, softening, and reaction basins) of all three treatment trains are in service. Basin outages can be scheduled to occur during off-peak seasons.

Seven of eight filters are operating; one is in standby mode for backwashing.

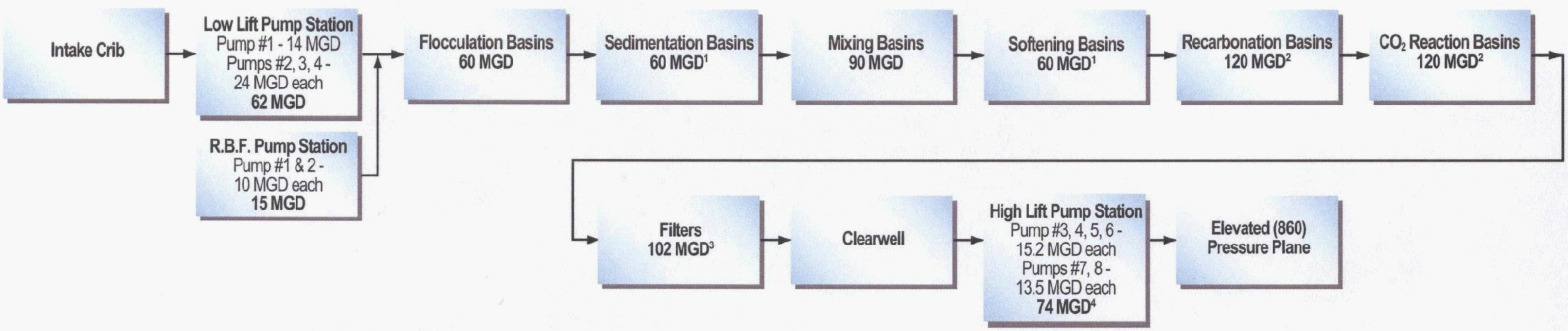
1.3 Criteria for Acceptable Modeling Results

After each model was calibrated, several scenarios were examined to establish the existing plant hydraulic capacity. Flow in the model was incrementally increased until one or more sets of criteria were exceeded. The following hydraulic criteria were developed:

- A minimum of 6 inches (and preferably 12 inches) of freeboard must be maintained in open basins.
- A minimum of 6 inches of headspace must be maintained in basins with covers, if the covers were not designed for uplift.
- The amount of fall downstream of a weir has to be equal to or greater than the head on the weir upstream.
- The minimum head loss through the filters is 8 feet.
- Influent weirs may be flooded.

Using these criteria, existing conditions and several capacity scenarios and improvement options were modeled and evaluated for acceptance, as described in the following sections.

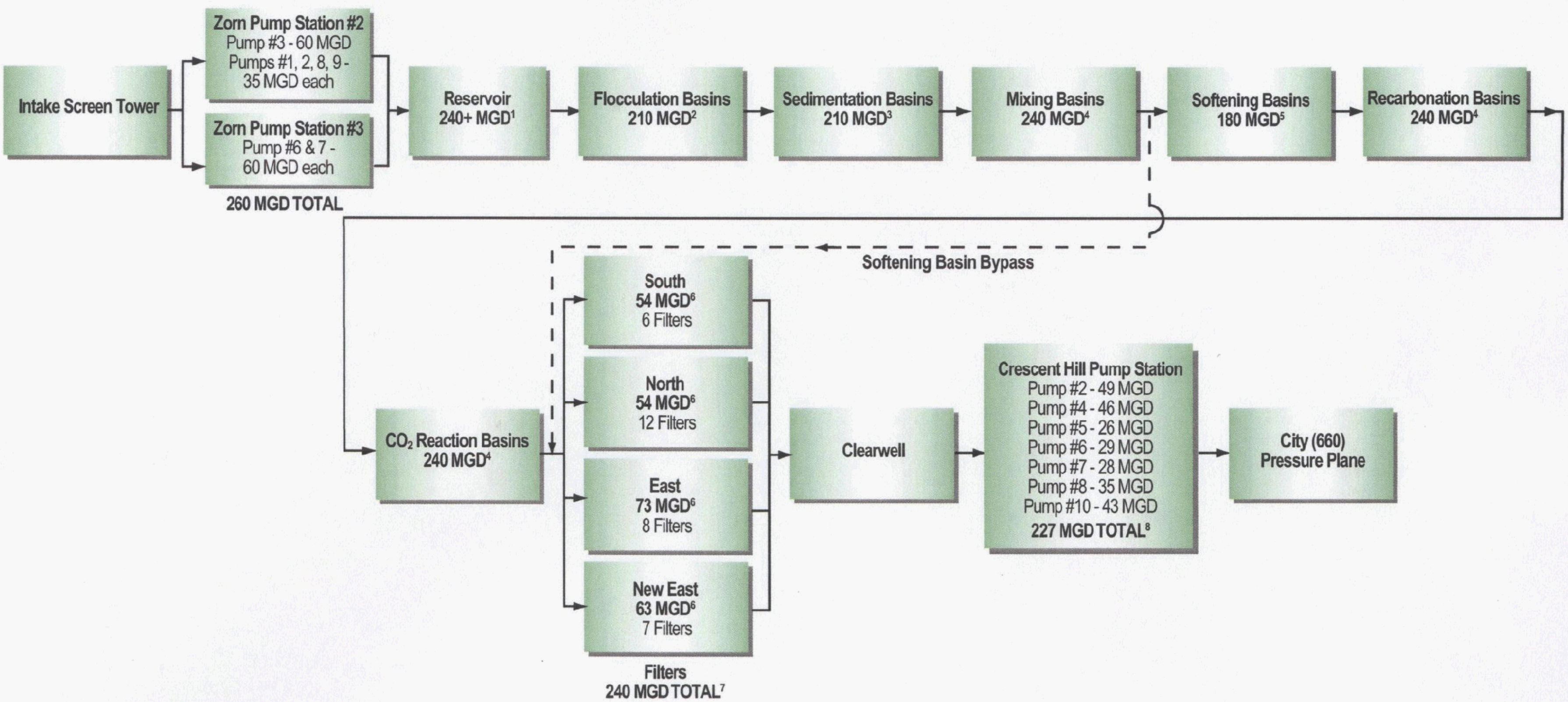
CURRENT PRODUCTION CAPABILITY: 60 MGD



[1] Based on surface loading rate criteria.
[2] No loading restrictions exist; however, inlet and outlet modifications may be required.
[3] Based on 8 filters at 5 gpm/sf.
[4] Pump #8 assumed to be in standby service.

FIGURE 1-1
Current Unit Process Capacities
B.E. Payne WTP

CURRENT PRODUCTION CAPABILITY: 180 MGD



1 Based on hydraulic modeling.
2 Based on detention time. Flocculation basins exceed max. flow-through velocity.
3 Based on surface loading rate. Weir overflow rate exceeded.
4 No loading restrictions exist; however, inlet and outlet modifications may be required.
5 Softening basins do not achieve 240 min. detention time.
6 Based on 3 gpm/sf filter rate. Inlet modifications may be required.
7 Total capacity was rounded down to be consistent with the sanitary survey.
8 Pump #6 assumed to be in standby service.

FIGURE 1-2
Current Unit Process Capacities
Crescent Hill WTP

WB072007004MKE Figure 1-2_v9.ai 08-09-07 sls/jls

CH2MHILL

SECTION 2

BEWTP Results and Conclusions

2.1 Hydraulic Capacity

A survey of the BEPWTP facilities was conducted to obtain baseline hydraulic data for calibrating the model. Tops of walls, weirs, launders, and channels were surveyed to check consistency within the plant as well as to compare the plant to existing record drawings. Table 2-1 summarizes the results of the structures survey. The basin walls are within 0.5 inch of the record drawings. The effluent weirs on the coagulation basins are within 0.25 inch of the record drawings. Varying elevations were surveyed for the softening basin effluent weirs. One reading on softening basin 2 weirs gave an elevation nearly 5 inches lower than the record drawing elevation; this difference is probably due to survey error, since no other variances of this magnitude were observed. Overall, the softening basin effluent weirs are within 0.5 inch of the record drawings. The reaction basin effluent weirs are a little more than 1 inch lower than the record drawings.

After the structure and control point elevations were obtained, the hydraulic model was assembled. One HYDRO model scenario was conducted for the existing treatment plant to calibrate the model. Two sets of survey data were obtained at two different flows; however, the difference between the high and low flows—about 4 mgd—was far less than had been anticipated. The low-flow data were selected for calibrating the model. After the model was assembled and run, minor losses and coefficients were adjusted until the model HGL output was within 0.04 foot of the actual water surface elevation surveyed. Some model elements produced a head loss less than that found by the field survey and required adjustments outside of normal parameters for the given element. Possible reasons for the model discrepancy could be sediment deposits in tunnels or partially closed gates, which increase friction losses. Table 2-1 summarizes the calibrated model outputs and the actual survey readings. Overall, the model tracks very well with the actual conditions with a few exceptions. Notes to Table 2-1 explain why the difference between the model and surveyed elevation may have occurred. Some water surfaces are turbulent, and obtaining an accurate surveyed reading of the surface is sometimes difficult.

2.1.1 Existing WTP Capacity

All treatment basins are currently being renovated. New effluent weirs are being installed in the coagulation, softening, and reaction basins; a new influent box is being constructed in each recarbonation basin; and new clarifier mechanisms are being installed in the coagulation and softening basins, among other improvements. The new construction will alter the hydraulics through each treatment train. The renovation work has only recently begun, and therefore no calibration data could be obtained for the new facilities. However, reasonable coefficients were used for the new facilities for modeling future hydraulic capacities.

Prior to beginning the renovations now underway, the maximum plant hydraulic capacity was 70 mgd. The first criterion violated at increased capacity was the softening basin

effluent weirs having inadequate fall into the discharge launder. Higher flow rates would result in a backwater condition at the effluent weir and create uneven discharge over the length of each weir. The existing reaction basin effluent weirs are installed at an elevation of 470.75 feet (the average of six survey readings across the weirs). The original construction drawings for the basins called out an elevation of 470.84 feet. The lower installed elevation for the weirs allows 70 mgd to be pushed through the plant instead of the rated 60 mgd. The present renovations will include installing the new reaction basin effluent weirs at the original elevation of 470.84 feet and constructing a new carbon dioxide diffuser and contact structure in the recarbonation basin with an inlet that is 42 inches by 42 inches in size. The 17 present 10-by-48-inch inlet ports into the recarbonation basin will be covered with steel plates. The new 42-inch inlet to the recarbonation basin will create additional head loss as flow exits the softening basin launder. As a result, the additional head loss reduces plant capacity to 57 mgd to avoid flooding the effluent weirs at the softening basins. Lowering the reaction basin effluent weirs to 470.75 feet will allow for additional head drop at the recarbonation influent structure and will increase the hydraulic capacity to 60 mgd.
Table 2-4 shows results of the model at 57 mgd with all three treatment trains in service, including the new basin renovations. Figure 2-1 shows the HGL though BEPWTP at the calibration flow prior to the present basin renovations, and Figure 2-2 shows the HGL at the maximum hydraulic capacity of 57 mgd with the new basin renovations in service. During preparation of this report, the LWC was advised about the imminent decrease in capacity because of ongoing plant modifications, so plans are underway to lower the reaction basin weirs. As a result, this plant is now assumed to have an existing capacity of 60 mgd.

2.1.2 Modeling Results for 90-mgd Improvements

The first proposed capacity scenario is a plant flow of 90 mgd. The plant flow was entered into the model and run. Three options were identified to hydraulically handle 90 mgd through the WTP.

Option 1A includes raising basin effluent weirs only. Owing to the larger head loss through the recarbonation basin inlet port, the softening basin weirs need to be raised 7 inches to prevent flooding of the weir or exceeding the criterion set for flow over weirs. The recarbonation inlet restriction would cause the water in the launders to back up, resulting in a 7-inch freeboard in the softening basins. Raising the softening basin weirs would require a higher water level in the mixing basin to provide a driving head to push water through the softening basins. The mixing basin freeboard would be reduced to 2.5 inches, and the softening influent conduit headspace would be reduced to 4 inches. The coagulation basin effluent weir would need to be raised 5 inches, and the resulting freeboard in the coagulation basins would be 9 inches. The flocculation basin water surface elevation rises, resulting in 4 inches of freeboard in the flocculation basins and the coagulation influent conduit being pressurized with 0.2 inch of uplift pressure. Table 2-5 shows the model results of a plant flow of 90 mgd with the raised weirs. Some of the basin freeboards would be less than required to satisfy the criterion, so their concrete walls would need to be extended. Although the coagulation influent channel and mixing basin influent channel covers would need to be removed, additional wall height would be gained, since the covers are 8 inches thick, and satisfactory freeboard would be attained. Because the six existing coagulation flash mixers are supported by the channel cover, a new support system fabricated from structural steel to support the mixers, or a section of the concrete cover could be left in place for each mixer, but these ideas need a structural investigation prior to designing modifications.

Option 2A increases the recarbonation inlet port size as well as raising weirs, but not to the extent raised in Option 1A. At the current size of 42 by 42 inches, the recarbonation inlet port would create 0.62 feet of head loss at a plant flow of 90 mgd. Enlarging the port to 60 inches wide by 48 inches high would reduce the head loss through the orifice to 0.23 feet. The softening basin weirs would still need to be raised, but only by 2 inches. The softening basin freeboard would be 12 inches, which is acceptable. The mixing basin freeboard would be less than the desired minimum of 12 inches but is acceptable at 7 inches, and the walls would not need to be extended. Raising weirs at the coagulation basins would also be required for this option. The coagulation basin weirs would need to be raised only 1 inch, and the resulting basin freeboard would be 13 inches. The flocculation basin freeboard would be acceptable at 7.5 inches even though it is less than the desired 12 inches. Headspace in the coagulation influent conduit would be reduced to 2 inches, so the cover would need to be removed. Table 2-6 shows the results of the model at 90 mgd with the larger recarbonation inlet port and the raised weirs.

Option 3A minimizes the amount of work required to increase the plant capacity. The desired goal was to eliminate the need to raise the softening or coagulation basin weirs as well as eliminate the need to enlarge the recarbonation basin inlet port. This goal could be accomplished just by lowering the reaction basin effluent weirs. There would be adequate freefall downstream of the reaction basin effluent weirs, which allows the weirs to be lowered and still maintain the minimum criterion set for flow over weirs. By lowering the reaction basin effluent weirs 6 inches, enough head drop would be gained through the plant that other basin modifications would not be required to attain the 90-mgd hydraulic capacity through the WTP. The softening, mixing, coagulation, and flocculation basin freeboards would be 14, 9.5, 14.5, and 8.5 inches, respectively, which are acceptable. The headspace in the softening influent conduit and coagulation influent conduit would be 9.5 and 2.5 inches, respectively, so the coagulation influent conduit covers would need to be removed, and the mixers would need a new or modified support system. Table 2-7 shows the model results with a plant flow of 90 mgd and lower reaction basin effluent weirs.

Figure 2-3 shows the hydraulic profile through BEPWTP for each of the three options at 90 mgd.

2.1.3 Modeling Results for 120-mgd Improvements

The second proposed capacity scenario is a plant flow of 120 mgd. The plant flow was entered into the model and run. Two options were identified to hydraulically handle 120 mgd through the WTP:

Option 2B enlarged the recarbonation inlet port, raised basin effluent weirs, and added basin inlet and outlet sluice gates. The recarbonation basin inlet port area was increased by a little more than double the current size. Enlarging the opening any more would not add much additional hydraulic benefit because there are other sites that would be more restrictive at 120 mgd. The recarbonation influent box contains an underflow baffle wall that creates a head loss that cannot easily be relieved. The softening basin effluent weirs would be raised 5 inches, and the resulting softening basin freeboard would be 8.5 inches. The head losses between the softening and mixing basins would be large, and the water surface elevation in the mixing basins would be higher than the top of the existing wall. Basin walls from the mixing basins upstream to the coagulation influent conduit would need to be raised to contain the water and provide adequate freeboard. Coagulation basin effluent weirs would be raised 8 inches, and additional sluice gates would be added for the flocculation basin influent, coagulation basin effluent, and the mixing basin influent. Table 2-8 shows the results of the model at 120 mgd with the larger recarbonation inlet port, raised weirs, and additional sluice gates.

Option 3B for the 120-mgd scenario is similar to Option 3A for the 90-mgd scenario. The reaction basin effluent weirs would be lowered; however, additional modifications would be required to hydraulically pass 120 mgd through the plant. The recarbonation basin inlet port would need to be enlarged, which in combination with the lower reaction basin effluent weirs would eliminate the need to raise the softening basin effluent weirs. However, the coagulation basin weirs would still need to be raised. The additional sluice gates for the flocculation basin influent, coagulation basin effluent, and mixing basin influent would be added for this option. The mixing basin freeboard would be only 3.5 inches, and the flocculation basin freeboard would be 0.25 inch; thus the walls of both basins would need to be extended. Table 2-9 shows the results of the model at 120 mgd with the lowered reaction basin weirs, additional sluice gates, and raised coagulation basin weirs.

Figure 2-4 shows the hydraulic profile through BEPWTP for both of the options at 120 mgd.

Table 2-10 summarizes the hydraulic modifications required at BEPWTP for each option at plant flows of 90 mgd and 120 mgd.

2.1.4 High-Service Pumps

The BEPWTP high-service pumps were examined to determine the existing station pumping capacity. Station capacity is defined as the total pumping capacity with one unit out of service. The pump capacities were determined by calculating each pump total dynamic head (TDH) and selecting the corresponding flow from the pump curves. TDH was calculated by adding estimated station losses (from the suction to the discharge pressure gauge) to the discharge head (computed from the gauge pressure reading) and subtracting the suction head (typically the clear well water surface elevation).

Pumps 3, 4, 5, and 6 discharge directly into a 60-inch water main supplying the distribution system. Pumps 7 and 8 discharge to a 36-inch water main that connects to the 60-inch water main. Prior to connecting to the 60-inch water main, the 36-inch water main splits, with one leg conveying water out to the distribution system and the other leg connecting to the 60-inch water main. The capacity of Pumps 3, 4, 5, and 6 was determined to be 15.2 mgd each at a pump station discharge gauge pressure of 184.9 pounds per square inch (psi), which was recorded during a peak pumping event in June 2005. Pumps 7 and 8 were determined to have a capacity of 13.5 mgd each at the same gauge pressure. Total pumping capacity was calculated to be 87.8 mgd, with all pumps on and discharge pressure held to 184.9 psi.

The minimum desired high-service station pumping capacity was determined by LWC staff to be equal to the WTP capacity. The existing station capacity was calculated to be 74.3 mgd (one 13.5 mgd pump in standby duty), which provides the high service pump capacity desired by LWC at the plant production rate of 60 mgd. At higher plant capacities, however, the high-service pumping capacity requirements will exceed the existing capacity.

2.2 BEPWTP Treatment Processes

Table 2-11 summarizes the loading rates and hydraulic retention times (HRTs) for the treatment processes for BEPWTP and compares them to existing "Recommended Standards for Water Works" (also known as Ten States Standards) and KY DOW general design guidelines.

2.2.1 Flocculation Basins

The flow-through velocity in the flocculation basins exceeds the Ten States Standards recommended maximum at present and proposed capacities. KY DOW design criteria do not contain guidelines for flow-through velocity in flocculation units. Basin detention time exceeds the recommended minimum for both Ten States Standards (30 minutes) and KY DOW guidelines (40–60 minutes) at the present capacity of 60 mgd, but is less than the KY DOW minimum detention time at 90 mgd and is less than both the KY DOW and Ten States Standards recommended minimum at 120 mgd.

2.2.2 Coagulation Basins

The coagulation basins were assessed in terms of detention time, surface overflow rate, and weir loading rate. Ten States Standards and KY DOW guidelines contain the same recommended minimum detention time of 240 minutes. The basin detention time at the present capacity is less than the recommended minimum. The weir overflow rates for the coagulation basins exceed the Ten States Standards recommended maximum limit of 20,000 gallons per day per foot (gpd/ft). KY DOW guidelines do not contain a recommended maximum weir overflow rate. Surface loading is below the recommended maximum rate for both KY DOW and the Ten States Standards at the present flow of 60 mgd. At 90 mgd, the surface loading rate exceeds the KY DOW recommended maximum and is equal to the Ten States Standards maximum. KY DOW and Ten States Standards recommended maximums are both exceeded at 120 mgd. Subject to KY DOW approval, tube settlers with integral effluent finger weirs could be retrofitted into the basins to effectively handle the overages of detention time, overflow rates, and weir overflow rates.

2.2.3 Slow Mix Basins

The slow mix basins are subject to the Ten States Standards recommendations for flocculation basins. KY DOW does not publish guidelines for slow mix basin design. Because the slow mix basins are in the same size as the flocculation basins, the flow-through velocity at present and proposed flow rates exceeds the recommended Ten States Standards maximum, and the detention time is higher than the Ten States Standards recommended minimum for 60 and 90 mgd, and is less than Ten States Standards 120 mgd, which is the same as that for the flocculation basins.

2.2.4 Softening Basins

The softening basins are subject to the same Ten States Standards' recommendations as coagulation basins, and the basins are the same size the coagulation basins. KY DOW does not publish guidelines for softening basin design. Surface loading is below the Ten States Standards recommended maximum rate at the present flow of 60 mgd and is equal to the recommended maximum rate at 90 mgd. The Ten States Standards recommended maximum is exceeded at 120 mgd. The basin detention time at present and future capacities is less than the recommended minimum. The weir overflow rates for the softening basins exceed the Ten States Standards recommended maximum. Again, similar to the coagulation basins and subject to KY DOW approval, tube settlers with integral effluent finger weirs could be retrofitted into the basins to effectively handle the overages of detention time, overflow rates, and weir overflow rates.

2.2.5 Clear Wells

KY DOW requires that the clear well volume be at a minimum 15 percent of the total 24-hour plant capacity. The existing clear well has a volume of 6 million gallons and is inadequately sized at the present capacity of 60 mgd and at proposed future capacities of 90 and 120 mgd.

2.2.6 Filtration

Filtration rate at the present flow of 60 mgd exceeds KY DOW requirements of 2 gallons per minute per square foot (gpm/ft^2) for rapid sand filters. However, high-rate filtration up to 5 gpm/ft^2 is permitted with continuous turbidity monitoring of each filter effluent and acceptable performance. LWC presently monitors turbidity on each filter effluent. The present rate is less than 5 gpm/ft^2 at 60 mgd and is acceptable. The filtration rate would be 5.07 gpm/ft^2 with 7 of 8 filters in service at 90 mgd; however, this rate may be acceptable to KY DOW as long as all filters are performing successfully. Proposed flows of 120 mgd will result in a filtration rate of 6.76 gpm/ft^2 with 7 of 8 filters in service, a much greater variance. Full-scale demonstration testing showing acceptable filter performance would be required by KY DOW to approve this higher rate.

2.3 BEPWTP Chemical Feed Systems

Table 2-11 summarizes the existing feed systems and future capacities required for the chemicals used at BEP, based on historical feed rates. Each chemical feed system was analyzed to determine its adequacy under existing and future flow conditions on the basis of storage capacity and feed capacity.

2.3.1 Chemical Storage

Table 2-11 lists storage requirements under two conditions. Required storage is calculated on the basis of average dose at average flow for 30 days, and maximum dose at average flow for 14 days. The worst-case condition would dictate the recommended storage capacity required. The treatment plant flow rate was assumed to have a 1.5 peaking factor. Average flow was determined by dividing the plant capacity by 1.5.

The powdered activated carbon (PAC) system contains two 40,000-gallon storage tanks. PAC is not dosed on a regular basis. It is used primarily during taste and odor events or if there is a spill on the Ohio River. If the WTP were expanded to a 120-mgd capacity at maximum dose and average flow, the storage required would be 40,240 gallons. There is adequate existing storage capacity to meet this requirement.

The existing chlorine storage, 24 tons, is sufficient for the present capacity of 60 mgd. At a plant capacity of 90 mgd, the required storage for average dose and average flow conditions would exceed the existing available storage. At 120 mgd the required storage at both flow conditions would exceed current existing storage capacity.

At the present capacity of 60 mgd and future capacities of 90 and 120 mgd, the available ferric chloride storage, 77,000 gallons, exceeds the required ferric chloride storage at average dose and average flow conditions. At 90- and 120-mgd capacity, the required storage exceeds existing storage at maximum dose and average flow conditions.

The existing cationic polymer storage is 5,100 gallons. The required storage for polymer is less than existing storage for all flow conditions except at 120-mgd capacity, where the required storage exceeds available storage at maximum dose and average flow.

Storage requirements for lime and fluoride at all flow conditions are less than the present available capacity of 560 tons for lime and 10,000 gallons for fluoride.

The available ammonia storage is 1,800 gallons. The required storage is less than available storage at all flow conditions except average dose and average flow at 120-mgd plant capacity.

A new carbon dioxide storage and metering facility is currently under construction. The new carbon dioxide storage capacity will be 100 tons. The existing storage is adequate for the existing and 90 mgd WTP capacity, but required storage at 120 mgd will exceed what is available.

2.3.2 Chemical Feed Capacity

The chemical feed capacity analysis compared the required capacity at maximum dose and average WTP flow to the existing available feeding capacity. Table 2-11 indicates the firm feed capacity of the existing chemical systems. Existing firm feed capacity was determined by assuming one of the largest metering pumps or feeders is out of service.

Firm feed capacity is adequate for PAC at all flow conditions. Firm feed capacity is inadequate for the polymer and ammonia systems at all flow conditions. Chlorine and ferric chloride feed systems are inadequate for plant capacities of 90 and 120 mgd. The lime firm feed capacity is inadequate at a plant capacity of 120 mgd. Firm feed capacity of fluoride is inadequate at plant capacities of 90 and 120 mgd.

TABLE 2-1
BE Payne WTP
Structure Elevations
Louisville Water Company Water Treatment Plant Capacity Study

Structure Description	June 2006 Surveyed Elevation	Facility Record Drawings Elevation	Difference	
Coagulation Basin Influent Conduit Top of Wall	474.975	475.0	-0.02	
Flocculation Basin Top of Wall	474.445	474.5	-0.06	
Coagulation Basin Top of Wall	473.965	474.0	-0.04	
Coagulation Basin #1 Effluent Weirs	472.976	473.0	-0.02	
Coagulation Basin #2 Effluent Weirs	472.981	473.0	-0.02	
Coagulation Basin #3 Effluent Weirs	472.981	473.0	-0.02	
Coagulation Basin #1 Effluent Launder Invert	467.685	467.67	0.01	
Coagulation Basin #2 Effluent Launder Invert	467.725	467.67	0.06	
Coagulation Basin #3 Effluent Launder Invert	467.685	467.67	0.01	
Softening Basin Influent Conduit	472.075	474.0	-1.93	*
Softening Basin #1 Effluent Weirs	471.453	471.5	-0.05	
Softening Basin #2 Effluent Weirs	471.258	471.5	-0.24	*
Softening Basin #3 Effluent Weirs	471.488	471.5	-0.01	
CO2 Reaction Basin #1 Effluent Weirs	470.748	470.84	-0.09	
CO2 Reaction Basin #2 Effluent Weirs	470.748	470.84	-0.09	
CO2 Reaction Basin #3 Effluent Weirs	470.788	470.84	-0.05	
Filter Observation Floor	470.902	470.79	0.11	

* Probable Survey Error

TABLE 2-2
BE Payne WTP
Survey and Calibration Hydraulic Summary
Louisville Water Company Water Treatment Plant Capacity Study

	Water Surface		Difference*	
Location	**Model @ 35.6 mgd**	**Survey Measurement**		**Model Notes**
Coagulation Basin Influent Conduit	473.695	473.665	0.030	Inside Top of Conduit = 474.308'
Flocculation Basin #1		473.425		
Flocculation Basin #2	473.354	473.435	-0.081	Possible sediment in tunnel.
Coagulation Basin #1		473.095		Weir Elevation = 472.976'
Coagulation Basin #2	473.128	473.155	-0.027	Weir Elevation = 472.981'
Coagulation Basin #1 Effluent Launder At Discharge		472.165		Top of Launder Wall
Coagulation Basin #1 Effluent Launder At H.P.		472.285		Top of Launder Wall
Coagulation Basin #2 Effluent Launder At Discharge	472.146	472.185	-0.039	Top of Launder Wall
Coagulation Basin #2 Effluent Launder At H.P.	472.185	472.225	-0.040	Top of Launder Wall
Softening Basin Influent Conduit	472.087	472.075	0.012	
Mixing Basin #1 Influent Channel		472.055		
Mixing Basin #2 Influent Channel	472.039	472.035	0.004	
Mixing Basin #1		471.865		
Mixing Basin #2	471.796	471.865	-0.069	Possible sediment in tunnel.
Softening Basin #1		471.56		Weir Elevation = 471.453'
Softening Basin #2	471.57	471.59	-0.020	Weir Elevation = 471.423'
Softening Basin #1 Effluent Launder South		471.14		Top of Launder Wall
Softening Basin #1 Effluent Launder North		471.21		Top of Launder Wall
Softening Basin #2 Effluent Launder South	471.179	471.17	0.009	Top of Launder Wall
Softening Basin #2 Effluent Launder North	471.189	471.65	-0.461	Survey reading appears to be erroneous.
Recarbonation Basin #1		470.92		
Recarbonation Basin #2	470.885	470.91	-0.025	
CO2 Reaction Basin #1		470.91		Weir Elevation = 470.748'
CO2 Reaction Basin #2	470.877	470.89	-0.013	Weir Elevation = 470.748'
CO2 Reaction Basin #1 Effluent Gullet		469.21		Top of Launder Wall
CO2 Reaction Basin #2 Effluent Gullet	469.213	469.2	0.013	Top of Launder Wall
CO2 Reaction Basin Flume At South End	469.207	469.22	-0.013	Inside Top of Conduit = 471.833'
Filter Influent Flume (@ O/S Filter #2)	469.188	469.172	0.016	Inside Top of Flume = 470.069'
Filter Influent Flume (@ O/S Filter #7)		469.172		Inside Top of Flume = 470.069'
Filter #3 (In Service)	469.152	469.152	0.000	
West Clear Water Reservoir	451.647	451.647	0.000	Inside Top of Clearwell = 459.33'
East Clear Water Reservoir		451.607		Inside Top of Clearwell = 459.33'

* Calibration goal was to obtain 0.04' maximum difference between actual and modeled water surfaces.

TABLE 2-3
BE Payne WTP
35.6 mgd
2 Treatment Trains in Service
6 of 8 Filters in Service
Louisville Water Company Water Treatment Plant Capacity Study

Node	Description	HGL DN	HGL UP	EGL DN	EGL UP	D HGL	Notes
245	Flocculation Basin Influent Sluice Gate	473.638	473.695	473.638	473.695	0.057	
240	Flocculation Basin Influent Weir	473.354	473.638	473.354	473.638	0.284	
235	Flocculation Basin Effluent Port	473.348	473.354	473.348	473.354	0.006	
230	Flocculation Basin Effluent Sluice Gate	473.254	473.348	473.273	473.348	0.094	
225	Coagulation Basin Influent Conduit	473.205	473.254	473.224	473.273	0.049	
220	Coagulation Basin Influent Column	473.188	473.209	473.202	473.224	0.021	
215	Coagulation Basin Column Orifice	473.128	473.202	473.128	473.202	0.074	
210	Coagulation Basin Effluent Weir	472.185	473.128	472.185	473.128	0.943	Freefall over weir.
205	Coagulation Basin Effluent Launder	472.146	472.185	472.162	472.185	0.039	
200	Coagulation Basin Effluent Sluice Gate	472.087	472.162	472.087	472.162	0.075	
195	Mixing Basin Influent Sluice Gate	472.039	472.087	472.039	472.087	0.048	
190	Mixing Basin Influent Weir	471.796	472.039	471.796	472.039	0.243	
185	Mixing Basin Effluent Port	471.79	471.796	471.79	471.796	0.006	
180	Mixing Basin Effluent Sluice Gate	471.696	471.79	471.715	471.79	0.094	
175	Softening Basin Influent Conduit	471.647	471.696	471.666	471.715	0.049	
170	Softening Basin Influent Column	471.63	471.651	471.644	471.666	0.021	
165	Softening Basin Column Orifice	471.57	471.644	471.57	471.644	0.074	
160	Softening Basin Effluent Weir	471.189	471.57	471.189	471.57	0.381	
155	Softening Basin Effluent Launder	471.172	471.189	471.179	471.189	0.017	
150	Recarbonation Basin Influent Weir	470.885	471.179	470.885	471.179	0.294	
145	Reaction Basin Influent Baffle Wall	470.877	470.885	470.877	470.885	0.008	
140	Reaction Basin Effluent Weir	469.233	470.877	469.233	470.877	1.644	Freefall over weir.
135	Reaction Basin Effluent Launder	469.213	469.233	469.222	469.233	0.02	
130	Reaction Basin Effluent Gullet	469.213	469.222	469.218	469.222	0.009	
125	2 of 3 Reaction Basin #2 Effluent	469.216	469.217	469.216	469.218	0.001	
120	Reaction Basin #2 Effluent	469.214	469.216	469.214	469.216	0.002	
115	1 of 3 Reaction Basin #1 Effluent	469.211	469.214	469.212	469.215	0.003	
110	2 of 3 Reaction Basin #1 Effluent	469.209	469.211	469.21	469.212	0.002	
105	Total Reaction Basin Effluent	469.207	469.208	469.21	469.211	0.001	
100	Filter Influent Tunnel	469.201	469.204	469.206	469.21	0.003	
95	Filter Influent Conduit/Channel Transition	469.191	469.206	469.192	469.206	0.015	
90	Filter Influent Channel	469.19	469.191	469.192	469.192	0.001	
85	Filter Influent Channel	469.182	469.186	469.188	469.192	0.004	
80	Filter Influent Butterfly Valve	469.152	469.188	469.152	469.188	0.036	
75	Filter Bed Loss + Rate Controller	455.425	469.152	455.479	469.152	13.727	Filter Bed + Rate Controller
70	Effluent Elbow	455.403	455.425	455.457	455.479	0.022	
65	Filter #1 Effluent Conduit Entry	455.348	455.403	455.402	455.457	0.055	
60	West Filter Effluent DS of #1	455.398	455.4	455.4	455.402	0.002	
55	West Filter Effluent DS of #3	455.388	455.391	455.397	455.4	0.003	
50	West Filter Effluent DS of #5	455.372	455.376	455.393	455.398	0.004	
45	West Filter Effluent DS of #7	455.37	455.372	455.391	455.393	0.002	
40	West Filter Effluent Conduit Under Chem. Bldg. Tunnel	455.37	455.38	455.381	455.391	0.01	
35	West Filter Effluent Conduit	455.369	455.375	455.375	455.381	0.006	
30	West Filter Effluent Conduit Entry	455.324	455.375	455.346	455.375	0.051	
25	Filtered Water Channel	455.318	455.324	455.34	455.346	0.006	
20	Filtered Water Effluent Weir	451.747	455.339	451.75	455.34	3.592	Freefall over weir.
15	Clearwell Influent Channel	451.745	451.747	451.748	451.75	0.002	
10		451.647	451.748	451.647	451.748	0.101	
5	Clearwell	451.647	451.647	451.647	451.647	0	

Note: Calibration was performed on the existing treatment plant without present basin modifications.

TABLE 2-4
BE Payne WTP
57 mgd - Maximum Hydraulic Capacity
3 Treatment Trains in Service, Present Basin Modifications Included
7 of 8 Filters In Service
Louisville Water Company Water Treatment Plant Capacity Study

Node	Description	HGL DN	HGL UP	EGL DN	EGL UP	D HGL	Notes
255	Flocculation Basin Influent Sluice Gate	473.647	473.712	473.647	473.712	0.065	7" Headspace in Coagulation Influent Conduit.
250	Flocculation Basin Influent Weir	473.330	473.647	473.330	473.647	0.317	
245	Flocculation Basin Effluent Port	473.324	473.330	473.324	473.330	0.006	13" Flocculation Basin Freeboard.
240	Flocculation Basin Effluent Sluice Gate	473.216	473.324	473.238	473.324	0.108	
235	Coagulation Basin Influent Conduit	473.160	473.216	473.182	473.238	0.056	
230	Coagulation Basin Influent Column	473.141	473.165	473.158	473.182	0.024	
225	Coagulation Basin Column Orifice	473.134	473.158	473.134	473.158	0.024	
220	Coagulation Basin Effluent Weir	472.233	473.134	472.233	473.134	0.901	Freefall over Coagulation Basin effluent weir.
215	Coagulation Basin Effluent Launder	472.189	472.233	472.208	472.233	0.044	21" Coagulation Basin Freeboard.
210	Coagulation Basin Effluent Sluice Gate	472.122	472.208	472.122	472.208	0.086	
205	Mixing Basin Influent Sluice Gate	472.067	472.122	472.067	472.122	0.055	14.5" Headspace in Softening Influent Conduit.
200	Mixing Basin Influent Weir	471.830	472.067	471.830	472.067	0.237	
195	Mixing Basin Effluent Port	471.824	471.830	471.824	471.830	0.006	14" Mixing Basin Freeboard.
190	Mixing Basin Effluent Sluice Gate	471.716	471.824	471.738	471.824	0.108	
185	Softening Basin Influent Conduit	471.660	471.716	471.682	471.738	0.056	
180	Softening Basin Influent Column	471.641	471.665	471.658	471.682	0.024	
175	Softening Basin Column Orifice	471.634	471.658	471.634	471.658	0.024	
170	Softening Basin Effluent Weir	471.356	471.634	471.356	471.634	0.278	Limiting Point Of Restriction
165	Softening Basin Effluent Launder	471.338	471.356	471.346	471.356	0.018	13.5" Softening Basin Freeboard.
160	CO2 Injection Box Influent	471.097	471.346	471.097	471.346	0.249	
155	CO2 Injection Box Influent Baffle Port	471.004	471.097	471.004	471.097	0.093	
150	CO2 Injection Box Effluent	470.969	471.004	470.969	471.004	0.035	
145	Reaction Basin Influent Baffle Wall	470.959	470.969	470.959	470.969	0.01	
140	Reaction Basin Effluent Weir	469.343	470.959	469.343	470.959	1.616	Freefall over Reaction Basin effluent weir.
135	Reaction Basin Effluent Launder	469.324	469.343	469.333	469.343	0.019	
130	Reaction Basin Effluent Gullet	469.323	469.333	469.328	469.333	0.01	
125	2 of 3 Reaction Basin #2 Effluent	469.325	469.326	469.326	469.328	0.001	
120	Reaction Basin #2 Effluent	469.322	469.324	469.324	469.327	0.002	
115	1 of 3 Reaction Basin #1 Effluent	469.319	469.321	469.323	469.325	0.002	
110	2 of 3 Reaction Basin #1 Effluent	469.315	469.318	469.320	469.323	0.003	
105	Total Reaction Basin Effluent	469.313	469.314	469.319	469.320	0.001	
100	Filter Influent Tunnel	469.297	469.306	469.311	469.320	0.009	
95	Filter Influent Conduit/Channel Transition	469.271	469.311	469.275	469.311	0.04	
90	Filter Influent Channel	469.270	469.271	469.275	469.275	0.001	
85	Filter Influent Channel	469.251	469.259	469.267	469.275	0.008	
80	Filter Influent Butterfly Valve	469.198	469.267	469.198	469.267	0.069	
75	Filter Bed Loss + Rate Controller	458.844	469.198	458.946	469.198	10.354	Filter Bed + Control Valve
70	Effluent Elbow	458.803	458.844	458.905	458.946	0.041	
65	Filter #1 Effluent Conduit Entry	458.700	458.803	458.802	458.905	0.103	
60	West Filter Effluent DS of #1	458.799	458.800	458.802	458.802	0.001	
55	West Filter Effluent DS of #3	458.791	458.793	458.800	458.802	0.002	
50	West Filter Effluent DS of #5	458.777	458.780	458.797	458.800	0.003	
45	West Filter Effluent DS of #7	458.759	458.762	458.795	458.797	0.003	
40	West Filter Effluent Conduit Under Chem. Bldg. Tunnel	458.726	458.759	458.762	458.795	0.033	
35	West Filter Effluent Conduit	458.723	458.742	458.743	458.762	0.019	
30	West Filter Effluent Conduit Entry	458.621	458.743	458.644	458.743	0.122	
25	Filtered Water Channel	458.618	458.621	458.641	458.644	0.003	
20		458.558	458.640	458.561	458.641	0.082	
15	Clearwell Influent Channel	458.556	458.558	458.559	458.561	0.002	
10	Clearwell Influent Butterfly Valve	458.300	458.559	458.300	458.559	0.259	
5	Clearwell	458.300	458.300	458.300	458.300		

TABLE 2-5
BE Payne WTP
90 mgd - Option 1A
3 Treatment Trains in Service; Present Basin Modifications Included
7 of 8 Filters in Service
New Modifications - Basin Effluent Weirs Raised
Louisville Water Company Water Treatment Plant Capacity Study

Node	Description	HGL DN	HGL UP	EGL DN	EGL UP	D HGL	Notes
255	Flocculation Basin Influent Sluice Gate	474.192	474.354	474.193	474.354	0.162	0.3" Uplift in Coagulation Influent Conduit.
250	Flocculation Basin Influent Weir	474.109	474.192	474.109	474.193	0.083	
245	Flocculation Basin Effluent Port	474.093	474.109	474.093	474.109	0.016	4" Flocculation Basin Freeboard
240	Flocculation Basin Effluent Sluice Gate	473.826	474.093	473.879	474.093	0.267	
235	Coagulation Basin Influent Conduit	473.686	473.826	473.740	473.879	0.14	
230	Coagulation Basin Influent Column	473.638	473.698	473.679	473.740	0.06	
225	Coagulation Basin Column Orifice	473.621	473.679	473.621	473.679	0.058	
220	Coagulation Basin Effluent Weir	473.276	473.621	473.276	473.621	0.345	Weir raised 473.00' to 473.46'
215	Coagulation Basin Effluent Launder	473.205	473.276	473.235	473.276	0.071	8.5" Coagulation Basin Freeboard
210	Coagulation Basin Effluent Sluice Gate	473.021	473.235	473.021	473.235	0.214	
205	Mixing Basin Influent Sluice Gate	472.883	473.021	472.883	473.021	0.138	3.5" Headspace in Softening Influent Conduit.
200	Mixing Basin Influent Weir	472.819	472.883	472.819	472.883	0.064	
195	Mixing Basin Effluent Port	472.803	472.819	472.803	472.819	0.016	2" Mixing Basin Freeboard
190	Mixing Basin Effluent Sluice Gate	472.536	472.803	472.589	472.803	0.267	
185	Softening Basin Influent Conduit	472.396	472.536	472.450	472.589	0.14	
180	Softening Basin Influent Column	472.348	472.408	472.389	472.450	0.06	
175	Softening Basin Column Orifice	472.331	472.389	472.331	472.389	0.058	
170	Softening Basin Effluent Weir	471.967	472.331	471.967	472.331	0.364	Weir raised 471.50' to 472.17'
165	Softening Basin Effluent Launder	471.931	471.967	471.947	471.967	0.036	6" Softening Basin Freeboard
160	CO2 Injection Box Influent	471.328	471.947	471.328	471.947	0.619	Existing 42" x 42" Orifice. Velocity = 3.8 fps.
155	CO2 Injection Box Influent Baffle Port	471.095	471.328	471.095	471.328	0.233	
150	CO2 Injection Box Effluent	471.007	471.095	471.007	471.095	0.088	
145	Reaction Basin Influent Baffle Wall	470.983	471.007	470.983	471.007	0.024	
140	Reaction Basin Effluent Weir	469.301	470.983	469.301	470.983	1.682	Freefall over Reaction Basin effluent weir.
135	Reaction Basin Effluent Launder	469.249	469.301	469.274	469.301	0.052	
130	Reaction Basin Effluent Gullet	469.249	469.274	469.261	469.274	0.025	
125	2 of 3 Reaction Basin #2 Effluent	469.255	469.257	469.260	469.261	0.002	
120	Reaction Basin #2 Effluent	469.251	469.253	469.258	469.260	0.002	
115	1 of 3 Reaction Basin #1 Effluent	469.246	469.249	469.256	469.258	0.003	
110	2 of 3 Reaction Basin #1 Effluent	469.241	469.244	469.253	469.256	0.003	
105	Total Reaction Basin Effluent	469.236	469.238	469.252	469.253	0.002	
100	Filter Influent Tunnel	469.197	469.219	469.230	469.252	0.022	
95	Filter Influent Conduit/Channel Transition	469.130	469.230	469.140	469.230	0.1	
90	Filter Influent Channel	469.129	469.130	469.140	469.140	0.001	
85	Filter Influent Channel	469.078	469.097	469.121	469.140	0.019	
80	Filter Influent Butterfly Valve	468.950	469.120	468.950	469.120	0.17	
75	Filter Bed Loss + Rate Controller	459.575	468.950	459.830	468.950	9.375	Filter Bed + Control Valve
70	Effluent Elbow	459.472	459.575	459.728	459.830	0.103	
65	Filter #1 Effluent Conduit Entry	459.215	459.472	459.470	459.728	0.257	
60	West Filter Effluent DS of #1	459.464	459.465	459.469	459.470	0.001	
55	West Filter Effluent DS of #3	459.444	459.447	459.466	459.469	0.003	
50	West Filter Effluent DS of #5	459.409	459.416	459.459	459.466	0.007	
45	West Filter Effluent DS of #7	459.363	459.370	459.452	459.459	0.007	
40	West Filter Effluent Conduit Under Chem. Bldg. Tunnel	459.281	459.363	459.369	459.452	0.082	
35	West Filter Effluent Conduit	459.273	459.320	459.322	459.369	0.047	
30	West Filter Effluent Conduit Entry	459.020	459.322	459.076	459.322	0.302	
25		459.012	459.020	459.068	459.076	0.008	
20	Filtered Water Effluent Weir	458.941	459.066	458.948	459.068	0.125	
15	Clearwell Influent Channel	458.939	458.941	458.946	458.948	0.002	
10	Clearwell Influent Butterfly Valve	458.300	458.945	458.300	458.945	0.645	60" Butterfly Valve. Velocity = 3.6 fps.
5	Clearwell	458.300	458.300	458.300	458.300		

TABLE 2-6
BE Payne WTP
90 mgd - Option 2A
3 Treatment Trains in Service; Present Basin Modifications Included
7 of 8 Filters in Service
New Modifications - Larger Recarbonation Basin Influent Port and Raised Coagulation and Softening Basin Effluent Weirs
Louisville Water Company Water Treatment Plant Capacity Study

Node	Description	HGL DN	HGL UP	EGL DN	EGL UP	D HGL	Notes
255	Flocculation Basin Influent Sluice Gate	473.936	474.098	473.936	474.098	0.162	2.5" Headspace in Coagulation Influent Conduit.
250	Flocculation Basin Influent Weir	473.729	473.936	473.729	473.936	0.207	
245	Flocculation Basin Effluent Port	473.713	473.729	473.713	473.729	0.016	8.5" Flocculation Basin Freeboard
240	Flocculation Basin Effluent Sluice Gate	473.446	473.713	473.499	473.713	0.267	
235	Coagulation Basin Influent Conduit	473.306	473.446	473.359	473.499	0.14	
230	Coagulation Basin Influent Column	473.253	473.318	473.299	473.359	0.06	
225	Coagulation Basin Column Orifice	473.241	473.299	473.241	473.299	0.058	
220	Coagulation Basin Effluent Weir	472.896	473.241	472.896	473.241	0.345	Weir raised 473.00' to 473.08'
215	Coagulation Basin Effluent Launder	472.812	472.896	472.848	472.896	0.084	13" Coagulation Basin Feeboard
210	Coagulation Basin Effluent Sluice Gate	472.633	472.848	472.633	472.848	0.215	
205	Mixing Basin Influent Sluice Gate	472.496	472.633	472.496	472.633	0.137	8" Headspace in Softening Influent Conduit.
200	Mixing Basin Influent Weir	472.399	472.496	472.399	472.496	0.097	
195	Mixing Basin Effluent Port	472.383	472.399	472.383	472.399	0.016	7" Mixing Basin Freeboard
190	Mixing Basin Effluent Sluice Gate	472.116	472.383	472.169	472.383	0.267	
185	Softening Basin Influent Conduit	471.976	472.116	472.030	472.169	0.14	
180	Softening Basin Influent Column	471.928	471.988	471.969	472.030	0.06	
175	Softening Basin Column Orifice	471.911	471.969	471.911	471.969	0.058	
170	Softening Basin Effluent Weir	471.583	471.911	471.583	471.911	0.328	Weir raised 471.50' to 471.75'
165	Softening Basin Effluent Launder	471.542	471.583	471.560	471.583	0.041	11" Softening Basin Freeboard
160	CO2 Injection Box Influent	471.328	471.560	471.328	471.560	0.232	Enlarged 60" x 48" Orifice. Velocity = 2.3 fps.
155	CO2 Injection Box Influent Baffle Port	471.095	471.328	471.095	471.328	0.233	
150	CO2 Injection Box Effluent	471.007	471.095	471.007	471.095	0.088	
145	Reaction Basin Influent Baffle Wall	470.983	471.007	470.983	471.007	0.024	
140	Reaction Basin Effluent Weir	469.301	470.983	469.301	470.983	1.682	Freefall over Reaction Basin effluent weir.
135	Reaction Basin Effluent Launder	469.249	469.301	469.274	469.301	0.052	
130	Reaction Basin Effluent Gullet	469.249	469.274	469.261	469.274	0.025	
125	2 of 3 Reaction Basin #2 Effluent	469.255	469.257	469.260	469.261	0.002	
120	Reaction Basin #2 Effluent	469.251	469.253	469.258	469.260	0.002	
115	1 of 3 Reaction Basin #1 Effluent	469.246	469.249	469.256	469.258	0.003	
110	2 of 3 Reaction Basin #1 Effluent	469.241	469.244	469.253	469.256	0.003	
105	Total Reaction Basin Effluent	469.236	469.238	469.252	469.253	0.002	
100	Filter Influent Tunnel	469.197	469.219	469.230	469.252	0.022	
95	Filter Influent Conduit/Channel Transition	469.130	469.230	469.140	469.230	0.1	
90	Filter Influent Channel	469.129	469.130	469.140	469.140	0.001	
85	Filter Influent Channel	469.078	469.097	469.121	469.140	0.019	
80	Filter Influent Butterfly Valve	468.950	469.120	468.950	469.120	0.17	
75	Filter Bed Loss + Rate Controller	459.575	468.950	459.830	468.950	9.375	Filter Bed + Control Valve
70	Effluent Elbow	459.472	459.575	459.728	459.830	0.103	
65	Filter #1 Effluent Conduit Entry	459.215	459.472	459.470	459.728	0.257	
60	West Filter Effluent DS of #1	459.464	459.465	459.469	459.470	0.001	
55	West Filter Effluent DS of #3	459.444	459.447	459.466	459.469	0.003	
50	West Filter Effluent DS of #5	459.409	459.416	459.459	459.466	0.007	
45	West Filter Effluent DS of #7	459.363	459.370	459.452	459.459	0.007	
40	West Filter Effluent Conduit Under Chem. Bldg. Tunnel	459.281	459.363	459.369	459.452	0.082	
35	West Filter Effluent Conduit	459.273	459.320	459.322	459.369	0.047	
30	West Filter Effluent Conduit Entry	459.020	459.322	459.076	459.322	0.302	
25		459.012	459.020	459.068	459.076	0.008	
20	Filtered Water Effluent Weir	458.941	459.066	458.948	459.068	0.125	
15	Clearwell Influent Channel	458.939	458.941	458.946	458.948	0.002	
10	Clearwell Influent Butterfly Valve	458.300	458.945	458.300	458.945	0.645	60" Butterfly Valve. Velocity = 3.6 fps.
5	Clearwell	458.300	458.300	458.300	458.300		

TABLE 2-7
BE Payne WTP
90 mgd - Option 3A
3 Treatment Trains in Service, Present Basin Modifications Included
7 of 8 Filters in Service
New Modifications - Lowered Reaction Basin Effluent Weirs
Louisville Water Company Water Treatment Plant Capacity Study

Node	Description	HGL DN	HGL UP	EGL DN	EGL UP	D HGL	
255	Flocculation Basin Influent Sluice Gate	473.896	474.058	473.896	474.058	0.162	3" Headspace in Coagulation Influent Conduit.
250	Flocculation Basin Influent Weir	473.649	473.896	473.649	473.896	0.247	
245	Flocculation Basin Effluent Port	473.633	473.649	473.633	473.649	0.016	9.5" Flocculation Basin Freeboard.
240	Flocculation Basin Effluent Sluice Gate	473.366	473.633	473.419	473.633	0.267	
235	Coagulation Basin Influent Conduit	473.226	473.366	473.28	473.419	0.14	
230	Coagulation Basin Influent Column	473.178	473.238	473.219	473.28	0.06	
225	Coagulation Basin Column Orifice	473.161	473.219	473.161	473.219	0.058	
220	Coagulation Basin Effluent Weir	472.742	473.161	472.742	473.161	0.419	Freefall over Coagulation Basin effluent weir.
215	Coagulation Basin Effluent Launder	472.654	472.742	472.691	472.742	0.088	15" Coagulation Basin Freeboard.
210	Coagulation Basin Effluent Sluice Gate	472.477	472.691	472.477	472.691	0.214	
205	Mixing Basin Influent Sluice Gate	472.339	472.477	472.339	472.477	0.138	10" Headspace in Softening Influent Conduit.
200	Mixing Basin Influent Weir	472.149	472.339	472.149	472.339	0.19	
195	Mixing Basin Effluent Port	472.133	472.149	472.133	472.149	0.016	10" Mixing Basin Freeboard.
190	Mixing Basin Effluent Sluice Gate	471.866	472.133	471.919	472.133	0.267	
185	Softening Basin Influent Conduit	471.726	471.866	471.78	471.919	0.14	
180	Softening Basin Influent Column	471.678	471.738	471.719	471.78	0.06	
175	Softening Basin Column Orifice	471.661	471.719	471.661	471.719	0.058	
170	Softening Basin Effluent Weir	471.303	471.661	471.303	471.661	0.358	Freefall over Softening Basin effluent weir.
165	Softening Basin Effluent Launder	471.257	471.303	471.277	471.303	0.046	14" Softening Basin Freeboard.
160	CO2 Injection Box Influent	470.658	471.277	470.658	471.277	0.619	Existing 42" x 42" Orifice. Velocity = 3.8 fps.
155	CO2 Injection Box Influent Baffle Port	470.425	470.658	470.425	470.658	0.233	
150	CO2 Injection Box Effluent	470.337	470.425	470.337	470.425	0.088	
145	Reaction Basin Influent Baffle Wall	470.313	470.337	470.313	470.337	0.024	
140	Reaction Basin Effluent Weir	469.301	470.313	469.301	470.313	1.012	Freefall over Reaction Basin effluent weir.
135	Reaction Basin Effluent Launder	469.249	469.301	469.274	469.301	0.052	
130	Reaction Basin Effluent Gullet	469.249	469.274	469.261	469.274	0.025	
125	2 of 3 Reaction Basin #2 Effluent	469.255	469.257	469.26	469.261	0.002	
120	Reaction Basin #2 Effluent	469.251	469.253	469.258	469.26	0.002	
115	1 of 3 Reaction Basin #1 Effluent	469.246	469.249	469.256	469.258	0.003	
110	2 of 3 Reaction Basin #1 Effluent	469.241	469.244	469.253	469.256	0.003	
105	Total Reaction Basin Effluent	469.236	469.238	469.252	469.253	0.002	
100	Filter Influent Tunnel	469.197	469.219	469.23	469.252	0.022	
95	Filter Influent Conduit/Channel Transition	469.13	469.23	469.14	469.23	0.1	
90	Filter Influent Channel	469.129	469.13	469.14	469.14	0.001	
85	Filter Influent Channel	469.078	469.097	469.121	469.14	0.019	
80	Filter Influent Butterfly Valve	468.95	469.12	468.95	469.12	0.17	
75	Filter Bed Loss + Rate Controller	459.575	468.95	459.83	468.95	9.375	Filter Bed + Control Valve
70	Effluent Elbow	459.472	459.575	459.728	459.83	0.103	
65	Filter #1 Effluent Conduit Entry	459.215	459.472	459.47	459.728	0.257	
60	West Filter Effluent DS of #1	459.464	459.465	459.469	459.47	0.001	
55	West Filter Effluent DS of #3	459.444	459.447	459.466	459.469	0.003	
50	West Filter Effluent DS of #5	459.409	459.416	459.459	459.466	0.007	
45	West Filter Effluent DS of #7	459.363	459.37	459.452	459.459	0.007	
40	West Filter Effluent Conduit Under Chem. Bldg. Tunnel	459.281	459.363	459.369	459.452	0.082	
35	West Filter Effluent Conduit	459.273	459.32	459.322	459.369	0.047	
30	West Filter Effluent Conduit Entry	459.02	459.322	459.076	459.322	0.302	
25		459.012	459.02	459.068	459.076	0.008	
20	Filtered Water Effluent Weir	458.941	459.066	458.948	459.068	0.125	
15	Clearwell Influent Channel	458.939	458.941	458.946	458.948	0.002	
10	Clearwell Influent Butterfly Valve	458.3	458.945	458.3	458.945	0.645	60" Butterfly Valve. Velocity = 3.6 fps.
5	Clearwell	458.3	458.3	458.3	458.3		

TABLE 2-8
BE Payne WTP
120 mgd - Option 2B
3 Treatment Trains in Service, Present Basin Modifications Included
7 of 8 Filters in Service
New Modifications - Larger Recarbonation Basin Influent Port, Raised Coagulation and Softening Basin Effluent Weirs, and Additional Flocculation, Coagulation, and Mixing Basin Sluice Gates
Louisville Water Company Water Treatment Plant Capacity Study

Node	Description	HGL DN	HGL UP	EGL DN	EGL UP	D HGL	Notes
255	Flocculation Basin Influent Sluice Gate	474.820	474.892	474.820	474.892	0.072	Additional Flocculation Basin Influent Gate. 6.5" Uplift in Coagulation Influent Conduit.
250	Flocculation Basin Influent Weir	474.744	474.820	474.744	474.820	0.076	
245	Flocculation Basin Effluent Port	474.717	474.744	474.717	474.744	0.027	TOW = 474.45'
240	Flocculation Basin Effluent Sluice Gate	474.241	474.717	474.336	474.717	0.476	Existing 60" x 60" Gate. Velocity = 2.5 fps.
235	Coagulation Basin Influent Conduit	473.992	474.241	474.088	474.336	0.249	
230	Coagulation Basin Influent Column	473.906	474.013	473.981	474.088	0.107	
225	Coagulation Basin Column Orifice	473.878	473.981	473.878	473.981	0.103	
220	Coagulation Basin Effluent Weir	473.456	473.878	473.456	473.878	0.422	Weir raised 473.00' to 473.67'
215	Coagulation Basin Effluent Launder	473.334	473.456	473.386	473.456	0.122	6.5" Coagulation Basin Freeboard
210	Coagulation Basin Effluent Sluice Gate	473.291	473.386	473.291	473.386	0.095	Additional Coagulation Basin Effluent Gate.
205	Mixing Basin Influent Sluice Gate	473.229	473.291	473.229	473.291	0.062	Additional Mixing Basin Influent Gate. 0.5" Uplift in Softening Influent Conduit.
200	Mixing Basin Influent Weir	473.154	473.229	473.154	473.229	0.075	
195	Mixing Basin Effluent Port	473.127	473.154	473.127	473.154	0.027	TOW = 473.00'
190	Mixing Basin Effluent Sluice Gate	472.651	473.127	472.746	473.127	0.476	Existing 60" x 60" Gate. Velocity = 2.5 fps.
185	Softening Basin Influent Conduit	472.402	472.651	472.498	472.746	0.249	
180	Softening Basin Influent Column	472.316	472.423	472.391	472.498	0.107	
175	Softening Basin Column Orifice	472.288	472.391	472.288	472.391	0.103	
170	Softening Basin Effluent Weir	471.877	472.288	471.877	472.288	0.411	Weir raised 471.50' to 472.08'
165	Softening Basin Effluent Launder	471.810	471.877	471.840	471.877	0.067	7" Softening Basin Freeboard
160	CO_2 Injection Box Influent	471.613	471.840	471.613	471.840	0.227	Enlarged 72" x 54" Orifice. Velocity = 2.3 fps.
155	CO_2 Injection Box Influent Baffle Port	471.200	471.613	471.200	471.613	0.413	Existing 120" x 24" Orifice. Velocity = 3.1 fps.
150	CO_2 Injection Box Effluent	471.043	471.200	471.043	471.200	0.157	
145	Reaction Basin Influent Baffle Wall	471.000	471.043	471.000	471.043	0.043	
140	Reaction Basin Effluent Weir	469.415	471.000	469.415	471.000	1.585	Freefall over weir.
135	Reaction Basin Effluent Launder	469.334	469.415	469.374	469.415	0.081	
130	Reaction Basin Effluent Gullet	469.331	469.374	469.352	469.374	0.043	
125	2 of 3 Reaction Basin #2 Effluent	469.343	469.344	469.351	469.352	0.001	
120	Reaction Basin #2 Effluent	469.337	469.339	469.349	469.351	0.002	
115	1 of 3 Reaction Basin #1 Effluent	469.330	469.332	469.346	469.349	0.002	
110	2 of 3 Reaction Basin #1 Effluent	469.322	469.325	469.343	469.346	0.003	
105	Total Reaction Basin Effluent	469.314	469.316	469.342	469.344	0.002	
100	Filter Influent Tunnel	469.243	469.283	469.303	469.342	0.04	
95	Filter Influent Conduit/Channel Transition	469.125	469.303	469.144	469.303	0.178	
90	Filter Influent Channel	469.124	469.125	469.142	469.144	0.001	
85	Filter Influent Channel	469.031	469.066	469.108	469.142	0.035	
80	Filter Influent Butterfly Valve	468.805	469.108	468.805	469.108	0.303	
75	Filter Bed Loss + Rate Controller	460.501	468.805	460.955	468.805	8.304	Filter Bed + Control Valve
70	Effluent Elbow	460.320	460.501	460.773	460.955	0.181	
65	Filter #1 Effluent Conduit Entry	459.862	460.320	460.315	460.773	0.458	30" Wall Pipe. Velocity = 5.4 fps.
60	West Filter Effluent DS of #1	460.304	460.306	460.314	460.315	0.002	
55	West Filter Effluent DS of #3	460.269	460.275	460.308	460.314	0.006	
50	West Filter Effluent DS of #5	460.207	460.220	460.295	460.308	0.013	
45	West Filter Effluent DS of #7	460.126	460.138	460.283	460.295	0.012	
40	West Filter Effluent Conduit Under Chem. Bldg. Tunnel	459.979	460.126	460.136	460.283	0.147	
35	West Filter Effluent Conduit	459.964	460.048	460.053	460.136	0.084	
30	West Filter Effluent Conduit Entry	459.516	460.053	459.616	460.053	0.537	80" x 60" Orifice. Velocity = 3.2 fps.
25		459.501	459.516	459.601	459.616	0.015	
20	Filtered Water Effluent Weir	459.438	459.598	459.449	459.601	0.16	
15	Clearwell Influent Channel	459.437	459.438	459.448	459.449	0.001	
10	Clearwell Influent Butterfly Valve	458.300	459.447	458.300	459.447	1.147	60" Butterfly. Velocity = 4.7 fps.
5	Clearwell	458.300	458.300	458.300	458.300		

LWC 2899

TABLE 2-9

BE Payne WTP

120 mgd - Option 3B

3 Treatment Trains in Service, Present Basin Modifications Included

7 of 8 Filters in Service

New Modifications - Lower Reaction Basin Effluent Weirs, Larger Recarbonation Basin Influent Port, Raised Coagulation Basin Effluent Weirs, and Additional Flocculation, Coagulation, and Mixing Basin Sluice Gates

Louisville Water Company Water Treatment Plant Capacity Study

Node	Description	HGL DN	HGL UP	EGL DN	EGL UP	D HGL	Notes
255	Flocculation Basin Influent Sluice Gate	474.350	474.422	474.350	474.422	0.072	Additional Flocculation Basin Influent Gate. 1.5" Uplift in Coagulation Influent Conduit.
250	Flocculation Basin Influent Weir	474.244	474.350	474.244	474.350	0.106	
245	Flocculation Basin Effluent Port	474.217	474.244	474.217	474.244	0.027	2" Flocculation Basin Freeboard
240	Flocculation Basin Effluent Sluice Gate	473.741	474.217	473.836	474.217	0.476	Existing 60" x 60" Gate. Velocity = 2.5 fps.
235	Coagulation Basin Influent Conduit	473.492	473.741	473.588	473.836	0.249	
230	Coagulation Basin Influent Column	473.406	473.513	473.481	473.588	0.107	
225	Coagulation Basin Column Orifice	473.378	473.481	473.378	473.481	0.103	
220	Coagulation Basin Effluent Weir	472.931	473.378	472.931	473.378	0.447	Weir raised 473.00' to 473.17'
215	Coagulation Basin Effluent Launder	472.782	472.931	472.846	472.931	0.149	12.5" Coagulation Basin Freeboard
210	Coagulation Basin Effluent Sluice Gate	472.750	472.846	472.750	472.846	0.096	Additional Coagulation Basin Effluent Gate.
205	Mixing Basin Influent Sluice Gate	472.689	472.750	472.689	472.750	0.061	Additional Mixing Basin Influent Gate. 6.5" Headspace in Softening Influent Conduit.
200	Mixing Basin Influent Weir	472.574	472.689	472.574	472.689	0.115	
195	Mixing Basin Effluent Port	472.547	472.574	472.547	472.574	0.027	5" Mixing Basin Freeboard
190	Mixing Basin Effluent Sluice Gate	472.071	472.547	472.166	472.547	0.476	Existing 60" x 60" Gate. Velocity = 2.5 fps.
185	Softening Basin Influent Conduit	471.822	472.071	471.918	472.166	0.249	
180	Softening Basin Influent Column	471.736	471.843	471.811	471.918	0.107	
175	Softening Basin Column Orifice	471.708	471.811	471.708	471.811	0.103	
170	Softening Basin Effluent Weir	471.277	471.708	471.277	471.708	0.431	Freefall over Softening Basin effluent weir.
165	Softening Basin Effluent Launder	471.193	471.277	471.230	471.277	0.084	14.5" Softening Basin Freeboard
160	CO2 Injection Box Influent	470.943	471.230	470.943	471.230	0.287	Enlarged 72" x 48" Orifice. Velocity = 2.6 fps.
155	CO2 Injection Box Influent Baffle Port	470.530	470.943	470.530	470.943	0.413	Existing 120" x 24" Orifice. Velocity = 3.1 fps.
150	CO2 Injection Box Effluent	470.373	470.530	470.373	470.530	0.157	
145	Reaction Basin Influent Baffle Wall	470.331	470.373	470.331	470.373	0.042	
140	Reaction Basin Effluent Weir	469.415	470.331	469.415	470.331	0.916	Freefall over Reaction Basin effluent weir.
135	Reaction Basin Effluent Launder	469.334	469.415	469.374	469.415	0.081	
130	Reaction Basin Effluent Gullet	469.331	469.374	469.352	469.374	0.043	
125	2 of 3 Reaction Basin #2 Effluent	469.343	469.344	469.351	469.352	0.001	
120	Reaction Basin #2 Effluent	469.337	469.339	469.349	469.351	0.002	
115	1 of 3 Reaction Basin #1 Effluent	469.330	469.332	469.346	469.349	0.002	
110	2 of 3 Reaction Basin #1 Effluent	469.322	469.325	469.343	469.346	0.003	
105	Total Reaction Basin Effluent	469.314	469.316	469.342	469.344	0.002	
100	Filter Influent Tunnel	469.243	469.283	469.303	469.342	0.04	
95	Filter Influent Conduit/Channel Transition	469.125	469.303	469.144	469.303	0.178	
90	Filter Influent Channel	469.124	469.125	469.142	469.144	0.001	
85	Filter Influent Channel	469.031	469.066	469.108	469.142	0.035	
80	Filter Influent Butterfly Valve	468.805	469.108	468.805	469.108	0.303	
75	Filter Bed Loss + Rate Controller	460.501	468.805	460.955	468.805	8.304	Filter Bed + Control Valve
70	Effluent Elbow	460.320	460.501	460.773	460.955	0.181	
65	Filter #1 Effluent Conduit Entry	459.862	460.320	460.315	460.773	0.458	30" Wall Pipe. Velocity = 5.4 fps.
60	West Filter Effluent DS of #1	460.304	460.306	460.314	460.315	0.002	
55	West Filter Effluent DS of #3	460.269	460.275	460.308	460.314	0.006	
50	West Filter Effluent DS of #5	460.207	460.220	460.295	460.308	0.013	
45	West Filter Effluent DS of #7	460.126	460.138	460.283	460.295	0.012	
40	West Filter Effluent Conduit Under Chem. Bldg. Tunnel	459.979	460.126	460.136	460.283	0.147	
35	West Filter Effluent Conduit	459.964	460.048	460.053	460.136	0.084	
30	West Filter Effluent Conduit Entry	459.516	460.053	459.616	460.053	0.537	80" x 60" Orifice. Velocity = 3.2 fps.
25		459.501	459.516	459.601	459.616	0.015	
20	Filtered Water Effluent Weir	459.438	459.598	459.449	459.601	0.16	
15	Clearwell Influent Channel	459.437	459.438	459.448	459.449	0.001	
10	Clearwell Influent Butterfly Valve	458.300	459.447	458.300	459.447	1.147	60" Butterfly. Velocity = 4.7 fps.
5	Clearwell	458.300	458.300	458.300	458.300		

TABLE 2-10
BE Payne WTP
Plant Hydraulic Modifications Summary
Louisville Water Company Water Treatment Plant Capacity Study

Option 1 - Raised Weirs Only
Option 2 - Enlarge Reaction Basin Influent Port
Option 3 - Lower Reaction Basin Effluent Weirs

	90 MGD - Option 1A		90 MGD - Option 2A		90 MGD - Option 3A	
Description\Flow	Modification	Resulting Basin Freeboard	Modification	Resulting Basin Freeboard	Modification	Resulting Basin Freeboard or Headspace
Coagulation Basin Influent Conduit	-	-0.3"1	-	2.5"	-	3"
Flocculation Basin	-	4"	-	8.5"	-	9.5"
Raise Coagulation Basin Effluent Weir Invert Elevation	473.46'	8.5"	473.08'	13"	-	15"
Softening Basin Influent Conduit	-	3.5"	-	8"	-	10"
Mixing Basin	-	2"	-	7"	-	10"
Raise Softening Basin Effluent Weir Invert Elevation	472.17'	6"	471.75'	11"	-	14"
Enlarge Recarbonation Basin Influent Port	-	-	60"w X 48"h	-	-	-
Lower Reaction Basin Effluent Weir Invert Elevation	-	-	-	-	470.17'	-

	120 MGD - Option 1B		120 MGD - Option 2B		120 MGD - Option 3B	
Description\Flow	Modification	Resulting Basin Freeboard	Modification	Resulting Basin Freeboard	Modification	Resulting Basin Freeboard
Coagulation Basin Influent Conduit	Not Feasible			-6.5"1	-	-1.5"1
Additional Flocculation Basin Influent Gate			48"w X 72"h	-	48"w X 72"h	-
Flocculation Basin			-	-3.5"1	-	2"
Raise Coagulation Basin Effluent Weir Invert Elevation			473.67'	6.5"	473.17'	12.5"
Additional Coagulation Basin Effluent Gate			60"w X 60"h	-	60"w X 60"h	-
Softening Basin Influent Conduit			-	-0.5"1	-	6.5"
Additional Mixing Basin Influent Gate			48"w X 72"h	-	48"w X 72"h	-
Mixing Basin			-	-2"1	-	5"
Raise Softening Basin Effluent Weir Invert Elevation			472.08'	7"	-	14.5"
Enlarge Recarbonation Basin Influent Port			72"w X 54"h		72"w X 48"h	-
Lower Reaction Basin Effluent Weir Invert Elevation			-	-	470.17'	-

1. Negative freeboard indicates amount the water surface is above existing structures.
2. Existing effluent weir elevations are 470.84' (Reaction Basin), 471.50' (Softening Basin), & 473.00' (Coagulation Basin).
3. No option exists for raising weirs only for 120 MGD capacity.

TABLE 2-11
BE Payne WTP
Process Capacity Summary
Louisville Water Company Water Treatment Plant Capacity Study

Flow, mgd			Ten States	Kentucky	60	90	120
Treatment Process		**Existing**	**Standards[1]**	**Criteria**			
Flocculation Units							
Total Number of Units		3					
Units 1-3							
Width (ft)		38.5					
Depth (ft)		17					
Volume (cf, each)		89,667					
Units In Service	3						
Flow-Through Velocity (fpm)			0.5 - 1.5		2.8	4.3	5.7
Detention Time (min.)			30	40-60	48.3	32.2	24.1
Coagulation/Sedimentation Units							
Total Number of Units		3					
Units 1-3							
Area (sf, each)		20,498					
Depth (ft)		16					
Volume (cf, each)		327,968					
Units In Service	3						
Detention Time (min.)			240	240	188	125	94
Surface Loading Rate (gpm/sf)			0.5	0.75	0.68	1.02	1.36
Weir Overflow Rate (gpd/ft)			20,000		34,965	52,448	69,930
Softening Units							
Total Number of Units		3					
Mixing Units 1-3							
Width (ft)		38.5					
Depth (ft)		17					
Volume (cf, each)		89,667					
Units In Service	3						
Flow-Through Velocity (fpm)			0.5 - 1.5		2.8	4.3	5.7
Detention Time (min.)			30		48.3	32.2	24.1
Softening Units 1-3							
Area (sf, each)		20,498					
Depth (ft)		16					
Volume (cf, each)		327,968					
Units In Service	3						
Detention Time (min.)			240		188	125	94
Surface Loading Rate (gpm/sf)			0.5	0.75[3]	0.68	1.02	1.36
Weir Overflow Rate (gpd/ft)			20,000		34,965	52,448	69,930
Recarbonation Basins 1-3							
Area (sf, each)		3,000					
Depth (ft)		15.5					
Volume (cf, each)		46,500					
Units In Service	3						
Detention Time (min.)					25	17	13

Flow, mgd			Ten States	Kentucky	60	90	120
Treatment Process		**Existing**	**Standards[1]**	**Criteria**			
CO2 Reaction Basins 1-3							
Area (sf, each)		15,000					
Depth (ft)		15.5					
Volume (cf, each)		232,500					
Units In Service	3						
Detention Time (min.)					125	83	63
Surface Loading Rate (gpm/sf)					0.93	1.39	1.85
Weir Overflow Rate (gpd/ft)					25,641	38,462	51,282
Filtration							
Total Number of Units		8					
Units 1-8							
Area (sf, each)		1,760					
Units In Service	7						
Rate (gpm/sf)			None	5[7]	3.38	5.07	6.76
Clearwell							
Volume (MG)		6		15%			
Percent Full	100%						
Volume Required, MG				216	9.0	13.5	18.0
High Service Pumps							
System Pressure (psi)		184.9					
Station Capacity (mgd)[4,5]		72.6			60.0	90.0	120.0
Pump No. 3 Capacity (mgd)		15.2					
Pump No. 4 Capacity (mgd)		15.2					
Pump No. 5 Capacity (mgd)		15.2					
Pump No. 6 Capacity (mgd)		15.2					
Pump No. 7 Capacity (mgd)		13.5					
Pump No. 8 Capacity (mgd)		13.5					
Chemical Feed Systems[4]							
Powdered Activated Carbon (1 lb/gal)							
Available Storage (gal)		77,088					
Firm Capacity (gph)		180					
Average Dose (# Solution/MG)[6]		0					
Max Dose (# Solution/MG)		300					
Storage Required At Average Dose & Average Flow For 30 Days (gal)					0	0	0
Storage Required At Maximum Dose & Average Flow For 14 Days (gal)					20,119	30,179	40,238
Feed Required Max (gph)					90	135	180
Chlorine (99.5%)							
Available Storage (ton)		24					
Firm Capacity (ppd)		4,000					
Average Dose (# Chlorine/MG)		33					
Max Dose (# Chlorine/MG)		45					
Storage Required At Average Dose & Average Flow For 30 Days (ton)					19.7	29.6	39.4
Storage Required At Maximum Dose & Average Flow For 14 Days (ton)					12.7	19.1	25.5
Feed Required Max (ppd)					2,730	4,095	5,460

Flow, mgd Treatment Process		Existing	Ten States Standards[1]	Kentucky Criteria	60	90	120
Ferric Chloride (37%)							
Available Storage (gal)		77,000					
Firm Capacity (gph)		351					
Average Dose (# Ferric/MG)		111					
Max Dose (# Ferric/MG)		400					
Storage Required At Average Dose & Average Flow For 30 Days (gal)					32,061	48,091	64,121
Storage Required At Maximum Dose & Average Flow For 14 Days (gal)					53,761	80,641	107,522
Feed Required Max(gph)					240	360	480
Coagulant Aid							
Available Storage (gal)		5,100					
Firm Capacity (gph)		2.5					
Average Dose (# Polymer/MG)		10					
Max Dose (# Polymer/MG)		45					
Storage Required At Average Dose & Average Flow For 30 Days (gal)					1,411	2,117	2,823
Storage Required At Maximum Dose & Average Flow For 14 Days (gal)					2,964	4,445	5,927
Feed Required Max (gph)					13	20	26
Lime (99.5%)							
Available Storage (ton)		560					
Firm Capacity (pph)		2,000					
Average Dose (# Lime/MG)		250					
Max Dose (# Lime/MG)		425					
Storage Required At Average Dose & Average Flow For 30 Days (ton)					151	226	302
Storage Required At Maximum Dose & Average Flow For 14 Days (ton)					120	179	239
Feed Required Max (pph)					1068	1602	2137
Ammonia (99.5%)							
Available Storage (gal)		1,800					
Firm Capacity (pph)		16					
Average Dose (# Ammonia/MG)		6.9					
Max Dose (# Ammonia/MG)		10					
Storage Required At Average Dose & Average Flow For 30 Days (gal)					993	1,490	1,987
Storage Required At Maximum Dose & Average Flow For 14 Days (gal)					681	1,021	1,362
Feed Required Max (pph)					25	38	51
Fluoride (19%)							
Available Storage (gal)		10,000					
Firm Capacity (gph)		12					
Average Dose (# Fluoride/MG)		5.8					
Max Dose (# Fluoride/MG)		8.3					
Storage Required At Average Dose & Average Flow For 30 Days (gal)					3,536	5,303	7,071
Storage Required At Maximum Dose & Average Flow For 14 Days (gal)					2,357	3,536	4,714
Feed Required Max (gph)					10.5	15.8	21.0

Flow, mgd		Existing	Ten States Standards[1]	Kentucky Criteria	60	90	120
Treatment Process							
Carbon Dioxide							
Available Storage (tons)		100					
Firm Capacity (pph)		340					
Average Dose (#/MG)		N/A					
Max Dose (#/MG)		200					
Storage Required At Average Dose & Average Flow For 30 Days (tons)					N/A	N/A	N/A
Storage Required At Maximum Dose & Average Flow For 14 Days (tons)					56	84	113
Feed Required Max (pph)					503	754	1,005

NOTES:

1 Ten States Standards 30-Day Recommended Chemical Storage Does Not Distinguish Between Average Or Maximum Dosage.

2 Highlighted Values Either Exceed Existing Capacity Or Are Less Than The Recommended Storage.

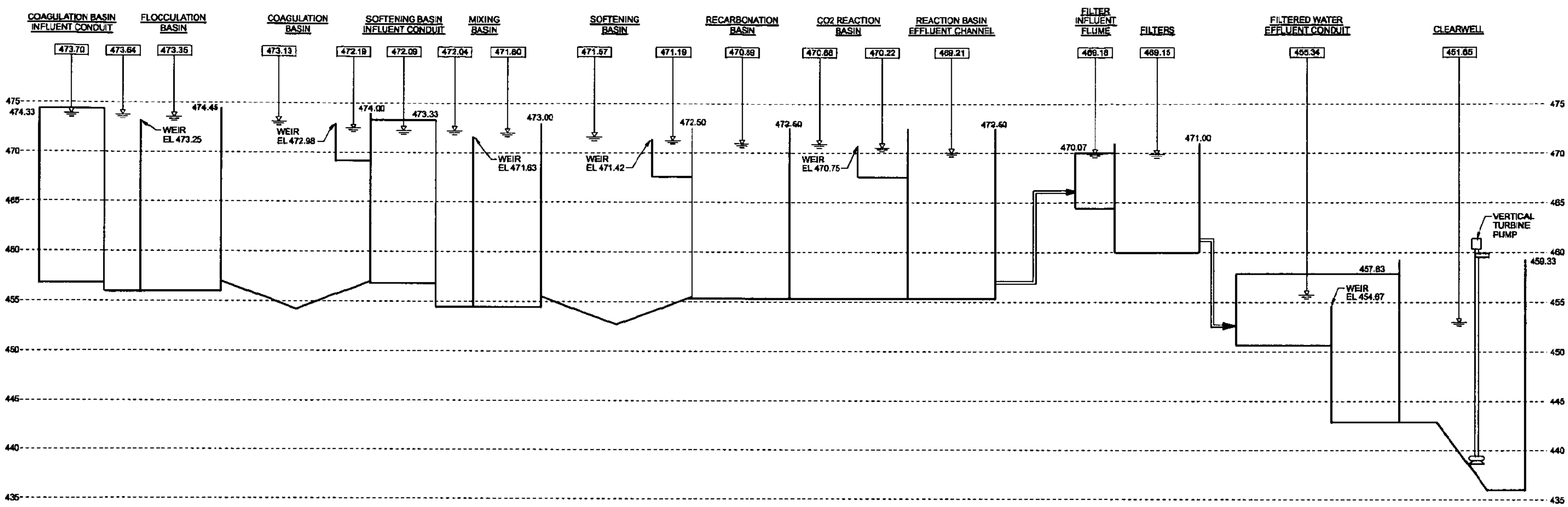
3 No KDOW guidance available for softening units; use same rate as given for conventional sedimentation.

4 Firm capacity is the capacity with largest unit out of service.

5 High service pump capacity is to be at least 100% of WTP capacity.

6 Intermittent treatment for tastes and odors.

7 Requires continuous turbidity monitoring on individual filters at rates above 2 gpm/sf.



HYDRAULIC CRITERIA

- D ≥ H FOR CONTROL WEIRS
- 6" MINIMUM FREEBOARD IN BASINS AND CHANNELS, 12" PREFERRED
- 6" MINIMUM HEAD SPACE IN COVERED CHANNELS NOT DESIGNED FOR UPLIFT
- 5' MINIMUM DROP THROUGH FILTERS AND CONTROL VALVE
- INFLUENT WEIRS CAN BE FLOODED
- FULL CLEARWELL

35.8 MGD CALIBRATION

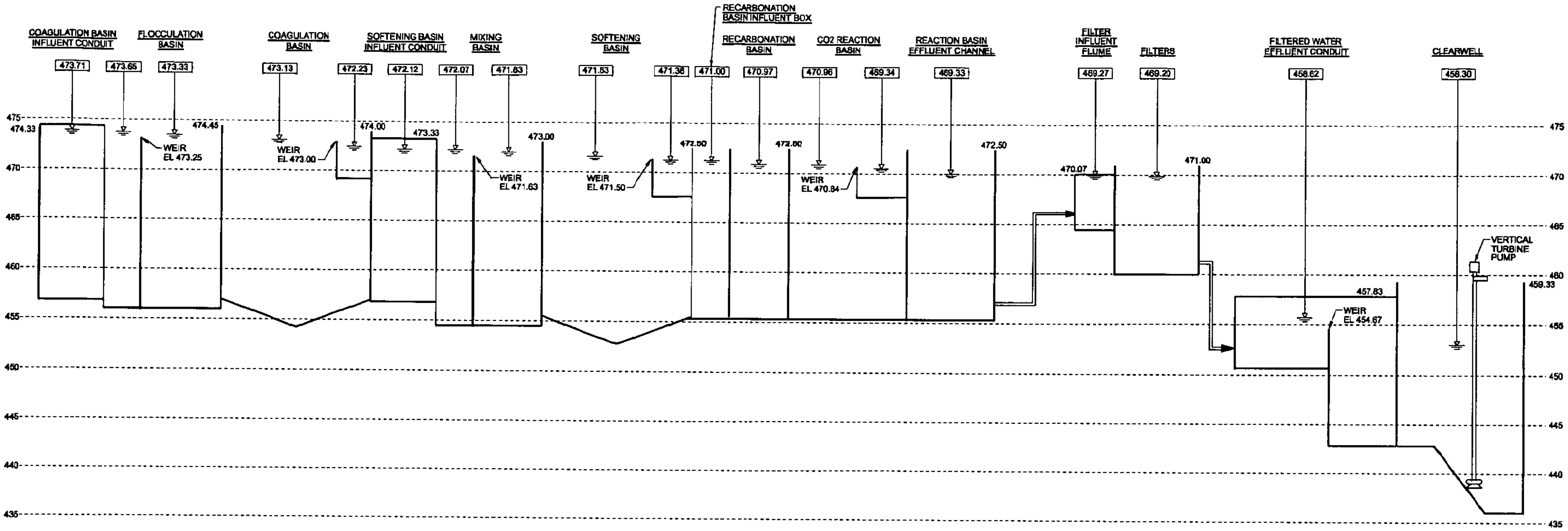
35.8 MGD { 2 TREATMENT TRAINS
6 OF 8 FILTERS
CLEARWELL @ EL 451.65 }

NOTE:
MODEL CALIBRATION COMPLETED PRIOR TO CURRENT BASIN RENOVATIONS.

FIGURE 2-1
BE PAYNE WTP
EXISTING HYDRAULIC PROFILE
VERTICAL = 1" = 10'
HORIZONTAL = NOT TO SCALE

CH2MHILL

FILENAME: 01rf001d_346133.dgn PLOT DATE: 12-SEP-2006



MAXIMUM CLEARWELL EL 458.30 PROVIDED BY LWC IS 0.3 FEET HIGHER THAN BOTTOM OF CLEARWELL ROOF BEAMS.

HYDRAULIC CRITERIA

- D ≥ H FOR CONTROL WEIRS
- 6" MINIMUM FREEBOARD IN BASINS AND CHANNELS, 12" PREFERRED
- 6" MINIMUM HEAD SPACE IN COVERED CHANNELS NOT DESIGNED FOR UPLIFT
- 6" MINIMUM DROP THROUGH FILTERS AND CONTROL VALVE
- INFLUENT WEIRS CAN BE FLOODED
- FULL CLEARWELL

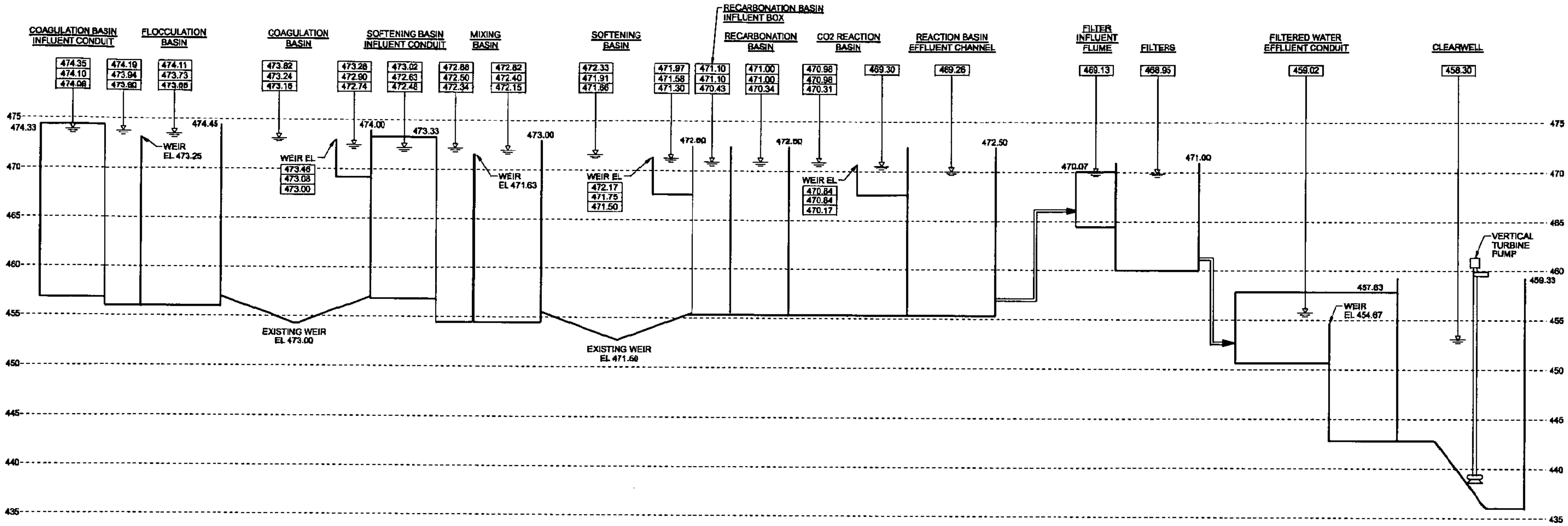
▭ 57 MGD MAXIMUM CAPACITY HGL

NOTE:
MODEL INCLUDES PRESENT BASIN MODIFICATIONS.

FIGURE 2-2
BE PAYNE WTP
57 MGD HYDRAULIC PROFILE
VERTICAL = 1" = 10'
HORIZONTAL = NOT TO SCALE

CH2MHILL

FILENAME: 01nf003d_346133.dgn PLOT DATE: 12-SEP-2006



HYDRAULIC CRITERIA

- D ≥ H FOR CONTROL WEIRS
- 6" MINIMUM FREEBOARD IN BASINS AND CHANNELS, 12" PREFERRED
- 6" MINIMUM HEAD SPACE IN COVERED CHANNELS NOT DESIGNED FOR UPLIFT
- 6" MINIMUM DROP THROUGH FILTERS AND CONTROL VALVE
- INFLUENT WEIRS CAN BE FLOODED
- FULL CLEARWELL

RAISED WEIRS
LARGER RECARBONATION INLET
LOWER REACTION BASIN WEIRS

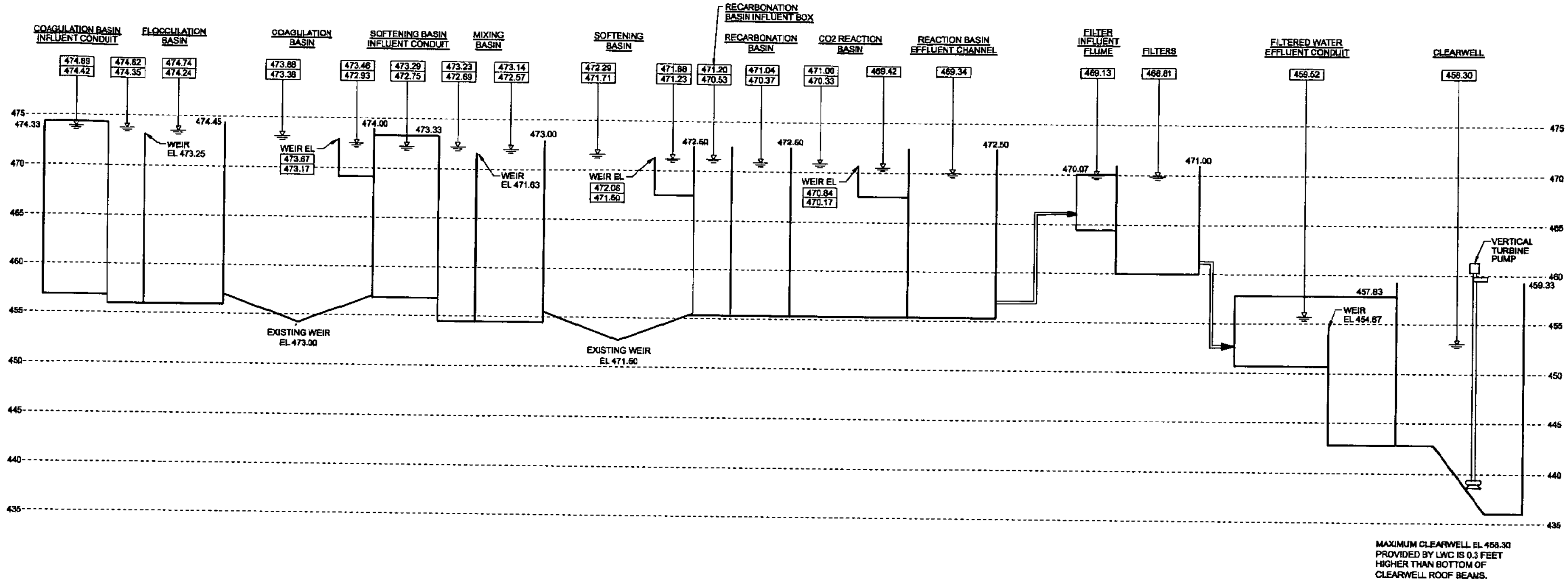
NOTE:
3 TREATMENT TRAINS
7 OF 8 FILTERS
CLEARWELL @ EL 458.30

FIGURE 2-3
BE PAYNE WTP
90 MGD HYDRAULIC PROFILE
VERTICAL = 1" = 10'
HORIZONTAL = NOT TO SCALE

FILENAME: 01nf007d_348133.dgn PLOT DATE: 12-SEP-2006

CH2MHILL

LWC 2908



HYDRAULIC CRITERIA

- D ≥ H FOR CONTROL WEIRS
- 6" MINIMUM FREEBOARD IN BASINS AND CHANNELS, 12" PREFERRED
- 6" MINIMUM HEAD SPACE IN COVERED CHANNELS NOT DESIGNED FOR UPLIFT
- 6" MINIMUM DROP THROUGH FILTERS AND CONTROL VALVE
- INFLUENT WEIRS CAN BE FLOODED
- FULL CLEARWELL

LARGER RECARBONATION INLET AND RAISED WEIRS
LOWER REACTION BASIN WEIRS

TREATMENT CONDITIONS
3 TREATMENT TRAINS
7 OF 8 FILTERS
CLEARWELL AT EL 458.30

FIGURE 2-4
BE PAYNE WTP
120 MGD HYDRAULIC PROFILE
VERTICAL = 1" = 10'
HORIZONTAL = NOT TO SCALE

FILENAME: 01rf008d_348133.dgn PLOT DATE: 12-SEP-2006

CH2MHILL

LWC 2909

SECTION 3

CHWTP Results and Conclusions

3.1 Hydraulic Capacity

A survey of the CHWTP treatment structures and water surfaces was conducted. Tops of walls, weirs, launders, and channels were surveyed to check their consistency within the plant as well as their consistency with existing record drawings. Table 3-1 summarizes the results of the structures survey. The surveyed elevations are, on average, approximately 1 foot lower than those shown on the record drawings.

The key elevations for use in the model are hydraulic control points; those most important for CHWTP are the basin weirs. The survey results show that not all the softening basin effluent weirs are set at the same elevation. There is a difference of 0.085 foot between the highest and lowest softening basin weirs. The surveyed elevations are an average of two readings from opposite sides of the basins. Variations in weir elevation also exist within each basin. The weirs in softening basin 5, for example, had a difference of 0.08 foot from one side to the other. Likewise, the effluent weir elevations for the reaction basins are not equal. Reaction basin 3 effluent weirs are 0.11 foot lower than the weirs for basin 1, and the basin 2 weirs are halfway between those of 1 and 3. It is unclear why the weirs were installed at different elevations. The lowest elevation weir of a basin set is the limiting hydraulic control point.

Attempts were made to obtain accurate elevations of the slow mix basin influent weirs; however, an uneven crust of calcium carbonate scale has developed on the weirs making a nonuniform weir elevation. In some places along the weirs, the crust had broken free, creating an irregular weir surface. This problem was addressed by taking three or four elevation readings across the encrusted weir and averaging the readings. The resulting average elevation was entered into the model and then minor adjustments were made to have the model produce the actual surveyed water surface elevation.

The coagulation basin effluent weirs are also not all installed at the same elevation. The south basin weirs are approximately 0.05 foot higher than the north basin weirs, and within each basin set (the four south basin weirs and four north basin weirs), a difference of 0.03 foot exists between basins. However, the coagulation basins contain V-notch weirs, and it is difficult to survey the notch invert with a flat-bottomed survey rod; thus the technique used for surveying V-notch weirs may introduce error into the readings. After the structure survey results for CHWTP were obtained from the surveyor and analyzed, it was decided instead to survey the top of the weir for V-notch weirs and the notch depth would then be subtracted to obtain the invert for any future weir surveying.

After the structure and control point elevations were obtained, the hydraulic model was assembled. Two HYDRO model scenarios were conducted for the existing treatment plant to calibrate the model. Water surfaces were surveyed at plant flow rates of approximately 103 and 151 mgd. After the model was assembled, it was run at each of the two flow rates. Minor losses and coefficients were adjusted until the model HGL output was within

0.04 foot of the actual water surface elevation surveyed. Table 3-2 summarizes and compares the calibrated model outputs and the actual survey readings. The model tracks well with the actual conditions with a few exceptions. The notes in the table explain why the difference between the model and surveyed elevation may have occurred. Some water surfaces are very turbulent and obtaining an accurate surveyed reading of the surface is sometimes difficult. The complete model results for the two calibration runs are shown in Table 3-3 for 103 mgd and Table 3-4 for 151 mgd.

3.1.1 Existing WTP Capacity

After the model was calibrated, several scenarios were examined to establish the existing plant hydraulic capacity. Flow in the model was incrementally increased until basin weirs began to flood. The first weirs to flood were the reaction basin effluent weirs. At approximately 180 mgd, the effluent weirs for reaction basin 3 start to experience backwater effects owing to high effluent channel water levels. The softening basin weirs have approximately 0.16 feet of drop over the effluent weirs, and the coagulation basins have approximately 3.6 feet of drop over the effluent weirs at 180 mgd. Figure 3-1 shows the HGL through CHWTP at the two calibration flows and at the current maximum hydraulic capacity of 180 mgd.

It is noteworthy that when the north filters are decommissioned, about 133 mgd of filtered water flows through the east filter group at a total plant flow rate of 180 mgd, if the south and east filters are loaded evenly. The east filter effluent conduit can accommodate only about 130 mgd without causing uplift on the conduit at its east end.

3.1.2 Modeling Results for 210-mgd Improvements

The first future capacity scenario (Option 1) is a plant flow of 210 mgd. The plant flow was entered into the model and run. The north filters were assumed to be out of service, and filtration rates for the south and east filters were assumed to be equal for all filters—14 in the east group and 5 in the south group. Each time a hydraulic restriction, such as flooding of a weir, was encountered, the control point was reestablished, and the model was then run again. For each successive model run, a control point or restriction working upstream through the plant was modified.

The first problem encountered was the reaction basin effluent weirs. To conform to the hydraulic criteria established, the reaction basin weirs would need to be raised to achieve the 210-mgd flow rate. Raising the weirs enough to prevent backwater effects would result in a reaction basin freeboard of 9.5 inches, an acceptable range. The next significant flow restriction encountered is the effluent conduit for softening basins 1 and 2. The conduit is constructed beneath the floor of slow mix basin 3 and would be very difficult to enlarge. A simple solution would be to redirect the effluent from softening basin 1 to reduce the flow through the effluent conduit. A new effluent port could be constructed in the southwest corner of softening basin 1 and a short channel or conduit constructed to convey the basin effluent flow into the north end of the reaction basin influent channel. The existing conduit beneath slow mix basin 3, which currently conveys flow from softening basins 1 and 2, would carry only softening basin 2 effluent after the new softening basin 1 effluent port is constructed. This effectively reduces the flow by 50 percent, which will reduce the friction loss at the restriction by 75 percent.

Once the softening basin 1 effluent is redirected to relieve the conduit beneath slow mix basin 3, the critical flow path then shifts to softening basins 3 and 4. The softening basin effluent weirs would also need to be raised to accommodate 210 mgd, and the required weir elevation would then be determined by the friction losses downstream of softening basins 3 and 4. Raising the softening basin weirs would result in a freeboard in the softening basins of 10 inches. The higher softening basin water surface would create a freeboard in the slow mix basin of 7 inches, which is less than the recommended 12 inches, but still acceptable. Sufficient freefall over the coagulation basin effluent weirs exists, and no additional improvements would be needed for 210 mgd.

Without modification, the filter effluent conduit for the east filter would develop uplift. The west end of the conduit slopes downward from the first east filter to the clear well entrance and is probably designed for uplift; however, an investigation of the entire conduit, especially the segment within the east filter pipe gallery, should be made to determine whether it can resist an uplift force. Installing a new 36-inch pipeline connecting the east end of this conduit to the west to chamber 1 of the clear well, routed in the Frankfort Avenue right-of-way, would alleviate the backpressure on the conduit and eliminate the uplift.

Because these proposed modifications are relatively low-cost and simple to accomplish, no other options for 210-mgd capacity were developed. Table 3-6 shows the results of the model at 210 mgd. The HGL for each 210-mgd option is shown in Figure 3-2.

3.1.3 Modeling Results for 240-mgd Improvements

The second future capacity scenario is a plant flow of 240 mgd. Again, the north filters were assumed to be out of service, and filtration rates for the south and east filters were assumed to be equal. The east filter bank is fed by a single conduit entering from the south between filters 25 and 27. The conduit tapers as it enters the filter influent channel, creating a large flow restriction. The east filter influent conduit flow restriction needs to be relieved to allow the plant to hydraulically handle 240 mgd. All of the modifications that are required for 210 mgd are also required for 240 mgd; however, the final weir elevations vary. Two proposed methods of relieving the east filter influent conduit were modeled.

Option 2A uses most of the existing piping beneath the control building. The southwest tower contains 60-inch pipe connections that connect the tower with the west end of the east filter influent channel and the tower to the north–south filter influent piping east of the clear well. Both connections are currently closed to prevent settled water from entering the filter influent streams. The proposed piping disconnects the 60-inch pipe from the tower and joins them outside the tower. The new piping would allow filter influent water to flow from the north-south filter influent piping into the east end of the east filter influent channel. A 60-inch pipe can handle approximately 32 mgd for the existing east filter influent conduit to relieve the restriction. Table 3-7 shows the model results at 240 mgd with a new east filter influent conduit. The reaction basin and softening basin weirs are raised, and softening basin 1 effluent has been redirected to bypass the conduit beneath slow mix basin 3.

Option 2B includes connecting a 60-inch pipe from the reaction basin effluent channel near the northwest corner of reaction basin 3; running it around the west, south, and east sides of the softening basins; and tying it into the east filter influent channel on the east side. The new pipe would provide a conduit for softened water to flow from the reaction basin effluent channel directly into the east filter bank as well as provide redundancy for the east filter influent. The approximate flow through the new 60-inch pipe would be 38 mgd. The basin modifications required are the same as those recommended for Option 2A; however, the final weir elevations are different. Table 3-8 shows the model results for 240 mgd with the new 60-inch pipe feeding the east side of the east filter influent channel. Figure 3-3 shows the HGL through the treatment plant for each 240-mgd option.

As with the 210-mgd scenario, without modification the filter effluent conduit for the east filters develops uplift. Installing a new 48-inch pipeline connecting the east end of this conduit to the west to chamber 1 of the clear well, routed in the Frankfort Avenue right-of-way, alleviates the backpressure on the conduit and eliminates the uplift.

Table 3-9 is a summary of the hydraulic modifications required at CHWTP for each option at plant flows of 210 mgd and 240 mgd. No basin modifications were needed for the slow mix basins, but they are included in the table to show the freeboard for each option.

3.1.4 Softening Basin Bypass

Another model scenario conducted for CHWTP was to determine whether 240 mgd could be handled hydraulically through the treatment plant while bypassing the softening basins. The existing facilities were studied to first determine whether it was possible to bypass softening by simply redirecting flows. After reviewing the drawings, it was determined that by changing the position of some of the gates at the softening basins, settled water could be diverted directly to the filter influent channel. The following valves would need to be placed in the positions indicated to bypass softening:

- Butterfly valves 302, 303, and 304 need to be closed
- Influent valves 345–347 and 353–355 from slow mix basins 5 and 6 need to be closed
- Sluice gates 305, 306, 311, 453, and 454 need to be open
- Gate valve 308 needs to be open

If these conditions are met, the plant will be able to handle a flow rate of 240 mgd in the softening basin bypass mode. Gate valve 308 would need to be opened to allow settled water to enter the east filter influent channel from the southwest tower. If this valve is not open, the softening basin influent channel would overflow because of the large head required to pass 240 mgd through sluice gate 305. Approximately 95 mgd would enter the east filter bank through the southwest tower and into the east end of the filter influent channel through valve 308. Opening gate valve 310 at the southwest tower would aid in relieving flow through sluice gate 305, though doing so would not be necessary. Table 3-10 shows the results of the model at 240 mgd with settled water entering directly into the filters. Figure 3-4 shows the HGL through the plant with the softening basins bypassed and settled water entering directly to the filters.

3.1.5 Decommissioning South Filters

A final model scenario conducted for CHWTP was to determine whether 240 mgd could be handled hydraulically through the treatment plant with the softening basins in service, but without using the south filters. Two of the 15 east filters were assumed to be in standby service for this analysis. This scenario was successful only when new connections to the west and east ends of the east filter influent channel were installed to reduce the bottleneck of sending all 240 mgd into the current east filter influent channel. If this bottleneck is not addressed, the reaction basin and softening basin walls would have to be raised to maintain the same filter influent channel water level set point for filter rate control. Table 3-11 shows the results of the model at 240 mgd using only 13 east filters. Note that the average filtration rate with 13 filters would be 6.1 gpm/ft^2. This is a high filtration rate, which would require a demonstration project for KY DOW acceptance; however, acceptable filter performance at this filtration rate is technically achievable.

Although 240 mgd can be delivered to the east filters using the same filter influent channel water level set point if the filter influent modifications are implemented, the filter effluent channel would become pressurized and the filtered water velocity at the exit point into the clear well would be over 14 feet per second. As a result, a new 60-inch filtered water pipeline would be required to connect the east end of the filtered water channel, and be routed in the Frankfort Avenue right-of-way west to chamber 1 of the clear well.

3.1.6 Clear Wells

The existing clear well has a volume of 25 million gallons, which is slightly smaller than the KY DOW–required volume of 15 percent of the total 24-hour plant capacity, which is 27 million gallons at a plant capacity of 180 mgd. Based on this criterion, the clear well would be undersized for any future capacity increases; however, the KY DOW has previously rated CHWTP for a nominal capacity of 240 mgd, so clear well improvements are considered to be discretionary.

3.1.7 High-Service Pumps

The CHWTP high-service pumps were examined to determine the existing station pumping capacity. As for BEPWTP, the pump capacities were determined from pressure readings on the pump discharge and clear well water level. The high-service pumps discharge into three water mains that convey the finished water to the distribution system. Two of the water mains connect to the distribution system north and south of the pump station, and the third main connects to the distribution system to the north. The mains leave the pump station as 48- and 60-inch pipes to the south and as two 48-inch pipes and a 42-inch pipe to the north. Owing to the age of the pump impellers, each pump was derated 10 percent to account for impeller wear because the measured flow rates were less than those indicated on the original pump performance curves. The pump number and respective capacity in millions of gallons per day are shown in the adjacent table.

Pump No.	Capacity, mgd
2	48.7
4	45.6
5	25.9
6	29.2
7	27.9
8	36.3
10	42.8

Capacities are based on a pump station discharge gauge pressure of 71.8 psi, which was recorded during a peak pumping event in June 2005. Under this pressure condition all pumps have a combined total of 256.4 mgd. Assuming Pump 6, the largest of the smaller units, is in standby service, the existing station capacity was therefore computed to be 227.2 mgd. Existing pump flowmeter data are available for comparison to calculated flows; however, the accuracy of the meters is not known.

Minimum high-service station pumping capacity was determined by LWC staff to be at least equal to the WTP capacity. Therefore, at the current plant capacity of 180 mgd, high-service pumping capacity is more than adequate. At higher plant capacities, however, the high-service pumping capacity requirements will exceed the existing capacity.

3.2 CHWTP Treatment Processes

Table 3-12 summarizes the loading rates and HRT for the treatment processes for CHWTP and compares them to the existing Ten States Standards and KY DOW general design guidelines.

3.2.1 Flocculation Basins

The flow-through velocity in the flocculation basins exceeds the Ten States Standards recommended maximum at present and proposed capacities. KY DOW design criteria do not contain guidelines for flow-through velocity in flocculation units. Detention time exceeds the recommended minimum for Ten States Standards up to 240 mgd, but is less than the KY DOW recommended minimum detention time at 240 mgd.

3.2.2 Coagulation Basins

The coagulation basins were assessed in terms of detention time, surface overflow rate, and weir loading rate. Ten States Standards and KY DOW guidelines contain the same recommended minimum detention time of 240 minutes. The computed basin detention time at present and future capacities is greater than the recommended minimum. The computed weir overflow rates for the coagulation basins exceed the Ten States Standards' recommended maximum at present and proposed capacities. KY DOW guidelines do not contain recommended weir overflow rates. The calculated surface loading is below the recommended maximum rate for both KY DOW and the Ten State Standards at 180 mgd and 210 mgd. At 240 mgd, the surface loading rate exceeds the KY DOW recommended maximum, but remains below the Ten States Standards' maximum.

3.2.3 Slow Mix Basins

The slow mix basins are subject to the same Ten States Standards recommendations as flocculation basins. The flow-through velocity at present and proposed flow rates exceeds the recommended maximum; however, the detention time is greater than the recommended minimum for present capacity and both proposed future capacities.

3.2.4 Softening Basins

The softening basins are subject to the same Ten States Standards recommendations as coagulation basins. Actual surface loading remains below the recommended maximum rate at present and proposed capacities. The detention time is less than the recommended time for present and future capacity. Weir overflow rate exceeds the recommended rate at both present and the two proposed capacities.

3.2.5 Filtration

Filtration rates at present and proposed capacities exceed KY DOW requirements of 2 gpm/ft^2 for rapid sand filters, but not the high-rate filtration up to 5 gpm/ft^2 permitted with continuous turbidity monitoring of each filter effluent. LWC presently monitors turbidity on each filter effluent. The present and proposed future rates are less than 5 gpm/ft^2 and are acceptable.

The north filter bank may be decommissioned in the near future. The filtration rate at present and proposed future capacities with only the south and east filter banks in service is still less than the KY DOW allowable maximum of 5 gpm/ft^2, assuming an equal loading rate for each filter.

3.3 CHWTP Chemical Feed Systems

Table 3-12 summarizes the existing feed systems and future capacities required for the chemicals used at CHWTP. Each chemical feed system was analyzed to determine its adequacy under existing and future flow conditions based on storage capacity and feed capacity.

3.3.1 Chemical Storage

Table 3-12 lists storage requirements under two conditions. Ten States Standards recommends providing a 30-day supply of chemicals used for treatment. The recommendation does not include information on what plant flow rate or chemical dose is used for calculating storage requirements. Required storage is calculated based on average dose at average flow for 30 days, and maximum dose at average flow for 14 days. The worst case condition would dictate the recommended storage capacity required. The treatment plant flow rate was assumed to have a 1.5 peaking factor. Average flow was determined by dividing the plant capacity by 1.5.

Presently, there is adequate storage under both flow conditions up to a plant capacity of 240 mgd for PAC, chlorine, polymer, ammonia, and fluoride.

Adequate storage exists for lime under both flow conditions up to a plant capacity of 210 mgd. At 240 mgd, the present storage is inadequate for the average dose and average flow condition for 30 days, but is sufficient for 14 days of storage at maximum dose and average flow.

The existing ferric chloride storage is inadequate for both flow conditions at the present 180-mgd capacity and both future proposed capacities. At the present capacity of 180 mgd, the available storage for average flow and maximum dose is only 7 days.

3.3.2 Chemical Feed Capacity

The chemical feed systems were examined to verify whether the firm capacity for each system is adequate to deliver the required amounts of chemical. Maximum doses were used to calculate the maximum feed rates. Firm capacity is the maximum feeding capacity with one of the largest units out of service for each system.

Chemical feed systems currently in use for PAC, ferric chloride, polymer, lime, ammonia, and fluoride have adequate capacity to deliver the chemicals at the current capacity of 180 mgd and proposed future capacities of 210 and 240 mgd for maximum dose. The feed system for chlorine is inadequate at a plant capacity of 240 mgd and maximum dose.

TABLE 3-1
CHWTP Structure Elevations
Louisville Water Company Water Treatment Plant Capacity Study

Structure Description	June 2006 Surveyed Elevation	Facility Record Drawings Elevation*	Difference	Notes
Raw Water Reservoir Top of Berm	582.559			
Raw Water Reservoir Gatehouse Top Floor	583.839			
North Coagulation Building Top Floor	575.744			
North Coagulation Building Observation Walkway At Center	575.304			
South Coagualtion Building Top Floor	573.074			
South Coagulation Building Observation Walkway At Center	572.594			
North Basin #1 Weir Notch	571.144			Surveyed elevation is average of 4 corner points. 0.13' difference between high and low points.
North Basin #2 Weir Notch	571.174			Surveyed elevation is average of 4 corner points. 0.03' difference between high and low points.
North Basin #3 Weir Notch	571.169			Surveyed elevation is average of 4 corner points. 0.04' difference between high and low points.
North Basin #4 Weir Notch	571.174			Surveyed elevation is average of 4 corner points. 0.05' difference between high and low points.
South Basin #5 Weir Notch	571.229			Surveyed elevation is average of 4 corner points. 0.09' difference between high and low points.
South Basin #6 Weir Notch	571.202			Surveyed elevation is average of 4 corner points. 0.08' difference between high and low points.
South Basin #7 Weir Notch	571.202			Surveyed elevation is average of 4 corner points. 0.07' difference between high and low points.
South Basin #8 Weir Notch	571.217			Surveyed elevation is average of 4 corner points. 0.12' difference between high and low points.
Bottom of North Coagulation Basin Effluent Launder At Discharge	565.719			Surveyed elevation is average of 4 basin effluent launders.
Bottom of South Coagulation Basin Effluent Launder At Discharge	565.709			Surveyed elevation is average of 4 basin effluent launders.
Top of Wall Elevation of Northwest Tower	581.494			
Top of Wall Elevation of Northeast Tower	583.704			
Top of Wall Elevation of Southwest Tower	581.344	582.14	-0.80	1926 Record Drawings.
Top of Wall Elevation of Southeast Tower	582.244			
West Softening Basin Observation Walkway	562.932	563.97	-1.04	Surveyed elevation is average of 2 points. 1971 Record Drawings.
Softening Basin Observation Walkways/Curb	563.723	564.64	-0.92	Surveyed elevation is average of 5 points. 1944 and 1971 Record Drawings.
Slow Mix Basin 1 Influent Weir	563.426	563.64	-0.21	Weir crusted over. Surveyed elevation is average of 3 points on crust. 1944 Record Drawings
Slow Mix Basin 2 Influent Weir	563.152	563.64	-0.49	Weir crusted over. Surveyed elevation is average of 3 points on crust. 1944 Record Drawings.
Slow Mix Basin 3 Influent Weir	563.352	564.14	-0.79	Weir crusted over. Surveyed elevation is average of 3 points on crust. 1956 Record Drawings.
Slow Mix Basin 4 Influent Weir	563.364	564.14	-0.78	Weir crusted over. Surveyed elevation is average of 4 points on crust. 1956 Record Drawings.
Slow Mix Basin 5 Top of Influent Baffle Wall	562.224			
Slow Mix Basin 6 Top of Influent Baffle Wall	562.174			
Softening Basin #1 Weir	562.689	563.64	-0.95	Surveyed elevation is average of 2 points. 1944 Record Drawings.
Softening Basin #2 Weir	562.709	563.64	-0.93	Surveyed elevation is average of 2 points. 1944 Record Drawings.
Softening Basin #3 Weir	562.719	563.64	-0.92	Surveyed elevation is average of 2 points. 1956 Record Drawings.
Softening Basin #4 Weir	562.704	563.64	-0.94	Surveyed elevation is average of 2 points. 1956 Record Drawings.
Softening Basin #5 Weir	562.634	563.64	-1.01	Surveyed elevation is average of 2 points. 1971 Record Drawings.
Softening Basin #6 Weir	562.669	563.64	-0.97	Surveyed elevation is average of 2 points. 1971 Record Drawings.
CO2 Reaction Basin #1 Effluent Weirs	561.779	562.67	-0.89	Surveyed elevation is average of 2 points. 1971 Record Drawings.
CO2 Reaction Basin #2 Effluent Weirs	561.724	562.67	-0.95	Two points surveyed the same. 1971 Record Drawings.
CO2 Reaction Basin #3 Effluent Weirs	561.674	562.67	-1.00	Two points surveyed the same. 1971 Record Drawings.
Observation Floor of North Filters	562.264	562.50	-0.24	1979 Record Drawings.
Observation Floor of South Filters	562.289	563.14	-0.85	1971 Record Drawings. (562.50 - 1979 and 1992 Record Drawings.)
Observation Floor of East Filters	561.504	562.14	-0.64	1926 and 1944 Record Drawings. (561.62 - 1979 Record Drawings.)
North Filters Top of Wall				No continuous curb. Top of Wall is same as Observation Floor.
South Filters Top of Wall				No continuous curb. Top of Wall is same as Observation Floor.
East Filters Top of Wall	561.314			
Bottom of North Filters Influent Channel	558.074			
Bottom of South Filters Influent Channel	558.424			
Bottom of East Filters Influent Channel	556.294	557.14	-0.85	1926 and 1944 Record Drawings. (556.44 - 1979 Record Drawings.)

TABLE 3-1
CHWTP Structure Elevations
Louisville Water Company Water Treatment Plant Capacity Study

Structure Description	June 2006 Surveyed Elevation	Facility Record Drawings Elevation*	Difference	Notes
Top of North Filters Backwash Trough				Could Not Obtain.
Bottom of North Filters Backwash Trough				Could Not Obtain.
Top of South Filters (#3) Backwash Trough	558.789	559.04	-0.25	1992 Record Drawings.
Bottom of South Filters (#3) Backwash Trough	557.129			
Top of Old East Filters (#19) Backwash Trough	555.724			
Bottom of Old East Filters (#19) Backwash Trough	554.014			
Top of New East Filters (#32) Backwash Trough	555.734			
Bottom of New East Filters (#32) Backwash Trough	554.194			
North Filters (#8)Top of Media	555.214			Southeast corner of filter.
South Filters (#3) Top of Media	555.654	556.56	-0.91	Surveyed elevation is average of 4 corners. 1992 Record Drawings.
Old East (#19) Top of Media	553.131			Surveyed elevation is average of 3 corners.
New East (#32) Top of Media	553.667			Surveyed elevation is average of 4 corners.
Top of Clearwell Access Hatch - Chamber #2	553.074			
Top of Clearwell Access Hatch - Chamber #3	552.424			
Top of Clearwell Access Hatch - Chamber #4	552.354			

* Record drawing elevations were converted from LWC datum to NGVD29 datum with +404.14' correction.

TABLE 3-2
Survey and Calibration Hydraulic Summary
Louisville Water Company Water Treatment Plant Capacity Study

	103 MGD			151 MGD			
Treatment Structure	Low Flow Model	Low Flow Actual	Diff.	High Flow Model	High Flow Actual	Diff.	Notes
North Raw Water Reservoir	580.268	580.299	-0.031				
South Raw Water Reservoir	579.6	579.629	-0.029				
North Flocculation Basins Inlet		571.264			571.324		
Flocculation Basin #1		571.224			571.274		
Flocculation Basin #2		571.224			571.284		
Flocculation Basin #3		571.204			571.254		
Flocculation Basin #4		571.224			571.274		
North Coagulation Basin #1		571.084			571.184		
North Coagulation Basin #2		571.124			571.184		
North Coagulation Basin #3		571.154			571.174		
North Coagulation Basin #4		571.134			571.154		
North Coagulation Basin #1 Effluent Launder		566.244			566.484		
North Coagulation Basin #2 Effluent Launder		566.204			566.584		
North Coagulation Basin #3 Effluent Launder		566.364			566.744		
North Coagulation Basin #4 Effluent Launder		566.184			566.614		
South Flocculation Basins Inlet	571.213	571.314	-0.101	571.308	571.449	-0.141	
Flocculation Basin #5		571.284			571.349		
Flocculation Basin #6		571.304			571.389		
Flocculation Basin #7	571.183	571.274	-0.091	571.249	571.309	-0.060	Possible sediment buildup in tunnel.
Flocculation Basin #8		571.294			571.389		
South Coagulation Basin #5		571.204			571.229		
South Coagulation Basin #6		571.164			571.219		
South Coagulation Basin #7	571.156	571.194	-0.038	571.176	571.219	-0.043	
South Coagulation Basin #8		571.174			571.249		
South Coagulation Basin #5 Effluent Launder		566.424			566.929		
South Coagulation Basin #6 Effluent Launder		566.494			566.939		
South Coagulation Basin #7 Effluent Launder	566.39	566.544	-0.154	566.588	566.809	-0.221	Survey point was upstream of launder discharge. 567.365' high point in model.
South Coagulation Basin #8 Effluent Launder		566.394			566.799		
Northeast Tower	564.701	564.804	-0.103	565.945	566.204	-0.259	Sediment deposition in tunnel and resulting section area not known.
Northwest Tower		564.884			566.169		
Southeast Tower	564.645	564.714	-0.069	565.825	565.854	-0.029	
Southwest Tower		*562.194*			566.014		Low flow survey reading error.
Softening Basins Influent Splitter Box	563.979	564.019	-0.040	564.364	564.359	0.005	
Slow Mix Basin #1 Influent	563.739	563.739	0.000	563.851	563.799	0.052	Crusting on weir prevents obtaining uniform weir elevation.
Slow Mix Basin #2 Influent		563.529			563.579		
Slow Mix Basin #3 Influent		563.849			563.904		

TABLE 3-2

Survey and Calibration Hydraulic Summary

Louisville Water Company Water Treatment Plant Capacity Study

	103 MGD			151 MGD			
Treatment Structure	**Low Flow Model**	**Low Flow Actual**	**Diff.**	**High Flow Model**	**High Flow Actual**	**Diff.**	**Notes**
Slow Mix Basin #4 Influent		563.649			563.764		
Slow Mix Basin #1	562.786	562.779	0.007	563.087	563.039	0.048	Model over predicts due to submerged Sedimentation Basin Weir.
Slow Mix Basin #2		562.849			563.079		
Slow Mix Basin #3		562.959			563.284		
Slow Mix Basin #4		562.899			563.164		
Softening Basin #1	562.752	562.729	0.023	563.014	562.839	0.175	Effluent Weir(~562.69') submerged. Model over predicts due to submerged weir.
Softening Basin #2		562.759			562.919		
Softening Basin #3		562.769			562.794		
Softening Basin #4		562.739			562.784		
Softening Basin #1 Effluent Launder	562.306	562.309	-0.003	562.896	562.799	0.097	Actual flow split between softening basins appears uneven. Model assumes even flow split.
Softening Basin #2 Effluent Launder		562.379			562.909		
Softening Basin #3 Effluent Launder		562.259			562.784		
Softening Basin #4 Effluent Launder		562.139			562.654		
Recarbonation Basin #1	562.242	562.249	-0.007	562.749	***564.314***	-1.565	High flow survey reading error.
CO2 Reaction Basin Influent Channel-North	561.96	561.969	-0.009	562.146	562.194	-0.048	
CO2 Reaction Basin Influent Channel-South	561.949	561.959	-0.010	562.128	562.074	0.054	
CO2 Reaction Basin #1	561.816	561.809	0.007	561.842	561.774	0.068	Survey error is apparent since high flow elevation is lower than low flow elevation.
CO2 Reaction Basin #2		561.799			561.764		
CO2 Reaction Basin Effluent Channel	560.849	560.939	-0.090	561.262	561.454	-0.192	
Softened Water Channel	560.804	560.699	0.105	561.185	561.214	-0.029	
Softened Water Channel To N&S Filters	560.716	560.759	-0.043	560.997	***562.954***	-1.957	High flow survey reading error.
Softened Water Channel To East Filters	560.721	560.709	0.012	561.006	561.059	-0.053	
North Filters Influent Channel		560.574			560.894		
South Filters Influent Channel		560.654			560.989		
East Filters Influent Channel	560.491	560.404	0.087	560.466	560.174	0.292	Banked water at direction change creates uneven water surface.
East Filters Influent Channel - East End	560.499	560.484	0.015	560.483	560.476	0.007	Estimated level based on actual filter level less influent losses.

TABLE 3-3
CHWTP
103 mgd - Calibration
4 of 6 Softening Trains in Service
Louisville Water Company Water Treatment Plant Capacity Study

Node	Description	HGL DN	HGL UP	EGL DN	EGL UP	D HGL
385	Raw Water Supply - North Reservoir	580.233	580.245	580.331	580.343	0.012
380	108" North Reservoir Effluent Sluice Gate	580.163	580.331	580.163	580.331	0.168
375	108" South Reservoir Influent Sluice Gate	579.996	580.163	579.996	580.163	0.167
370	108" South Reservoir Effluent Sluice Gate	579.828	579.996	579.828	579.996	0.168
365	108" Influent Sluice Gate	579.563	579.828	579.661	579.828	0.265
360	Raw Water Supply - South Reservoir	579.511	579.563	579.609	579.661	0.052
355	Raw Water Supply	579.252	579.452	579.409	579.609	0.200
350	South Sedimentation Basin Supply	579.180	579.212	579.376	579.409	0.032
345	South Sedimentation Basin Influent Control Valve US	578.968	578.969	579.375	579.376	0.001
340	South Basin Influent Control Valve	570.816	578.968	571.224	579.375	8.152
335	South Sedimentation Basin Influent Control Valve DS	570.815	570.816	571.223	571.224	0.001
330	South Sedimentation Basin Supply	571.022	571.026	571.219	571.223	0.004
325	Flocculator Influent Conduit	571.206	571.212	571.213	571.219	0.006
320	Flocculator Influent Sluice Gate	571.183	571.213	571.183	571.213	0.030
315	Flocculator Effluent Baffle	571.176	571.183	571.180	571.183	0.007
310	Sedimentation Basin Influent Conduit	571.175	571.176	571.179	571.180	0.001
305	Sedimentation Basin Influent Column Orifice	571.156	571.179	571.156	571.179	0.023
300	Coag Basin Effluent Weir	567.010	571.156	567.010	571.156	4.146
295	Coagulation Basin Effluent Launder	566.390	567.010	566.713	567.010	0.620
290	Clarifier Effluent Vertical Conduit	565.047	565.049	565.050	565.052	0.002
285	Clarifier Effluent Sluice Gate	564.987	565.050	564.993	565.050	0.063
280	Coag Basin Rectangular Effluent Conduit	564.975	564.987	564.982	564.993	0.012
275	South Coag Basin Effluent Tunnel	564.758	564.927	564.813	564.982	0.169
270	East Tunnel	564.623	564.791	564.645	564.813	0.168
265	Southeast Tower Gate	564.283	564.645	564.283	564.645	0.362
260	Softening Basin Influent (Butterfly Valve)	563.979	564.283	563.979	564.283	0.304
255	Slow Mix Basin Influent (Sluice Gate)	563.739	563.979	563.740	563.979	0.240
250	Slow Mix Basin Influent Weir	562.786	563.739	562.786	563.740	0.953
245	Slow Mix Basin Effluent Baffle Wall - Orifice	562.761	562.786	562.771	562.786	0.025
240	Softening Basin Influent Conduit	562.742	562.761	562.752	562.771	0.019
235	Softening Basin Effluent Weir	562.416	562.752	562.416	562.752	0.336
230	Softening Basin Effluent Launder	562.352	562.416	562.378	562.416	0.064
225	Softening Basin Effluent Orifice	562.288	562.378	562.350	562.378	0.090
220	Recarbonation Basin Effluent Conduit	562.198	562.288	562.260	562.350	0.090
215	Recarb Basin Effluent Gate #365	562.102	562.260	562.102	562.260	0.158
210	Recarb Basin Effluent Gate #366	561.967	562.102	561.992	562.102	0.135
205	Softening Basin #1 & 2 Effluent Conduit	561.947	561.967	561.971	561.992	0.020

Node	Description	HGL DN	HGL UP	EGL DN	EGL UP	D HGL
200	Reaction Basin Influent Channel	561.949	561.960	561.960	561.971	0.011
195	Reaction Basin Influent Sluice Gate	561.845	561.960	561.858	561.960	0.115
190	Reaction Basin Influent Conduit	561.840	561.845	561.852	561.858	0.005
185	Reaction Basin Influent Baffle	561.816	561.852	561.816	561.852	0.036
180	Reaction Basin Effluent Weir	560.877	561.816	560.877	561.816	0.939
175	Reaction Basin Effluent Launder	560.839	560.877	560.858	560.877	0.038
170	Reaction Basin Effluent Gullet	560.805	560.858	560.831	560.858	0.053
165	Reaction Basin #2 Effluent Channel North-1	560.829	560.831	560.830	560.831	0.002
160	Reaction Basin #2 Effluent Channel North	560.826	560.829	560.828	560.830	0.003
155	Reaction Basin #1 Effluent Channel North-3	560.822	560.825	560.825	560.828	0.003
150	Reaction Basin #1 Effluent Channel North-2	560.817	560.820	560.822	560.825	0.003
145	Reaction Basin #1 Effluent Channel North-1	560.811	560.814	560.819	560.823	0.003
140	Reaction Basin #1 Effluent Channel North	560.803	560.808	560.815	560.819	0.005
135	Reaction Basin #1 Effluent	560.782	560.803	560.794	560.815	0.021
130	Softened Water Conduit Entry	560.712	560.794	560.724	560.794	0.082
125	Softened Water Effluent Conduit	560.697	560.712	560.709	560.724	0.015
120	Softened Water Conduit	560.695	560.700	560.704	560.709	0.005
115	East Filter Influént - New Conduit	560.696	560.698	560.702	560.704	0.002
110	East Filter Influent-New Conduit	560.695	560.695	560.702	560.702	0.000
105	Sluice Gate At East Filter Influent	560.589	560.702	560.647	560.702	0.113
100	Dogleg At East Filter Influent	560.554	560.589	560.612	560.647	0.035
95	East Filter Influent Conduit	560.457	560.554	560.514	560.612	0.097
90	New East Filter Influent	560.483	560.491	560.507	560.514	0.008
85	Filter Influent - Downstream of #27 & 28.	560.494	560.498	560.502	560.507	0.004
80	Filter Influent - Downstream of #29 & 30.	560.499	560.501	560.500	560.502	0.002
75	Filter Influent	560.292	560.336	560.456	560.500	0.044
70	Filter Influent Butterfly Valve	560.275	560.292	560.439	560.456	0.017
65	Filter Influent	560.190	560.275	560.354	560.439	0.085
60	Filter Headloss	543.040	560.354	543.204	560.354	17.314
55	Filter Effluent Pipe	542.799	543.040	542.964	543.204	0.241
50	Filter Effluent Chamber Weir	542.801	542.963	542.804	542.964	0.162
45	E. Filter Effluent Upstream of 29 & 30	542.798	542.801	542.802	542.804	0.003
40	E. Filter Effluent Upstream of 27 & 28	542.768	542.773	542.797	542.802	0.005
35	E. Filter Effluent Upstream of 25 & 26	542.699	542.715	542.782	542.797	0.016
30	E. Filter Effluent Upstream of 23 & 24	542.586	542.612	542.759	542.782	0.026
25	E. Filter Effluent Upstream of 21 & 22	542.401	542.453	542.717	542.759	0.052
20	E. Filter Effluent Upstream of 19 & 20	542.230	542.305	542.663	542.718	0.075
15	East Filter Effluent Conduit	541.794	542.094	542.492	542.663	0.300
10	East Filter Clearwell Influent	541.208	541.797	542.322	542.492	0.589
5	Clearwell - Chamber #1	538.000	538.000	538.000	538.000	

TABLE 3-4
CHWTP
151 mgd - Calibration
4 of 6 Softening Trains in Service
Louisville Water Company Water Treatment Plant Capacity Study

Node	Description	HGL DN	HGL UP	EGL DN	EGL UP	D HGL
385	Raw Water Supply - North Reservoir	580.354	580.379	580.563	580.588	0.025
380	108" North Reservoir Effluent Sluice Gate	580.204	580.563	580.204	580.563	0.359
375	108" South Reservoir Influent Sluice Gate	579.845	580.204	579.845	580.204	0.359
370	108" South Reservoir Effluent Sluice Gate	579.487	579.845	579.487	579.845	0.358
365	108" Influent Sluice Gate	578.918	579.487	579.128	579.487	0.569
360	Raw Water Supply - South Reservoir	578.808	578.918	579.017	579.128	0.110
355	Raw Water Supply	578.253	578.682	578.588	579.017	0.429
350	South Sedimentation Basin Supply	578.139	578.202	578.525	578.588	0.063
345	South Sedimentation Basin Influent Control Valve US	577.723	577.725	578.523	578.525	0.002
340	South Basin Influent Control Valve	570.529	577.723	571.328	578.523	7.194
335	South Sedimentation Basin Influent Control Valve DS	570.527	570.529	571.326	571.328	0.002
330	South Sedimentation Basin Supply	570.933	570.941	571.318	571.326	0.008
325	Flocculator Influent Conduit	571.295	571.305	571.308	571.318	0.010
320	Flocculator Influent Sluice	571.249	571.308	571.249	571.308	0.059
315	Flocculator Effluent Baffle	571.235	571.249	571.243	571.249	0.014
310	Sedimentation Basin Influent Conduit	571.214	571.235	571.222	571.243	0.021
305	Sedimentation Basin Influent Column Orifice	571.176	571.222	571.176	571.222	0.046
300	Coag Basin Effluent Weir	567.365	571.176	567.365	571.176	3.811
295	Coagulation Basin Effluent Launder	566.588	567.365	567.010	567.365	0.777
290	Clarifier Effluent Vertical Conduit	566.713	566.717	566.721	566.725	0.004
285	Clarifier Effluent Sluice Gate	566.583	566.721	566.597	566.721	0.138
280	Coag Basin Rectangular Effluent Conduit	566.558	566.583	566.572	566.597	0.025
275	South Coag Basin Effluent Tunnel	566.073	566.450	566.195	566.572	0.377
270	East Tunnel	565.775	566.145	565.825	566.195	0.370
265	Southeast Tower Gate	565.014	565.825	565.014	565.825	0.811
260	Softening Basin Influent (Butterfly Valve)	564.364	565.014	564.364	565.014	0.650
255	Slow Mix Basin Influent (Sluice Gate)	563.851	564.364	563.852	564.364	0.513
250	Slow Mix Basin Influent Weir	563.087	563.851	563.087	563.852	0.764
245	Slow Mix Basin Effluent Baffle Wall - Orifice	563.032	563.087	563.054	563.087	0.055
240	Softening Basin Influent Conduit	562.992	563.032	563.014	563.054	0.040
235	Softening Basin Effluent Weir	563.007	563.014	563.007	563.014	0.007
230	Softening Basin Effluent Launder	562.896	563.007	562.941	563.007	0.111
225	Softening Basin Effluent Orifice	562.749	562.941	562.882	562.941	0.192
220	Recarbonation Basin Effluent Conduit	562.656	562.749	562.788	562.882	0.093
215	Recarb Basin Effluent Gate #365	562.449	562.788	562.449	562.788	0.339
210	Recarb Basin Effluent Gate #366	562.162	562.449	562.214	562.449	0.287
205	Softening Basin #1 & 2 Effluent Conduit	562.119	562.162	562.170	562.214	0.043

Node	Description	HGL DN	HGL UP	EGL DN	EGL UP	D HGL
200	Reaction Basin Influent Channel	562.128	562.146	562.152	562.170	0.018
195	Reaction Basin Influent Sluice Gate	561.906	562.152	561.933	562.152	0.246
190	Reaction Basin Influent Conduit	561.893	561.906	561.921	561.933	0.013
185	Reaction Basin Influent Baffle	561.842	561.921	561.842	561.921	0.079
180	Reaction Basin Effluent Weir	561.295	561.842	561.295	561.842	0.547
175	Reaction Basin Effluent Launder	561.245	561.295	561.270	561.295	0.050
170	Reaction Basin Effluent Gullet	561.176	561.270	561.223	561.270	0.094
165	Reaction Basin #2 Effluent Channel North-1	561.220	561.222	561.221	561.223	0.002
160	Reaction Basin #2 Effluent Channel North	561.214	561.218	561.218	561.221	0.004
155	Reaction Basin #1 Effluent Channel North-3	561.207	561.211	561.214	561.218	0.004
150	Reaction Basin #1 Effluent Channel North-2	561.198	561.203	561.209	561.214	0.005
145	Reaction Basin #1 Effluent Channel North-1	561.186	561.192	561.203	561.209	0.006
140	Reaction Basin #1 Effluent Channel North	561.172	561.179	561.196	561.203	0.007
135	Reaction Basin #1 Effluent	561.145	561.172	561.168	561.196	0.027
130	Softened Water Conduit Entry	560.992	561.168	561.017	561.168	0.176
125	Softened Water Effluent Conduit	560.960	560.992	560.985	561.017	0.032
120	Softened Water Conduit	560.957	560.967	560.975	560.985	0.010
115	East Filter Influent - New Conduit	560.959	560.963	560.971	560.975	0.004
110	East Filter Influent-New Conduit	560.956	560.957	560.970	560.971	0.001
105	Sluice Gate At East Filter Influent	560.712	560.970	560.849	560.970	0.258
100	Dogleg At East Filter Influent	560.629	560.712	560.767	560.849	0.083
95	East Filter Influent Conduit	560.397	560.629	560.534	560.767	0.232
90	New East Filter Influent	560.447	560.466	560.515	560.534	0.019
85	Filter Influent - Downstream of #27 & 28.	560.469	560.481	560.504	560.515	0.012
80	Filter Influent - Downstream of #29 & 30.	560.483	560.491	560.496	560.503	0.008
75	Filter Influent	560.190	560.255	560.431	560.496	0.065
70	Filter Influent Butterfly Valve	560.166	560.190	560.407	560.431	0.024
65	Filter Influent	560.040	560.166	560.281	560.407	0.126
60	Filter Headloss	544.100	560.281	544.341	560.281	16.181
55	Filter Effluent Pipe	543.747	544.100	543.989	544.341	0.353
50	Filter Effluent Chamber Weir	543.863	543.988	543.888	543.989	0.125
45	E. Filter Effluent Upstream of 29 & 30	543.859	543.863	543.884	543.888	0.004
40	E. Filter Effluent Upstream of 27 & 28	543.803	543.812	543.875	543.884	0.009
35	E. Filter Effluent Upstream of 25 & 26	543.706	543.729	543.853	543.875	0.023
30	E. Filter Effluent Upstream of 23 & 24	543.630	543.656	543.830	543.853	0.026
25	E. Filter Effluent Upstream of 21 & 22	543.455	543.501	543.791	543.830	0.046
20	E. Filter Effluent Upstream of 19 & 20	543.185	543.266	543.732	543.792	0.081
15	East Filter Effluent Conduit	542.671	542.857	543.638	543.732	0.186
10	East Filter Clearwell Influent	541.956	542.673	543.443	543.638	0.717
5	Clearwell - Chamber #1	541.200	541.200	541.200	541.200	

LWC 2925

TABLE 3-5
CHWTP
180 mgd - Maximum Hydraulic Capacity
6 of 6 Softening Trains in Service
14 of 15 East Filters In Service, 5 of 6 South Filters in Service, North Filters Decommisioned
Louisville Water Company Water Treatment Plant Capacity Study

Node	Description	HGL DN	HGL UP	EGL DN	EGL UP	D HGL	
385	Raw Water Supply - North Reservoir	580.251	580.287	580.549	580.585	0.036	
380	108" North Reservoir Effluent Sluice Gate	580.039	580.549	580.039	580.549	0.51	
375	108" South Reservoir Influent Sluice Gate	579.529	580.039	579.529	580.039	0.51	
370	108" South Reservoir Effluent Sluice Gate	579.019	579.529	579.019	579.529	0.51	
365	108" Influent Sluice Gate	578.212	579.019	578.509	579.019	0.807	
360	Raw Water Supply - South Reservoir	578.055	578.212	578.353	578.509	0.157	
355	Raw Water Supply	577.266	577.876	577.743	578.353	0.61	
350	South Sedimentation Basin Supply	577.105	577.195	577.652	577.743	0.09	
345	South Sedimentation Basin Influent Control Valve US	576.514	576.517	577.649	577.652	0.003	
340	South Basin Influent Control Valve	570.266	576.514	571.402	577.649	6.248	
335	South Sedimentation Basin Influent Control Valve DS	570.263	570.266	571.399	571.402	0.003	
330	South Sedimentation Basin Supply	570.840	570.851	571.388	571.399	0.011	
325	Flocculator Influent Conduit	571.354	571.369	571.373	571.388	0.015	
320	Flocculator Influent Sluice	571.289	571.373	571.289	571.373	0.084	
315	Flocculator Effluent Baffle	571.269	571.289	571.281	571.289	0.02	
310	Sedimentation Basin Influent Conduit	571.240	571.269	571.252	571.281	0.029	
305	Sedimentation Basin Influent Column Orifice	571.186	571.252	571.186	571.252	0.066	
300	Coag Basin Effluent Weir	567.553	571.186	567.553	571.186	3.633	
295	Coagulation Basin Effluent Launder	566.693	567.553	567.167	567.553	0.86	
290	Clarifier Effluent Vertical Conduit	566.921	566.926	566.932	566.937	0.005	
285	Clarifier Effluent Sluice Gate	566.736	566.932	566.756	566.932	0.196	
280	Coag Basin Rectangular Effluent Conduit	566.700	566.736	566.720	566.756	0.036	
275	South Coag Basin Effluent Tunnel	566.011	566.547	566.184	566.720	0.536	
270	East Tunnel	565.591	566.113	565.662	566.184	0.522	
265	Southeast Tower Gate	564.510	565.662	564.510	565.662	1.152	
260	Softening Basin Influent (Butterfly Valve)	564.099	564.510	564.099	564.510	0.411	
255	Slow Mix Basin Influent (Sluice Gate)	563.781	564.099	563.781	564.099	0.318	
250	Slow Mix Basin Influent Weir	562.805	563.781	562.805	563.781	0.976	
245	Slow Mix Basin Effluent Baffle Wall - Orifice	562.770	562.805	562.784	562.805	0.035	
240	Softening Basin Influent Conduit	562.745	562.770	562.759	562.784	0.025	
235	Softening Basin Effluent Weir	562.594	562.759	562.594	562.759	0.165	*
230	Softening Basin Effluent Launder	562.513	562.594	562.545	562.594	0.081	
225	Softening Basin Effluent Orifice	562.425	562.545	562.508	562.545	0.12	
220	Recarbonation Basin Effluent Conduit	562.366	562.425	562.449	562.508	0.059	
215	Recarb Basin Effluent Gate #365	562.235	562.449	562.235	562.449	0.214	
210	Recarb Basin Effluent Gate #366	562.054	562.235	562.087	562.235	0.181	

LWC 2926

Node	Description	HGL DN	HGL UP	EGL DN	EGL UP	D HGL
205	Softening Basin #1 & 2 Effluent Conduit	562.027	562.054	562.060	562.087	0.027
200	Reaction Basin Influent Channel	562.030	562.045	562.046	562.060	0.015
195	Reaction Basin Influent Sluice Gate	561.891	562.046	561.908	562.046	0.155
190	Reaction Basin Influent Conduit	561.883	561.891	561.901	561.908	0.008
185	Reaction Basin Influent Baffle	561.851	561.901	561.851	561.901	0.05
180	Reaction Basin Effluent Weir	561.495	561.851	561.495	561.851	0.356
175	Reaction Basin Effluent Launder	561.481	561.495	561.488	561.495	0.014
170	Reaction Basin Effluent Gullet	561.436	561.488	561.462	561.488	0.052
165	Reaction Basin #2 Effluent Channel North-1	561.448	561.456	561.453	561.462	0.008
160	Reaction Basin #2 Effluent Channel North	561.438	561.445	561.446	561.454	0.007
155	Reaction Basin #1 Effluent Channel North-3	561.427	561.434	561.439	561.447	0.007
150	Reaction Basin #1 Effluent Channel North-2	561.415	561.422	561.432	561.440	0.007
145	Reaction Basin #1 Effluent Channel North-1	561.402	561.410	561.425	561.432	0.008
140	Reaction Basin #1 Effluent Channel North	561.388	561.396	561.416	561.425	0.008
135	Reaction Basin #1 Effluent	561.357	561.388	561.385	561.416	0.031
130	Softened Water Conduit Entry	561.161	561.385	561.197	561.385	0.224
125	Softened Water Effluent Conduit	561.123	561.161	561.159	561.197	0.038
120	Softened Water Conduit	561.118	561.133	561.144	561.159	0.015
115	East Filter Influent - New Conduit	561.121	561.127	561.138	561.144	0.006
110	East Filter Influent-New Conduit	561.117	561.118	561.137	561.138	0.001
105	Sluice Gate At East Filter Influent	560.768	561.137	560.964	561.137	0.369
100	Dogleg At East Filter Influent	560.651	560.768	560.846	560.964	0.117
95	East Filter Influent Conduit	560.320	560.651	560.516	560.846	0.331
90	New East Filter Influent	560.389	560.417	560.489	560.516	0.028
85	Filter Influent - Downstream of #27 & 28.	560.422	560.439	560.473	560.489	0.017
80	Filter Influent - Downstream of #29 & 30.	560.444	560.455	560.462	560.473	0.011
75	Filter Influent	560.027	560.120	560.370	560.462	0.093
70	Filter Influent Butterfly Valve	559.993	560.027	560.336	560.370	0.034
65	Filter Influent	559.815	559.993	560.158	560.336	0.178
60	Filter Headloss	544.785	560.158	545.128	560.158	15.373
55	Filter Effluent Pipe	544.284	544.785	544.627	545.128	0.501
50	Filter Effluent Chamber Weir	544.494	544.625	544.525	544.627	0.131
45	E. Filter Effluent Upstream of 29 & 30	544.489	544.494	544.520	544.525	0.005
40	E. Filter Effluent Upstream of 27 & 28	544.423	544.435	544.507	544.520	0.012
35	E. Filter Effluent Upstream of 25 & 26	544.310	544.343	544.475	544.507	0.033
30	E. Filter Effluent Upstream of 23 & 24	544.229	544.256	544.450	544.475	0.027
25	E. Filter Effluent Upstream of 21 & 22	544.039	544.086	544.411	544.450	0.047
20	E. Filter Effluent Upstream of 19 & 20	543.749	543.831	544.349	544.411	0.082
15	East Filter Effluent Conduit	543.205	543.387	544.254	544.349	0.182
10	East Filter Clearwell Influent	542.357	543.146	544.045	544.254	0.789
5	Clearwell - Chamber #1	541.200	541.200	541.200	541.200	

* Limiting Point of Restriction

TABLE 3-6
CHWTP
210 mgd - Option 1 (Only option for this capacity)
6 of 6 Softening Trains in Service
14 of 15 East Filters in Service, 5 of 6 South Filters in Service, North Filters Decommissioned
55 mgd to South Filters/155 mgd to East Filters
Modifications - Weirs Raised and Softening Basin Effluent Modified
Louisville Water Company Water Treatment Plant Capacity Study

Node	Description	HGL DN	HGL UP	EGL DN	EGL UP	D HGL	Notes
385	Raw Water Supply - North Reservoir	578.063	578.112	578.468	578.517	0.049	
380	108" North Reservoir Effluent Sluice Gate	577.774	578.468	577.774	578.468	0.694	
375	108" South Reservoir Influent Sluice Gate	577.080	577.774	577.080	577.774	0.694	
370	108" South Reservoir Effluent Sluice Gate	576.386	577.080	576.386	577.080	0.694	
365	108" Influent Sluice Gate	574.419	576.386	574.824	576.386	1.967	
360	Raw Water Supply - South Reservoir	574.206	574.419	574.611	574.824	0.213	
355	Raw Water Supply	573.132	573.962	573.781	574.611	0.83	Existing 96" Pipe.
350	South Sedimentation Basin Supply	572.912	573.035	573.658	573.781	0.123	
345	South Sedimentation Basin Influent Control Valve US	572.108	572.112	573.654	573.658	0.004	
340	South Basin Influent Control Valve	569.943	572.108	571.489	573.654	2.165	20% closed.
335	South Sedimentation Basin Influent Control Valve DS	569.939	569.943	571.485	571.489	0.004	
330	South Sedimentation Basin Supply	570.724	570.740	571.470	571.485	0.016	
325	Flocculator Influent Conduit	571.425	571.444	571.451	571.470	0.019	
320	Flocculator Influent Sluice	571.336	571.451	571.336	571.451	0.115	
315	Flocculator Effluent Baffle	571.309	571.336	571.325	571.336	0.027	
310	Sedimentation Basin Influent Conduit	571.269	571.309	571.285	571.325	0.04	
305	Sedimentation Basin Influent Column Orifice	571.195	571.285	571.195	571.285	0.09	
300	Coag Basin Effluent Weir	567.737	571.195	567.737	571.195	3.458	Freefall over Coagulation Basin weir.
295	Coagulation Basin Effluent Launder	566.795	567.737	567.321	567.737	0.942	
290	Clarifier Effluent Vertical Conduit	566.917	566.925	566.932	566.940	0.008	
285	Clarifier Effluent Sluice Gate	566.667	566.932	566.693	566.932	0.265	
280	Coag Basin Rectangular Effluent Conduit	566.617	566.667	566.644	566.693	0.05	
275	South Coag Basin Effluent Tunnel	565.679	566.408	565.915	566.644	0.729	
270	East Tunnel	565.112	565.818	565.208	565.915	0.706	
265	Southeast Tower Gate	564.820	565.208	564.820	565.208	0.388	
260	Softening Basin Influent (Butterfly Valve)	564.260	564.820	564.260	564.820	0.56	
255	Slow Mix Basin Influent (Sluice Gate)	563.827	564.260	563.828	564.260	0.433	Partially closed sluice gate to balance flow.
250	Slow Mix Basin Influent Weir	563.140	563.827	563.140	563.828	0.687	Freefall over weir.
245	Slow Mix Basin Effluent Baffle Wall - Orifice	563.093	563.140	563.112	563.140	0.047	7" Slow Mix Basin Freeboard
240	Softening Basin Influent Conduit	563.058	563.093	563.077	563.112	0.035	
235	Softening Basin Effluent Weir	562.766	563.077	562.766	563.077	0.311	Weir raised to 563.00'
230	Softening Basin Effluent Launder	562.499	562.766	562.598	562.766	0.267	10" Softening Basin Freeboard
225	Softening Basin Effluent Orifice	562.519	562.598	562.547	562.598	0.079	
220	Recarbonation Basin Effluent Conduit	562.498	562.519	562.527	562.547	0.021	Redirect Softening Basin #1 Effluent

Node	Description	HGL DN	HGL UP	EGL DN	EGL UP	D HGL	Notes
215	Recarb Basin Effluent Gate #365	562.454	562.527	562.454	562.527	0.073	Redirect Softening Basin #1 Effluent
210	Recarb Basin Effluent Gate #366	562.392	562.454	562.403	562.454	0.062	Redirect Softening Basin #1 Effluent
205	Softening Basin #1 & 2 Effluent Conduit	562.383	562.392	562.394	562.403	0.009	Redirect Softening Basin #1 Effluent
200	Reaction Basin Influent Channel	562.357	562.374	562.377	562.394	0.017	
195	Reaction Basin Influent Sluice Gate	562.167	562.377	562.190	562.377	0.21	
190	Reaction Basin Influent Conduit	562.156	562.167	562.180	562.190	0.011	
185	Reaction Basin Influent Baffle	562.112	562.180	562.112	562.180	0.068	9.5" Reaction Basin Freeboard.
180	Reaction Basin Effluent Weir	561.844	562.112	561.844	562.112	0.268	Weir raised to 562.00'
175	Reaction Basin Effluent Launder	561.828	561.844	561.835	561.844	0.016	
170	Reaction Basin Effluent Gullet	561.774	561.835	561.804	561.835	0.061	
165	Reaction Basin #2 Effluent Channel North-1	561.786	561.797	561.794	561.804	0.011	
160	Reaction Basin #2 Effluent Channel North	561.773	561.782	561.785	561.794	0.009	
155	Reaction Basin #1 Effluent Channel North-3	561.759	561.768	561.775	561.785	0.009	
150	Reaction Basin #1 Effluent Channel North-2	561.744	561.753	561.766	561.776	0.009	
145	Reaction Basin #1 Effluent Channel North-1	561.727	561.737	561.756	561.767	0.01	
140	Reaction Basin #1 Effluent Channel North	561.708	561.719	561.746	561.756	0.011	
135	Reaction Basin #1 Effluent	561.672	561.708	561.709	561.746	0.036	
130	Softened Water Conduit Entry	561.404	561.709	561.453	561.709	0.305	
125	Softened Water Effluent Conduit	561.352	561.404	561.400	561.453	0.052	
120	Softened Water Conduit	561.346	561.366	561.381	561.400	0.02	
115	East Filter Influent - New Conduit	561.350	561.358	561.373	561.381	0.008	
110	East Filter Influent-New Conduit	561.346	561.346	561.372	561.373	0	
105	Sluice Gate At East Filter Influent	560.884	561.372	561.144	561.372	0.488	Existing Sluice Gate
100	Dogleg At East Filter Influent	560.729	560.884	560.988	561.144	0.155	
95	East Filter Influent Conduit	560.291	560.729	560.551	560.988	0.438	Tapered conduit.
90	New East Filter Influent	560.427	560.455	560.524	560.551	0.028	
85	Filter Influent - Downstream of #27 & 28.	560.468	560.482	560.511	560.524	0.014	
80	Filter Influent - Downstream of #29 & 30.	560.493	560.500	560.504	560.510	0.007	
75	Filter Influent	559.912	560.037	560.378	560.504	0.125	
70	Filter Influent Butterfly Valve	559.865	559.912	560.332	560.378	0.047	
65	Filter Influent	559.623	559.865	560.090	560.332	0.242	
60	Filter Headloss	545.493	560.090	545.960	560.090	14.597	Filter Bed + Controller
55	Filter Effluent Pipe	544.811	545.493	545.277	545.960	0.682	Existing 24" Pipe. 5.5 fps velocity.
50	Filter Effluent Chamber Weir	545.136	545.276	545.153	545.277	0.14	
45	E. Filter Effluent Upstream of 29 & 30	545.133	545.136	545.150	545.153	0.003	
40	E. Filter Effluent Upstream of 27 & 28	545.070	545.081	545.140	545.150	0.011	
35	E. Filter Effluent Upstream of 25 & 26	544.951	544.982	545.108	545.140	0.031	
30	E. Filter Effluent Upstream of 23 & 24	544.783	544.826	545.065	545.108	0.043	
25	E. Filter Effluent Upstream of 21 & 22	544.555	544.622	544.998	545.065	0.067	
20	E. Filter Effluent Upstream of 19 & 20	544.309	544.358	544.949	544.998	0.049	
15	East Filter Effluent Conduit	543.715	543.889	544.821	544.917	0.174	
10	East Filter Clearwell Influent	543.321	543.463	544.679	544.822	0.142	
5	Clearwell - Chamber #1	541.200	541.200	541.200	541.200		

TABLE 3-7
CHWTP
240 mgd - Option 2A
6 of 6 Softening Trains in Service
14 of 15 East Filters in Service, 5 of 6 South Filters in Service, North Filters Decommissioned
63 mgd to South Filters/177 mgd to East Filters
Modifications - 60-Inch Influent Pipe to West End of East Filters, Weirs Raised, and Softening Basin Effluent Modified
Louisville Water Company Water Treatment Plant Capacity Study

Node	Description	HGL DN	HGL UP	EGL DN	EGL UP	D HGL	Notes
385	Raw Water Supply - North Reservoir	580.174	580.237	580.703	580.766	0.063	
380	108" North Reservoir Effluent Sluice Gate	579.796	580.703	579.796	580.703	0.907	
375	108" South Reservoir Influent Sluice Gate	578.890	579.796	578.890	579.796	0.906	
370	108" South Reservoir Effluent Sluice Gate	577.983	578.890	577.983	578.890	0.907	
365	108" Influent Sluice Gate	575.415	577.983	575.944	577.983	2.568	
360	Raw Water Supply - South Reservoir	575.136	575.415	575.665	575.944	0.279	
355	Raw Water Supply	573.733	574.818	574.580	575.665	1.085	Existing 96" Pipe
350	South Sedimentation Basin Supply	573.446	573.607	574.420	574.580	0.161	
345	South Sedimentation Basin Influent Control Valve US	572.396	572.401	574.415	574.420	0.005	
340	South Basin Influent Control Valve	569.568	572.396	571.588	574.415	2.828	20% closed.
335	South Sedimentation Basin Influent Control Valve DS	569.563	569.568	571.583	571.588	0.005	
330	South Sedimentation Basin Supply	570.589	570.609	571.563	571.583	0.02	
325	Flocculator Influent Conduit	571.503	571.528	571.537	571.563	0.025	
320	Flocculator Influent Sluice	571.387	571.537	571.387	571.537	0.15	
315	Flocculator Effluent Baffle	571.352	571.387	571.372	571.387	0.035	
310	Sedimentation Basin Influent Conduit	571.300	571.352	571.321	571.372	0.052	
305	Sedimentation Basin Influent Column Orifice	571.204	571.321	571.204	571.321	0.117	
300	Coag Basin Effluent Weir	568.229	571.204	568.229	571.204	2.975	Freefall over Coagulation Basin weir.
295	Coagulation Basin Effluent Launder	567.794	568.229	567.975	568.229	0.435	
290	Clarifier Effluent Vertical Conduit	567.945	567.955	567.964	567.975	0.01	
285	Clarifier Effluent Sluice Gate	567.617	567.964	567.652	567.964	0.347	
280	Coag Basin Rectangular Effluent Conduit	567.553	567.617	567.588	567.652	0.064	
275	South Coag Basin Effluent Tunnel	566.327	567.280	566.635	567.588	0.953	
270	East Tunnel	565.591	566.509	565.717	566.635	0.918	
265	Southeast Tower Gate	565.210	565.717	565.210	565.717	0.507	
260	Softening Basin Influent (Butterfly Valve)	564.479	565.210	564.479	565.210	0.731	
255	Slow Mix Basin Influent (Sluice Gate)	563.913	564.479	563.914	564.479	0.566	Partially closed sluice gate to balance flow.
250	Slow Mix Basin Influent Weir	563.497	563.913	563.497	563.914	0.416	Freefall over Mixing Basin weir.
245	Slow Mix Basin Effluent Baffle Wall - Orifice	563.435	563.497	563.460	563.497	0.062	3" Mixing Basin Freeboard.
240	Softening Basin Influent Conduit	563.390	563.435	563.414	563.460	0.045	
235	Softening Basin Effluent Weir	563.035	563.414	563.035	563.414	0.379	Weir raised to 563.33'.
230	Softening Basin Effluent Launder	562.715	563.035	562.834	563.035	0.32	6" Softening Basin Freeboard.
225	Softening Basin Effluent Orifice	562.731	562.834	562.768	562.834	0.103	
220	Recarbonation Basin Effluent Conduit	562.704	562.731	562.741	562.768	0.027	Redirect Softening Basin #1 Effluent.

Node	Description	HGL DN	HGL UP	EGL DN	EGL UP	D HGL	Notes
215	Recarb Basin Effluent Gate #365	562.646	562.741	562.646	562.741	0.095	Redirect Softening Basin #1 Effluent.
210	Recarb Basin Effluent Gate #366	562.566	562.646	562.580	562.646	0.08	Redirect Softening Basin #1 Effluent.
205	Softening Basin #1 & 2 Effluent Conduit	562.554	562.566	562.568	562.580	0.012	Redirect Softening Basin #1 Effluent.
200	Reaction Basin Influent Channel	562.523	562.543	562.549	562.568	0.02	
195	Reaction Basin Influent Sluice Gate	562.274	562.549	562.305	562.549	0.275	
190	Reaction Basin Influent Conduit	562.260	562.274	562.291	562.305	0.014	
185	Reaction Basin Influent Baffle	562.203	562.291	562.203	562.291	0.088	8.5" Reaction Basin Freeboard.
180	Reaction Basin Effluent Weir	561.908	562.203	561.908	562.203	0.295	Weir raised to 562.08'.
175	Reaction Basin Effluent Launder	561.889	561.908	561.897	561.908	0.019	
170	Reaction Basin Effluent Gullet	561.818	561.897	561.858	561.897	0.079	
165	Reaction Basin #2 Effluent Channel North-1	561.835	561.848	561.845	561.858	0.013	
160	Reaction Basin #2 Effluent Channel North	561.818	561.830	561.833	561.845	0.012	
155	Reaction Basin #1 Effluent Channel North-3	561.800	561.812	561.821	561.833	0.012	
150	Reaction Basin #1 Effluent Channel North-2	561.781	561.793	561.810	561.822	0.012	
145	Reaction Basin #1 Effluent Channel North-1	561.759	561.772	561.797	561.810	0.013	
140	Reaction Basin #1 Effluent Channel North	561.735	561.749	561.784	561.797	0.014	
135	Reaction Basin #1 Effluent	561.691	561.735	561.740	561.784	0.044	
130	Softened Water Conduit Entry	561.341	561.740	561.405	561.740	0.399	Channel Entry Into Conduit.
125	Softened Water Effluent Conduit	561.273	561.341	561.337	561.405	0.068	
120	Softened Water Conduit	561.267	561.292	561.311	561.337	0.025	
115	East Filter Influent - New Conduit	561.276	561.285	561.302	561.311	0.009	
110	East Filter Influent-New Conduit	561.270	561.271	561.301	561.302	0.001	
105	Sluice Gate At East Filter Influent	560.831	561.301	561.033	561.301	0.47	Existing Sluice Gate
100	Dogleg At East Filter Influent	560.709	560.831	560.911	561.033	0.122	
95	East Filter Influent Conduit	560.368	560.709	560.570	560.911	0.341	
90	New East Filter Influent	560.409	560.445	560.536	560.570	0.036	
85	Filter Influent - Downstream of #27 & 28.	560.464	560.482	560.519	560.536	0.018	
80	Filter Influent - Downstream of #29 & 30.	560.497	560.505	560.510	560.519	0.008	
75	Filter Influent	559.737	559.901	560.347	560.511	0.164	
70	Filter Influent Butterfly Valve	559.677	559.737	560.286	560.347	0.06	
65	Filter Influent	559.361	559.677	559.970	560.286	0.316	
60	Filter Headloss	546.361	559.970	546.970	559.970	13.609	Filter Bed + Control Valve
55	Filter Effluent Pipe	545.470	546.361	546.079	546.970	0.891	Existing 24" Pipe. 6.3 fps.
50	Filter Effluent Chamber Weir	545.931	546.077	545.953	546.079	0.146	
45	E. Filter Effluent Upstream of 29 & 30	545.928	545.931	545.950	545.953	0.003	
40	E. Filter Effluent Upstream of 27 & 28	545.845	545.859	545.936	545.950	0.014	
35	E. Filter Effluent Upstream of 25 & 26	545.689	545.730	545.895	545.936	0.041	
30	E. Filter Effluent Upstream of 23 & 24	545.470	545.526	545.839	545.895	0.056	
25	E. Filter Effluent Upstream of 21 & 22	545.172	545.260	545.751	545.839	0.088	
20	E. Filter Effluent Upstream of 19 & 20	544.788	544.915	545.623	545.751	0.127	
15	East Filter Effluent Conduit	544.336	544.484	545.474	545.623	0.148	
10	East Filter Clearwell Influent	543.328	543.700	545.102	545.474	0.372	
5	Clearwell - Chamber #1	541.200	541.200	541.200	541.200		

TABLE 3-8
CHWTP
240 mgd - Option 2B
6 of 6 Softening Trains in Service
14 of 15 East Filters in Service, 5 of 6 South Filters in Service, North Filters Decommissioned
63 MGD to South Filters/177 MGD to East Filters
Modifications - 60-Inch Influent Pipe to East End of East Filters, Weirs Raised, and Softening Basin Effluent Modified
Louisville Water Company Water Treatment Plant Capacity Study

Node	Description	HGL DN	HGL UP	EGL DN	EGL UP	D HGL	Notes
385	Raw Water Supply - North Reservoir	580.174	580.237	580.703	580.766	0.063	
380	108" North Reservoir Effluent Sluice Gate	579.796	580.703	579.796	580.703	0.907	
375	108" South Reservoir Influent Sluice Gate	578.890	579.796	578.890	579.796	0.906	
370	108" South Reservoir Effluent Sluice Gate	577.983	578.890	577.983	578.890	0.907	
365	108" Influent Sluice Gate	575.415	577.983	575.944	577.983	2.568	
360	Raw Water Supply - South Reservoir	575.136	575.415	575.665	575.944	0.279	
355	Raw Water Supply	573.733	574.818	574.580	575.665	1.085	Existing 96" Pipe
350	South Sedimentation Basin Supply	573.446	573.607	574.420	574.580	0.161	
345	South Sedimentation Basin Influent Control Valve US	572.396	572.401	574.415	574.420	0.005	
340	South Basin Influent Control Valve	569.568	572.396	571.588	574.415	2.828	20% closed.
335	South Sedimentation Basin Influent Control Valve DS	569.563	569.568	571.583	571.588	0.005	
330	South Sedimentation Basin Supply	570.589	570.609	571.563	571.583	0.02	
325	Flocculator Influent Conduit	571.503	571.528	571.537	571.563	0.025	
320	Flocculator Influent Sluice	571.387	571.537	571.387	571.537	0.15	
315	Flocculator Effluent Baffle	571.352	571.387	571.372	571.387	0.035	
310	Sedimentation Basin Influent Conduit	571.300	571.352	571.321	571.372	0.052	
305	Sedimentation Basin Influent Column Orifice	571.204	571.321	571.204	571.321	0.117	
300	Coag Basin Effluent Weir	568.204	571.204	568.204	571.204	3	Freefall over Coagulation Basin weir.
295	Coagulation Basin Effluent Launder	567.753	568.204	567.941	568.204	0.451	
290	Clarifier Effluent Vertical Conduit	567.911	567.921	567.930	567.941	0.01	
285	Clarifier Effluent Sluice Gate	567.583	567.930	567.618	567.930	0.347	
280	Coag Basin Rectangular Effluent Conduit	567.519	567.583	567.554	567.618	0.064	
275	South Coag Basin Effluent Tunnel	566.293	567.246	566.601	567.554	0.953	
270	East Tunnel	565.557	566.475	565.683	566.601	0.918	
265	Southeast Tower Gate	565.177	565.683	565.177	565.683	0.506	
260	Softening Basin Influent (Butterfly Valve)	564.445	565.177	564.445	565.177	0.732	
255	Slow Mix Basin Influent (Sluice Gate)	563.880	564.445	563.880	564.445	0.565	Partially closed sluice gate to balance flow.
250	Slow Mix Basin Influent Weir	563.377	563.880	563.377	563.880	0.503	Freefall over Mixing Basin weir.
245	Slow Mix Basin Effluent Baffle Wall - Orifice	563.315	563.377	563.340	563.377	0.062	4" Mixing Basin Freeboard.
240	Softening Basin Influent Conduit	563.270	563.315	563.294	563.340	0.045	
235	Softening Basin Effluent Weir	562.961	563.294	562.961	563.294	0.333	Weir raised to 563.21'.
230	Softening Basin Effluent Launder	562.631	562.961	562.754	562.961	0.33	7.5" Softening Basin Freeboard.
225	Softening Basin Effluent Orifice	562.651	562.754	562.688	562.754	0.103	
220	Recarbonation Basin Effluent Conduit	562.624	562.651	562.661	562.688	0.027	Redirect Softening Basin #1 Effluent.

Node	Description	HGL DN	HGL UP	EGL DN	EGL UP	D HGL	Notes
215	Recarb Basin Effluent Gate #365	562.566	562.661	562.566	562.661	0.095	Redirect Softening Basin #1 Effluent.
210	Recarb Basin Effluent Gate #366	562.486	562.566	562.500	562.566	0.08	Redirect Softening Basin #1 Effluent.
205	Softening Basin #1 & 2 Effluent Conduit	562.474	562.486	562.488	562.500	0.012	Redirect Softening Basin #1 Effluent.
200	Reaction Basin Influent Channel	562.443	562.462	562.469	562.488	0.019	
195	Reaction Basin Influent Sluice Gate	562.194	562.469	562.225	562.469	0.275	
190	Reaction Basin Influent Conduit	562.180	562.194	562.211	562.225	0.014	
185	Reaction Basin Influent Baffle	562.123	562.211	562.123	562.211	0.088	9.5" Reaction Basin Freeboard.
180	Reaction Basin Effluent Weir	561.831	562.123	561.831	562.123	0.292	Weir raised to 562.00'.
175	Reaction Basin Effluent Launder	561.811	561.831	561.820	561.831	0.02	
170	Reaction Basin Effluent Gullet	561.738	561.820	561.779	561.820	0.082	
165	Reaction Basin #2 Effluent Channel North-1	561.756	561.770	561.766	561.779	0.014	
160	Reaction Basin #2 Effluent Channel North	561.739	561.751	561.754	561.766	0.012	
155	Reaction Basin #1 Effluent Channel North-3	561.721	561.733	561.742	561.754	0.012	
150	Reaction Basin #1 Effluent Channel North-2	561.701	561.713	561.731	561.742	0.012	
145	Reaction Basin #1 Effluent Channel North-1	561.679	561.692	561.718	561.731	0.013	
140	Reaction Basin #1 Effluent Channel North	561.655	561.669	561.704	561.718	0.014	
135	Reaction Basin #1 Effluent	561.610	561.655	561.660	561.704	0.045	
130	Softened Water Conduit Entry	561.280	561.659	561.325	561.659	0.379	
125	Softened Water Effluent Conduit	561.232	561.280	561.277	561.325	0.048	
120	Softened Water Conduit	561.227	561.245	561.259	561.277	0.018	
115	East Filter Influent - New Conduit	561.232	561.239	561.252	561.259	0.007	
110	East Filter Influent-New Conduit	561.227	561.228	561.251	561.252	0.001	
105	Sluice Gate At East Filter Influent	560.839	561.251	561.047	561.251	0.412	Existing Sluice Gate
100	Dogleg At East Filter Influent	560.714	560.839	560.922	561.047	0.125	
95	East Filter Influent Conduit	560.362	560.714	560.570	560.922	0.352	
90	New East Filter Influent	560.409	560.445	560.536	560.570	0.036	
85	Filter Influent - Downstream of #27 & 28.	560.464	560.482	560.519	560.536	0.018	
80	Filter Influent - Downstream of #29 & 30.	560.497	560.505	560.510	560.519	0.008	
75	Filter Influent	559.737	559.901	560.347	560.511	0.164	
70	Filter Influent Butterfly Valve	559.677	559.737	560.286	560.347	0.06	
65	Filter Influent	559.361	559.677	559.970	560.286	0.316	
60	Filter Headloss	546.361	559.970	546.970	559.970	13.609	Filter Bed + Control Valve
55	Filter Effluent Pipe	545.470	546.361	546.079	546.970	0.891	Existing 24" Pipe. 6.3 fps.
50	Filter Effluent Chamber Weir	545.931	546.077	545.953	546.079	0.146	
45	E. Filter Effluent Upstream of 29 & 30	545.928	545.931	545.950	545.953	0.003	
40	E. Filter Effluent Upstream of 27 & 28	545.845	545.859	545.936	545.950	0.014	
35	E. Filter Effluent Upstream of 25 & 26	545.689	545.730	545.895	545.936	0.041	
30	E. Filter Effluent Upstream of 23 & 24	545.470	545.526	545.839	545.895	0.056	
25	E. Filter Effluent Upstream of 21 & 22	545.172	545.260	545.751	545.839	0.088	
20	E. Filter Effluent Upstream of 19 & 20	544.788	544.915	545.623	545.751	0.127	
15	East Filter Effluent Conduit	544.336	544.484	545.474	545.623	0.148	
10	East Filter Clearwell Influent	543.328	543.700	545.102	545.474	0.372	
5	Clearwell - Chamber #1	541.200	541.200	541.200	541.200		

TABLE 3-9
CHWTP
Plant Hydraulic Modifications Summary
Louisville Water Company Water Treatment Plant Capacity Study

Description\Flow	210 MGD - Option 1 Modification	210 MGD - Option 1 Resulting Basin Freeboard	240 MGD - Option 2A Modification	240 MGD - Option 2A Resulting Basin Freeboard	240 MGD - Option 2B Modification	240 MGD - Option 2B Resulting Basin Freeboard
New East Filter Influent-West End			60" Pipe			
New East Filter Influent-East End					60" Pipe	
Raise Reaction Basin Effluent Weir Invert Elevation	562.00'	9.5"	562.08'	8.5"	562.00'	9.5"
New Softening Basin #2 Outlet	60"x60"	10"	60"x60"	6"	60"x60"	7.5"
Raise Softening Basin Effluent Weir Invert Elevation	563.00'		563.33'		563.21'	
Slow Mix Basins	-	7"	-	3"	-	4.5"

1. Existing average Reaction Basin effluent weir elevation is 561.72'.
2. Existing average Softening Basin effluent weir elevation is 562.69'.

TABLE 3-10
CHWTP
240 mgd
Softening Trains Bypassed
14 of 15 East Filters in Service, 5 of 6 South Filters in Service, North Filters Decommissionec
63 mgd to South Filters/177 mgd to East Filters
Modifications - 60-Inch Connection Pipe to West End of East Filters Placed into Service
Louisville Water Company Water Treatment Plant Capacity Study

Node	Description	HGL DN	HGL UP	EGL DN	EGL UP	D HGL	Notes
240	Raw Water Supply - North Reservoir	580.133	580.197	580.662	580.726	0.064	
235	108" North Reservoir Effluent Sluice Gate	579.756	580.662	579.756	580.662	0.906	
230	108" South Reservoir Influent Sluice Gate	578.849	579.756	578.849	579.756	0.907	
225	108" South Reservoir Effluent Sluice Gate	577.943	578.849	577.943	578.849	0.906	
220	108" Influent Sluice Gate	575.374	577.943	575.903	577.943	2.569	
215	Raw Water Supply - South Reservoir	575.096	575.374	575.625	575.903	0.278	
210	Raw Water Supply	573.693	574.777	574.54	575.625	1.084	Existing 96" Pipe
205	South Sedimentation Basin Supply	573.406	573.566	574.38	574.54	0.16	
200	South Sedimentation Basin Influent Control Valve US	572.355	572.36	574.375	574.38	0.005	
195	South Basin Influent Control Valve	569.568	572.355	571.588	574.375	2.787	20% closed.
190	South Sedimentation Basin Influent Control Valve DS	569.563	569.568	571.583	571.588	0.005	
185	South Sedimentation Basin Supply	570.589	570.609	571.563	571.583	0.02	
180	Flocculator Influent Conduit	571.503	571.528	571.537	571.563	0.025	
175	Flocculator Influent Sluice	571.387	571.537	571.387	571.537	0.15	
170	Flocculator Effluent Baffle	571.352	571.387	571.372	571.387	0.035	
165	Sedimentation Basin Influent Conduit	571.3	571.352	571.321	571.372	0.052	
160	Sedimentation Basin Influent Column Orifice	571.204	571.321	571.204	571.321	0.117	
155	Coag Basin Effluent Weir	567.913	571.204	567.913	571.204	3.291	Freefall over Coagulation Basin weir.
150	Coagulation Basin Effluent Launder	566.893	567.913	567.468	567.913	1.02	
145	Clarifier Effluent Vertical Conduit	565.815	565.826	565.835	565.845	0.011	
140	Clarifier Effluent Sluice Gate	565.488	565.835	565.522	565.835	0.347	
135	Coag Basin Rectangular Effluent Conduit	565.424	565.488	565.458	565.522	0.064	
130	South Coag Basin Effluent Tunnel	564.198	565.15	564.506	565.458	0.952	
125	East Tunnel	563.462	564.38	563.588	564.506	0.918	
120	Southeast Tower Gate	563.081	563.588	563.081	563.588	0.507	
115	Sluice Gate At 5&6 Settled Water Influent	561.31	563.081	561.31	563.081	1.771	Existing Sluice Gate. New Flow Path.
110	Sluice Gate To Lower Conduit	560.72	561.31	560.72	561.31	0.59	Existing Sluice Gate. New Flow Path.
105	Sluice Gate At East Filter Influent	560.615	560.72	560.688	560.72	0.105	
100	Dogleg At East Filter Influent	560.572	560.615	560.645	560.688	0.043	
95	East Filter Influent Conduit	560.449	560.572	560.522	560.645	0.123	~80 MGD In Conduit

Node	Description	HGL DN	HGL UP	EGL DN	EGL UP	D HGL	Notes
90	New East Filter Influent	560.355	560.393	560.487	560.522	0.038	
85	Filter Influent - Downstream of #27 & 28.	560.412	560.43	560.469	560.487	0.018	
80	Filter Influent - Downstream of #29 & 30.	560.446	560.455	560.46	560.469	0.009	
75	Filter Influent	559.688	559.851	560.297	560.461	0.163	
70	Filter Influent Butterfly Valve	559.627	559.688	560.236	560.297	0.061	
65	Filter Influent	559.311	559.627	559.92	560.236	0.316	
60	Filter Headloss	546.361	559.92	546.97	559.92	13.559	Filter Bed + Control Valve
55	Filter Effluent Pipe	545.47	546.361	546.079	546.97	0.891	Existing 24" Pipe. 6.3 fps.
50	Filter Effluent Chamber Weir	545.931	546.077	545.953	546.079	0.146	
45	E. Filter Effluent Upstream of 29 & 30	545.928	545.931	545.95	545.953	0.003	
40	E. Filter Effluent Upstream of 27 & 28	545.845	545.859	545.936	545.95	0.014	
35	E. Filter Effluent Upstream of 25 & 26	545.689	545.73	545.895	545.936	0.041	
30	E. Filter Effluent Upstream of 23 & 24	545.47	545.526	545.839	545.895	0.056	
25	E. Filter Effluent Upstream of 21 & 22	545.172	545.26	545.751	545.839	0.088	
20	E. Filter Effluent Upstream of 19 & 20	544.788	544.915	545.623	545.751	0.127	
15	East Filter Effluent Conduit	544.336	544.484	545.474	545.623	0.148	
10	East Filter Clearwell Influent	543.328	543.7	545.102	545.474	0.372	
5	Clearwell - Chamber #1	541.2	541.2	541.2	541.2		

TABLE 3-11
CHWTP
240 MGD
6 of 6 Softening Trains in Service
13 of 15 East Filters in Servce, North and South Filters Decommissioned
Modifications - 60-Inch Influent Pipe to East and West Ends of East Filters, Weirs Raised, and Softening Basin Effluent Modified
Louisville Water Commpany Water Treatment Plant Capacity Study

Node	Description	HGL DN	HGL UP	EGL DN	EGL UP	D HGL	Notes
385	Raw Water Supply - North Reservoir	580.174	580.237	580.703	580.766	0.063	
380	108" North Reservoir Effluent Sluice Gate	579.796	580.703	579.796	580.703	0.907	
375	108" South Reservoir Influent Sluice Gate	578.890	579.796	578.890	579.796	0.906	
370	108" South Reservoir Effluent Sluice Gate	577.983	578.890	577.983	578.890	0.907	
365	108" Influent Sluice Gate	575.415	577.983	575.944	577.983	2.568	
360	Raw Water Supply - South Reservoir	575.136	575.415	575.665	575.944	0.279	
355	Raw Water Supply	573.733	574.818	574.580	575.665	1.085	Existing 96" Pipe
350	South Sedimentation Basin Supply	573.446	573.607	574.420	574.580	0.161	
345	South Sedimentation Basin Influent Control Valve US	572.396	572.401	574.415	574.420	0.005	
340	South Basin Influent Control Valve	569.568	572.396	571.588	574.415	2.828	20" closed.
335	South Sedimentation Basin Influent Control Valve DS	569.563	569.568	571.583	571.588	0.005	
330	South Sedimentation Basin Supply	570.589	570.609	571.563	571.583	0.020	
325	Flocculator Influent Conduit	571.503	571.528	571.537	571.563	0.025	
320	Flocculator Influent Sluice	571.387	571.537	571.387	571.537	0.150	
315	Flocculator Effluent Baffle	571.352	571.387	571.372	571.387	0.035	
310	Sedimentation Basin Influent Conduit	571.300	571.352	571.321	571.372	0.052	
305	Sedimentation Basin Influent Column Orifice	571.204	571.321	571.204	571.321	0.117	
300	Coag Basin Effluent Weir	568.229	571.204	568.229	571.204	2.975	Freefall over Coagulation Basin weir.
295	Coagulation Basin Effluent Launder	567.794	568.229	567.975	568.229	0.435	
290	Clarifier Effluent Vertical Conduit	567.945	567.955	567.964	567.975	0.010	
285	Clarifier Effluent Sluice Gate	567.617	567.964	567.652	567.964	0.347	
280	Coag Basin Rectangular Effluent Conduit	567.553	567.617	567.588	567.652	0.064	
275	South Coag Basin Effluent Tunnel	566.327	567.280	566.635	567.588	0.953	
270	East Tunnel	565.591	566.509	565.717	566.635	0.918	
265	Southeast Tower Gate	565.210	565.717	565.210	565.717	0.507	
260	Softening Basin Influent (Butterfly Valve)	564.479	565.210	564.479	565.210	0.731	
255	Slow Mix Basin Influent (Sluice Gate)	563.913	564.479	563.914	564.479	0.566	Partially closed sluice gate to balanace flow.
250	Slow Mix Basin Influent Weir	563.497	563.913	563.497	563.914	0.416	Freefall over Mixing Basin weir.
245	Slow Mix Basin Effluent Baffle Wall - Orifice	563.435	563.497	563.460	563.497	0.062	3" Mixing Basin Freeboard.
240	Softening Basin Influent Conduit	563.390	563.435	563.414	563.460	0.045	
235	Softening Basin Effluent Weir	563.035	563.414	563.035	563.414	0.379	Weir raised to 563.33'.
230	Softening Basin Effluent Launder	562.715	563.035	562.834	563.035	0.320	6" Softening Basin Freeboard.
225	Softening Basin Effluent Orifice	562.731	562.834	562.768	562.834	0.103	
220	Recarbonation Basin Effluent Conduit	562.704	562.731	562.741	562.768	0.027	Redirect Softening Basin #1 Effluent.
215	Recarb Basin Effluent Gate #365	562.646	562.741	562.646	562.741	0.095	Redirect Softening Basin #1 Effluent.
210	Recarb Basin Effluent Gate #366	562.566	562.646	562.580	562.646	0.080	Redirect Softening Basin #1 Effluent.
205	Softening Basin #1 & 2 Effluent Conduit	562.554	562.566	562.568	562.580	0.012	Redirect Softening Basin #1 Effluent.
200	Reaction Basin Influent Channel	562.523	562.543	562.549	562.568	0.020	
195	Reaction Basin Influent Sluice Gate	562.274	562.549	562.305	562.549	0.275	

Node	Description	HGL DN	HGL UP	EGL DN	EGL UP	D HGL	Notes
190	Reaction Basin Influent Conduit	562.260	562.274	562.291	562.305	0.014	
185	Reaction Basin Influent Baffle	562.203	562.291	562.203	562.291	0.088	8.5" Reaction Basin Freeboard.
180	Reaction Basin Effluent Weir	561.914	562.203	561.914	562.203	0.289	Weir raised to 562.08'.
175	Reaction Basin Effluent Launder	561.895	561.914	561.904	561.914	0.019	
170	Reaction Basin Effluent Gullet	561.825	561.904	561.864	561.904	0.079	
165	Reaction Basin #2 Effluent Channel North-1	561.842	561.855	561.851	561.864	0.013	
160	Reaction Basin #2 Effluent Channel North	561.825	561.836	561.840	561.851	0.011	
155	Reaction Basin #1 Effluent Channel North-3	561.807	561.818	561.828	561.840	0.011	
150	Reaction Basin #1 Effluent Channel North-2	561.787	561.799	561.817	561.828	0.012	
145	Reaction Basin #1 Effluent Channel North-1	561.765	561.779	561.804	561.817	0.014	
140	Reaction Basin #1 Effluent Channel North	561.750	561.762	561.792	561.804	0.012	
135	Reaction Basin #1 Effluent	561.710	561.750	561.752	561.792	0.040	
130	Softened Water Conduit Entry	561.417	561.752	561.461	561.752	0.335	
125	Softened Water Effluent Conduit	561.371	561.417	561.414	561.461	0.046	
120	Softened Water Conduit	561.346	561.371	561.389	561.414	0.025	
115	East Filter Influent - New Conduit	561.353	561.363	561.380	561.389	0.010	
110	East Filter Influent-New Conduit	561.348	561.348	561.379	561.380	0.000	
105	Sluice Gate At East Filter Influent	560.852	561.379	561.108	561.379	0.527	Existing Sluice Gate.
100	Dogleg At East Filter Influent	560.698	560.852	560.954	561.108	0.154	
95	East Filter Influent Conduit	560.265	560.698	560.522	560.954	0.433	Existing East Filter Influent Conduit.
90	New East Filter Influent	560.367	560.402	560.489	560.522	0.035	
85	Filter Influent - Downstream of #27 & 28.	560.449	560.460	560.479	560.489	0.011	
80	Filter Influent - Downstream of #29 & 30.	560.477	560.479	560.477	560.479	0.002	
75	Filter Influent	558.846	559.191	560.133	560.477	0.345	
70	Filter Influent Butterfly Valve	558.718	558.846	560.004	560.133	0.128	
65	Filter Influent	558.052	558.718	559.338	560.004	0.666	Existing 24" Pipe. 7.9 fps.
60	Filter Headloss	548.052	559.338	549.338	559.338	11.286	Filter Bed + Control Valve
55	Filter Effluent Pipe	546.171	548.052	547.458	549.338	1.881	Existing 24" Pipe. 7.9 fps.
50	Filter Effluent Chamber Weir	547.263	547.455	547.313	547.458	0.192	
45	E. Filter Effluent Upstream of 29 & 30	547.256	547.263	547.305	547.313	0.007	
40	E. Filter Effluent Upstream of 27 & 28	547.077	547.107	547.275	547.305	0.030	
35	E. Filter Effluent Upstream of 25 & 26	546.738	546.827	547.186	547.275	0.089	
30	E. Filter Effluent Upstream of 23 & 24	546.269	546.390	547.065	547.186	0.121	
25	E. Filter Effluent Upstream of 21 & 22	545.633	545.822	546.875	547.065	0.189	
20	E. Filter Effluent Upstream of 19 & 20	544.814	545.086	546.603	546.875	0.272	
15	East Filter Effluent Conduit	544.330	544.512	546.420	546.603	0.182	
10	East Filter Clearwell Influent	537.943	538.741	541.200	541.998	0.798	Existing 72"x52" Conduit. 14.5 fps.
5	Clearwell - Chamber #1	541.200	541.200	541.200	541.200		

TABLE 3-12
Crescent Hill Water Treatment Plant
Process Capacity Summary
Louisville Water Company Water Treatment Plant Capacity Study

Flow, mgd			Ten States	Kentucky	180	210	240
Process		**Existing**	**Standards[1]**	**Criteria**			
Flocculation Units							
Total Number of Units		8					
Units 1-4 (North Basins)							
Width (ft)		22.75					
Depth (ft)		22					
Volume (cf, each)		89,089					
Units In Service	4						
Flow-Through Velocity (fpm)			0.5 - 1.5		3.8	4.5	5.1
Detention Time (min.)			30	40-60	46.4	39.8	34.8
Units 5-8 (South Basins)							
Width (ft)		24.5					
Depth (ft)		24					
Volume (cf, each)		104,664					
Units In Service	4						
Flow-Through Velocity (fpm)			0.5 - 1.5		3.8	4.5	5.1
Detention Time (min.)			30	40-60	46.4	39.8	34.8
Coagulation/Sedimentation Units							
Total Number of Units		8					
Units 1-4 (North Basins)							
Area (sf, each)		20,900					
Depth (ft)		28					
Volume (cf, each)		638,928					
Units In Service	4						
Detention Time (min.)			240	240	332	284	249
Surface Loading Rate (gpm/sf)			0.5	0.75	0.63	0.73	0.84
Weir Overflow Rate (gpd/ft)			20,000		32,787	38,252	43,717
Units 5-8 (South Basins)							
Area (sf, each)		28,900					
Depth (ft)		24					
Volume (cf, each)		746,496					
Units In Service	4						
Detention Time (min.)			240	240	332	284	249
Surface Loading Rate (gpm/sf)			0.5	0.75	0.63	0.73	0.84
Weir Overflow Rate (gpd/ft)			20,000		38,404	44,804	51,205
Softening Units							
Total Number of Units		6					
Slow Mix Units 1-4							
Width (ft)		50.5					
Depth (ft)		16.5					
Volume (cf, each)		147,485					
Units In Service	4						
Flow-Through Velocity (fpm)			0.5 - 1.5		3.3	3.9	4.5
Detention Time (min.)			30		53.0	45.4	39.7
Slow Mix Units 5-6							
Width (ft)		50.5					
Depth (ft)		16.5					
Volume (cf, each)		164,150					
Units In Service	2						
Flow-Through Velocity (fpm)			0.5 - 1.5		3.3	3.9	4.5
Detention Time (min.)			30		58.9	50.5	44.2

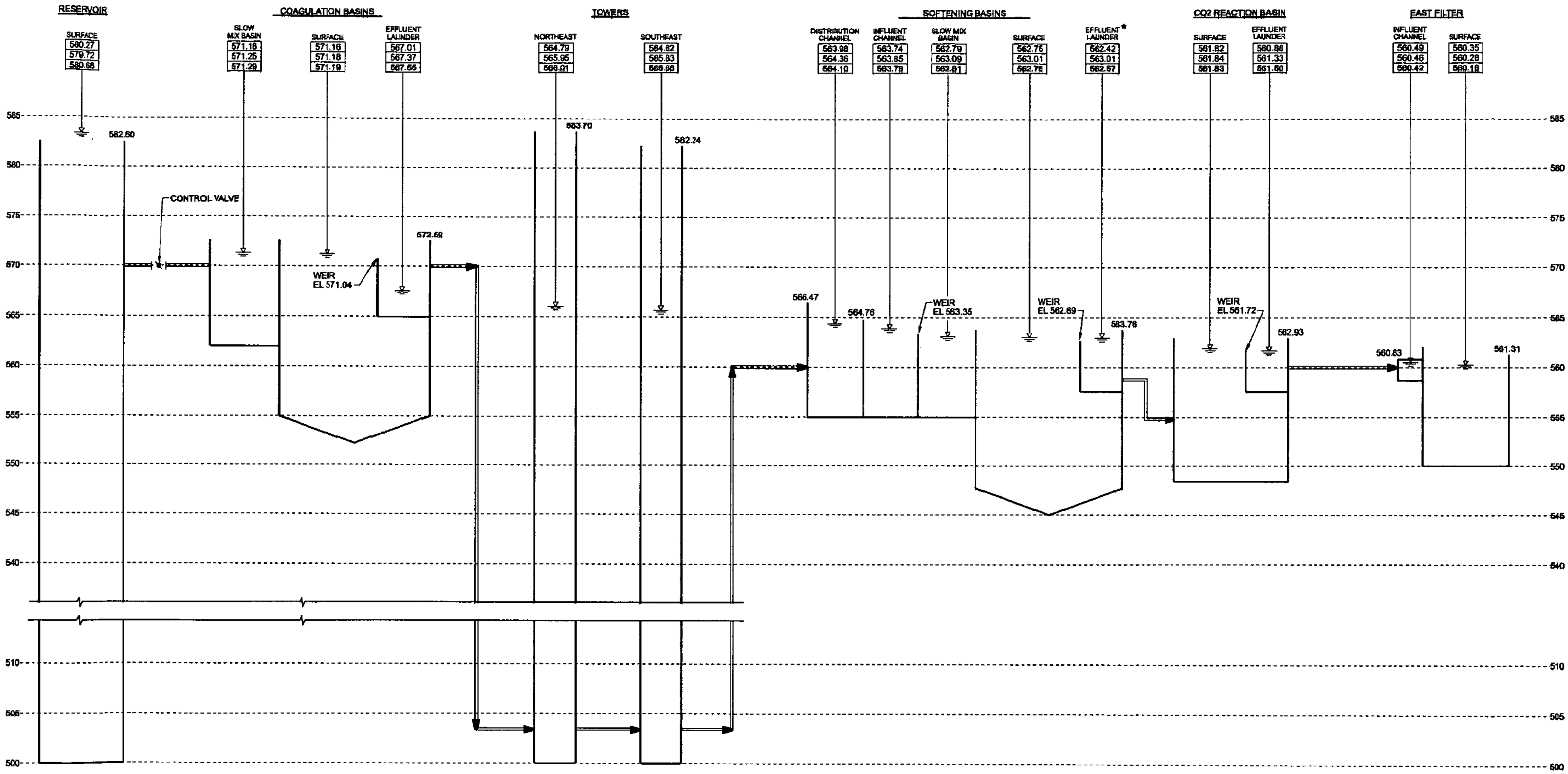
Flow, mgd			Ten States	Kentucky	180	210	240
Process		**Existing**	**Standards[1]**	**Criteria**			
Softening Units 1-6							
Area (sf, each)		37,249					
Depth (ft)		16					
Volume (cf, each)		628,996					
Units In Service	6						
Detention Time (min.)			240		226	194	169
Surface Loading Rate (gpm/sf)			0.5	0.75[3]	0.56	0.65	0.75
Weir Overflow Rate (gpd/ft)			20,000		38,860	45,337	51,813
Recarbonation Basin #1							
Volume (cf, each)		15,810					
Detention Time (min.)					2.8	2.4	2.1
Recarbonation Basin #2							
Volume (cf, each)		77,376					
Detention Time (min.)					13.9	11.9	10.4
Recarbonation Basin #3							
Area (sf, each)		71,424					
Detention Time (min.)					12.8	11.0	9.6
CO2 Reaction Basins 1&2							
Area (sf)		28,644					
Depth (ft)		15.25					
Volume (cf, each)		436,821					
Units In Service	2						
Detention Time (min.)					79	67	59
Surface Loading Rate (gpm/sf)					1.45	1.69	1.94
Weir Overflow Rate (gpd/ft)					68,372	79,767	91,162
CO2 Reaction Basin 3							
Area (sf)		28,797					
Depth (ft)		15.25					
Volume (cf, each)		439,150					
Units In Service	1						
Detention Time (min.)					79	67	59
Surface Loading Rate (gpm/sf)					1.45	1.69	1.94
Weir Overflow Rate (gpd/ft)					63,583	74,180	84,777
Filtration							
Total Number of Units		33					
Units 1-6 (South Filters)							
Area (sf, each)		2,100					
Units In Service	5						
Rate (gpm/sf)			None	5[5]	3.13	3.65	4.18
Units 7-18 (North Filters)[6]							
Area (sf, each)		1,050					
Units In Service	0						
Rate (gpm/sf)			None	5[5]	3.13	3.65	4.18
Units 19-33 (East Filters)							
Area (sf, each)		2,100					
Units In Service	14						
Rate (gpm/sf)			None	5[5]	3.13	3.65	4.18
Clearwell							
Volume (MG)		25		15%			
Percent Full	100%						
Volume Required, MG					27	32	36
High Service Pumps							
System Pressure (psi)		71.8					

Flow, mgd			Ten States	Kentucky	180	210	240
Process		**Existing**	**Standards[1]**	**Criteria**			
Station Capacity (mgd) [7, 8, 9]		227.2			180	210	240
Pump No. 2 Capacity (mgd)		48.7					
Pump No. 4 Capacity (mgd)		45.6					
Pump No. 5 Capacity (mgd)		25.9					
Pump No. 6 Capacity (mgd)		29.2					
Pump No. 7 Capacity (mgd)		27.9					
Pump No. 8 Capacity (mgd)		36.3					
Pump No. 10 Capacity (mgd)		42.8					
Chemical Feed Systems [7]							
Powdered Activated Carbon (1 lb/1 gal)							
Available Storage (gal)		120000					
Firm Capacity (gph)		500					
Average Dose (# Solution/MG)		50					
Max Dose (# Solution/MG)		300					
Storage Required At Average Dose & Average Flow For 30 Days (gal)					21,592	25,191	28,790
Storage Required At Maximum Dose & Average Flow For 14 Days (gal)					60,358	70,417	80,477
Feed Required Max(gph)					269	314	359
Chlorine (99.5%)							
Available Storage (ton)		180					
Firm Capacity (ppd)		10000					
Average Dose (# Chlorine/MG)		32					
Max Dose (# Chlorine/MG)		45					
Storage Required At Average Dose & Average Flow For 30 Days (tons)					58	67	77
Storage Required At Maximum Dose & Average Flow For 14 Days (tons)					38	45	51
Feed Required Max(ppd)					8190	9554	10919
Ferric Chloride (37%)							
Available Storage (gal)		82000					
Max Feed Capacity (gph)		1500					
Average Dose (# Ferric/MG)		128					
Max Dose (# Ferric/MG)		400					
Storage Required At Average Dose & Average Flow For 30 Days (gal)					110,951	129,443	147,935
Storage Required At Maximum Dose & Average Flow For 14 Days (gal)					161,383	188,281	215,178
Feed Required Max(gph)					720	841	961
Cationic Polymer							
Available Storage (gal)		19000					
Max Feed Capacity (gph)		565					
Average Dose (# Polymer/MG)		4					
Max Dose (# Polymer/MG)		60					
Storage Required At Average Dose & Average Flow For 30 Days (gal)					1,764	2,058	2,352
Storage Required At Maximum Dose & Average Flow For 14 Days (gal)					11,855	13,830	15,806
Feed Required Max(gph)					53	62	71
Lime (99.5%)							
Available Storage (ton)		283					
Max Feed Capacity (pph)		4000					
Average Dose (# Lime/MG)		125					
Max Dose (# Lime/MG)		250					
Storage Required At Average Dose & Average Flow For 30 Days (tons)					226	264	302
Storage Required At Maximum Dose & Average Flow For 14 Days (tons)					211	246	282
Feed Required Max(pph)					1885	2199	2514
Ammonia (99.5%)							
Available Storage (gal)		12000					

Flow, mgd			Ten States Standards[1]	Kentucky Criteria	180	210	240
Process		Existing					
Max Feed Capacity (pph)		154					
Average Dose (# Ammonia/MG)		5.8					
Max Dose (# Ammonia/MG)		10					
Storage Required At Average Dose & Average Flow For 30 Days (gal)					2,508	2,926	3,344
Storage Required At Maximum Dose & Average Flow For 14 Days (gal)					4,362	5,089	5,816
Feed Required Max(pph)					76	88	101
Fluoride (19%)							
Available Storage (gal)		16800					
Max Feed Capacity (gph)		75					
Average Dose (# Fluoride/MG)		6.7					
Max Dose (# Fluoride/MG)		8.3					
Storage Required At Average Dose & Average Flow For 30 Days (gal)					12,198	14,231	16,264
Storage Required At Maximum Dose & Average Flow For 14 Days (gal)					7,071	8,250	9,428
Feed Required Max(gph)					31.6	36.8	42.1

NOTES:

1 Ten States Standards 30-Day Recommended Chemical Storage Does Not Distinquish Between Average Or Maximum Dosage.
2 Highlighted Values Either Exceed Existing Capacity Or Are Less Than The Recommended Storage.
3 No KDOW guidance available for softening units; use same rate as given for conventional sedimentation.
4 Only one feed unit exists.
5 Requires continuous turbidity monitoring on individual filters at rates above 2 gpm/sf.
6 North filters are assumed to be decommissioned.
7 Firm capacity excludes largest unit.
8 Pumps were derated 10% for impeller wear.
9 High service pump capacity is to be at least 100% of WTP capacity



HYDRAULIC CRITERIA

- D ≥ H FOR CONTROL WEIRS
- 6" MINIMUM FREEBOARD IN BASINS AND CHANNELS, 12" PREFERRED
- 6" MINIMUM HEAD SPACE IN COVERED CHANNELS NOT DESIGNED FOR UPLIFT
- 3' MINIMUM DROP THROUGH FILTERS AND CONTROL VALVE
- INFLUENT WEIRS CAN BE FLOODED
- FULL CLEARWELL

MAXIMUM CLEARWELL LEVEL WITHOUT PRESSURIZING FILTER EFFLUENT CONDUIT IS EL 540.50

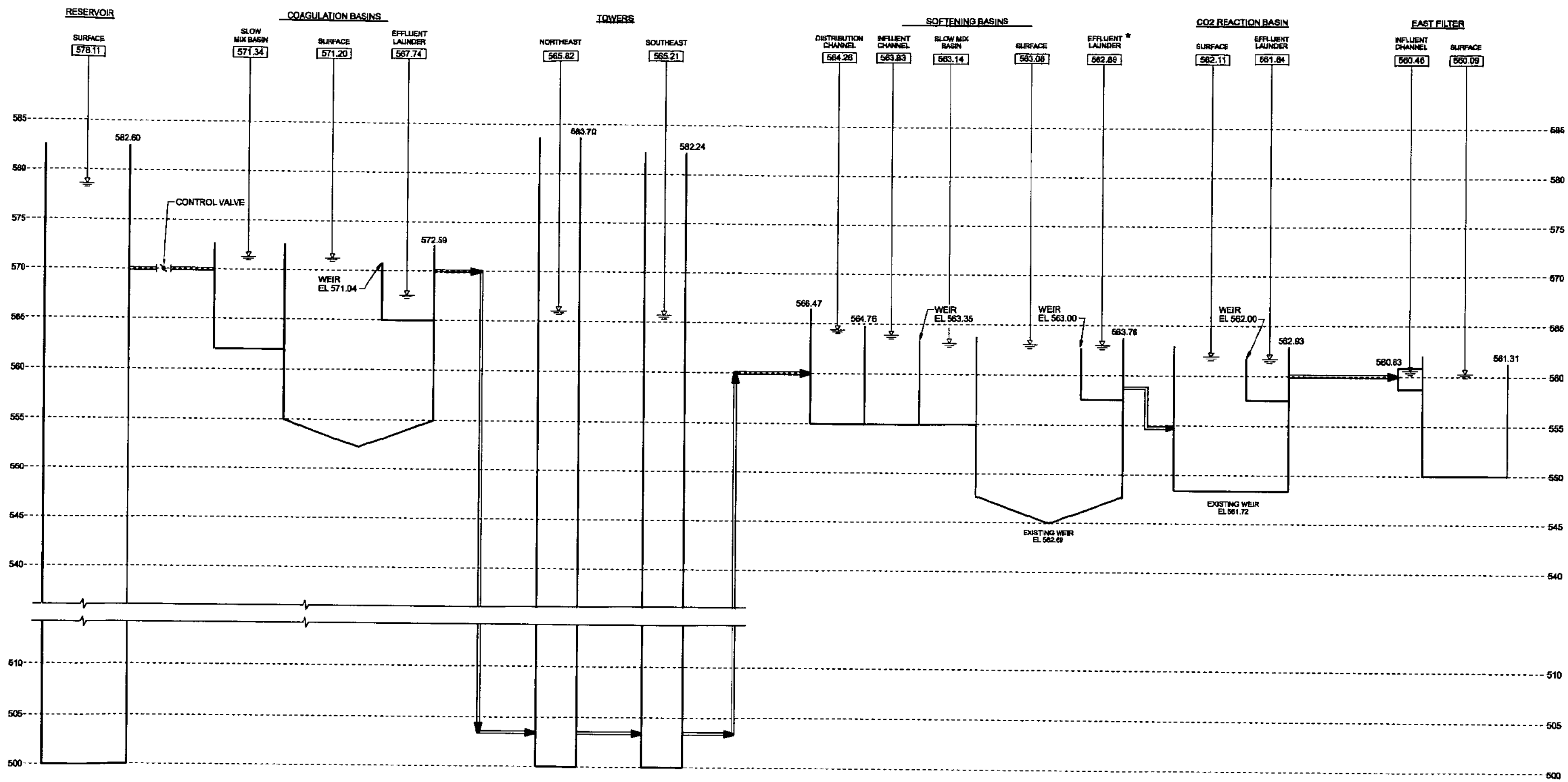
- 103 MGD CALIBRATION (4 OF 6 SOFTENING BASINS)
- 151 MGD CALIBRATION (4 OF 6 SOFTENING BASINS)
- 180 MGD MAXIMUM HYDRAULIC CAPACITY (6 OF 6 SOFTENING BASINS)

* SOFTENING BASIN #1 LAUNDER

FIGURE 3-1
CRESCENT HILL FILTER PLANT
EXISTING HYDRAULIC PROFILE
VERTICAL = 1" = 10'
HORIZONTAL = NOT TO SCALE

CH2MHILL

FILENAME: 01rf002d_346133.dgn PLOT DATE: 12-SEP-2006



HYDRAULIC CRITERIA

- D ≥ H FOR CONTROL WEIRS
- 6" MINIMUM FREEBOARD IN BASINS AND CHANNELS, 12" PREFERRED
- 6" MINIMUM HEAD SPACE IN COVERED CHANNELS NOT DESIGNED FOR UPLIFT
- 6" MINIMUM DROP THROUGH FILTERS AND CONTROL VALVE
- INFLUENT WEIRS CAN BE FLOODED
- FULL CLEARWELL

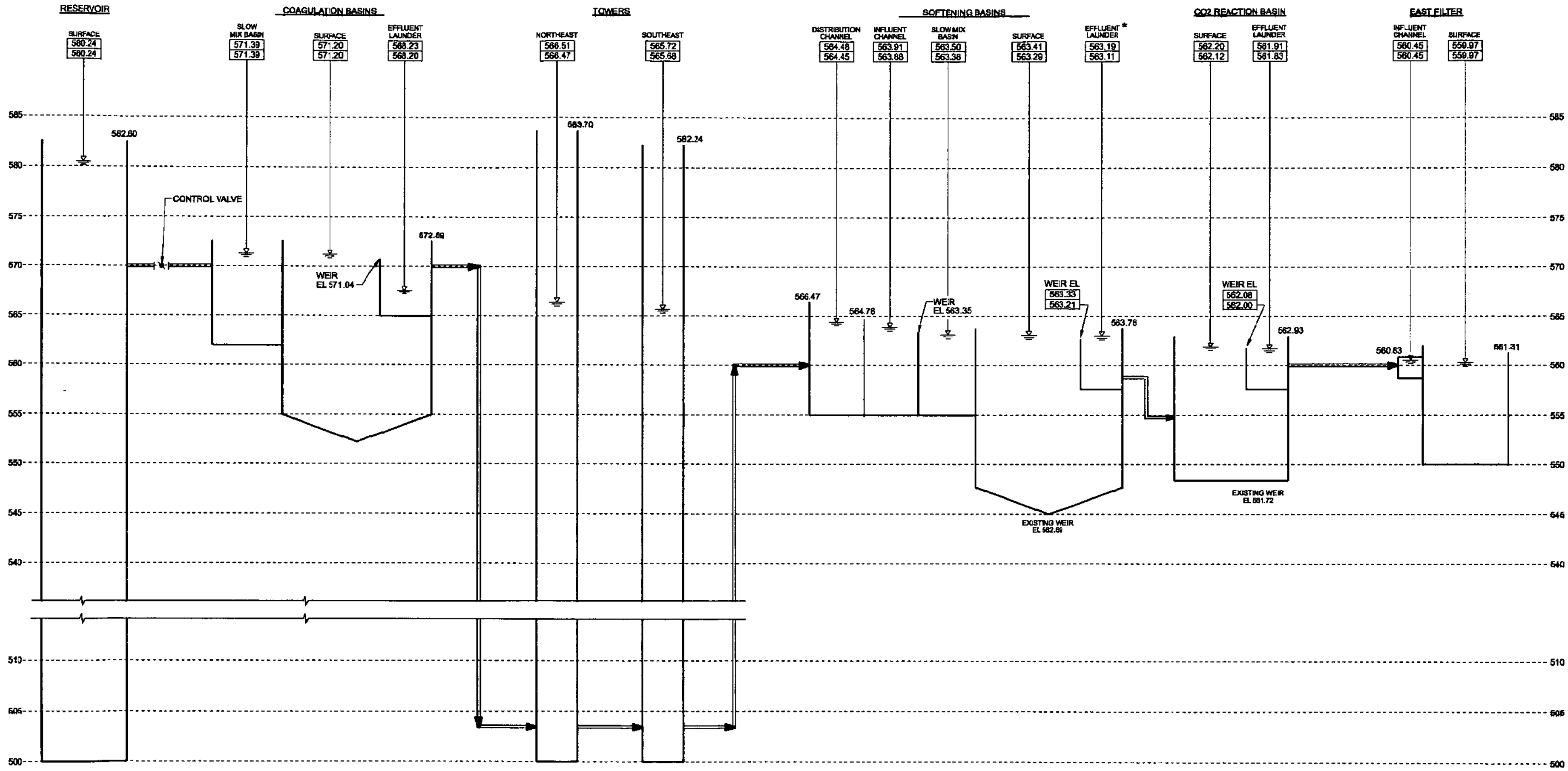
MAXIMUM CLEARWELL LEVEL WITHOUT PRESSURIZING FILTER EFFLUENT CONDUIT IS EL 540.50

*SOFTENING BASIN #3 / #4 LAUNDER

FIGURE 3-2
CRESCENT HILL FILTER PLANT
210 MGD HYDRAULIC PROFILE
VERTICAL = 1" = 10'
HORIZONTAL = NOT TO SCALE

FILENAME: 01rif004d_346133.dgn PLOT DATE: 12-SEP-2008

CH2MHILL



HYDRAULIC CRITERIA

- D ≥ H FOR CONTROL WEIRS
- 6" MINIMUM FREEBOARD IN BASINS AND CHANNELS, 12" PREFERRED
- 6" MINIMUM HEAD SPACE IN COVERED CHANNELS NOT DESIGNED FOR UPLIFT
- 6" MINIMUM DROP THROUGH FILTERS AND CONTROL VALVE
- INFLUENT WEIRS CAN BE FLOODED
- FULL CLEARWELL

MAXIMUM CLEARWELL LEVEL WITHOUT PRESSURIZING FILTER EFFLUENT CONDUIT IS EL 540.50

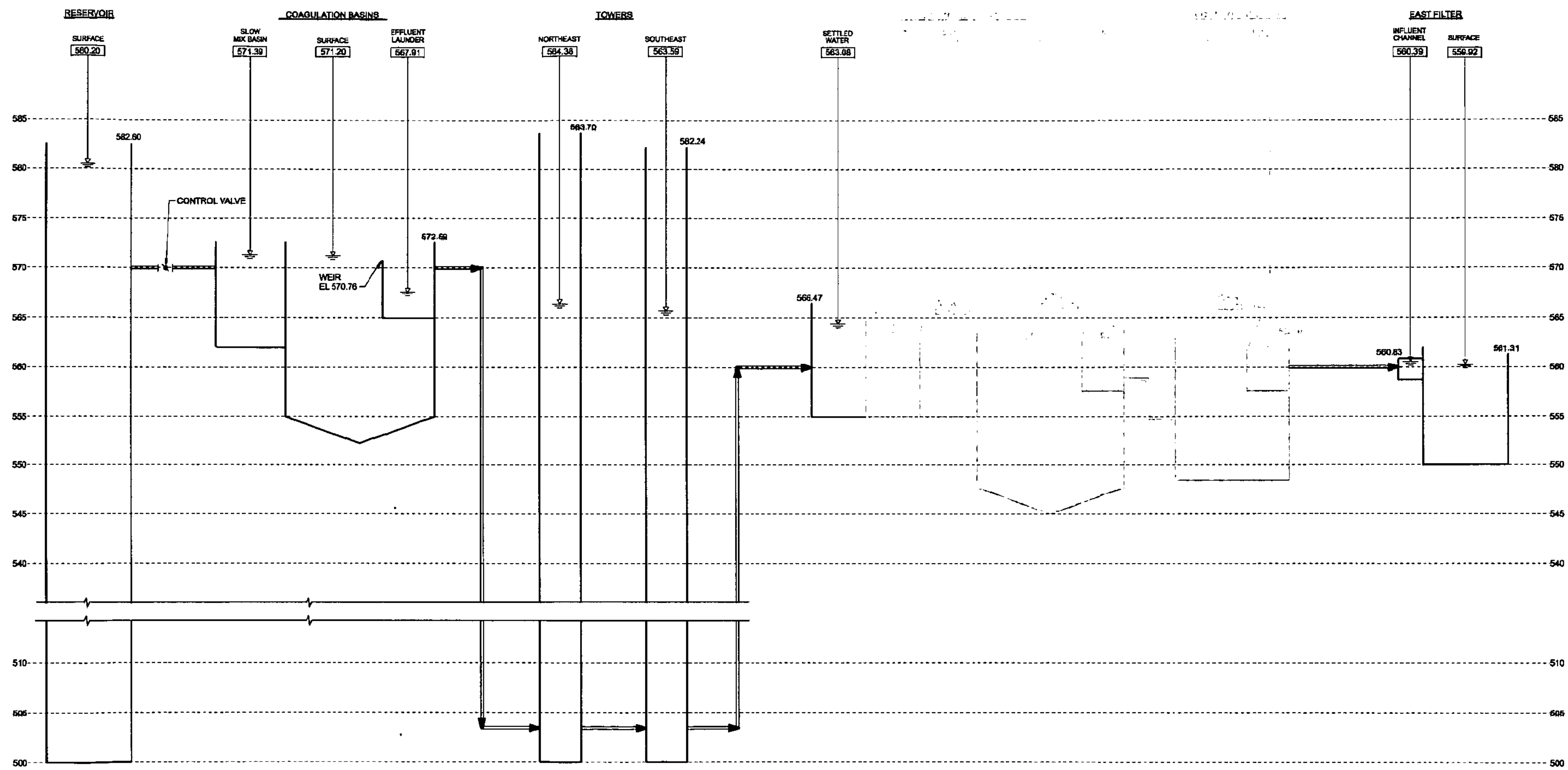
NEW WEST END EAST FILTER INFLUENT
NEW EAST END EAST FILTER INFLUENT

* SOFTENING BASIN #3 / #4 LAUNDER

FIGURE 3-3
CRESCENT HILL FILTER PLANT
240 MGD HYDRAULIC PROFILE
VERTICAL = 1" = 10'
HORIZONTAL = NOT TO SCALE

CH2MHILL

FILENAME: 01nl005d_346133.dgn PLOT DATE: 12-SEP-2006



MAXIMUM CLEARWELL LEVEL WITHOUT PRESSURIZING FILTER EFFLUENT CONDUIT IS EL 540.50

HYDRAULIC CRITERIA

- D ≥ H FOR CONTROL WEIRS
- 6" MINIMUM FREEBOARD IN BASINS AND CHANNELS, 12" PREFERRED
- 6" MINIMUM HEAD SPACE IN COVERED CHANNELS NOT DESIGNED FOR UPLIFT
- 6" MINIMMUM DROP THROUGH FILTERS AND CONTROL VALVE
- INFLUENT WEIRS CAN BE FLOODED
- FULL CLEARWELL

FIGURE 3-4
CRESCENT HILL FILTER PLANT
240 MGD SOFTENING BYPASSED HYDRAULIC PROFILE
VERTICAL = 1" = 10'
HORIZONTAL = NOT TO SCALE

CH2MHILL

FILENAME: 01nf008d_348133.dgn PLOT DATE: 12-SEP-2006

SECTION 4

Summary of Improvements

To help ensure that BEPWTP and CHWTP can successfully expand their capacities to meet future demands, several improvements are required to increase hydraulic, treatment, and chemical storage and feed capacities. Improvements identified in Sections 2 and 3 and further described in Section 4 are based mostly on KY DOW and other industry standards; however, these modifications will need to be further developed and reviewed with KY DOW to confirm their acceptance before moving forward with designing plant expansions.

All improvements were categorized as **Required** or **Discretionary**. Improvements were considered to be **Required** if the improvement would be needed to enable the WTP to: 1) meet KY DOW requirements consistently, and 2) maintain LWC's high standard of water quality. Improvements were considered to be **Discretionary** if their benefit would improve plant operations or redundancy. Some improvements that are based on KY DOW guidelines or recommendations, but are not requirements, would fall into the **Discretionary** category until further investigation is performed to indicate otherwise.

4.1 BEPWTP

Two specific future capacities were examined for BEPWTP. The following improvements are required for each of the two future capacities.

4.1.1 Expansion to 90 mgd

Hydraulic

One of the following three options must be implemented to boost hydraulic capacity:

- **Option 1A.** Raise softening basin effluent weirs to 472.17 feet and raise coagulation basin effluent weirs to 473.46 feet. Extend the mixing and flocculation basin walls and remove the coagulation and softening influent conduit covers.
- **Option 2A.** Raise softening basin effluent weirs to 471.75 feet, raise coagulation basin effluent weirs to 473.08 feet, and enlarge the recarbonation basin inlet to 60 inches wide by 48 inches high. Remove the coagulation influent conduit cover.
- **Option 3A.** Lower reaction basin effluent weirs to 470.17 feet. Remove the coagulation influent conduit cover.

Chemical Systems and Equipment

Provide 300 ft^2 (about 13 by 22 feet) of additional building storage space and install an additional 6 tons of chlorine storage. The chlorine feed rate capacity is slightly less than that required for 30 days of storage; however, increasing this capacity by such a small amount does not appear justified, particularly since chlorine feed rates will probably decrease with

River Bank Filtration (RBF) raw water, so this improvement should be considered discretionary.

The 14-day maximum dose and average flow storage criterion slightly exceeds the existing ferric chloride storage capacity at the 90-mgd plant capacity; however, the 30-day average dose storage criterion does not exceed existing capacity. The feed rate at 90 mgd would also exceed the firm metering pump capacity. Improvements to increase the ferric storage and feed capacities by such a small amount do not appear justified. However, one of the two existing tanks is reported to have a failed liner, and the other tank is cracked, so both need to be repaired or replaced. The cost for these repairs is not included in the cost estimate.

Install fourth 170-pounds-per-hour (pph) carbon dioxide feed unit to serve as a standby for the three existing units.

Replace existing coagulant aid polymer metering pumps with three new 10-gallons-per-hour (gph) pumps. This improvement should be considered discretionary since the future need for this polymer is questionable.

Replace existing ammoniators with three new 20-pph units.

Add one 9-gph, fluoride-metering pump.

Install two additional 15.2-mgd, 1,500-horsepower (hp) and one 13.5-mgd, 1,250-hp high-service pumps with associated piping and electrical equipment. Expand building by approximately 750 ft^2 per pump to accommodate new pumps.

Facilities and Processes

Install 4-foot-deep tube settlers with integral finger weirs/launders in the coagulation and softening basins, cantilevered about 13.3 feet off the perimeter walls. Each basin would be equipped with 6,944 ft^2 for a total of 20,832 ft^2 for the coagulation basins and 20,832 ft^2 for softening basins. The tube settlers in the softening basins should be considered a discretionary improvement since lime softening is not a critical process for providing safe drinking water.

Construct a third clear well connecting to the existing two clear wells. Provide 3 million gallons of volume to attain a total volume of 10 percent of the WTP capacity over a 24-hour period, or 7.5 million gallons of volume to attain a total volume of 15 percent of the WTP capacity over a 24-hour period. Although KY DOW design criteria calls for 15 percent of the WTP capacity over a 24-hour period, offsite elevated storage might be an alternative to onsite storage and this could be investigated with KY DOW before an expansion is planned. As a result, these clear well improvements should be considered discretionary unless they are shown to be necessary to meet KY DOW requirements or to address operating requirements. However, in the future LWC may choose to add clear well volume to increase process stability.

4.1.2 Expansion to 120 mgd

Hydraulic

One of the following two options must be implemented to boost hydraulic capacity:

- **Option 2B**. Raise softening basin effluent weirs to 472.08 feet and raise coagulation basin effluent weirs to 473.67 feet. Enlarge the recarbonation basin inlet to 72 inches wide by 54 inches high; install an additional 48 inches by 72 inches mixing basin and flocculation basin influent sluice gate and 60 inches by 60 inches coagulation basin effluent sluice gate for each basin. Extend the mixing and flocculation basin walls and remove the covers and extend the walls for the coagulation and softening influent conduits.
- **Option 3B**. Lower reaction basin effluent weirs to 470.17 feet. Enlarge the recarbonation basin inlet to 72 inches wide by 48 inches high, install an additional 48 inches by 72 inches mixing basin and flocculation basin influent sluice gate and 60 inches by 60 inches coagulation basin effluent sluice gate for each basin. Raise the coagulation basin effluent weirs to 473.17 feet. Extend the mixing and flocculation basin walls and remove the coagulation influent conduit top and extend the channel walls.

Chemical Systems and Equipment

Expand the storage room by 700 ft^2 (about 26 by 27 feet) to install an additional 16 tons of chlorine storage. (Note that the existing storage capacity is barely exceeded with the 120-mgd plant capacity using the 14-day maximum dose and average flow criterion; however, the recommendations herein are based on the more stringent 30-day criterion.) Provide two evaporators at 2,800 ponds per day (ppd) each. Replace three chlorinators, each with capacity for 2,800 ppd.

The 14-day maximum dose and average flow storage criterion considerably exceeds the existing ferric chloride storage capacity at the 120-mgd plant capacity; however, the 30-day average dose storage criterion still does not exceed the existing capacity. The feed rate requirement at 120 mgd would also exceed the firm metering pump capacity. An additional 35,000 gallons of ferric chloride storage and new metering pumps could be installed to supplement the existing storage, but these improvements should be treated as discretionary because the 30-day at average dose criterion is still met and ferric chloride dosages may substantially decline after the RBF raw water project is completed. We recommend that maximum dosages and consumption be reviewed regularly to determine whether future changes are warranted.

Install an additional 1,000 gallons of coagulant aid polymer storage and replace existing polymer-metering pumps with three new 13-gph pumps. Again, this improvement should be considered discretionary since the future need for this polymer is questionable.

Although the lime feed facilities would be short by a small margin, improvements to increase these capacities by such a small amount do not appear justified. We recommend that maximum dosages and consumption be reviewed regularly to determine whether future changes are warranted.

The ammonia storage requirement using the 30-day criterion exceeds available capacity, but using the 14-day criterion at maximum dose does not exceed available capacity, so improvements to expand storage do not appear justified. Ammonia availability and reliability of delivery should be evaluated to determine whether additional storage is warranted.

Replace existing ammoniators with three new 26-pph units.

Add one 9-gph, fluoride-metering pump.

Install three additional 15.2-mgd, 1,500-hp and one 13.5-mgd, 1,250-hp high-service pumps with associated piping and electrical equipment. Expand building by 750 ft^2 per pump to accommodate new pumps.

Facilities and Processes

Install 4-foot-deep tube settlers with integral finger weirs/launders in the coagulation and softening basins, cantilevered about 18.5 feet off the perimeter walls. Each basin would be equipped with 9,259 ft^2 for a total of 27,776 ft^2 for the coagulation basins and 27,776 ft^2 for softening basins.

Petition KY DOW to pilot test a filter to demonstrate effective filtration at rates above 5 gpm/ft^2.

Construct a third clear well connecting to the existing two clear wells. Provide 6 million gallons of volume to attain a total volume of 10 percent of the WTP capacity over a 24-hour period, or 12 million gallons of volume to attain a total volume of 15 percent of the WTP capacity over a 24-hour period. Although KY DOW design criteria calls for 15 percent of the WTP capacity over a 24-hour period, offsite elevated storage might be an alternative to onsite storage and this could be investigated with KY DOW before an expansion is planned. As a result, these clear well improvements should be considered discretionary unless they are shown to be necessary to meet KY DOW requirements or to address operating requirements.

Proposed modifications for BEWTP are described and summarized in Table 4-1.

4.1.3 Electrical Supply and Distribution System

A task included this project was to explore the possibility of expanding the existing power distribution system, as shown on Appendix B, Power Distribution One Line Diagram, dated August 2004. This one line diagram does not include electrical equipment that is fed from MCC-5 or MCC-6 or Unit Substation US-1 or US-2, but drawing excerpts were provided for review.

The high-service pumps would be the only significant new electrical loads for the plant expansion scenarios. On the basis of the above recommendations, the following new loads would occur:

Scenario	90 mgd	120 mgd
No. of 15.2 mgd pumps	1 @ 1,500 hp	3 @ 1,500 hp
No. of 13.5 mgd pumps	1 @ 1,250 hp	1 @ 1,250 hp

The following assumptions were made for developing and evaluating electrical loads:

1. The new high-service pumps mentioned above would be connected in a semibalanced fashion across MCC-1 and MCC-2.

2. The plant is normally operated in a balanced fashion, meaning that the tie circuit breaker 52-TIE is normally open and breakers 52-M1 and 52-M2 are normally closed.
3. One of the three existing 400-hp low lift pump station pumps is a standby unit. No new low lift pumps have been included in this analysis.
4. One of the existing 1,500-hp high lift pumps is a standby unit.
5. One of the two existing 350-hp blowers is a standby unit.
6. One of the two existing 700-hp wash water pumps is a standby unit.
7. The feeder ampacity to MCC-1 and MCC-2 matches the feeder breakers (52-F1 and 52-F2, 1,200 amps each).

The ratings of the existing buses, circuit breaker frame sizes, and transformer sizes were evaluated with considerations of scenarios 1 and 2. Nodal analysis was used after converting each motor and transformer into AC amperes at the appropriate voltage.

Two services are shown at the top of the one-line diagram. They are referred to as the underground service and the overhead service. Each one is fed through a 25-megavolt (MVA) transformer. We have been informed that the underground service is normally used. The 25-MVA underground service transformer feeds two 10-MVA step-down transformers via medium-voltage circuit breakers. Each of these 10-MVA transformers provide the 4,160-volt (V) power for all of the service equipment shown on the one-line diagram as well as the equipment at the two low-lift pump stations and unit substations US-1 and US-2.

If the underground service is lost, power would be provided to the water treatment plant via the overhead service without any loss of capacity to the plant.

The new pumps identified for 90-mgd and 120-mgd expansions can be accommodated by the power distribution system without replacing major gears (switchgear, transformers, tie switches, circuit breaker frames). However, any existing protective relays would need their settings changed for either capacity. In addition, the settings of several of the power circuit breakers would need adjustment. Plus, some of these breakers' rating plugs would need to be replaced with plugs of higher amperage rating.

Any expansion beyond 120 mgd is not recommended because the anticipated loads at this point approach the limits for

- MCC-1 bus
- MCC-2 bus
- The feeder breaker and feeder for MCC-1
- The feeder breaker and feeder for MCC-2

Although the power factor correction is not shown on the one-line diagram, it is provided in the MCC of each of the major loads, such as the pumps.

4.2 CHWTP

Two specific future capacities were examined for CHWTP. The following improvements are required for each of the two future capacities.

4.2.1 Expansion to 210 mgd

Hydraulic (Option 1 Only)

Raise reaction basin effluent weirs to 562.00 feet and raise softening basin effluent weirs to 563.00 feet.

Construct a new 60- by 60-inch softening basin 1 outlet in the southwest corner of the basin.

Connect the new outlet to north end of the reaction basin influent channel.

Chemical Systems and Equipment

The existing ferric chloride storage volume would be short by about 106,000 gallons; however, replacement facilities are scheduled to be constructed so this improvement is not included in the cost estimate.

A small increase in high service pumping capacity could be achieved by replacing one smaller high service pump (<30 mgd) with a larger pump (48 mgd similar to Pump No. 2) to obtain a net capacity increase of 18 or 20 mgd. However, this improvement is not necessary and considered discretionary because the existing station capacity at 227.2 mgd, exceeds the required capacity of 210 mgd for this capacity scenario.

Facilities and Processes

Install 4-foot-deep tube settlers with integral finger weirs/launders in the coagulation basins, cantilevered about 9.4 feet and 11.1 feet off the perimeter walls of the north and south basins, respectively. Each basin would be equipped with 5,100 ft^2 for a total of 20,400 ft^2 for the north coagulation basins and 7,052 ft^2 for a total of 28,208 ft^2 for the south coagulation basins. Although the Ten States Standards criteria for overflow rate and weir loading rate would be exceeded, the KY DOW criterion of 0.75 gpm/ft^2 for overflow rate is not exceeded so this improvement should be viewed as discretionary.

Construct a new 7-million-gallon clear well connecting to the existing clear well. Although KY DOW design criteria calls for 15 percent of the WTP capacity over a 24-hour period, offsite elevated storage might be an alternative to onsite storage and could be investigated with KY DOW before an expansion is planned. Furthermore, the CHWTP has been previously rated at a nominal capacity of 240 mgd. As a result, this clear well improvement should be considered discretionary unless it is shown to be necessary to meet KY DOW requirements or to address operating requirements. However, in the future LWC may choose to add clear well volume to increase process stability.

4.2.2 Expansion to 240 mgd

Hydraulic

One of the following two options must be implemented to boost hydraulic capacity:

- **Option 2A**. Install a 60-inch pipe around the outside of the southwest tower to provide a direct connection between present valves 308 and 310. Raise the reaction basin effluent weirs to 562.08 feet and raise the softening basin effluent weirs to 563.33 feet. Construct a new 60- by 60-inch softening basin 1 outlet in the southwest corner of the basin. Connect the new outlet to the north end of the reaction basin influent channel.

- **Option 2B**. Install a 60-inch pipe from the reaction basin effluent channel at the northwest corner of reaction basin 3 along the west, south, and east sides of the softening basins to the east end of the east filter influent conduit. Raise the reaction basin effluent weirs to 562.00 feet and raise the softening basin effluent weirs to 563.21 feet. Construct a new 60- by 60-inch softening basin 1 outlet in the southwest corner of the basin. Connect the new outlet to the north end of the Reaction basin influent channel.

Chemical Systems and Equipment

The existing ferric chloride storage volume would be short by about 133,000 gallons; however, replacement facilities are scheduled to be constructed, so this improvement is not included in the cost estimate.

Although the lime storage would be short by a small margin, improvements to increase this capacity by such a small amount does not appear justified. We recommend that maximum dosages and consumption be reviewed regularly to determine whether future changes are warranted.

Although the chlorine storage and feed facilities would be short by a small margin, improvements to increase this capacity by such a small amount do not appear justified. We recommend that maximum dosages and consumption be reviewed regularly to determine whether future changes are warranted.

A small increase in high service pumping capacity can be achieved by replacing one smaller high service pump (<30 mgd) with a larger pump (48 mgd similar to Pump No. 2) to obtain a net capacity increase of 18 or 20 mgd. This would bring pump station capacity to about 245 mgd, which would be sufficient to satisfy the criterion of setting station capacity to at least 100 percent of WTP capacity.

Alternatively, a discretionary improvement could be provided if more than 100 percent capacity were desired for this pump station. By installing two additional 35-mgd, 1,200-hp high-service pumps with associated piping and electrical equipment a firm station capacity of 278 mgd, which is 115 percent of WTP capacity, could be provided. For this improvement, assume a new building is needed to accommodate the two new pumps and it could be constructed on the north side of the existing high service pump station using an 12- by 24-foot wet well connected to the existing clear well with a 72-inch diameter pump. An at-grade building would house two vertical turbine pumps, each sized at 35 mgd and 1,200 hp.

Facilities and Processes

Install 4-foot-deep tube settlers with integral finger weirs/launders in the coagulation basins, cantilevered about 10.9 feet and 12.8 feet off the perimeter walls of the north and south basins, respectively. Each basin would be equipped with 5,828 ft^2 for a total of 23,314 ft^2 for the north coagulation basins and 8,060 ft^2 for a total of 32,238 ft^2 for the south coagulation basins.

Construct a new 11-million-gallon clear well connecting to the existing clear well. Although KY DOW design criteria calls for 15 percent of the WTP capacity over a 24-hour period, offsite elevated storage might be an alternative to onsite storage and could be investigated with KY DOW before an expansion is planned. Furthermore, the CHWTP has been previously rated at a nominal capacity of 240 mgd. As a result, similar to the 210 mgd expansion scenario, this clear well improvement should be considered discretionary unless it is shown to be necessary to meet KY DOW requirements or to address operating requirements.

Softening Basin Bypass

In addition to treatment through the existing unit processes at CHWTP, the option to bypass the softening basins was investigated. The existing facilities are capable of diverting 240 mgd settled water directly to the filters by placing certain valves in either an open or closed position as described above. The only modifications required would be to replace inoperable valves. A critical valve for bypassing the softening basins is valve 308. If the softening basins were bypassed valve 308 should be replaced because it probably has not been operated in over 35 years.

Proposed modifications for CHWTP are described and summarized in Table 4-2.

TABLE 4-1
Proposed BE Payne WTP Modifications

No.	Description	Option No.	Quantity	Unit	Remarks	Type[1]
1	Raise Coagulation Basin Walls and Weirs 0.46'.	1A	1,716	lf	3 basins at 572 lf each; demo exist weirs and lintels; install 6" conc cap to weir wall (8" thick); provide new 4x4x3/8 SST angle, FRP v-notch weir, and SST anchors	R
2	Raise Coagulation Basin Weir Plates 0.08'.	2A	1,716	lf	3 basins at 572 lf each; demo exist weirs and lintels and apply coating, provide new 4x4x3/8 SST angle, FRP v-notch weir, and SST anchors; no new concrete	R
3	Raise Coagulation Basin Walls and Weirs 0.67'	2B	1,716	lf	3 basins at 572 lf each; demo exist weirs and lintels; install 6" conc cap to weir wall (8" thick); provide new 4x4x3/8 SST angle, FRP v-notch weir, and SST anchors	R
4	Raise Coagulation Basin Weir Plates 0.17'	3B	1,716	lf	3 basins at 572 lf each; demo exist weirs and lintels and apply coating, provide new 4x4x3/8 SST angle, FRP v-notch weir, and SST anchors; no new concrete	R
5	Raise Softening Basin Walls and Weirs 0.67'	1A	1,716	lf	3 basins at 572 lf each; demo exist weirs and lintels; install 6" conc cap to weir wall (8" thick); provide new 4x4x3/8 SST angle, FRP v-notch weir, and SST anchors	R
6	Raise Softening Basin Weir Plates 0.25'	2A	1,716	lf	3 basins at 572 lf each; demo exist weirs and lintels and apply coating, provide new 4x4x3/8 SST angle, FRP v-notch weir, and SST anchors; no new concrete	R
7	Raise Softening Basin Walls and Weirs 0.58'	2B	1,716	lf	3 basins at 572 lf each; demo exist weirs and lintels; install 6" conc cap to weir wall (8" thick); provide new 4x4x3/8 SST angle, FRP v-notch weir, and SST anchors	R
8	Lower Reaction Basin Launder Walls and Weirs 0.67'	3A & 3B	2,340	lf	3 basins at 780 lf each; remove lintel and weir plate, sawcut and remove top 8" of launder wall (8" thick), coat top of wall, and reinstall existing lintel and weir plate with SST anchors.	R
9	Install additional 60"x60" Coag. Basin Effluent Sluice Gates	2B & 3B	3	ea	Saw cut 14" thick conc. wall, coat edges, install self-contained, surface-mounted Rodney Hunt sluice gate with manual floor stand operator.	R
10	Install additional 48"x72" Mixing Basin Influent Sluice Gates	2B & 3B	3	ea	Saw cut 14" thick conc. wall, coat edges, install self-contained, surface-mounted Rodney Hunt sluice gate with manual floor stand operator.	R
11	Install additional 48"x72" Floc Basin Influent Sluice Gates	2B & 3B	3	ea	Saw cut 14" thick conc. wall, coat edges, install self-contained, surface-mounted Rodney Hunt sluice gate with manual floor stand operator.	R
12	Enlarge Recarb Basin Influent Wall Openings to 60"x48"	2A	3	ea	Saw cut 14" thick conc. wall, coat edges	R

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No.	Description	Option No.	Quantity	Unit	Remarks	Type[1]
13	Enlarge Recarb Basin Influent Wall Openings to 72"x54"	2B	3	ea	Saw cut 14" thick conc. wall, coat edges	R
14	Enlarge Recarb Basin Influent Wall Openings to 72"x48"	3B	3	ea	Saw cut 14" thick conc. wall, coat edges	R
15	Demo Coagulated Water Distribution Channel Covers	1A & 2B	3,100	sf	Channel area is 10'x310' and 8" thick. Saw cut perimeter, remove and dispose. Coat saw cut edges.	R
16	Demo Mixing Basin Distribution Channel Covers	1A & 2B	3,100	sf	Channel area is 10'x310' and 8" thick. Saw cut perimeter, remove and dispose. Coat saw cut edges.	R
17	Raise Coagulated Water Distribution Channel Covers 0.5'	2B	640	lf	Install 6" conc cap to perimeter basin wall (14" thick)	R
18	Raise Floc Basin Walls 0.5'	1A & 3B	760	lf	Install 6" conc cap to perimeter basin wall (14" thick)	R
19	Raise Floc Basin Walls 1.0'	2B	760	lf	Install 12" conc cap to perimeter basin wall (14" thick)	R
20	Raise Mixing Basin Walls 0.5'	1A & 3B	760	lf	Install 6" conc cap to perimeter basin wall (14" thick)	R
21	Raise Mixing Basin Walls 1.0'	2B	760	lf	Install 12" conc cap to perimeter basin wall (14" thick)	R
22	Retrofit tube settlers in coagulation basins	1A, 2A & 3A	20,832	sf	Install 4' deep tube settlers with integral weir and launders cantilevered off perimeter walls of basins. Cantilevered width is 13.3' .	R
23	Retrofit tube settlers in softening basins	1A, 2A & 3A	20,832	sf	Install 4' deep tube settlers with integral weir and launders cantilevered off perimeter walls of basins. Cantilevered width is 13.3'.	D
24	Retrofit tube settlers in coagulation basins	2B & 3B	27,776	sf	Install 4' deep tube settlers with integral weir and launders cantilevered off perimeter walls of basins. Cantilevered width is 18.5' .	R
25	Retrofit tube settlers in softening basins	2B & 3B	27,776	sf	Install 4' deep tube settlers with integral weir and launders cantilevered off perimeter walls of basins. Cantilevered width is 18.5' .	D
26	Clear well expansion[2]	1A, 2A & 3A	3.0[3]	MG	Expand below grade clear well capacity by providing cast-in-place concrete, independent compartment interconnected to existing clear well using same elevations.	D
26a	Clear well expansion[2]	1A, 2A & 3A	7.5[4]	MG	Expand below grade clear well capacity by providing cast-in-place concrete, independent compartment interconnected to existing clear well using same elevations.	D
27	Clear well expansion[2]	2B & 3B	6.0[3]	MG	Expand below grade clear well capacity by providing cast-in-place concrete, independent compartment interconnected to existing clear well using same elevations.	D

No.	Description	Option No.	Quantity	Unit	Remarks	Type[1]
27a	Clear well expansion[2]	2B & 3B	12.0[4]	MG	Expand below grade clear well capacity by providing cast-in-place concrete, independent compartment interconnected to existing clear well using same elevations.	D
28	High service pumps and building expansion	1A, 2A & 3A	1 @ 15.2 and 1 @ 13.5	mgd	Vertical turbine pump at TDH = 450', one at 15.2 mgd (1500 hp) and one at 13.5 mgd (1250 hp), with connecting piping and valves. Assume an additional 750 sf of new building space per pump.	R
29	High service pumps and building expansion	2B & 3B	3 @ 15.2 and 1 @ 13.5	mgd	Vertical turbine pump at TDH = 450', three at 15.2 mgd (1500 hp) and one at 13.5 mgd (1250 hp), with connecting piping and valves. Assume an additional 750 sf of new building space per pump.	R
30	Increase coag. aid polymer metering pump capacity	ALL	3 @ 10	gph	Remove and replace existing pumps with 3 new metering pumps similar to Milton Roy Centrac S, 10 gal/hr each for the 90 mgd expansion or 13 gal/hr each for the 120 mgd expansion. Assume existing bldg space is adequate.	D
31	Increase coag. aid polymer storage	2B & 3B	1,000	gal	Add 1,000 gal storage tank (outdoors)	D
32	Increase ammoniator feed capacity	ALL	3 @ 20	pph	Provide 3 new ammoniators at 20 pph each for the 90 mgd expansion and 26 pph each for the 120 mgd expansion. Assume existing bldg space is adequate.	R
33	Increase fluoride metering pump capacity	ALL	1 @ 9	gph	Provide 1 new metering pump similar to Milton Roy Centrac S, at 9 gal/hr. Assume existing bldg space is adequate.	R
34	Provide standby carbon dioxide feed panel	ALL	170	pph	Provide 1 new panel similar to three existing ones just being installed. Assume existing bldg space is adequate.	R
35	Expand chlorine storage room	1A, 2A & 3A	6	ton	Expand the existing chlorine storage room by about 300 sf for additional equipment.	D
36	Expand chlorine storage room; convert chlorine system to liquid extraction and provide 2 evaporators	2B & 3B	5,600	ppd	Provide 2 evaporators at 2,800 lb/day each. Replace three chlorinators, each with capacity for 2,800 ppd. Expand the existing chlorine storage room by about 700 sf for additional equipment.	R
37	Increase ferric chloride metering pump capacity	2B & 3B	2 @ 70	gph	Provide 2 new metering pumps similar to Milton Roy Milroyal C, totaling 140 gal/hr. Assume existing bldg space is adequate.	D
38	Increase ferric chloride storage	2B & 3B	35,000	gal	Add 3 storage tank totalling 35,000 gal (outdoors) in new containment area.	D

Note:

[1]R=Required; D=Discretionary

[2]Only one clearwell option will be selected for each capacity option.

[3]Volume based on 10% of Water Treatment Plant capacity over 24 hours.

[4]Volume based on 15% of Water Treatment Plant capacity over 24 hours.

TABLE 4-2
Proposed Crescent Hill WTP Modifications

No.	Description	Option No.	Quantity	Unit	Remarks	Type[1]
1	Raise Softening Basin Weirs 0.18', Option 1	1	4,632	lf	6 basins at 772 lf each; demo exist weirs and lintels and apply coating, provide new 4x4x3/8 SST angle, FRP v-notch weir, and SST anchors; no new concrete	R
2	Raise Softening Basin Weirs 0.48', Option 2A	2A	4,632	lf	6 basins at 772 lf each; demo exist weirs and lintels; install 5" conc cap to weir wall (8" thick); provide new 4x4x3/8 SST angle, FRP v-notch weir, and SST anchors	R
3	Raise Softening Basin Weirs 0.39', Option 2B	2B	4,632	lf	6 basins at 772 lf each; demo exist weirs and lintels; install 5" conc cap to weir wall (8" thick); provide new 4x4x3/8 SST angle, FRP v-notch weir, and SST anchors	R
4	Raise Reaction Basin Weirs 0.28', Option 1 & 2B	1 & 2B	2,699	lf	2 basins at 876 lf each and 1 basin at 947 lf; demo exist weirs and lintels and apply coating, provide new 4x4x3/8 SST angle, FRP v-notch weir, and SST anchors; no new concrete	R
5	Raise Reaction Basin Weirs 0.36', Option 2A	2A	2,699	lf	2 basins at 876 lf each and 1 basin at 947 lf; demo exist weirs and lintels; install 5" conc cap to weir wall (8" thick); provide new 4x4x3/8 SST angle, FRP v-notch weir, and SST anchors	R
6	Install Orifice In Wall w/ 60"x60" Sluice Gate for Softening Basin No. 1	ALL	1	ea	Saw cut 14" thick conc. wall, coat edges, install self-contained, surface-mounted Rodney Hunt sluice gate with manual floor stand operator.	R
7	Install concrete cap on Slow Mix Basins 0.5'	2A & 2B	2,828	lf	4 basins at 458' + 2 basins at 498'; install 6" high concrete cap on 12" thick walls.	R
8	East end 60" filter influent connection	2B	2,150	lf	Low pressure 60" PCCP pipe with trenching and imported granular backfill, 6' average cover, partial shoring required, push-on joints, 7 90-degree ells, saw cut 2 existing 16" thick conc. walls for pipe penetrations plus two more wall penetrations at each termination point (penetrations must be watertight), 60" flgd resilient seat gate valve with electric actuator.	R
9	West end 60" filter influent connection	2A	30	lf	Class 150 60" DIP flanged joint pipe, 3 90-degree ells, 1 flgd resilient seat gate valve with electric actuator, restricted work space	R
10	East end 36" filter effluent connection	1	650	lf	Class 150 36" DIP push-on joint pipe, 4 90-degree ells, 1 resilient seat gate valve with electric actuator.	R
11	East end 48" filter effluent connection	2A & 2B	650	lf	Class 150 48" DIP push-on joint pipe, 4 90-degree ells, 1 resilient seat gate valve with electric actuator.	R

No.	Description	Option No.	Quantity	Unit	Remarks	Type[1]
12	Retrofit tube settlers in coagulation basins	1	48,608	sf	Install 4' deep tube settlers with integral weir and launders cantilevered off perimeter walls of basins. Cantilevered width is 9.4' or north basins and 11.1' for south basins.	D
13	Retrofit tube settlers in coagulation basins	2A & 2B	55,552	sf	Install 4' deep tube settlers with integral weir and launders cantilevered off perimeter walls of basins. Cantilevered width is 10.9' for north basins and 12.8' for south basins.	R
14	Clear well expansion	1	7	MG	Expand below grade clear well capacity by providing cast-in-place concrete, independent compartment interconnected to existing clear well using same elevations.	D
15	Clear well expansion	2A & 2B	11	MG	Expand below grade clear well capacity by providing cast-in-place concrete, independent compartment interconnected to existing clear well using same elevations.	D
16	High service pumps, 48 mgd	1	1	ea	Replace smallest existing pump with 48 mgd pump.	D
17	High service pumps, 48 mgd[2]	2A & 2B	1	ea	Replace smallest existing pump with 48 mgd pump.	R
18	High service pumps, 35 mgd[2]	2A & 2B	2	ea	Veritical turbine pumps at TDH = 165', 1200 hp, with connecting discharge piping and valves. Assume new building space and wet well will be constructed northwest of existing pump station.	D

Note:
[1]R=Required; D=Discretionary
[2]Only one pump option will be selected for the 240 mgd expansion.

SECTION 5

Cost Estimates for Recommended Modifications

Construction cost estimates have been prepared for the various capacity options and are included in Appendixes C and D. Because of the lack of scope development at this conceptual stage of engineering analysis, these estimates would be considered rough order-of-magnitude level. The expected accuracy range would be -50/+50 percent. A construction contingency of 15 percent is being used to account for unknowns. This conceptual cost estimate has been prepared for guidance in project evaluation and implementation from the information available. The final cost of the project will depend on actual labor and material costs, competitive market conditions, final project scope, schedule, detailed design documents, and other variable conditions. As a result, the final project cost will vary from these estimates.

The following assumptions were developed for preparation of the cost estimates.

1. Raising weirs up to 3 inches can be accomplished by installing new lintels and weir plates only without concrete wall extensions. At BEPWTP existing weirs are new and can be reused.
2. Raising weirs more than 3 inches will require extending the concrete launder wall.
3. New weirs will be V-notch type.
4. Basin wall extensions at BEPWTP are 14 inches thick and at CHWTP are 12 inches thick.
5. The clarifier mechanisms (turntable/platform elevation) in each basin do not restrict raising the weirs.
6. Conduit covers at BEPWTP can be cut vertically at the wall joint to maintain slab thickness as part of the wall.
7. New sluice gates shall be flush mount, self contained type with manual operator.
8. Buried piping will be low pressure prestressed concrete cylinder pipe (PCCP).
9. Interior piping will be class 150 ductile iron pip (DIP), flanged joints.
10. New valves will be flanged resilient seat gate type.
11. New below grade clear wells will be interconnected with existing.
12. New CHWTP pumps will be installed in a new pump building northwest of the existing high-service pump building using a brick veneer building above a wet well that is connected to Chamber 4 of the existing clear well. The proposed new pumps will be vertical turbine type and set at a 35-mgd capacity.
13. New BEPWTP pumps will be vertical turbine type, set into the existing or new clear well and kept at the same capacity as the existing two sizes.

14. Existing chemical building spaces are adequate for new and replacement metering pumps.
15. For BEPWTP electrical system, all units except one of the largest is in service for each system (high service, low service, etc.). Electrical loads are balanced between the two plant feeds.
16. Tube settler loading rate is 3 gpm/ft^2. Tube settler supports can be cantilevered off perimeter basin walls to the lengths required so that tube supports will not interfere with scraper mechanisms. The proposed configurations show a considerable cantilevered length, which would need to be confirmed by tube settler manufacturers prior to design.
17. Lime, ferric chloride, chlorine gas storage, and ferric chloride feed requirements for future capacities at CHWTP would not be met by existing facilities. Ferric chloride and chlorine facilities are scheduled for replacement, so modifications to these are not proposed. The variance for the lime storage requirement versus what is available is small, lime dosages in the short term are not critical to treatment, and providing new storage would be very expensive, so we do not recommend providing additional lime storage.
18. Several of the cost estimates are based on CH2M HILL historical data for similar projects.

Most of the estimated costs for the recommended modifications are related to process improvements, not hydraulics. For example, clear well storage is the single most expensive item and more clear well storage is needed for all future capacity scenarios.

Table 5-1 and Table 5-2 summarize the proposed modifications for BEPWTP and CHWTP, respectively. The cost items for each capacity scenario are stand-alone. For example, the costs shown for expansion to 120 mgd at BEPWTP are based on the plant's existing 60-mgd capacity and would not be added to the costs for expanding to 90 mgd. Likewise for CHWTP, the costs shown for expansion to 240 mgd are based on the plant's existing 180-mgd capacity and would not be added to the costs for expanding to 210 mgd. Each of the recommended improvements has been categorized as Required or Discretionary as previously defined in Section 4.

TABLE 5-1
Cost Estimates for Proposed BE Payne WTP Modifications

No.	Description	Quantity	Unit	Option Cost, $1,000s[1] 1A	2A	3A	2B	3B	Type[2]
	Capacity, mgd			**90**	**90**	**90**	**120**	**120**	
1	Raise Coagulation Basin Walls and Weirs 0.46'.	1,716	lf	$332					R
2	Raise Coagulation Basin Weir Plates 0.08'.	1,716	lf		$224				R
3	Raise Coagulation Basin Walls and Weirs 0.67'	1,716	lf				$332		R
4	Raise Coagulation Basin Weir Plates 0.17'	1,716	lf					$224	R
5	Raise Softening Basin Walls and Weirs 0.67'	1,716	lf	$332					R
6	Raise Softening Basin Weir Plates 0.25'	1,716	lf		$224				R
7	Raise Softening Basin Walls and Weirs 0.58'	1,716	lf				$332		R
8	Lower Reaction Basin Launder Walls and Weirs 0.67'	2,340	lf			$266		$266	R
9	Install additional 60"x60" Coag. Basin Effluent Sluice Gates	3	ea				$44	$44	R
10	Install additional 48"x72" Mixing Basin Influent Sluice Gates	3	ea				$49	$49	R
11	Install additional 48"x72" Floc Basin Influent Sluice Gates	3	ea				$49	$49	R
12	Enlarge Recarb Basin Influent Wall Openings to 60"x48"	3	ea		$6				R
13	Enlarge Recarb Basin Influent Wall Openings to 72"x54"	3	ea				$7		R
14	Enlarge Recarb Basin Influent Wall Openings to 72"x48"	3	ea					$7	R
15	Demo Coagulated Water Distribution Channel Covers	3,100	sf	$111			$111		R
16	Demo Mixing Basin Distribution Channel Covers	3,100	sf	$65			$65		R
17	Raise Coagulated Water Distribution Channel Covers 0.5'	640	lf				$65		R
18	Raise Floc Basin Walls 0.5'	760	lf	$77				$77	R
19	Raise Floc Basin Walls 1.0'	760	lf				$129		R
20	Raise Mixing Basin Walls 0.5'	760	lf	$77				$77	R
21	Raise Mixing Basin Walls 1.0'	760	lf				$129		R

				Option Cost, $1,000s[1]					
No.	Description	Quantity	Unit	1A	2A	3A	2B	3B	Type[2]
	Capacity, mgd			90	90	90	120	120	
22	Retrofit tube settlers in coagulation basins	20,832	sf	$2,930	$2,930	$2,930			R
23	Retrofit tube settlers in softening basins	20,832	sf	$2,930	$2,930	$2,930			D
24	Retrofit tube settlers in coagulation basins	27,776	sf				$3,907	$3,907	R
25	Retrofit tube settlers in softening basins	27,776	sf				$3,907	$3,907	D
26	Clear well expansion[3]	3.0[4]	MG	$5,529	$5,529	$5,529			D
26a	Clear well expansion[3]	7.5[5]	MG	$13,821	$13,821	$13,821			D
27	Clear well expansion[3]	6.0[4]	MG				$11,057	$11,057	D
27a	Clear well expansion[3]	12.0[5]	MG				$22,114	$22,114	D
28	High service pumps and building expansion	1 @ 15.2 and 1 @ 13.5	mgd	$1,693	$1,693	$1,693			R
29	High service pumps and building expansion	3 @ 15.2 and 1 @ 13.5	mgd				$3,547	$3,547	R
30	Increase Coag. Aid Polymer metering pump capacity	3 @ 10	gph	$43	$43	$43	$43	$43	D
31	Increase Coag. Aid Polymer Storage	1,000	gal				$6	$6	D
32	Increase Ammonia metering pump capacity	3 @ 20	pph	$45	$45	$45	$45	$45	R
33	Increase fluoride metering pump capacity	1 @ 9	gph	$14	$14	$14	$14	$14	R
34	Provide standby carbon dioxide feed panel	170	pph	$15	$15	$15	$15	$15	R
35	Expand chlorine storage room by 300 sf	6	ton	$90	$90	$90			D
36	Convert chlorine system to liquid extraction and provide two 2,800 ppd evaporators; expand chlorine storage room by 700 sf	16	ton				$240	$240	R
37	Increase ferric chloride metering pump capacity	2 @ 70	gph				$56	$56	D
38	Increase ferric chloride storage	35,000	gal				$196	$196	D
	TOTAL REQUIRED			**$5,691**	**$5,151**	**$4,963**	**$9,080**	**$8,561**	
	TOTAL DISCRETIONARY			**$16,884**	**$16,884**	**$16,884**	**$26,322**	**$26,322**	
	COMBINED TOTAL[6]			**$22,575**	**$22,035**	**$21,847**	**$35,402**	**$34,883**	

Note:

[1]Costs shown are total amounts to expand from current capacity to each respective capacity in the table.

[2]R=Required; D=Discretionary

[3]Only one clear well option will be selected for each capacity option.

[4]Volume based on 10% of Water Treatment Plant capacity over 24 hours.

[5]Volume based on 15% of Water Treatment Plant capacity over 24 hours.

[6]The cost for the clear well at 10% of WTP capacity is not included in the Discretionary or Combined sums.

TABLE 5-2

Cost Estimates for Proposed Crescent Hill WTP Modifications

No.	Description	Quantity	Unit	Option Cost, $1000's[1] 1	2A	2B	Type[2]
	Capacity, mgd			**210**	**240**	**240**	
1	Raise Softening Basin Weirs, Option 1	4,632	lf	$606			R
2	Raise Softening Basin Weirs, Option 2A	4,632	lf		$865		R
3	Raise Softening Basin Weirs, Option 2B	4,632	lf			$865	R
4	Raise Reaction Basin Weirs, Option 1 & 2B	2,699	lf	$353		$353	R
5	Raise Reaction Basin Weirs, Option 2A	2,699	lf		$762		R
6	Install Orifice In Wall w/ 60"x60" Sluice Gate for Softening Basin No. 1	1	ea	$48	$48	$48	R
7	Install concrete cap on Slow Mix Basins	2,828	lf		$255	$255	R
8	East end 60" filter influent connection	2,150	lf			$3,600	R
9	West end 60" filter influent connection	30	lf		$398		R
10	East end 36" filter effluent connection	650	lf	$639			R
11	East end 48" filter effluent connection	650	lf		$852	$852	R
12	Retrofit tube settlers in coagulation basins	48,608	sf	$6,838			D
13	Retrofit tube settlers in coagulation basins	55,552	sf		$7,814	$7,814	R
14	Clear well expansion	7	MG	$12,900			D
15	Clear well expansion	11	MG		$20,271	$20,271	D
16	High service pumps, 48 mgd[3,5]	1	ea	$900			D
17	High service pumps, 48 mgd[3,5]	1	ea		$900	$900	R
18	High service pumps, 35 mgd[4,5]	2	ea		$3,345	$3,345	D
	TOTAL REQUIRED			$1,646	$11,894	$14,687	
	TOTAL DISCRETIONARY			$20,638	$23,616	$23,616	
	COMBINED TOTAL[6]			**$22,284**	**$32,165**	**$34,958**	

Note:

[1]Costs shown are total amounts to expand from current capacity to each respective capacity in the table.

[2]R=Required; D=Discretionary

[3]Includes replacing the smallest existing pump with a new 48 mgd pump.

[4]Includes building sized for 2 pumps.

[5]Only one pump option will be selected for 210 MGD expansion.

[6]Option 2A and 2B totals reflect required cost to replace a pump with a new 48 mgd pump (line 17) and do not include the discretionary cost to add new pumps (line 18).

Recommendations for Implementation

Previous sections of this report identified hydraulic, process, and equipment deficiencies that will result if the WTP capacities are increased. The identification of these deficiencies and improvement options that were developed to correct the deficiencies were based on industry and KY DOW standards and on evaluation criteria developed with LWC staff during this project. Prior to any improvements being designed to correct the deficiencies, the criteria should be revisited in more detail. Consider the following:

- Clear well expansions are the single most costly item for any proposed WTP capacity increase. The clear well volume needed for disinfection contact time should be assessed. At CHWTP the clear well is not used to meet regulatory contact time requirements, and once the RBF Phase 2 improvements are implemented, the BEWTP clear well also will not be used to meet contact time requirements. The equalization volume needed for diurnal demand and variable pumping patterns should be determined and compared to available storage (as compared to dead storage that cannot be used) in the clear wells. The resulting need for clear well volume at each plant may or may not correspond to the KY DOW criterion of providing 15 percent of one day's WTP capacity. If the needed volume is less than 15 percent, KY DOW should be contacted with LWC's findings to request a variance from this requirement. Also, elevated storage offsite in the distribution system might be considered by KY DOW as offsetting the lack of storage onsite, but this would need to be confirmed in discussions with KY DOW.
- High-service pump capacities were based on an arbitrary guideline of 100 percent of the WTP capacity and matching the existing hydraulic grade line of the distribution system. The true capacity needed to meet future diurnal demand requirements in each pressure zone by each WTP should be determined by computer modeling of the distribution system network to obtain more-realistic operating conditions. New pump sizes were set equal to existing pump sizes at BEPWTP. Instead, it may be advisable to replace existing pumps with larger pumps at both plants in the next WTP capacity expansion to avoid excessive pumping units.
- Chemical storage and feed rates were determined on the basis of historical average and maximum feed rates. Feed rates in the future may change, particularly at BEPWTP, which will be converted to 100 percent riverbank filtration water, and should be revisited to better determine future feed rates so that new feed and/or storage facilities are not unnecessarily acquired or accidentally ignored.
- Filtration rates at BEPWTP (and at CHWTP if the South Filters are decommissioned) will exceed the KY DOW established maximum rate of 5 gpm/ft^2, if the plant capacities are increased. As a result, it will be necessary and prudent to design and conduct a full-scale demonstration project for high-rating filters beyond 5 gpm/ft^2. This project should be planned with involvement by KY DOW staff.

- Retrofitting tube settlers into existing settling basins allows for much greater capacity without increasing the settling basin footprint. However, the estimated cost for this work is significant, ranging from $3 to $4 million at BEPWTP to $7 to $8 million at CHWTP. Tube settlers also have a life span of 10–15 years, depending on manufacturer and operations and maintenance methods. Prior to design of such retrofits, the feasibility and estimated costs should be revisited and compared to the cost of constructing high-rate clarification processes within the same footprint to replace the coagulation and softening basins. Candidate high-rate clarification processes include the following:
  - Upflow solids contact (sludge blanket) clarifiers
  - Sand-ballasted sedimentation
  - Inclined-plate sedimentation with new sludge collection technology
- Criteria were established for minimum freeboard of 6 inches (12 inches preferred) in open basins and minimum headspace of 6 inches in conduits and tanks with covers not designed for uplift. Wall extensions and lid removals were recommended on the basis of these criteria. These criteria should be revisited to confirm that 6 inches of freeboard is adequate prior to changes being made to the hydraulic grade lines in either plant.

Appendix A
Survey Point Elevations—BEPWTP

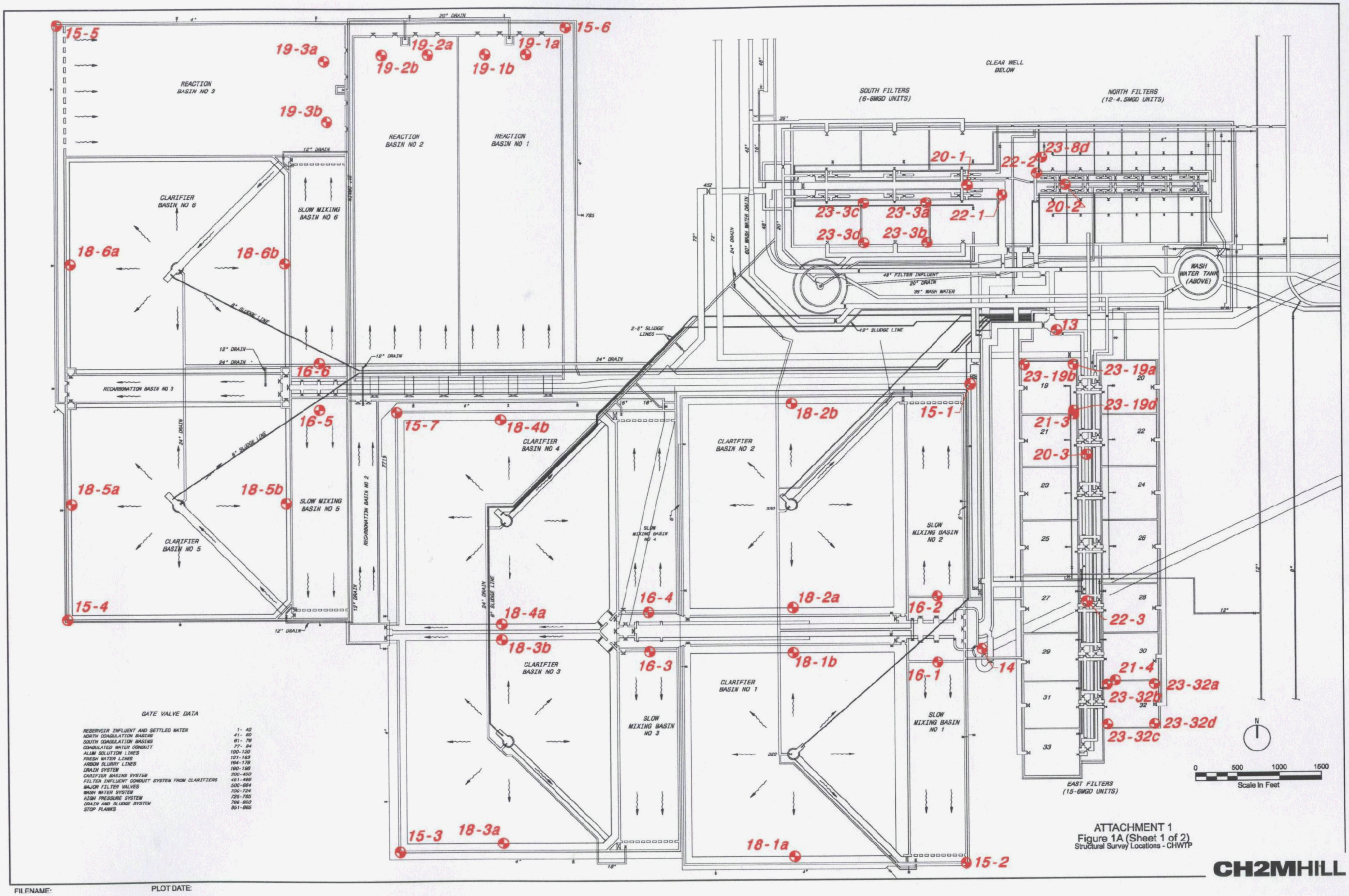
Appendix A
TABLE 1A
Structural Survey Point Elevations--BEPWTP

Structure Description	Survey Point	June 2006 Surveyed Elevation
Coagulation Basin Influent Conduit Top of Wall	1-1	474.975
Flocculation Basin Top of Wall	1-2	474.445
Coagulation Basin Top of Wall	1-3	473.965
West Basin Walkway	1-4	467.685
Coagulation Basin #1 Effluent Weirs	2-1a	473.008
	2-1b	472.968
	2-1c	472.978
	2-1d	472.948
Coagulation Basin #2 Effluent Weirs	2-2a	472.968
	2-2b	472.978
	2-2c	472.968
	2-2d	473.008
Coagulation Basin #3 Effluent Weirs	2-3a	472.968
	2-3b	472.968
	2-3c	473.018
	2-3d	472.968
Coagulation Basin #1 Effluent Launder Invert	3-1	467.685
Coagulation Basin #2 Effluent Launder Invert	3-2	467.725
Coagulation Basin #3 Effluent Launder Invert	3-3	467.685
Softening Basin #1 Effluent Weirs	6-1a	471.473
	6-1b	471.433
Softening Basin #2 Effluent Weirs	6-2a	471.093
	6-2b	471.423
Softening Basin #3 Effluent Weirs	6-3a	471.483
	6-3b	471.493
CO2 Reaction Basin #1 Effluent Weirs	7-1a	470.723
	7-1b	470.773
CO2 Reaction Basin #2 Effluent Weirs	7-2a	470.763
	7-2b	470.733
CO2 Reaction Basin #3 Effluent Weirs	7-3a	470.793
	7-3b	470.783
Filter Observation Floor	8	470.902
Top of Filter Media (#3)	11-3a	464.052
	11-3b	464.092
	11-3c	464.232
	11-3d	464.262
Top of Filter Media (#6)	11-6a	463.342
	11-6b	463.412
	11-6c	463.562
	11-6d	463.472

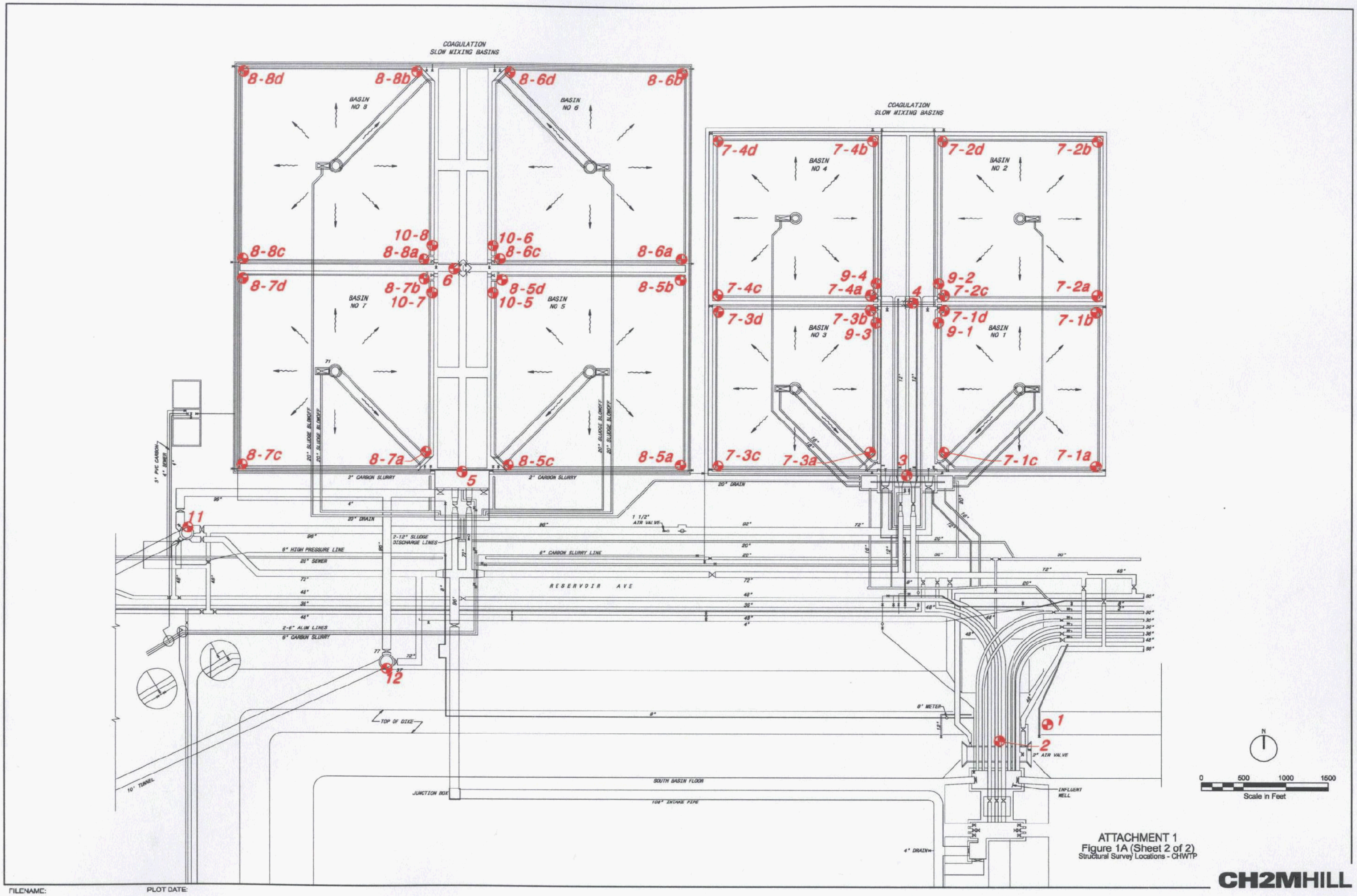
Appendix A
Table 1B
Structural Survey Point Elevations–CHWTP

Structure Description	Survey Point	June 2006 Surveyed Elevation
Raw Water Reservoir Top of Berm	1	582.559
Raw Water Reservoir Gatehouse Top Floor	2	583.839
North Coagulation Building Top Floor	3	575.744
North Coagulation Building Observation Walkway At Center	4	575.304
South Coagualtion Building Top Floor	5	573.074
South Coagulation Building Observation Walkway At Center	6	572.594
North Basin #1 Weir Notch	7-1a	571.174
	7-1b	571.214
	7-1c	571.084
	7-1d	571.104
North Basin #2 Weir Notch	7-2a	571.194
	7-2b	571.174
	7-2c	571.164
	7-2d	571.164
North Basin #3 Weir Notch	7-3a	571.174
	7-3b	571.174
	7-3c	571.184
	7-3d	571.144
North Basin #4 Weir Notch	7-4a	571.144
	7-4b	571.194
	7-4c	571.174
	7-4d	571.184
South Basin #5 Weir Notch	8-5a	571.224
	8-5b	571.254
	8-5c	571.264
	8-5d	571.174
South Basin #6 Weir Notch	8-6a	571.194
	8-6b	571.244
	8-6c	571.164
	8-6d	571.204
South Basin #7 Weir Notch	8-7a	571.204
	8-7b	571.164
	8-7c	571.204
	8-7d	571.234
South Basin #8 Weir Notch	8-8a	571.154
	8-8b	571.204
	8-8c	571.234
	8-8d	571.274
Bottom of North Coagulation Basin Effluent Launder At Discharge	9-1	565.684
	9-2	565.654
	9-3	565.854
	9-4	565.684
Bottom of South Coagulation Basin Effluent Launder At Discharge	10-5	565.704
	10-6	565.684
	10-7	565.744
	10-8	565.704
Top of Wall Elevation of Northwest Tower	11	581.494
Top of Wall Elevation of Northeast Tower	12	583.704
Top of Wall Elevation of Southwest Tower	13	581.344
Top of Wall Elevation of Southeast Tower	14	582.244

Structure Description	Survey Point	June 2006 Surveyed Elevation
West Softening Basin Observation Walkway	15-5	562.894
	15-6	562.969
Softening Basin Observation Walkways/Curb	15-1	563.614
	15-2	563.759
	15-3	563.769
	15-4	563.694
	15-7	563.779
Slow Mix Basin 1 Influent Weir	16-1	563.152
Slow Mix Basin 2 Influent Weir	16-2	563.426
Slow Mix Basin 3 Influent Weir	16-3	563.364
Slow Mix Basin 4 Influent Weir	16-4	563.352
Slow Mix Basin 5 Top of Influent Baffle Wall	16-5	562.224
Slow Mix Basin 6 Top of Influent Baffle Wall	16-6	562.174
Softening Basin #1 Weir	18-1a	562.689
	18-1b	562.729
Softening Basin #2 Weir	18-2a	562.699
	18-2b	562.679
Softening Basin #3 Weir	18-3a	562.719
	18-3b	562.689
Softening Basin #4 Weir	18-4a	562.719
	18-4b	562.719
Softening Basin #5 Weir	18-5a	562.674
	18-5b	562.594
Softening Basin #6 Weir	18-6a	562.664
	18-6b	562.674
CO2 Reaction Basin #1 Effluent Weirs	19-1a	561.774
	19-1b	561.784
CO2 Reaction Basin #2 Effluent Weirs	19-2a	561.724
	19-2b	561.724
CO2 Reaction Basin #3 Effluent Weirs	19-3a	561.674
	19-3b	561.674
Observation Floor of East Filters	20-3	561.504
Observation Floor of North Filters	20-2	562.264
Observation Floor of South Filters	20-1	562.289
East Filters Top of Wall	21-3	561.314
	21-4	561.164
Bottom of North Filters Influent Channel	22-2	558.074
Bottom of South Filters Influent Channel	22-1	558.424
Bottom of East Filters Influent Channel	22-3	556.294
North Filters (#8)Top of Media	23-8d	555.214
South Filters (#3) Top of Media	23-3a	555.609
	23-3b	555.699
	23-3c	555.609
	23-3d	555.699
Old East (#19) Top of Media	23-19a	553.194
	23-19b	553.164
	23-19d	553.034
New East (#32) Top of Media	23-32a	554.294
	23-32b	552.924
	23-32c	553.134
	23-32d	554.314



ATTACHMENT 1
Figure 1A (Sheet 1 of 2)
Structural Survey Locations - CHWTP



ATTACHMENT 1
Figure 1A (Sheet 2 of 2)
Structural Survey Locations - CHWTP

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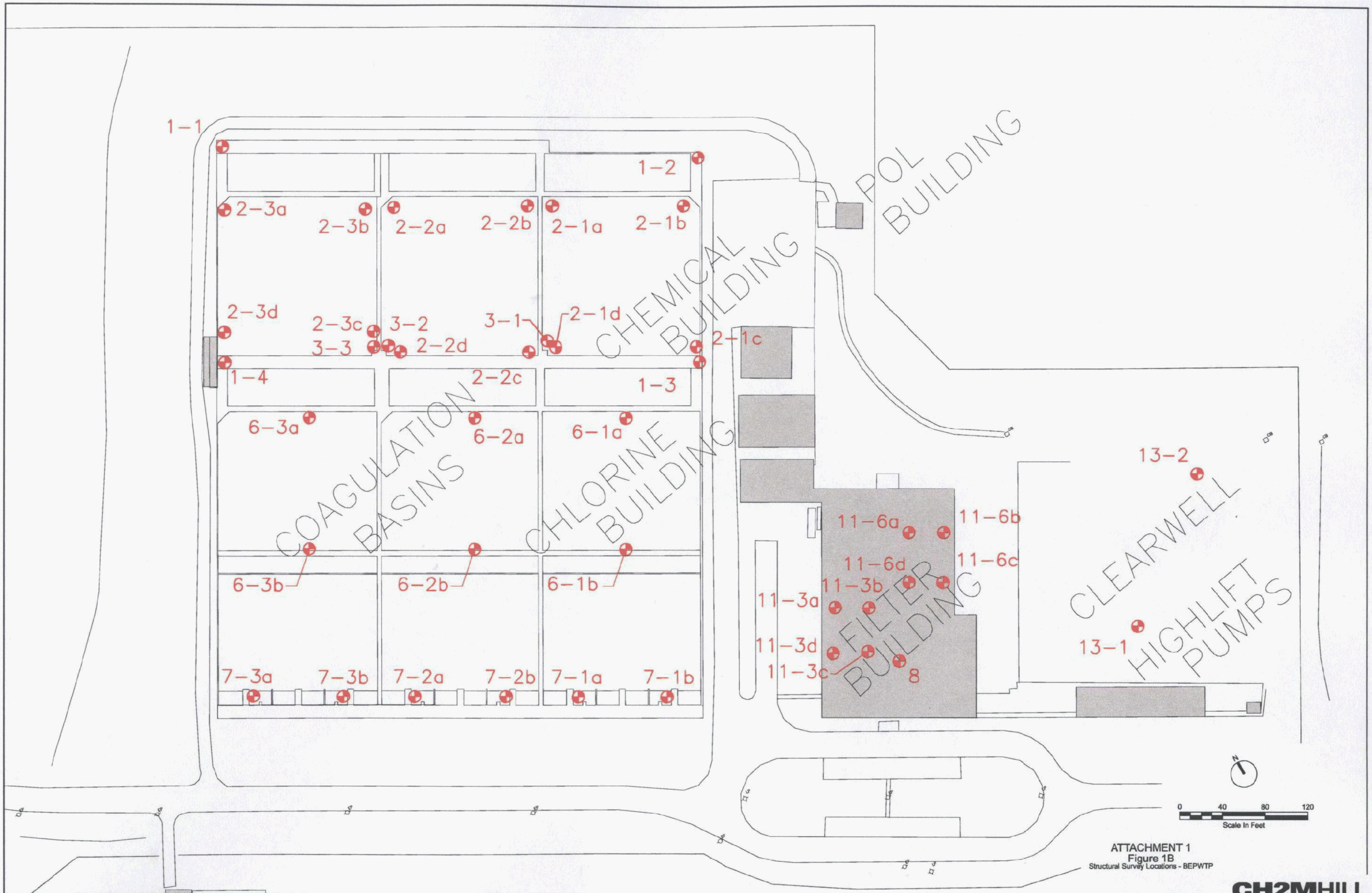

ATTACHMENT 1
Figure 1B
Structural Survey Locations - BEPWTP

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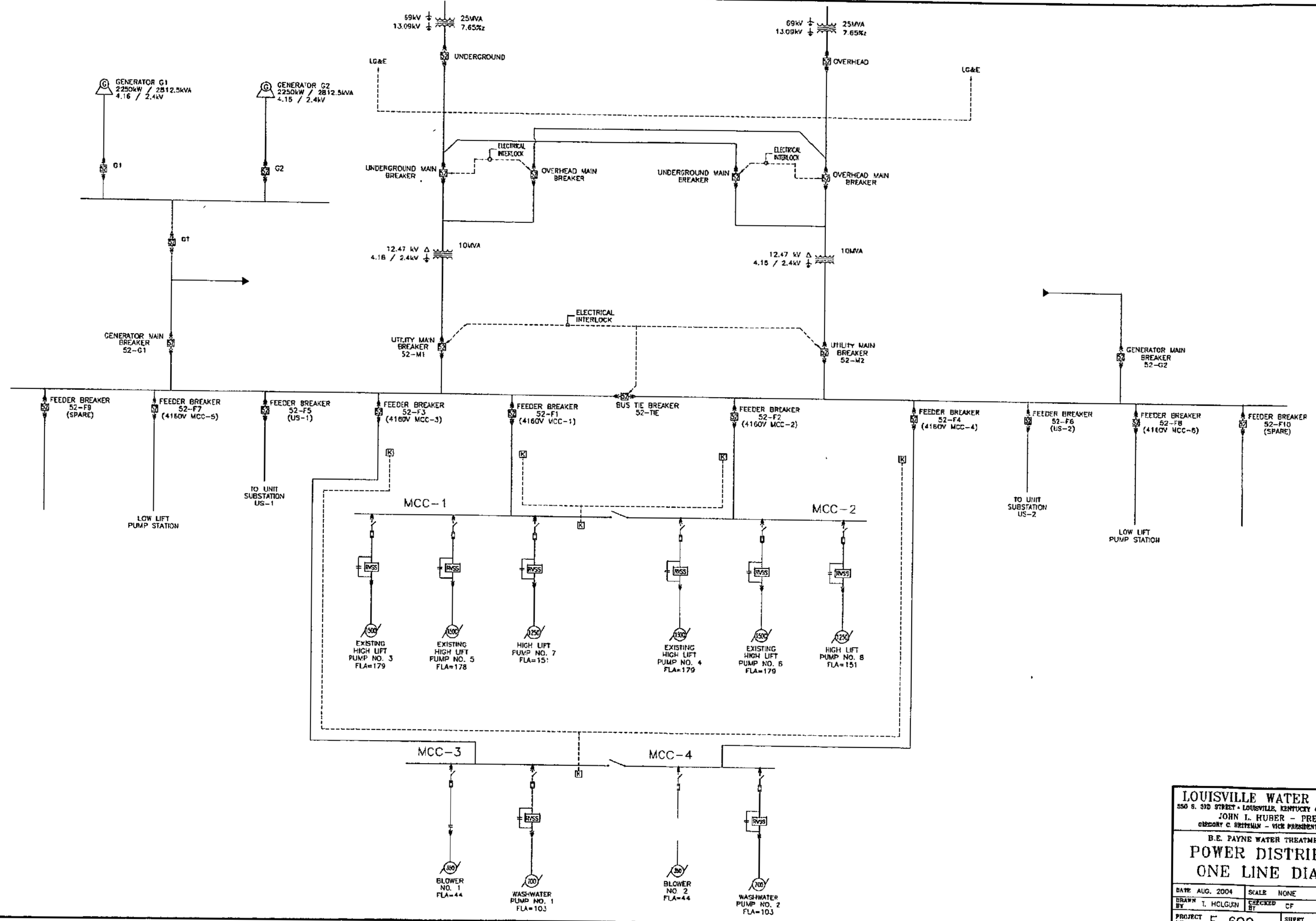
LWC 2973

Appendix B
BEPWTP Power Distribution One-Line Diagram



LOUISVILLE WATER COMPANY
550 S. 3RD STREET • LOUISVILLE, KENTUCKY 40202 • (502) 569-3600
JOHN L. HUBER – PRESIDENT
GREGORY C. HEITZMAN – VICE PRESIDENT/CHIEF ENGINEER

B.E. PAYNE WATER TREATMENT PLANT

POWER DISTRIBUTION ONE LINE DIAGRAM

DATE AUG. 2004	SCALE NONE	REVISED DATE
DRAWN BY T. HOLGUIN	CHECKED BY CF	ENGR. C. FAULTZ
PROJECT NO. E-600	SHEET 1 OF 1	

Appendix C
BEPWTP Construction Cost Estimates

CH2MHILL
Estimating Services

ESTIMATE MATRIX SUMMARY Ver 3.9

PROJECT:	BE Paynes WTP Modifications
CLIENT NAME:	Louisville Water Co.
LOCATION:	Louisville, KY
DESIGN STAGE:	Conceptual
PROJECT MGR:	Jerry Anderson/ LOU
ESTIMATOR:	D. Jones / GNV
CHECKED BY:	

PROJECT No.:	346133.01.A1
CONTRACT No.:	
ESTIMATE No.:	
BID DATE:	
CCI INDEX:	9/25/06 - 7763.15
REV No.:	Rev. 1 12/12/06
TEMPLATE No.:	4.1

#	FACILITIES	%'s	01000 GENERAL	02000 SITEWORK	03000 CONCRETE	04000 MASONRY	05000 METALS	06000 WOOD	07000 MOISTURE	08000 DOORS	09000 FINISHES	10000 SPECIALS	11000 EQUIP	12000 FURNISH	13000 I &C	14000 CONVEY	15000 MECH	16000 ELECT	TOTAL
01	Coagulation Basin Weirs Opt 1A		3.00% $9,947		$98,778		$207,806				$15,025								$331,556
02	Coagulation Basin Weirs Opt 2A		3.00% $6,733				$207,806				$9,900								$224,439
03	Coagulation Basin Weirs Opt 2B		3.00% $9,947		$98,778		$207,806				$15,025								$331,556
04	Coagulation Basin Weirs Opt 3B		3.00% $6,733				$207,806				$9,900								$224,439
05	Softening Basin Weirs Opt 1A		3.00% $9,947		$98,778		$207,806				$15,025								$331,556
06	Softening Basin Weirs Opt 2A		3.00% $6,733				$207,806				$9,900								$224,439
07	Softening Basin Weirs Opt 2B		3.00% $9,947		$98,778		$207,806				$15,025								$331,556
08	Reaction Basin Weirs Opt 2A		3.00% $7,993		$127,385		$104,279				$26,776								$266,433
09	Coag. Basin 2B & 3B Sluice Gates		3.00% $1,307		$6,662								$35,612						$43,582
10	Mixing Basin 2B & 3B Sluice		3.00% $1,463		$6,542								$40,761						$48,766
11	Floc Basin 2B & 3B Sluice Gates		3.00% $1,463		$6,542								$40,761						$48,766
12	Recarb Basin Infl Wall Opening		3.00% $181		$5,696						$141								$6,017
13	Recarb Basin Infl Wall Opening		3.00% $224		$7,085						$163								$7,473

CH2M HILL, Inc.

Report Date:
12/12/2006 11:06:45

CH2MHILL
Estimating Services

ESTIMATE MATRIX SUMMARY Ver 3.9

PROJECT: BE Paynes WTP Modifications
CLIENT NAME: Louisville Water Co.
LOCATION: Louisville, KY
DESIGN STAGE: Conceptual
PROJECT MGR: Jerry Anderson/ LOU
ESTIMATOR: D. Jones / GNV
CHECKED BY:

PROJECT No.: 346133.01.A1
CONTRACT No.:
ESTIMATE No.:
BID DATE:
CCI INDEX: 9/25/06 - 7763.15
REV No.: Rev. 1 12/12/06
TEMPLATE No.: 4.1

#	FACILITIES %'s	01000 GENERAL	02000 SITEWORK	03000 CONCRETE	04000 MASONRY	05000 METALS	06000 WOOD	07000 MOISTURE	08000 DOORS	09000 FINISHES	10000 SPECIALS	11000 EQUIP	12000 FURNISH	13000 I &C	14000 CONVEY	15000 MECH	16000 ELECT	TOTAL
14	Recarb Basin Infl Wall Opening	3.00% $207		$6,542						$157								$6,906
15	Coag Wtr Channel Covers 1A & 2B	3.00% $3,340		$47,453						$958							$59,584	$111,335
16	Mix Basin Channel Covers 1A & 2B	3.00% $3,340		$47,453						$958							$59,584	$111,335
17	Raise Coag Wtr Channel Covers	3.00% $1,940		$59,616						$3,103								$64,659
18	Raise Floc Basin Walls 1A & 3B	3.00% $2,303		$70,794						$3,685								$76,782
19	Raise Floc Basin Walls 2B	3.00% $3,859		$119,388						$5,383								$128,630
20	Raise Mixing Basin Walls 1A & 3B	3.00% $2,303		$70,794						$3,685								$76,782
21	Raise Mixing Basin Walls 2B	3.00% $3,859		$119,388						$5,383								$128,630
22	Coag B Tube Settlers 1A,2A & 3A	3.00% $87,911										$2,842,470						$2,930,382
23	Soften B Tube Settlers 1A,2A&3A	3.00% $207,263										$2,842,470						$6,908,782
24	Coag Basins Tube Settlers 2B&3B	3.00% $117,215										$3,789,960						$3,907,175
25	Softening B Tube Settlers 2B&3B	3.00% $117,215										$3,789,960						$3,907,175
26	Clear Well Expan. 1A,2A &3A	3.00% $414,631		$*,***,***														$13,821,025

Report Date:
12/12/2006 11:06:45

LWC 2978

CH2MHILL
Estimating Services

ESTIMATE MATRIX SUMMARY Ver 3.9

PROJECT: BE Paynes WTP Modifications
CLIENT NAME: Louisville Water Co.
LOCATION: Louisville, KY
DESIGN STAGE: Conceptual
PROJECT MGR: Jerry Anderson/ LOU
ESTIMATOR: D. Jones / GNV
CHECKED BY:

PROJECT No.: 346133.01.A1
CONTRACT No.:
ESTIMATE No.:
BID DATE:
CCI INDEX: 9/25/06 - 7763.15
REV No.: Rev. 1 12/12/06
TEMPLATE No.: 4.1

#	FACILITIES %'s	01000 GENERAL	02000 SITEWORK	03000 CONCRETE	04000 MASONRY	05000 METALS	06000 WOOD	07000 MOISTURE	08000 DOORS	09000 FINISHES	10000 SPECIALS	11000 EQUIP	12000 FURNISH	13000 I &C	14000 CONVEY	15000 MECH	16000 ELECT	TOTAL
27	Clear Well Expan. 2B & 3B	3.00% $663,409		$*,***,***														$22,113,640
28	H S Pumps & Bldg 1A,2A&3A	3.00% $76,182		$670,320								$947,617		5.00% $126,971		$464,385	10.00% $253,942	$2,539,416
29	H S Pumps & Bldg ,2B&3B	3.00% $133,031		$1,228,919								$1,633,293		5.00% $221,719		$773,974	10.00% $443,437	$4,434,374
30	Coag Aid Polymer Metering Pumps	3.00% $1,288		$452												$41,181		$42,920
31	Coag Aid Polymer Storage	3.00% $184		$452								$4,320				$1,192		$6,148
32	Ammonia Metering Pumps	3.00% $1,343		$452												$42,969		$44,763
33	Fluoride Metering Pumps	3.00% $432		$226												$13,727		$14,384
34	Carbon Dioxide Feed Panel	3.00% $461										$14,896						$15,357
35	Convert CL Sys to Liquid	3.00% $3,225		$74,480								$29,792						$107,497
36	Ferric Chloride Metering Pumps	3.00% $1,672		$452												$53,602		$55,725
37	Ferric Chloride Storage	3.00% $5,879		$20,736								$160,430				$8,938		$195,983

Report Date:
12/12/2006 11:06:45

CH2MHILL
Estimating Services

ESTIMATE MATRIX SUMMARY Ver 3.9

PROJECT:	BE Paynes WTP Modifications
CLIENT NAME:	Louisville Water Co.
LOCATION:	Louisville, KY
DESIGN STAGE:	Conceptual
PROJECT MGR:	Jerry Anderson/ LOU
ESTIMATOR:	D. Jones / GNV
CHECKED BY:	

PROJECT No.:	346133.01.A1
CONTRACT No.:	
ESTIMATE No.:	
BID DATE:	
CCI INDEX:	9/25/06 - 7763.15
REV No.:	Rev. 1 12/12/06
TEMPLATE No.:	4.1

#	FACILITIES	%'s	01000 GENERAL	02000 SITEWORK	03000 CONCRETE	04000 MASONRY	05000 METALS	06000 WOOD	07000 MOISTURE	08000 DOORS	09000 FINISHES	10000 SPECIALS	11000 EQUIP	12000 FURNISH	13000 I &C	14000 CONVEY	15000 MECH	16000 ELECT	TOTAL
	TOTAL		$1,925,110	$0	$37,949,562	$0	$1,558,923	$0	$0	$0	$140,193	$0	$16,172,342	$0	$348,690	$0	$1,399,966	$816,547	$64,170,382
	PERCENT OF TOTAL		3.00%	0.00%	59.14%	0.00%	2.43%	0.00%	0.00%	0.00%	0.22%	0.00%	25.20%	0.00%	0.54%	0.00%	2.18%	1.27%	

PROJECT PARAMETER PRICING

Project Size	--------------->	1.00	LS
Cost Per LS	--------------->	$64,170,382	$/LS

Project Notes: The cost estimates have been prepared for guidance in project evaluation and implementation from the information available at the time of the estimate. The final cost of the project will depend upon the actual labor and material costs, competitive market conditions, final project costs, implementation schedule and other variable factors. As a result, the final project costs will vary from the estimates presented herein. Because of this, project feasibility and funding needs must be carefully reviewed prior to making specific financial decisions to help ensure proper project evaluation and adequate funding. A contingency has been included for a provision of unforeseeable elements of cost, within the defined project scope.

Report Date:
12/12/2006 11:06:45

LWC 2980

CH2MHILL
Estimating Services

CH2MHILL MARKUPS REPORT No. 1 - Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

MARKUPS SETS USED

MARKUP RESOURCE	DESCRIPTION	MARKUP COMPONENT ITEM	PERCENT	TO-MAT'L	TO-LABOR	TO-EQUIP	TO-INSTALL S/C
GC-MK	CH2M HILL Standard Markup Set	Success PWS Branch assigned to: CH2M Hill National Average Template					
		1. Overhead	10.00%	Yes	Yes	Yes	Yes
		2. Profit	5.00%	Yes	Yes	Yes	Yes
		3. Mob/ Demob	3.00%	Yes	Yes	Yes	Yes
		4. Preformance Bond	1.20%	Yes	Yes	Yes	Yes
		5. Insurance	1.50%	Yes	Yes	Yes	Yes
		6. Contingency	15.00%	Yes	Yes	Yes	Yes
		7. Escalation	6.00%	Yes	Yes	Yes	Yes

CH2MHILL Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
01 Coagulation Basin Weirs Opt 1A CONCRETE									
050903400400	Unit Costs---->	0.16	CARP	0.167	7.83			7.99	11.90
Drilling, layout,, 4" deep, 5/8" dia, conc, for Dowels	2,574.00 Ea.	$412	46.87	430	$20,149			$20,560	**$30,627**
090601200700	Unit Costs---->		A1A	0.036	1.70	1.40		3.11	4.63
Concrete, scarify skin	1,149.72 S.F.		47.32	41	$1,959	$1,612		$3,571	**$5,319**
033100203050812	Unit Costs---->	288.47	CONC06	24.738	1069.46	528.49		1886.42	2810.00
Concrete Cap Cast-in-Place, 4,000psi, 8" Wide x 6" Deep	22.36 CY	$6,450	43.23	553	$23,913	$11,817		$42,180	**$62,832**
Subtotal		$6,862			$46,020	$13,429		$66,311	
Markups using GC-MK		$3,360			$22,532	$6,575			$32,466
TOTAL 03000 CONCRETE		**$10,222**		**1,024**	**$68,552**	**$20,004**		**$66,311**	**$98,778**
1.00 LS									
1.00 LS									***$0.00***
01 Coagulation Basin Weirs Opt 1A METALS									
	Unit Costs---->		E3	0.080	4.91	0.30		5.21	7.76
Demo Existing Weirs and Lintels	1,716.00 LF		61.41	137	$8,430	$510		$8,941	**$13,318**
	Unit Costs---->	3.10	E3	0.030	1.84	0.11		5.05	7.53
Instal New 4 x 4 x 3/8" Angle Stainless Steel	16,816.80 LB	$52,132	61.41	505	$30,982	$1,875		$84,989	**$126,600**
	Unit Costs---->	22.00	E3	0.070	4.30	0.26		26.56	39.56
FRP V Notch Weir	1,716.00 LF	$37,752	61.41	120	$7,377	$446		$45,575	**$67,889**
Subtotal		$89,884			$46,789	$2,832		$139,505	
Markups using GC-MK		$44,007			$22,908	$1,386			$68,301
TOTAL 05000 METALS		**$133,891**		**762**	**$69,697**	**$4,218**		**$139,505**	**$207,806**
1.00 LS									
1.00 LS									***$0.00***

LWC 2982

CH2MHILL Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
01 Coagulation Basin Weirs Opt 1A FINISHES									
039206000150	Unit Costs---->	2.10	CEFI	0.030	1.27			3.37	5.02
Patching concrete at Weir , small area, epoxy grout	1,716.00 LF	$3,604	42.43	51	$2,184			$5,788	**$8,622**
	Unit Costs---->						1.50	1.50	2.23
Coating, Concrete Cap	2,865.72 SF						$4,299	$4,299	**$6,403**
Subtotal		$3,604			$2,184		$4,299	$10,087	
Markups using GC-MK		$1,764			$1,069		$2,105		$4,938
TOTAL 09000 FINISHES		**$5,368**		**51**	**$3,254**		**$6,403**	**$10,087**	**$15,025**
1.00 LS									
1.00 LS									***$0.00***

LWC 2983

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
02 Coagulation Basin Weirs Opt 2A METALS									
	Unit Costs---->		E3	0.080	4.91	0.30		5.21	7.76
Demo Existing Weirs and Lintels	1,716.00 LF		61.41	137	$8,430	$510		$8,941	**$13,318**
	Unit Costs---->	3.10	E3	0.030	1.84	0.11		5.05	7.53
Instal New 4 x 4 x 3/8" Angle Stainless Steel	16,816.80 LB	$52,132	61.41	505	$30,982	$1,875		$84,989	**$126,600**
	Unit Costs---->	22.00	E3	0.070	4.30	0.26		26.56	39.56
FRP V Notch Weir	1,716.00 LF	$37,752	61.41	120	$7,377	$446		$45,575	**$67,889**
Subtotal		$89,884			$46,789	$2,832		$139,505	
Markups using GC-MK		$44,007			$22,908	$1,386			$68,301
TOTAL 05000 METALS		**$133,891**		**762**	**$69,697**	**$4,218**		**$139,505**	**$207,806**
	1.00 LS								
	1.00 LS								***$0.00***
02 Coagulation Basin Weirs Opt 2A FINISHES									
039206000150	Unit Costs---->	2.10	CEFI	0.030	1.27			3.37	5.02
Patching concrete at Weir , small area, epoxy grout	1,716.00 LF	$3,604	42.43	51	$2,184			$5,788	**$8,622**
	Unit Costs---->						1.50	1.50	2.23
Coating Concrete At Weir	572.00 SF						$858	$858	**$1,278**
Subtotal		$3,604			$2,184		$858	$6,646	
Markups using GC-MK		$1,764			$1,069		$420		$3,254
TOTAL 09000 FINISHES		**$5,368**		**51**	**$3,254**		**$1,278**	**$6,646**	**$9,900**
	1.00 LS								
	1.00 LS								***$0.00***

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
03 Coagulation Basin Weirs Opt 2B CONCRETE									
050903400400	Unit Costs---->	0.16	CARP	0.167	7.83			7.99	11.90
Drilling, layout,, 4" deep, 5/8" dia, conc, for Dowels	2,574.00 Ea.	$412	46.87	430	$20,149			$20,560	**$30,627**
090601200700	Unit Costs---->		A1A	0.036	1.70	1.40		3.11	4.63
Concrete, scarify skin	1,149.72 S.F.		47.32	41	$1,959	$1,612		$3,571	**$5,319**
033100203050812	Unit Costs---->	288.47	CONC06	24.738	1069.46	528.49		1886.42	2810.00
Concrete Cap Cast-in-Place, 4,000psi, 8" Wide x 6" Deep	22.36 CY	$6,450	43.23	553	$23,913	$11,817		$42,180	**$62,832**
Subtotal		$6,862			$46,020	$13,429		$66,311	
Markups using GC-MK		$3,360			$22,532	$6,575			$32,466
TOTAL 03000 CONCRETE		**$10,222**		**1,024**	**$68,552**	**$20,004**		**$66,311**	**$98,778**
1.00 LS									
1.00 LS									***$0.00***

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
03 Coagulation Basin Weirs Opt 2B METALS									
	Unit Costs---->		E3	0.080	4.91	0.30		5.21	7.76
Demo Existing Weirs and Lintels	1,716.00 LF		61.41	137	$8,430	$510		$8,941	**$13,318**
	Unit Costs---->	3.10	E3	0.030	1.84	0.11		5.05	7.53
Instal New 4 x 4 x 3/8" Angle Stainless Steel	16,816.80 LB	$52,132	61.41	505	$30,982	$1,875		$84,989	**$126,600**
	Unit Costs---->	22.00	E3	0.070	4.30	0.26		26.56	39.56
FRP V Notch Weir	1,716.00 LF	$37,752	61.41	120	$7,377	$446		$45,575	**$67,889**
Subtotal		$89,884			$46,789	$2,832		$139,505	
Markups using GC-MK		$44,007			$22,908	$1,386			$68,301
TOTAL 05000 METALS		**$133,891**		**762**	**$69,697**	**$4,218**		**$139,505**	**$207,806**
1.00 LS									
1.00 LS									***$0.00***

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	CREW MH	CREW LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
03 Coagulation Basin Weirs Opt 2B FINISHES									
039206000150	Unit Costs---->	2.10	CEFI	0.030	1.27			3.37	5.02
Patching concrete at Weir , small area, epoxy grout	1,716.00 LF	$3,604	42.43	51	$2,184			$5,788	**$8,622**
	Unit Costs---->						1.50	1.50	2.23
Coating, Concrete Cap	2,865.72 SF						$4,299	$4,299	**$6,403**
Subtotal		$3,604			$2,184		$4,299	$10,087	
Markups using GC-MK		$1,764			$1,069		$2,105		$4,938
TOTAL 09000 FINISHES		**$5,368**		**51**	**$3,254**		**$6,403**	**$10,087**	**$15,025**
1.00 LS									
1.00 LS									***$0.00***

CH2MHILL Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
04 Coagulation Basin Weirs Opt 3B METALS									
	Unit Costs---->		E3	0.080	4.91	0.30		5.21	7.76
Demo Existing Weirs and Lintels	1,716.00 LF		61.41	137	$8,430	$510		$8,941	**$13,318**
	Unit Costs---->	3.10	E3	0.030	1.84	0.11		5.05	7.53
Instal New 4 x 4 x 3/8" Angle Stainless Steel	16,816.80 LB	$52,132	61.41	505	$30,982	$1,875		$84,989	**$126,600**
	Unit Costs---->	22.00	E3	0.070	4.30	0.26		26.56	39.56
FRP V Notch Weir	1,716.00 LF	$37,752	61.41	120	$7,377	$446		$45,575	**$67,889**
Subtotal		$89,884			$46,789	$2,832		$139,505	
Markups using GC-MK		$44,007			$22,908	$1,386			$68,301
TOTAL 05000 METALS	**1.00 LS**	**$133,891**		**762**	**$69,697**	**$4,218**		**$139,505**	**$207,806**
	1.00 LS								***$0.00***
04 Coagulation Basin Weirs Opt 3B FINISHES									
039206000150	Unit Costs---->	2.10	CEFI	0.030	1.27			3.37	5.02
Patching concrete at Weir , small area, epoxy grout	1,716.00 LF	$3,604	42.43	51	$2,184			$5,788	**$8,622**
	Unit Costs---->						1.50	1.50	2.23
Coating Concrete At Weir	572.00 SF						$858	$858	**$1,278**
Subtotal		$3,604			$2,184		$858	$6,646	
Markups using GC-MK		$1,764			$1,069		$420		$3,254
TOTAL 09000 FINISHES	**1.00 LS**	**$5,368**		**51**	**$3,254**		**$1,278**	**$6,646**	**$9,900**
	1.00 LS								***$0.00***

LWC 2987

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

05 Softening Basin Weirs Opt 1A — CONCRETE

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
050903400400	Unit Costs---->	0.16	CARP	0.167	7.83			7.99	11.90
Drilling, layout,, 4" deep, 5/8" dia, conc, for Dowels	2,574.00 Ea.	$412	46.87	430	$20,149			$20,560	**$30,627**
090601200700	Unit Costs---->		A1A	0.036	1.70	1.40		3.11	4.63
Concrete, scarify skin	1,149.72 S.F.		47.32	41	$1,959	$1,612		$3,571	**$5,319**
033100203050812	Unit Costs---->	288.47	CONC06	24.738	1069.46	528.49		1886.42	2810.00
Concrete Cap Cast-in-Place, 4,000psi, 8" Wide x 6" Deep	22.36 CY	$6,450	43.23	553	$23,913	$11,817		$42,180	**$62,832**
Subtotal		$6,862			$46,020	$13,429		$66,311	
Markups using GC-MK		$3,360			$22,532	$6,575			$32,466
TOTAL 03000 CONCRETE **1.00 LS** ***1.00 LS***		**$10,222**		**1,024**	**$68,552**	**$20,004**		**$66,311**	**$98,778** ***$0.00***

05 Softening Basin Weirs Opt 1A — METALS

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
	Unit Costs---->		E3	0.080	4.91	0.30		5.21	7.76
Demo Existing Weirs and Lintels	1,716.00 LF		61.41	137	$8,430	$510		$8,941	**$13,318**
	Unit Costs---->	3.10	E3	0.030	1.84	0.11		5.05	7.53
Instal New 4 x 4 x 3/8" Angle Stainless Steel	16,816.80 LB	$52,132	61.41	505	$30,982	$1,875		$84,989	**$126,600**
	Unit Costs---->	22.00	E3	0.070	4.30	0.26		26.56	39.56
FRP V Notch Weir	1,716.00 LF	$37,752	61.41	120	$7,377	$446		$45,575	**$67,889**
Subtotal		$89,884			$46,789	$2,832		$139,505	
Markups using GC-MK		$44,007			$22,908	$1,386			$68,301
TOTAL 05000 METALS **1.00 LS** ***1.00 LS***		**$133,891**		**762**	**$69,697**	**$4,218**		**$139,505**	**$207,806** ***$0.00***

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
05 Softening Basin Weirs Opt 1A FINISHES									
039206000150	Unit Costs---->	2.10	CEFI	0.030	1.27			3.37	5.02
Patching concrete at Weir , small area, epoxy grout	1,716.00 LF	$3,604	42.43	51	$2,184			$5,788	**$8,622**
	Unit Costs---->						1.50	1.50	2.23
Coating, Concrete Cap	2,865.72 SF						$4,299	$4,299	**$6,403**
Subtotal		$3,604			$2,184		$4,299	$10,087	
Markups using GC-MK		$1,764			$1,069		$2,105		$4,938
TOTAL 09000 FINISHES		**$5,368**		**51**	**$3,254**		**$6,403**	**$10,087**	**$15,025**
	1.00 LS								
	1.00 LS								***$0.00***

LWC 2989

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	CREW MH	CREW LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
06 Softening Basin Weirs Opt 2A METALS									
	Unit Costs---->		E3	0.080	4.91	0.30		5.21	7.76
Demo Existing Weirs and Lintels	1,716.00 LF		61.41	137	$8,430	$510		$8,941	**$13,318**
	Unit Costs---->	3.10	E3	0.030	1.84	0.11		5.05	7.53
Instal New 4 x 4 x 3/8" Angle Stainless Steel	16,816.80 LB	$52,132	61.41	505	$30,982	$1,875		$84,989	**$126,600**
	Unit Costs---->	22.00	E3	0.070	4.30	0.26		26.56	39.56
FRP V Notch Weir	1,716.00 LF	$37,752	61.41	120	$7,377	$446		$45,575	**$67,889**
Subtotal		$89,884			$46,789	$2,832		$139,505	
Markups using GC-MK		$44,007			$22,908	$1,386			$68,301
TOTAL 05000 METALS		**$133,891**		**762**	**$69,697**	**$4,218**		**$139,505**	**$207,806**
1.00 LS									
1.00 LS									***$0.00***
06 Softening Basin Weirs Opt 2A FINISHES									
039206000150	Unit Costs---->	2.10	CEFI	0.030	1.27			3.37	5.02
Patching concrete at Weir , small area, epoxy grout	1,716.00 LF	$3,604	42.43	51	$2,184			$5,788	**$8,622**
	Unit Costs---->						1.50	1.50	2.23
Coating Concrete At Weir	572.00 SF						$858	$858	**$1,278**
Subtotal		$3,604			$2,184		$858	$6,646	
Markups using GC-MK		$1,764			$1,069		$420		$3,254
TOTAL 09000 FINISHES		**$5,368**		**51**	**$3,254**		**$1,278**	**$6,646**	**$9,900**
1.00 LS									
1.00 LS									***$0.00***

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
07 Softening Basin Weirs Opt 2B CONCRETE									
050903400400	Unit Costs---->	0.16	CARP	0.167	7.83			7.99	11.90
Drilling, layout,, 4" deep, 5/8" dia, conc, for Dowels	2,574.00 Ea.	$412	46.87	430	$20,149			$20,560	**$30,627**
090601200700	Unit Costs---->		A1A	0.036	1.70	1.40		3.11	4.63
Concrete, scarify skin	1,149.72 S.F.		47.32	41	$1,959	$1,612		$3,571	**$5,319**
033100203050812	Unit Costs---->	288.47	CONC06	24.738	1069.46	528.49		1886.42	2810.00
Concrete Cap Cast-in-Place, 4,000psi, 8" Wide x 6" Deep	22.36 CY	$6,450	43.23	553	$23,913	$11,817		$42,180	**$62,832**
Subtotal		$6,862			$46,020	$13,429		$66,311	
Markups using GC-MK		$3,360			$22,532	$6,575			$32,466
TOTAL 03000 CONCRETE	**1.00 LS** / ***1.00 LS***	**$10,222**		**1,024**	**$68,552**	**$20,004**		**$66,311**	**$98,778** / ***$0.00***
07 Softening Basin Weirs Opt 2B METALS									
	Unit Costs---->		E3	0.080	4.91	0.30		5.21	7.76
Demo Existing Weirs and Lintels	1,716.00 LF		61.41	137	$8,430	$510		$8,941	**$13,318**
	Unit Costs---->	3.10	E3	0.030	1.84	0.11		5.05	7.53
Instal New 4 x 4 x 3/8" Angle Stainless Steel	16,816.80 LB	$52,132	61.41	505	$30,982	$1,875		$84,989	**$126,600**
	Unit Costs---->	22.00	E3	0.070	4.30	0.26		26.56	39.56
FRP V Notch Weir	1,716.00 LF	$37,752	61.41	120	$7,377	$446		$45,575	**$67,889**
Subtotal		$89,884			$46,789	$2,832		$139,505	
Markups using GC-MK		$44,007			$22,908	$1,386			$68,301
TOTAL 05000 METALS	**1.00 LS** / ***1.00 LS***	**$133,891**		**762**	**$69,697**	**$4,218**		**$139,505**	**$207,806** / ***$0.00***

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
07 Softening Basin Weirs Opt 2B FINISHES									
039206000150	Unit Costs---->	2.10	CEFI	0.030	1.27			3.37	5.02
Patching concrete at Weir , small area, epoxy grout	1,716.00 LF	$3,604	42.43	51	$2,184			$5,788	**$8,622**
	Unit Costs---->						1.50	1.50	2.23
Coating, Concrete Cap	2,865.72 SF						$4,299	$4,299	**$6,403**
Subtotal		$3,604			$2,184		$4,299	$10,087	
Markups using GC-MK		$1,764			$1,069		$2,105		$4,938
TOTAL 09000 FINISHES **1.00 LS** ***1.00 LS***		**$5,368**		**51**	**$3,254**		**$6,403**	**$10,087**	**$15,025** ***$0.00***

CH2MHILL Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
08 Reaction Basin Weirs Opt 2A CONCRETE									
022203600820	Unit Costs---->	0.47	B89B	0.210	8.31	6.09		14.87	22.15
Saw cutting, concrete walls, rod reinforcing, 2"inch of depth	4,680.00 L.F.	$2,200	39.55	983	$38,871	$28,510		$69,581	**$103,648**
022203101450	Unit Costs---->		B9C	0.571	20.86	2.10		22.96	34.20
Cutout demo, conc walls, bar reinf	38.90 C.F.		36.53	22	$811	$82		$893	**$1,330**
039206000150	Unit Costs---->	6.20	CEFI	0.080	3.40			9.60	14.29
Patching conc 1/4" thick, small area, epoxy grout	1,567.80 S.F.	$9,720	42.43	125	$5,322			$15,042	**$22,407**
Subtotal		$11,920			$45,004	$28,592		$85,517	
Markups using GC-MK		$5,836			$22,034	$13,999			$41,869
TOTAL 03000 CONCRETE		**$17,756**		**1,130**	**$67,039**	**$42,591**		**$85,517**	**$127,385**
1.00 LS									
1.00 LS									***$0.00***

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
08 Reaction Basin Weirs Opt 2A METALS									
	Unit Costs---->		E3	0.080	4.91	0.30		5.21	7.76
Demo Existing Weirs and Lintels	2,340.00 LF		61.41	187	$11,496	$696		$12,192	**$18,161**
	Unit Costs---->		E3	0.030	1.84	0.11		1.95	2.91
Instal Existing 4 x 4 x 3/8" Angle Stainless Steel	22,932.00 LB		61.41	688	$42,248	$2,557		$44,805	**$66,741**
	Unit Costs---->	1.00	E3	0.070	4.30	0.26		5.56	8.28
Install Existing V Notch Weir	2,340.00 LF	$2,340	61.41	164	$10,059	$609		$13,008	**$19,376**
Subtotal		$2,340			$63,803	$3,861		$70,005	
Markups using GC-MK		$1,146			$31,238	$1,891			$34,274
TOTAL 05000 METALS		**$3,486**		**1,039**	**$95,041**	**$5,752**		**$70,005**	**$104,279**
1.00 LS									
1.00 LS									***$0.00***

CH2MHILL Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
08 Reaction Basin Weirs Opt 2A FINISHES									
039206000150	Unit Costs---->	2.10	CEFI	0.030	1.27			3.37	5.02
Patching concrete at Weir , small area, epoxy grout	4,632.00 LF	$9,727	42.43	139	$5,896			$15,624	**$23,273**
	Unit Costs---->						1.50	1.50	2.23
Coating, Concrete	1,567.80 SF						$2,352	$2,352	**$3,503**
Subtotal		$9,727			$5,896		$2,352	$17,975	
Markups using GC-MK		$4,762			$2,887		$1,151		$8,801
TOTAL 09000 FINISHES		**$14,490**		**139**	**$8,783**		**$3,503**	**$17,975**	**$26,776**
1.00 LS									
1.00 LS									***$0.00***

LWC 2994

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
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ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

09 Coag. Basin 2B & 3B Sluice Gates — CONCRETE

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
022203600820	Unit Costs---->	0.47	B89B	0.210	8.31	6.09		14.87	22.15
Saw cutting, concrete walls, rod reinforcing, 2"inch of depth	120.00 L.F.	$56	39.55	25	$997	$731		$1,784	**$2,658**
022203101450	Unit Costs---->		B9C	0.571	20.86	2.10		22.96	34.20
Cutout demo, conc walls, bar reinf	87.75 C.F.		36.53	50	$1,830	$184		$2,015	**$3,001**
039206000150	Unit Costs---->	6.20	CEFI	0.080	3.40			9.60	14.29
Patching conc 1/4" thick, small area, epoxy grout	70.20 S.F.	$435	42.43	6	$238			$674	**$1,003**
Subtotal		$492			$3,065	$915		$4,472	
Markups using GC-MK		$241			$1,501	$448			$2,190
TOTAL 03000 CONCRETE		**$732**		**81**	**$4,566**	**$1,364**		**$4,472**	**$6,662**
1.00 LS									
1.00 LS									***$0.00***

09 Coag. Basin 2B & 3B Sluice Gates — EQUIPMENT

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
112852800106060	Unit Costs---->	18021.84	L5	85.200	5034.72	850.78		23907.34	
Sluice Gate, Cast-Iron, 304 SST Stem, 12" Wall Thimble, 60" x 60" w/Manual Oper	1.00 EA	$18,022	59.09	85	$5,035	$851		$23,907	**$35,612**
Subtotal		$18,022			$5,035	$851		$23,907	
Markups using GC-MK		$8,823			$2,465	$417			$11,705
TOTAL 11000 EQUIPMENT		**$26,845**		**85**	**$7,500**	**$1,267**		**$23,907**	**$35,612**
1.00 LS									
1.00 LS									***$0.00***

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Estimating Services

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ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
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DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
10 Mixing Basin 2B & 3B Sluice Gates CONCRETE									
022203600820	Unit Costs---->	0.47	B89B	0.210	8.31	6.09		14.87	22.15
Saw cutting, concrete walls, rod reinforcing, 2"inch of depth	120.00 L.F.	$56	39.55	25	$997	$731		$1,784	**$2,658**
022203101450	Unit Costs---->		B9C	0.571	20.86	2.10		22.96	34.20
Cutout demo, conc walls, bar reinf	84.24 C.F.		36.53	48	$1,757	$177		$1,934	**$2,881**
039206000150	Unit Costs---->	6.20	CEFI	0.080	3.40			9.60	14.29
Patching conc 1/4" thick, small area, epoxy grout	70.20 S.F.	$435	42.43	6	$238			$674	**$1,003**
Subtotal		$492			$2,992	$908		$4,392	
Markups using GC-MK		$241			$1,465	$445			$2,150
TOTAL 03000 CONCRETE **1.00 LS** ***1.00 LS***		**$732**		**79**	**$4,457**	**$1,353**		**$4,392**	**$6,542** ***$0.00***

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
10 Mixing Basin 2B & 3B Sluice Gates EQUIPMENT									
112852800106666	Unit Costs---->	20725.11	L5	96.100	5678.83	959.63		27363.57	
Sluice Gate, Cast-Iron, 304 SST Stem, 12" Wall Thimble, 48" x 72" w/Manual Oper	1.00 EA	$20,725	59.09	96	$5,679	$960		$27,364	**$40,761**
Subtotal		$20,725			$5,679	$960		$27,364	
Markups using GC-MK		$10,147			$2,780	$470			$13,397
TOTAL 11000 EQUIPMENT **1.00 LS** ***1.00 LS***		**$30,872**		**96**	**$8,459**	**$1,429**		**$27,364**	**$40,761** ***$0.00***

![CH2MHILL Estimating Services]

CH2MHILL Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
11 Floc Basin 2B & 3B Sluice Gates CONCRETE									
022203600820	Unit Costs---->	0.47	B89B	0.210	8.31	6.09		14.87	22.15
Saw cutting, concrete walls, rod reinforcing, 2"inch of depth	120.00 L.F.	$56	39.55	25	$997	$731		$1,784	**$2,658**
022203101450	Unit Costs---->		B9C	0.571	20.86	2.10		22.96	34.20
Cutout demo, conc walls, bar reinf	84.24 C.F.		36.53	48	$1,757	$177		$1,934	**$2,881**
039206000150	Unit Costs---->	6.20	CEFI	0.080	3.40			9.60	14.29
Patching conc 1/4" thick, small area, epoxy grout	70.20 S.F.	$435	42.43	6	$238			$674	**$1,003**
Subtotal		$492			$2,992	$908		$4,392	
Markups using GC-MK		$241			$1,465	$445			$2,150
TOTAL 03000 CONCRETE **1.00 LS** ***1.00 LS***		**$732**		**79**	**$4,457**	**$1,353**		**$4,392**	**$6,542** ***$0.00***

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
11 Floc Basin 2B & 3B Sluice Gates EQUIPMENT									
112852800106666	Unit Costs---->	20725.11	L5	96.100	5678.83	959.63		27363.57	
Sluice Gate, Cast-Iron, 304 SST Stem, 12" Wall Thimble, 48" x 72" w/Manual Oper	1.00 EA	$20,725	59.09	96	$5,679	$960		$27,364	**$40,761**
Subtotal		$20,725			$5,679	$960		$27,364	
Markups using GC-MK		$10,147			$2,780	$470			$13,397
TOTAL 11000 EQUIPMENT **1.00 LS** ***1.00 LS***		**$30,872**		**96**	**$8,459**	**$1,429**		**$27,364**	**$40,761** ***$0.00***

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
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ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
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DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
12 Recarb Basin Infl Wall Opening 2A CONCRETE									
022203600820	Unit Costs---->	0.47	B89B	0.210	8.31	6.09		14.87	22.15
Saw cutting, concrete walls, rod reinforcing, 2"inch of depth	108.00 L.F.	$51	39.55	23	$897	$658		$1,606	**$2,392**
022203101450	Unit Costs---->		B9C	0.571	20.86	2.10		22.96	34.20
Cutout demo, conc walls, bar reinf	70.20 C.F.		36.53	40	$1,464	$148		$1,612	**$2,401**
039206000150	Unit Costs---->	6.20	CEFI	0.080	3.40			9.60	14.29
Patching conc 1/4" thick, small area, epoxy grout	63.18 S.F.	$392	42.44	5	$214			$606	**$903**
Subtotal		$442			$2,576	$805		$3,824	
Markups using GC-MK		$217			$1,261	$394			$1,872
TOTAL 03000 CONCRETE	**1.00 LS**	**$659**		**68**	**$3,837**	**$1,200**		**$3,824**	**$5,696**
	1.00 LS								***$0.00***

Facility Notes: Three Wall Openings 60" x 48"

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
12 Recarb Basin Infl Wall Opening 2A FINISHES									
	Unit Costs---->						1.50	1.50	2.23
Coating, Concrete	63.18 SF						$95	$95	**$141**
Subtotal							$95	$95	
Markups using GC-MK							$46		$46
TOTAL 09000 FINISHES	**1.00 LS**						**$141**	**$95**	**$141**
	1.00 LS								***$0.00***

Facility Notes: Three Wall Openings 60" x 48"

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Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

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ESTIMATOR: D. Jones / GNV
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DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
13 Recarb Basin Infl Wall Opening 2B CONCRETE									
022203600820	Unit Costs---->	0.47	B89B	0.210	8.31	6.09		14.87	22.15
Saw cutting, concrete walls, rod reinforcing, 2"inch of depth	126.00 L.F.	$59	39.55	26	$1,047	$768		$1,873	**$2,791**
022203101450	Unit Costs---->		B9C	0.571	20.86	2.10		22.96	34.20
Cutout demo, conc walls, bar reinf	94.77 C.F.		36.53	54	$1,977	$199		$2,176	**$3,241**
039206000150	Unit Costs---->	6.20	CEFI	0.080	3.40			9.60	14.29
Patching conc 1/4" thick, small area, epoxy grout	73.71 S.F.	$457	42.43	6	$250			$707	**$1,053**
Subtotal		$516			$3,273	$967		$4,756	
Markups using GC-MK		$253			$1,603	$473			$2,329
TOTAL 03000 CONCRETE		**$769**		**86**	**$4,876**	**$1,440**		**$4,756**	**$7,085**
1.00 LS									
1.00 LS									***$0.00***

Facility Notes: Three Wall Openings 72" x 54"

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
13 Recarb Basin Infl Wall Opening 2B FINISHES									
	Unit Costs---->						1.50	1.50	2.23
Coating, Concrete	73.17 SF						$110	$110	**$163**
Subtotal							$110	$110	
Markups using GC-MK							$54		$54
TOTAL 09000 FINISHES							**$163**	**$110**	**$163**
1.00 LS									
1.00 LS									***$0.00***

Facility Notes: Three Wall Openings 72" x 54"

CH2MHILL Estimating Services

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PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
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ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
14 Recarb Basin Infl Wall Opening 2C CONCRETE									
022203600820	Unit Costs---->	0.47	B89B	0.210	8.31	6.09		14.87	22.15
Saw cutting, concrete walls, rod reinforcing, 2"inch of depth	120.00 L.F.	$56	39.55	25	$997	$731		$1,784	**$2,658**
022203101450	Unit Costs---->		B9C	0.571	20.86	2.10		22.96	34.20
Cutout demo, conc walls, bar reinf	84.24 C.F.		36.53	48	$1,757	$177		$1,934	**$2,881**
039206000150	Unit Costs---->	6.20	CEFI	0.080	3.40			9.60	14.29
Patching conc 1/4" thick, small area, epoxy grout	70.20 S.F.	$435	42.43	6	$238			$674	**$1,003**
Subtotal		$492			$2,992	$908		$4,392	
Markups using GC-MK		$241			$1,465	$445			$2,150
TOTAL 03000 CONCRETE **1.00 LS** ***1.00 LS***		**$732**		**79**	**$4,457**	**$1,353**		**$4,392**	**$6,542** ***$0.00***

Facility Notes: Three Wall Openings 72" x 48"

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
14 Recarb Basin Infl Wall Opening 2C FINISHES									
	Unit Costs---->						1.50	1.50	2.23
Coating, Concrete	70.20 SF						$105	$105	**$157**
Subtotal							$105	$105	
Markups using GC-MK							$52		$52
TOTAL 09000 FINISHES **1.00 LS** ***1.00 LS***							**$157**	**$105**	**$157** ***$0.00***

Facility Notes: Three Wall Openings 72" x 48"

LWC 3000

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
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DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
15 Coag Wtr Channel Covers 1A & 2B CONCRETE									
022203600820	Unit Costs---->	0.47	B89B	0.210	8.31	6.09		14.87	22.15
Saw cutting, concrete, rod reinforcing, 2"inch of depth	1,280.00 L.F.	$602	39.55	269	$10,631	$7,798		$19,031	**$28,348**
039206000150	Unit Costs---->	6.20	CEFI	0.080	3.40			9.60	14.29
Patching conc 1/4" thick, small area, epoxy grout	428.80 S.F.	$2,659	42.43	34	$1,456			$4,114	**$6,128**
022202505500	Unit Costs---->		B38	1.667	66.49	34.84		101.32	150.93
Site dml, conc7" to 24" thick, rod reinforced	76.93 C.Y.		39.89	128	$5,115	$2,680		$7,795	**$11,611**
022201304250	Unit Costs---->		B30	0.109	4.30	7.61		11.91	17.75
Concrete demo, add for disposal, to five miles	76.93 C.Y.		39.47	8	$331	$586		$917	**$1,365**
Subtotal		$3,260			$17,533	$11,063		$31,856	
Markups using GC-MK		$1,596			$8,584	$5,417			$15,597
TOTAL 03000 CONCRETE	**1.00 LS** / ***1.00 LS***	**$4,856**		**440**	**$26,117**	**$16,480**		**$31,856**	**$47,453** / ***$0.00***
15 Coag Wtr Channel Covers 1A & 2B FINISHES									
Coating, Concrete	Unit Costs----> 428.80 SF						1.50 / $643	1.50 / $643	2.23 / **$958**
Subtotal							$643	$643	
Markups using GC-MK							$315		$315
TOTAL 09000 FINISHES	**1.00 LS** / ***1.00 LS***						**$958**	**$643**	**$958** / ***$0.00***

Facility Notes: **Three Wall Openings 72" x 48"** (Concrete)

Facility Notes: **Three Wall Openings 72" x 48"** (Finishes)

LWC 3001

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

DESCRIPTION	QTY	UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
15 Coag Wtr Channel Covers 1A & 2B ELECTRICAL										
Unit Costs---->								40000.00	40000.00	
Demolish and Replace Conduit and Conductors	1.00	LS						$40,000	$40,000	**$59,584**
Subtotal								$40,000	$40,000	
Markups using GC-MK								$19,584		$19,584
TOTAL 16000 ELECTRICAL								**$59,584**	**$40,000**	**$59,584**
	1.00	LS								
	1.00	***LS***								***$0.00***

Facility Notes: **Three Wall Openings 72" x 48"**

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
16 Mix Basin Channel Covers 1A & 2B CONCRETE									
022203600820	Unit Costs---->	0.47	B89B	0.210	8.31	6.09		14.87	22.15
Saw cutting, concrete, rod reinforcing, 2"inch of depth	1,280.00 L.F.	$602	39.55	269	$10,631	$7,798		$19,031	**$28,348**
039206000150	Unit Costs---->	6.20	CEFI	0.080	3.40			9.60	14.29
Patching conc 1/4" thick, small area, epoxy grout	428.80 S.F.	$2,659	42.43	34	$1,456			$4,114	**$6,128**
022202505500	Unit Costs---->		B38	1.667	66.49	34.84		101.32	150.93
Site dml, conc7" to 24" thick, rod reinforced	76.93 C.Y.		39.89	128	$5,115	$2,680		$7,795	**$11,611**
022201304250	Unit Costs---->		B30	0.109	4.30	7.61		11.91	17.75
Concrete demo, add for disposal, to five miles	76.93 C.Y.		39.47	8	$331	$586		$917	**$1,365**
Subtotal		$3,260			$17,533	$11,063		$31,856	
Markups using GC-MK		$1,596			$8,584	$5,417			$15,597
TOTAL 03000 CONCRETE	**1.00 LS** / ***1.00 LS***	**$4,856**		**440**	**$26,117**	**$16,480**		**$31,856**	**$47,453** / ***$0.00***

Facility Notes: Three Wall Openings 72" x 48"

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
16 Mix Basin Channel Covers 1A & 2B FINISHES									
	Unit Costs---->						1.50	1.50	2.23
Coating, Concrete	428.80 SF						$643	$643	**$958**
Subtotal							$643	$643	
Markups using GC-MK							$315		$315
TOTAL 09000 FINISHES	**1.00 LS** / ***1.00 LS***						**$958**	**$643**	**$958** / ***$0.00***

Facility Notes: Three Wall Openings 72" x 48"

CH2MHILL Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
16 Mix Basin Channel Covers 1A & 2B ELECTRICAL									
	Unit Costs---->						40000.00	40000.00	
Demolish and Replace Conduit and Conductors	1.00 LS						$40,000	$40,000	**$59,584**
Subtotal							$40,000	$40,000	
Markups using GC-MK							$19,584		$19,584
TOTAL 16000 ELECTRICAL	**1.00 LS**						**$59,584**	**$40,000**	**$59,584**
	1.00 LS								***$0.00***

Facility Notes: Three Wall Openings 72" x 48"

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
17 Raise Coag Wtr Channel Covers CONCRETE									
050903400400	Unit Costs---->	0.16	CARP	0.167	7.83			7.99	11.90
Drilling, layout,, 4" deep, 5/8" dia, conc, for Dowels	1,280.00 Ea.	$205	46.87	214	$10,020			$10,224	**$15,230**
090601200700	Unit Costs---->		A1A	0.036	1.70	1.40		3.11	4.63
Concrete, scarify skin	748.80 S.F.		47.32	27	$1,276	$1,050		$2,326	**$3,464**
033100203050812	Unit Costs---->	288.53	CONC06	24.743	1069.66	528.59		1886.78	2810.55
Concrete Cap Cast-in-Place, 4,000psi, 14" Wide x 12" Deep	14.56 CY	$4,201	43.23	360	$15,574	$7,696		$27,472	**$40,922**
Subtotal		$4,406			$26,869	$8,746		$40,021	
Markups using GC-MK		$2,157			$13,155	$4,282			$19,594
TOTAL 03000 CONCRETE		**$6,563**		**601**	**$40,025**	**$13,028**		**$40,021**	**$59,616**
1.00 LS									
1.00 LS									***$0.00***
17 Raise Coag Wtr Channel Covers FINISHES									
	Unit Costs---->						1.50	1.50	2.23
Coating, Concrete Cap	1,388.80 SF						$2,083	$2,083	**$3,103**
Subtotal							$2,083	$2,083	
Markups using GC-MK							$1,020		$1,020
TOTAL 09000 FINISHES							**$3,103**	**$2,083**	**$3,103**
1.00 LS									
1.00 LS									***$0.00***

LWC 3005

CH2MHILL Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
18 Raise Floc Basin Walls 1A & 3B CONCRETE									
050903400400	Unit Costs---->	0.16	CARP	0.167	7.83			7.99	11.90
Drilling, layout,, 4" deep, 5/8" dia, conc, for Dowels	1,520.00 Ea.	$243	46.87	254	$11,898			$12,141	**$18,086**
090601200700	Unit Costs---->		A1A	0.036	1.70	1.40		3.11	4.63
Concrete, scarify skin	889.20 S.F.		47.32	32	$1,515	$1,247		$2,762	**$4,114**
033100203050812	Unit Costs---->	288.53	CONC06	24.743	1069.66	528.59		1886.78	2810.55
Concrete Cap Cast-in-Place, 4,000psi, 14" Wide x 12" Deep	17.29 CY	$4,989	43.23	428	$18,494	$9,139		$32,622	**$48,594**
Subtotal		$5,232			$31,907	$10,386		$47,525	
Markups using GC-MK		$2,562			$15,622	$5,085			$23,268
TOTAL 03000 CONCRETE 1.00 LS *1.00 LS*		**$7,793**		**714**	**$47,529**	**$15,471**		**$47,525**	**$70,794** *$0.00*

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
18 Raise Floc Basin Walls 1A & 3B FINISHES									
	Unit Costs---->						1.50	1.50	2.23
Coating, Concrete Cap	1,649.20 SF						$2,474	$2,474	**$3,685**
Subtotal							$2,474	$2,474	
Markups using GC-MK							$1,211		$1,211
TOTAL 09000 FINISHES 1.00 LS *1.00 LS*							**$3,685**	**$2,474**	**$3,685** *$0.00*

LWC 3006

CH2MHILL
Estimating Services

HILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

CT: BE Paynes WTP Modifications
N STAGE: Conceptual
CT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

IPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
Raise Floc Basin Walls 2B CONCRETE									
0400 ayout,, 4" deep, 5/8" dia, conc, for	Unit Costs----> 1,520.00 Ea.	0.16 $243	CARP 46.87	0.167 254	7.83 $11,898			7.99 $12,141	11.90 **$18,086**
0700 e., scarify skin	Unit Costs----> 889.20 S.F.		A1A 47.32	0.036 32	1.70 $1,515	1.40 $1,247		3.11 $2,762	4.63 **$4,114**
3050812 e Cap Cast-in-Place, 4,000psi, 14" Wide x D	Unit Costs----> 34.58 CY	288.53 $9,977	CONC06 43.23	24.743 856	1069.66 $36,989	528.59 $18,279		1886.78 $65,245	2810.55 **$97,189**
al s using GC-MK		$10,221 $5,004			$50,402 $24,677	$19,525 $9,560		$80,148	$39,240
L 03000 CONCRETE **1.00 LS** ***1.00 LS***		**$15,225**		**1,141**	**$75,079**	**$29,085**		**$80,148**	**$119,388** ***$0.00***
Raise Floc Basin Walls 2B FINISHES									
Concrete Cap	Unit Costs----> 2,409.20 SF						1.50 $3,614	1.50 $3,614	2.23 **$5,383**
al s using GC-MK							$3,614 $1,769	$3,614	$1,769
L 09000 FINISHES **1.00 LS** ***1.00 LS***							**$5,383**	**$3,614**	**$5,383** ***$0.00***

CH2MHILL Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
20 Raise Mixing Basin Walls 1A & 3B CONCRETE									
050903400400	Unit Costs---->	0.16	CARP	0.167	7.83			7.99	11.90
Drilling, layout,, 4" deep, 5/8" dia, conc, for Dowels	1,520.00 Ea.	$243	46.87	254	$11,898			$12,141	**$18,086**
090601200700	Unit Costs---->		A1A	0.036	1.70	1.40		3.11	4.63
Concrete, scarify skin	889.20 S.F.		47.32	32	$1,515	$1,247		$2,762	**$4,114**
033100203050812	Unit Costs---->	288.53	CONC06	24.743	1069.66	528.59		1886.78	2810.55
Concrete Cap Cast-in-Place, 4,000psi, 14" Wide x 12" Deep	17.29 CY	$4,989	43.23	428	$18,494	$9,139		$32,622	**$48,594**
Subtotal		$5,232			$31,907	$10,386		$47,525	
Markups using GC-MK		$2,562			$15,622	$5,085			$23,268
TOTAL 03000 CONCRETE		**$7,793**		**714**	**$47,529**	**$15,471**		**$47,525**	**$70,794**
1.00 LS									
1.00 LS									***$0.00***

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
20 Raise Mixing Basin Walls 1A & 3B FINISHES									
	Unit Costs---->						1.50	1.50	2.23
Coating, Concrete Cap	1,649.20 SF						$2,474	$2,474	**$3,685**
Subtotal							$2,474	$2,474	
Markups using GC-MK							$1,211		$1,211
TOTAL 09000 FINISHES							**$3,685**	**$2,474**	**$3,685**
1.00 LS									
1.00 LS									***$0.00***

LWC 3008

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
21 Raise Mixing Basin Walls 2B CONCRETE									
050903400400	Unit Costs---->	0.16	CARP	0.167	7.83			7.99	11.90
Drilling, layout,, 4" deep, 5/8" dia, conc, for Dowels	1,520.00 Ea.	$243	46.87	254	$11,898			$12,141	**$18,086**
090601200700	Unit Costs---->		A1A	0.036	1.70	1.40		3.11	4.63
Concrete, scarify skin	889.20 S.F.		47.32	32	$1,515	$1,247		$2,762	**$4,114**
033100203050812	Unit Costs---->	288.53	CONC06	24.743	1069.66	528.59		1886.78	2810.55
Concrete Cap Cast-in-Place, 4,000psi, 14" Wide x 12" Deep	34.58 CY	$9,977	43.23	856	$36,989	$18,279		$65,245	**$97,189**
Subtotal		$10,221			$50,402	$19,525		$80,148	
Markups using GC-MK		$5,004			$24,677	$9,560			$39,240
TOTAL 03000 CONCRETE	**1.00 LS**	**$15,225**		**1,141**	**$75,079**	**$29,085**		**$80,148**	**$119,388**
	1.00 LS								***$0.00***

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
21 Raise Mixing Basin Walls 2B FINISHES									
	Unit Costs---->						1.50	1.50	2.23
Coating, Concrete Cap	2,409.20 SF						$3,614	$3,614	**$5,383**
Subtotal							$3,614	$3,614	
Markups using GC-MK							$1,769		$1,769
TOTAL 09000 FINISHES	**1.00 LS**						**$5,383**	**$3,614**	**$5,383**
	1.00 LS								***$0.00***

CH2MHILL Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
22 Coag B Tube Settlers 1A,2A & 3A EQUIPMENT									
	Unit Costs---->						91.60	91.60	136.45
Instl 4' Deep Tube Settlers with Integral Weir and Launders	20,832.00 SF						$1,908,211	$1,908,211	**$2,842,470**
Subtotal							$1,908,211	$1,908,211	
Markups using GC-MK							$934,259		$934,259
TOTAL 11000 EQUIPMENT							**$2,842,470**	**$1,908,211**	**$2,842,470**
	1.00 LS								
	1.00 LS								***$0.00***

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
23 Soften B Tube Settlers 1A,2A&3A EQUIPMENT									
	Unit Costs---->						91.60	91.60	136.45
Instl 4' Deep Tube Settlers with Integral Weir and Launders	20,832.00 SF						$1,908,211	$1,908,211	**$2,842,470**
Subtotal							$1,908,211	$1,908,211	
Markups using GC-MK							$934,259		$934,259
TOTAL 11000 EQUIPMENT							**$2,842,470**	**$1,908,211**	**$2,842,470**
	1.00 LS								
	1.00 LS								***$0.00***

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
21 Soften B Tube Settlers 1A,2A&3A Coag Basins Tube Settlers 2B&3B EQUIPMENT									
	Unit Costs---->						91.60	91.60	136.45
Instl 4' Deep Tube Settlers with Integral Weir and Launders	27,776.00 SF						$2,544,282	$2,544,282	**$3,789,960**
Subtotal							$2,544,282	$2,544,282	
Markups using GC-MK							$1,245,679		$1,245,679
TOTAL 11000 EQUIPMENT							**$3,789,960**	**$2,544,282**	**$3,789,960**
	1.00 LS								
	1.00 LS								***$0.00***

LWC 3011

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

DESCRIPTION	QTY	UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
24 Coag Basins Tube Settlers 2B&3B EQUIPMENT										
Unit Costs---->								91.60	91.60	136.45
Instl 4' Deep Tube Settlers with Integral Weir and Launders	27,776.00	SF						$2,544,282	$2,544,282	**$3,789,960**
Subtotal								$2,544,282	$2,544,282	
Markups using GC-MK								$1,245,679		$1,245,679
TOTAL 11000 EQUIPMENT	**1.00**	**LS**						**$3,789,960**	**$2,544,282**	**$3,789,960**
	1.00	***LS***								***$0.00***

LWC 3012

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

DESCRIPTION	QTY	UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
25 Softening B Tube Settlers 2B&3B EQUIPMENT										
Unit Costs---->								91.60	91.60	136.45
Instl 4' Deep Tube Settlers with Integral Weir and Launders	27,776.00	SF						$2,544,282	$2,544,282	**$3,789,960**
Subtotal								$2,544,282	$2,544,282	
Markups using GC-MK								$1,245,679		$1,245,679
TOTAL 11000 EQUIPMENT	**1.00**	**LS**						**$3,789,960**	**$2,544,282**	**$3,789,960**
	1.00	***LS***								***$0.00***

LWC 3013

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

DESCRIPTION	QTY	UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
26 Clear Well Expan. 1A,2A &3A CONCRETE										
Unit Costs---->								1200000.00	1200000.00	1787519.20
Clearwell Expansion 7.5 MG	7.50	MG						$9,000,000	$9,000,000	**$13,406,394**
Subtotal								$9,000,000	$9,000,000	
Markups using GC-MK								$4,406,394		$4,406,394
TOTAL 03000 CONCRETE	**1.00**	**LS**						**$13,406,394**	**$9,000,000**	**$13,406,394**
	1.00	***LS***								***$0.00***

Facility Notes: **Expand below grade clear well capacity by providing cast-in-place concrete, independent compartment interconnected to existing clear well using same elevations.**

LWC 3014

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
27 Clear Well Expan. 2B & 3B CONCRETE									
	Unit Costs---->						1200000.00	1200000.00	1787519.20
Clearwell Expansion 12 MG	12.00 MG						$*,***,***	$*,***,***	**$21,450,230**
Subtotal							$14,400,000	$14,400,000	
Markups using GC-MK							$7,050,230		$7,050,230
TOTAL 03000 CONCRETE	**1.00 LS**						**$21,450,230**	**$14,400,000**	**$21,450,230**
	1.00 LS								***$0.00***

Facility Notes: **Expand below grade clear well capacity by providing cast-in-place concrete, independent compartment interconnected to existing clear well using same elevations.**

LWC 3015

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
28 H S Pumps & Bldg 1A,2A&3A CONCRETE									
New Building Space	Unit Costs----> 2,250.00 SF						200.00 $450,000	200.00 $450,000	297.92 **$670,320**
Subtotal							$450,000	$450,000	
Markups using GC-MK							$220,320		$220,320
TOTAL 03000 CONCRETE	**1.00 LS** ***1.00 LS***						**$670,320**	**$450,000**	**$670,320** ***$0.00***
28 H S Pumps & Bldg 1A,2A&3A EQUIPMENT									
11200101120017 Vertical Turbine Pump, 15.2 MGD, 450TDH, 1500 HP Notes: *Max Efficiency 79, Motor Variable Speed, Suction 14", Discharge 12", Column 12", Can Dia 24", Min Base to Suction Bell 84" Johnson Pump Company Quote 3/2003*	Unit Costs----> 2.00 EA	200000.00 $400,000	EQUIP01 47.99	350.000 700	16796.12 $33,592	13358.33 $26,717		230154.45 $460,309	342837.92 **$685,676**
11200101120017 Vertical Turbine Pump, 13.5 MGD, 450TDH, 1250 HP Notes: *Max Efficiency 79, Motor Variable Speed, Suction 14", Discharge 12", Column 12", Can Dia 24", Min Base to Suction Bell 84" Johnson Pump Company Quote 3/2003*	Unit Costs----> 1.00 EA	150000.00 $150,000	EQUIP01 47.99	300.000 300	14396.67 $14,397	11450.00 $11,450		175846.67 $175,847	**$261,941**
Subtotal		$550,000			$47,989	$38,167		$636,156	
Markups using GC-MK		$269,280			$23,495	$18,686			$311,461
TOTAL 11000 EQUIPMENT	**1.00 LS** ***1.00 LS***	**$819,280**		**1,000**	**$71,484**	**$56,853**		**$636,156**	**$947,617** ***$0.00***

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	CREW MH	CREW LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
28 H S Pumps & Bldg 1A,2A&3A MECHANICAL									
151000210601020	Unit Costs---->	5328.00	PIPE06	13.660	717.50	72.85		6118.36	9113.90
Valves, Historical Costs, Check Valve V600, Flanged, 20" Dia	3.00 EA-	$15,984	52.53	41	$2,153	$219		$18,355	**$27,342**
151000210101020	Unit Costs---->	4680.00	PIPE06	21.150	1110.92	112.80		5903.72	8794.18
Valves, Historical Costs, Gate Valve V100, Flanged, 20" Dia	3.00 EA	$14,040	52.53	63	$3,333	$338		$17,711	**$26,383**
150600130406685	Unit Costs---->	21567.74	PIPE08	87.245	4559.35	1607.05		27734.14	41312.76
CLDI, Flanged, C110, Reducing Tee, 60" x 36" Dia	3.00 EA	$64,703	52.26	262	$13,678	$4,821		$83,202	**$123,938**
150600110301408	Unit Costs---->	13525.34	PIPE08	49.340	2578.47	908.84		17012.65	25342.03
CLDI Pipe, Class 53, Flg x Flg,60" dia, 8' Spool Piece	3.00 EA	$40,576	52.26	148	$7,735	$2,727		$51,038	**$76,026**
150600110301419	Unit Costs---->	18909.24	PIPE08	84.960	4439.94	1564.96		24914.14	37112.09
CLDI Pipe, Class 53, Flg x Flg,60" dia, 19' Spool Piece	3.00 EA	$56,728	52.26	255	$13,320	$4,695		$74,742	**$111,336**
150600130409364	Unit Costs---->	4106.40	PIPE06	14.280	750.07	76.16		4932.63	7347.65
CLDI, Flanged, C110, Reducer, 36" x 20" Dia	3.00 EA	$12,319	52.53	43	$2,250	$228		$14,798	**$22,043**
150600110301262	Unit Costs---->	912.16	PIPE06	9.769	513.12	52.10		1477.38	2200.71
CLDI Pipe, Class 53, Flg x Flg,20" dia, 2' Spool Piece	3.00 EA	$2,736	52.53	29	$1,539	$156		$4,432	**$6,602**
150600110301264	Unit Costs---->	1050.66	PIPE06	12.048	632.83	64.26		1747.75	2603.45
CLDI Pipe, Class 53, Flg x Flg,20" dia, 4' Spool Piece	3.00 EA	$3,152	52.53	36	$1,898	$193		$5,243	**$7,810**
150600110301270	Unit Costs---->	1475.68	PIPE06	18.868	991.05	100.63		2567.37	3824.35
CLDI Pipe, Class 53, Flg x Flg,20" dia, 10' Spool Piece	3.00 EA	$4,427	52.53	57	$2,973	$302		$7,702	**$11,473**
150600110301279	Unit Costs---->	2165.35	PIPE06	29.470	1547.94	157.17		3870.46	5765.43
CLDI Pipe, Class 53, Flg x Flg,20" dia, 19' Spool Piece	3.00 EA	$6,496	52.53	88	$4,644	$472		$11,611	**$17,296**
150600130402020	Unit Costs---->	1263.39	PIPE06	16.650	874.55	88.80		2226.74	3316.95
CLDI Fitting, Flanged, C110-SR, 45 Deg Elbow, 250psi, 20" Dia	3.00 EA	$3,790	52.53	50	$2,624	$266		$6,680	**$9,951**
150600130406206	Unit Costs---->	1872.79	PIPE06	19.150	1005.87	102.13		2980.79	4440.18
CLDI, Flanged, C110, Reducing Tee, 20" x 6" Dia	3.00 EA	$5,618	52.53	57	$3,018	$306		$8,942	**$13,321**
150600130410020	Unit Costs---->	969.83	PIPE05	8.330	440.32	20.82		1430.97	2131.58
CLDI Fitting, Flanged, C110, Blind Flange, 250psi, Flat, 20" Dia	3.00 EA	$2,910	52.86	25	$1,321	$62		$4,293	**$6,395**

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
28 H S Pumps & Bldg 1A,2A&3A MECHANICAL									
ARV Assembly	Unit Costs----> 3.00 EA						1000.00 $3,000	1000.00 $3,000	1489.60 **$4,469**
Subtotal		$233,480			$60,486	$14,786	$3,000	$311,751	
Markups using GC-MK		$114,312			$29,614	$7,239	$1,469		$152,633
TOTAL 15000 MECHANICAL	**1.00 LS** ***1.00 LS***	**$347,791**		**1,155**	**$90,100**	**$22,025**	**$4,469**	**$311,751**	**$464,385** ***$0.00***

CH2MHILL Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
29 H S Pumps & Bldg ,2B&3B CONCRETE									
New Building Space	Unit Costs----> 3,750.00 SF						220.00 $825,000	220.00 $825,000	327.71 **$1,228,919**
Subtotal Markups using GC-MK							$825,000 $403,919	$825,000	$403,919
TOTAL 03000 CONCRETE **1.00 LS** ***1.00 LS***							**$1,228,919**	**$825,000**	**$1,228,919** ***$0.00***

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
29 H S Pumps & Bldg ,2B&3B EQUIPMENT									
11200101120017 Vertical Turbine Pump, 15.2 MGD, 450TDH, 1500 HP Notes: *Max Efficiency 79, Motor Variable Speed, Suction 14", Discharge 12", Column 12", Can Dia 24", Min Base to Suction Bell 84" Johnson Pump Company Quote 3/2003*	Unit Costs----> 4.00 EA	200000.00 $800,000	EQUIP01 47.99	350.000 1,400	16796.12 $67,184	13358.33 $53,433		230154.45 $920,618	342837.92 **$1,371,352**
11200101120017 Vertical Turbine Pump, 13.5 MGD, 450TDH, 1250 HP Notes: *Max Efficiency 79, Motor Variable Speed, Suction 14", Discharge 12", Column 12", Can Dia 24", Min Base to Suction Bell 84" Johnson Pump Company Quote 3/2003*	Unit Costs----> 1.00 EA	150000.00 $150,000	EQUIP01 47.99	300.000 300	14396.67 $14,397	11450.00 $11,450		175846.67 $175,847	**$261,941**
Subtotal Markups using GC-MK		$950,000 $465,119			$81,581 $39,942	$64,883 $31,767		$1,096,464	$536,828
TOTAL 11000 EQUIPMENT **1.00 LS** ***1.00 LS***		**$1,415,119**		**1,700**	**$121,523**	**$96,650**		**$1,096,464**	**$1,633,293** ***$0.00***

CH2MHILL
Estimating Services

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ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

29 H S Pumps & Bldg ,2B&3B
MECHANICAL

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
151000210601020	Unit Costs---->	5328.00	PIPE06	13.660	717.50	72.85		6118.36	9113.90
Valves, Historical Costs, Check Valve V600, Flanged, 20" Dia	5.00 EA-	$26,640	52.53	68	$3,588	$364		$30,592	**$45,569**
151000210101020	Unit Costs---->	4680.00	PIPE06	21.150	1110.92	112.80		5903.72	8794.18
Valves, Historical Costs, Gate Valve V100, Flanged, 20" Dia	5.00 EA	$23,400	52.53	106	$5,555	$564		$29,519	**$43,971**
150600130406685	Unit Costs---->	21567.74	PIPE08	87.245	4559.35	1607.05		27734.14	41312.76
CLDI, Flanged, C110, Reducing Tee, 60" x 36" Dia	5.00 EA	$107,839	52.26	436	$22,797	$8,035		$138,671	**$206,564**
150600110301408	Unit Costs---->	13525.34	PIPE08	49.340	2578.47	908.84		17012.65	25342.03
CLDI Pipe, Class 53, Flg x Flg,60" dia, 8' Spool Piece	5.00 EA	$67,627	52.26	247	$12,892	$4,544		$85,063	**$126,710**
150600110301419	Unit Costs---->	18909.24	PIPE08	84.960	4439.94	1564.96		24914.14	37112.09
CLDI Pipe, Class 53, Flg x Flg,60" dia, 19' Spool Piece	5.00 EA	$94,546	52.26	425	$22,200	$7,825		$124,571	**$185,560**
150600130409364	Unit Costs---->	4106.40	PIPE06	14.280	750.07	76.16		4932.63	7347.65
CLDI, Flanged, C110, Reducer, 36" x 20" Dia	5.00 EA	$20,532	52.53	71	$3,750	$381		$24,663	**$36,738**
150600110301262	Unit Costs---->	912.16	PIPE06	9.769	513.12	52.10		1477.38	2200.71
CLDI Pipe, Class 53, Flg x Flg,20" dia, 2' Spool Piece	5.00 EA	$4,561	52.53	49	$2,566	$261		$7,387	**$11,004**
150600110301264	Unit Costs---->	1050.66	PIPE06	12.048	632.83	64.26		1747.75	2603.45
CLDI Pipe, Class 53, Flg x Flg,20" dia, 4' Spool Piece	5.00 EA	$5,253	52.53	60	$3,164	$321		$8,739	**$13,017**
150600110301270	Unit Costs---->	1475.68	PIPE06	18.868	991.05	100.63		2567.36	3824.34
CLDI Pipe, Class 53, Flg x Flg,20" dia, 10' Spool Piece	5.00 EA	$7,378	52.53	94	$4,955	$503		$12,837	**$19,122**
150600110301279	Unit Costs---->	2165.35	PIPE06	29.470	1547.94	157.17		3870.46	5765.43
CLDI Pipe, Class 53, Flg x Flg,20" dia, 19' Spool Piece	5.00 EA	$10,827	52.53	147	$7,740	$786		$19,352	**$28,827**
150600130402020	Unit Costs---->	1263.39	PIPE06	16.650	874.55	88.80		2226.74	3316.95
CLDI Fitting, Flanged, C110-SR, 45 Deg Elbow, 250psi, 20" Dia	5.00 EA	$6,317	52.53	83	$4,373	$444		$11,134	**$16,585**
150600130406206	Unit Costs---->	1872.79	PIPE06	19.150	1005.87	102.13		2980.79	4440.18
CLDI, Flanged, C110, Reducing Tee, 20" x 6" Dia	5.00 EA	$9,364	52.53	96	$5,029	$511		$14,904	**$22,201**
150600130410020	Unit Costs---->	969.83	PIPE05	8.330	440.32	20.83		1430.97	2131.58
CLDI Fitting, Flanged, C110, Blind Flange, 250psi, Flat, 20" Dia	5.00 EA	$4,849	52.86	42	$2,202	$104		$7,155	**$10,658**

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
29 H S Pumps & Bldg ,2B&3B MECHANICAL									
	Unit Costs---->						1000.00	1000.00	1489.60
ARV Assembly	5.00 EA						$5,000	$5,000	**$7,448**
Subtotal		$389,133			$100,810	$24,643	$5,000	$519,586	
Markups using GC-MK		$190,519			$49,356	$12,065	$2,448		$254,389
TOTAL 15000 MECHANICAL	**1.00 LS** / ***1.00 LS***	**$579,652**		**1,925**	**$150,166**	**$36,708**	**$7,448**	**$519,586**	**$773,974** / ***$0.00***

LWC 3021

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
30 Coag Aid Polymer Metering Pumps CONCRETE									
033100201010012 Concrete Metering Pump Fnds, Cast-in-Place, 4,000psi	Unit Costs---->) 1.00 CY	102.60 $103	CONC01 43.26	3.724 4	161.11 $161	39.47 $39		303.18 $303	**$452**
Subtotal Markups using GC-MK		$103 $50			$161 $79	$39 $19		$303	 $148
TOTAL 03000 CONCRETE **1.00 LS** ***1.00 LS***		**$153**		**4**	**$240**	**$59**		**$303**	**$452** ***$0.00***

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
30 Coag Aid Polymer Metering Pumps MECHANICAL									
112 Milton Roy Metering Pump, Type Simplex, 24 gal per hr	Unit Costs---->) 3.00 EA	5000.00 $15,000	PPEQ1 30.75	7.000 21	215.24 $646			5215.24 $15,646	7768.62 **$23,306**
Piping and Valves at Meterimng Pump	Unit Costs---->) 3.00 LS						4000.00 $12,000	4000.00 $12,000	5958.40 **$17,875**
Subtotal Markups using GC-MK		$15,000 $7,344			$646 $316		$12,000 $5,875	$27,646	 $13,535
TOTAL 15000 MECHANICAL **1.00 LS** ***1.00 LS***		**$22,344**		**21**	**$962**		**$17,875**	**$27,646**	**$41,181** ***$0.00***

LWC 3022

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
31 Coag Aid Polymer Storage CONCRETE									
033100201010012	Unit Costs---->	102.60	CONC01	3.724	161.11	39.47		303.18	
Concrete TankFnd, Cast-in-Place, 4,000psi	1.00 CY	$103	43.26	4	$161	$39		$303	**$452**
Subtotal		$103			$161	$39		$303	
Markups using GC-MK		$50			$79	$19			$148
TOTAL 03000 CONCRETE 1.00 LS *1.00 LS*		**$153**		**4**	**$240**	**$59**		**$303**	**$452** *$0.00*
31 Coag Aid Polymer Storage EQUIPMENT									
	Unit Costs---->	2500.00			400.00			2900.00	
1,000 Gal Storage Tank	1.00 EA	$2,500			$400			$2,900	**$4,320**
Subtotal		$2,500			$400			$2,900	
Markups using GC-MK		$1,224			$196				$1,420
TOTAL 11000 EQUIPMENT 1.00 LS *1.00 LS*		**$3,724**			**$596**			**$2,900**	**$4,320** *$0.00*
31 Coag Aid Polymer Storage MECHANICAL									
	Unit Costs---->						800.00	800.00	
Piping and Valves at Tank	1.00 LS						$800	$800	**$1,192**

LWC 3023

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

DESCRIPTION	QTY	UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
31 Coag Aid Polymer Storage										
MECHANICAL										
Subtotal								$800	$800	
Markups using GC-MK								$392		$392
TOTAL 15000 MECHANICAL								**$1,192**	**$800**	**$1,192**
	1.00	LS								
	1.00	*LS*								*$0.00*

CH2MHILL Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
32 Ammonia Metering Pumps CONCRETE									
033100201010012	Unit Costs---->	102.60	CONC01	3.724	161.11	39.47		303.18	
Concrete Metering Pump Fnds, Cast-in-Place, 4,000psi	1.00 CY	$103	43.26	4	$161	$39		$303	**$452**
Subtotal		$103			$161	$39		$303	
Markups using GC-MK		$50			$79	$19			$148
TOTAL 03000 CONCRETE		**$153**		**4**	**$240**	**$59**		**$303**	**$452**
1.00 LS									
1.00 LS									***$0.00***

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
32 Ammonia Metering Pumps MECHANICAL									
112	Unit Costs---->	5400.00	PPEQ1	7.000	215.24			5615.24	8364.46
Milton Roy Metering Pump, Type Simplex, 31 gal per hr	3.00 EA	$16,200	30.75	21	$646			$16,846	**$25,093**
	Unit Costs---->						4000.00	4000.00	5958.40
Piping and Valves at Meterimng Pump	3.00 LS						$12,000	$12,000	**$17,875**
Subtotal		$16,200			$646		$12,000	$28,846	
Markups using GC-MK		$7,932			$316		$5,875		$14,123
TOTAL 15000 MECHANICAL		**$24,132**		**21**	**$962**		**$17,875**	**$28,846**	**$42,969**
1.00 LS									
1.00 LS									***$0.00***

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
33 Fluoride Metering Pumps CONCRETE									
033100201010012	Unit Costs---->	102.60	CONC01	3.724	161.10	39.48		303.18	451.62
Concrete Metering Pump Fnds, Cast-in-Place, 4,000psi	0.50 CY	$51	43.26	2	$81	$20		$152	**$226**
Subtotal		$51			$81	$20		$152	
Markups using GC-MK		$25			$39	$10			$74
TOTAL 03000 CONCRETE		**$76**		**2**	**$120**	**$29**		**$152**	**$226**
	1.00 LS								
	1.00 LS								***$0.00***

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
33 Fluoride Metering Pumps MECHANICAL									
112	Unit Costs---->	5000.00	PPEQ1	7.000	215.24			5215.24	
Metering Pump, Type Simplex	1.00 EA	$5,000	30.75	7	$215			$5,215	**$7,769**
	Unit Costs---->						4000.00	4000.00	
Piping and Valves at Meterimng Pump	1.00 LS						$4,000	$4,000	**$5,958**
Subtotal		$5,000			$215		$4,000	$9,215	
Markups using GC-MK		$2,448			$105		$1,958		$4,512
TOTAL 15000 MECHANICAL		**$7,448**		**7**	**$321**		**$5,958**	**$9,215**	**$13,727**
	1.00 LS								
	1.00 LS								***$0.00***

LWC 3026

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
34 Carbon Dioxide Feed Panel EQUIPMENT									
	Unit Costs---->						10000.00	10000.00	
Carbon Dioxide Feed Panel	1.00 EA						$10,000	$10,000	**$14,896**
Subtotal							$10,000	$10,000	
Markups using GC-MK							$4,896		$4,896
TOTAL 11000 EQUIPMENT							**$14,896**	**$10,000**	**$14,896**
1.00 LS									
1.00 LS									***$0.00***

LWC 3027

CH2MHILL Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
35 Convert CL Sys to Liquid Extraction CONCRETE									
Expand Existing Chlorine Storage Room by 250 SF	Unit Costs----> 250.00 SF						200.00 $50,000	200.00 $50,000	297.92 **$74,480**
Subtotal							$50,000	$50,000	
Markups using GC-MK							$24,480		$24,480
TOTAL 03000 CONCRETE **1.00 LS** ***1.00 LS***							**$74,480**	**$50,000**	**$74,480** ***$0.00***
35 Convert CL Sys to Liquid Extraction EQUIPMENT									
2 Evporators @ 2,800 lbs/day ea, Replace three Chorinators with 2,800 ppd	Unit Costs----> 1.00 LS						20000.00 $20,000	20000.00 $20,000	**$29,792**
Subtotal							$20,000	$20,000	
Markups using GC-MK							$9,792		$9,792
TOTAL 11000 EQUIPMENT **1.00 LS** ***1.00 LS***							**$29,792**	**$20,000**	**$29,792** ***$0.00***

LWC 3028

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
36 Ferric Chloride Metering Pumps CONCRETE									
033100201010012	Unit Costs---->	102.60	CONC01	3.724	161.11	39.47		303.18	
Concrete Metering Pump Fnds, Cast-in-Place, 4,000psi	1.00 CY	$103	43.26	4	$161	$39		$303	**$452**
Subtotal		$103			$161	$39		$303	
Markups using GC-MK		$50			$79	$19			$148
TOTAL 03000 CONCRETE		**$153**		**4**	**$240**	**$59**		**$303**	**$452**
1.00 LS									
1.00 LS									***$0.00***
36 Ferric Chloride Metering Pumps MECHANICAL									
112	Unit Costs---->	12500.00	PPEQ1	16.000	491.98			12991.98	19352.84
Milton Roy Metering Pump, Type Simplex, 24 gal per hr	2.00 EA	$25,000	30.75	32	$984			$25,984	**$38,706**
	Unit Costs---->						5000.00	5000.00	7448.00
Piping and Valves at Meterimng Pump	2.00 LS						$10,000	$10,000	**$14,896**
Subtotal		$25,000			$984		$10,000	$35,984	
Markups using GC-MK		$12,240			$482		$4,896		$17,618
TOTAL 15000 MECHANICAL		**$37,240**		**32**	**$1,466**		**$14,896**	**$35,984**	**$53,602**
1.00 LS									
1.00 LS									***$0.00***

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
37 Ferric Chloride Storage CONCRETE									
033100201010012	Unit Costs---->	102.60	CONC01	3.724	161.11	39.48		303.19	451.63
Concrete Tank Fnds, Cast-in-Place, 4,000psi	6.00 CY	$616	43.26	22	$967	$237		$1,819	**$2,710**
033100201010012	Unit Costs---->	102.59	CONC01	3.724	161.09	39.47		303.15	451.57
Concrete Slab on Grade, Cast-in-Place, 4,000psi, 12" Thick	26.67 CY	$2,736	43.26	99	$4,296	$1,053		$8,085	**$12,043**
033100202030012	Unit Costs---->	162.79	CONC04	5.554	239.37	44.08		446.24	664.72
Concrete Walls, Straigt, Cast-in-Place, 4,000psi, 12" Thick	9.00 CY	$1,465	43.10	50	$2,154	$397		$4,016	**$5,983**
Subtotal		$4,817			$7,417	$1,686		$13,920	
Markups using GC-MK		$2,358			$3,631	$826			$6,815
TOTAL 03000 CONCRETE		**$7,175**		**172**	**$11,049**	**$2,512**		**$13,920**	**$20,736**
1.00 LS									
1.00 LS									***$0.00***
37 Ferric Chloride Storage EQUIPMENT									
	Unit Costs---->	32500.00			3400.00			35900.00	53476.62
12,000 Gal Storage Tank	3.00 EA	$97,500			$10,200			$107,700	**$160,430**
Subtotal		$97,500			$10,200			$107,700	
Markups using GC-MK		$47,736			$4,994				$52,730
TOTAL 11000 EQUIPMENT		**$145,236**			**$15,194**			**$107,700**	**$160,430**
1.00 LS									
1.00 LS									***$0.00***

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: BE Paynes WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A1

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 12/12/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
37 Ferric Chloride Storage MECHANICAL									
	Unit Costs---->						2000.00	2000.00	2979.20
Piping and Valves at Tank	3.00 LS						$6,000	$6,000	**$8,938**
Subtotal							$6,000	$6,000	
Markups using GC-MK							$2,938		$2,938
TOTAL 15000 MECHANICAL							**$8,938**	**$6,000**	**$8,938**
	1.00 LS								
	1.00 LS								***$0.00***

LWC 3031

Appendix D
CHWTP Construction Cost Estimates

CH2MHILL
Estimating Services

ESTIMATE MATRIX SUMMARY Ver 3.9

PROJECT:	Cresent Hill WTP Modifications	PROJECT No.:	346133.01.A!
CLIENT NAME:	Louisville Water Co.	CONTRACT No.:	
LOCATION:	Louisville, KY	ESTIMATE No.:	
DESIGN STAGE:	Conceptual	BID DATE:	
PROJECT MGR:	Jerry Anderson/ LOU	CCI INDEX:	10/9/06 - 7882.53
ESTIMATOR:	D. Jones / GNV	REV No.:	Rev. 1 10/9/06
CHECKED BY:		TEMPLATE No.:	4.1

#	FACILITIES %'s	01000 GENERAL	02000 SITEWORK	03000 CONCRETE	04000 MASONRY	05000 METALS	06000 WOOD	07000 MOISTURE	08000 DOORS	09000 FINISHES	10000 SPECIALS	11000 EQUIP	12000 FURNISH	13000 I &C	14000 CONVEY	15000 MECH	16000 ELECT	TOTAL
01	Softening Basin Weirs Opt 1	3.00% $18,169				$560,932				$26,522								$605,622
02	Softening Basin Weirs Opt 2A	3.00% $25,955		$239,494		$560,932				$38,798								$865,179
03	Softening Basin Weirs Opt 2B	3.00% $25,955		$239,494		$560,932				$38,798								$865,179
04	Reaction Basin Weirs Opt 1 & 2B	3.00% $10,590				$326,847				$15,571								$353,008
05	Reaction Basin Weirs Opt 2A	3.00% $22,864		$139,556		$560,932				$38,798								$762,149
06	Softening Basin 1 Sluice Gate	3.00% $1,446		$2,221								$44,544						$48,211
07	Slow Mix Basin Conc Cap	3.00% $7,657		$234,930						$12,638								$255,225
08	Low Pressure 60" PCCP	3.00% $109,306	$3,524,690	$9,533														$3,643,529
09	60" CLDI Pipe	3.00% $11,930	$385,728															$397,657
10	Basins Tube Settlers Opt1	3.00% $205,127										$6,632,430						$6,837,557
11	Basins Tube Settlers Opt 2A & 2B	3.00% $234,431										$7,579,920						$7,814,351
12	Clear Well Expan. Opt 1	3.00% $386,989		$*,***,***														$12,899,623
13	Clear Well Expan. Opt 2A & 2B	3.00% $608,125		$*,***,***														$20,270,836

Report Date:
10/10/2006 16:56:28

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CH2MHILL
Estimating Services

ESTIMATE MATRIX SUMMARY Ver 3.9

PROJECT:	Cresent Hill WTP Modifications	PROJECT No.:	346133.01.A!
CLIENT NAME:	Louisville Water Co.	CONTRACT No.:	
LOCATION:	Louisville, KY	ESTIMATE No.:	
DESIGN STAGE:	Conceptual	BID DATE:	
PROJECT MGR:	Jerry Anderson/ LOU	CCI INDEX:	10/9/06 - 7882.53
ESTIMATOR:	D. Jones / GNV	REV No.:	Rev. 1 10/9/06
CHECKED BY:		TEMPLATE No.:	4.1

#	FACILITIES	%'s	01000 GENERAL	02000 SITEWORK	03000 CONCRETE	04000 MASONRY	05000 METALS	06000 WOOD	07000 MOISTURE	08000 DOORS	09000 FINISHES	10000 SPECIALS	11000 EQUIP	12000 FURNISH	13000 I &C	14000 CONVEY	15000 MECH	16000 ELECT	TOTAL
			3.00%												5.00%			12.00%	
14	High Service Pump Opt 1		$100,353	$819,945	$248,763	$214,502							$835,731		$167,255		$557,137	$401,412	$3,345,098
	TOTAL		$1,768,897	$4,730,363	$33,289,337	$214,502	$2,570,574	$0	$0	$0	$171,123	$0	$15,092,626	$0	$167,255	$0	$557,137	$401,412	**$58,963,225**
	PERCENT OF TOTAL		3.00%	8.02%	56.46%	0.36%	4.36%	0.00%	0.00%	0.00%	0.29%	0.00%	25.60%	0.00%	0.28%	0.00%	0.94%	0.68%	

PROJECT PARAMETER PRICING

Project Size	--------------->	1.00	LS
Cost Per LS	--------------->	$58,963,225	$/LS

Project Notes: The cost estimates have been prepared for guidance in project evaluation and implementation from the information available at the time of the estimate. The final cost of the project will depend upon the actual labor and material costs, competitive market conditions, final project costs, implementation schedule and other variable factors. As a result, the final project costs will vary from the estimates presented herein. Because of this, project feasibility and funding needs must be carefully reviewed prior to making specific financial decisions to help ensure proper project evaluation and adequate funding. A contingency has been included for a provision of unforeseeable elements of cost, within the defined project scope.

CH2MHILL
Estimating Services

CH2MHILL MARKUPS REPORT No. 1 - Ver 3.9

PROJECT: Cresent Hill WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A!

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 10/9/06

MARKUPS SETS USED

MARKUP RESOURCE	DESCRIPTION	MARKUP COMPONENT ITEM	PERCENT	TO-MAT'L	TO-LABOR	TO-EQUIP	TO-INSTALL S/C
GC-MK	CH2M HILL Standard Markup Set	Success PWS Branch assigned to: CH2M Hill National Average Template					
		1. Overhead	10.00%	Yes	Yes	Yes	Yes
		2. Profit	5.00%	Yes	Yes	Yes	Yes
		3. Mob/ Demob	3.00%	Yes	Yes	Yes	Yes
		4. Preformance Bond	1.20%	Yes	Yes	Yes	Yes
		5. Insurance	1.50%	Yes	Yes	Yes	Yes
		6. Contingency	15.00%	Yes	Yes	Yes	Yes
		7. Escalation	6.00%	Yes	Yes	Yes	Yes

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: Cresent Hill WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A!

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 10/9/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	CREW MH	CREW LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
01 Softening Basin Weirs Opt 1 METALS									
	Unit Costs---->		E3	0.080	4.91	0.30		5.21	7.76
Demo Existing Weirs and Lintels	4,632.00 LF		61.41	371	$22,756	$1,377		$24,134	**$35,949**
	Unit Costs---->	3.10	E3	0.030	1.84	0.11		5.05	7.53
Instal New 4 x 4 x 3/8" Angle Stainless Steel	45,393.60 LB	$140,720	61.41	1,362	$83,630	$5,061		$229,411	**$341,731**
	Unit Costs---->	22.00	E3	0.070	4.30	0.26		26.56	39.56
FRP V Notch Weir	4,632.00 LF	$101,904	61.41	324	$19,912	$1,205		$123,021	**$183,252**
Subtotal		$242,624			$126,298	$7,644		$376,566	
Markups using GC-MK		$118,789			$61,835	$3,742			$184,366
TOTAL 05000 METALS		**$361,413**		**2,057**	**$188,133**	**$11,386**		**$376,566**	**$560,932**
1.00 LS									
1.00 LS									***$0.00***
01 Softening Basin Weirs Opt 1 FINISHES									
039206000150	Unit Costs---->	2.10	CEFI	0.030	1.27			3.37	5.02
Patching concrete at Weir , small area, epoxy grout	4,632.00 LF	$9,727	42.43	139	$5,896			$15,624	**$23,273**
	Unit Costs---->						1.50	1.50	2.23
Coating Concrete At Weir	1,454.00 SF						$2,181	$2,181	**$3,249**
Subtotal		$9,727			$5,896		$2,181	$17,805	
Markups using GC-MK		$4,762			$2,887		$1,068		$8,717
TOTAL 09000 FINISHES		**$14,490**		**139**	**$8,783**		**$3,249**	**$17,805**	**$26,522**
1.00 LS									
1.00 LS									***$0.00***

LWC 3036

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: Cresent Hill WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A!

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 10/9/06

02 Softening Basin Weirs Opt 2A — CONCRETE

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
050903400400	Unit Costs---->	0.16	CARP	0.167	7.83			7.99	11.90
Drilling, layout,, 4" deep, 5/8" dia, conc, for Dowels	6,948.00 Ea.	$1,112	46.87	1,160	$54,387			$55,499	**$82,671**
090601200700	Unit Costs---->		A1A	0.036	1.70	1.40		3.11	4.63
Concrete, scarify skin	3,103.44 S.F.		47.32	112	$5,287	$4,352		$9,639	**$14,358**
033100203050812	Unit Costs---->	288.53	CONC06	24.743	1069.65	528.58		1886.76	2810.52
Concrete Cap Cast-in-Place, 4,000psi, 8" Wide x 5" Deep	50.69 CY	$14,625	43.23	1,254	$54,221	$26,794		$95,640	**$142,465**
Subtotal		$15,737			$113,895	$31,146		$160,778	
Markups using GC-MK		$7,705			$55,763	$15,249			$78,717
TOTAL 03000 CONCRETE		**$23,442**		**2,526**	**$169,658**	**$46,394**		**$160,778**	**$239,494**
1.00 LS									
1.00 LS									***$0.00***

02 Softening Basin Weirs Opt 2A — METALS

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
	Unit Costs---->		E3	0.080	4.91	0.30		5.21	7.76
Demo Existing Weirs and Lintels	4,632.00 LF		61.41	371	$22,756	$1,377		$24,134	**$35,949**
	Unit Costs---->	3.10	E3	0.030	1.84	0.11		5.05	7.53
Instal New 4 x 4 x 3/8" Angle Stainless Steel	45,393.60 LB	$140,720	61.41	1,362	$83,630	$5,061		$229,411	**$341,731**
	Unit Costs---->	22.00	E3	0.070	4.30	0.26		26.56	39.56
FRP V Notch Weir	4,632.00 LF	$101,904	61.41	324	$19,912	$1,205		$123,021	**$183,252**
Subtotal		$242,624			$126,298	$7,644		$376,566	
Markups using GC-MK		$118,789			$61,835	$3,742			$184,366
TOTAL 05000 METALS		**$361,413**		**2,057**	**$188,133**	**$11,386**		**$376,566**	**$560,932**
1.00 LS									
1.00 LS									***$0.00***

CH2MHILL Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: Cresent Hill WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A!

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 10/9/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
02 Softening Basin Weirs Opt 2A FINISHES									
039206000150	Unit Costs---->	2.10	CEFI	0.030	1.27			3.37	5.02
Patching concrete at Weir , small area, epoxy grout	4,632.00 LF	$9,727	42.43	139	$5,896			$15,624	**$23,273**
	Unit Costs---->						1.50	1.50	2.23
Coating, Concrete Cap	6,948.00 SF						$10,422	$10,422	**$15,525**
Subtotal		$9,727			$5,896		$10,422	$26,046	
Markups using GC-MK		$4,762			$2,887		$5,103		$12,752
TOTAL 09000 FINISHES		**$14,490**		**139**	**$8,783**		**$15,525**	**$26,046**	**$38,798**
	1.00 LS								
	1.00 LS								***$0.00***

LWC 3038

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: Cresent Hill WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A!

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 10/9/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
03 Softening Basin Weirs Opt 2B CONCRETE									
050903400400	Unit Costs---->	0.16	CARP	0.167	7.83			7.99	11.90
Drilling, layout,, 4" deep, 5/8" dia, conc, for Dowels	6,948.00 Ea.	$1,112	46.87	1,160	$54,387			$55,499	**$82,671**
090601200700	Unit Costs---->		A1A	0.036	1.70	1.40		3.11	4.63
Concrete, scarify skin	3,103.44 S.F.		47.32	112	$5,287	$4,352		$9,639	**$14,358**
033100203050812	Unit Costs---->	288.53	CONC06	24.743	1069.65	528.58		1886.76	2810.52
Concrete Cap Cast-in-Place, 4,000psi, 8" Wide x 5" Deep	50.69 CY	$14,625	43.23	1,254	$54,221	$26,794		$95,640	**$142,465**
Subtotal		$15,737			$113,895	$31,146		$160,778	
Markups using GC-MK		$7,705			$55,763	$15,249			$78,717
TOTAL 03000 CONCRETE		**$23,442**		**2,526**	**$169,658**	**$46,394**		**$160,778**	**$239,494**
1.00 LS									
1.00 LS									***$0.00***

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
03 Softening Basin Weirs Opt 2B METALS									
	Unit Costs---->		E3	0.080	4.91	0.30		5.21	7.76
Demo Existing Weirs and Lintels	4,632.00 LF		61.41	371	$22,756	$1,377		$24,134	**$35,949**
	Unit Costs---->	3.10	E3	0.030	1.84	0.11		5.05	7.53
Instal New 4 x 4 x 3/8" Angle Stainless Steel	45,393.60 LB	$140,720	61.41	1,362	$83,630	$5,061		$229,411	**$341,731**
	Unit Costs---->	22.00	E3	0.070	4.30	0.26		26.56	39.56
FRP V Notch Weir	4,632.00 LF	$101,904	61.41	324	$19,912	$1,205		$123,021	**$183,252**
Subtotal		$242,624			$126,298	$7,644		$376,566	
Markups using GC-MK		$118,789			$61,835	$3,742			$184,366
TOTAL 05000 METALS		**$361,413**		**2,057**	**$188,133**	**$11,386**		**$376,566**	**$560,932**
1.00 LS									
1.00 LS									***$0.00***

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: Cresent Hill WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A!

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 10/9/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
03 Softening Basin Weirs Opt 2B FINISHES									
039206000150	Unit Costs---->	2.10	CEFI	0.030	1.27			3.37	5.02
Patching concrete at Weir , small area, epoxy grout	4,632.00 LF	$9,727	42.43	139	$5,896			$15,624	**$23,273**
	Unit Costs---->						1.50	1.50	2.23
Coating, Concrete Cap	6,948.00 SF						$10,422	$10,422	**$15,525**
Subtotal		$9,727			$5,896		$10,422	$26,046	
Markups using GC-MK		$4,762			$2,887		$5,103		$12,752
TOTAL 09000 FINISHES **1.00 LS** ***1.00 LS***		**$14,490**		**139**	**$8,783**		**$15,525**	**$26,046**	**$38,798** ***$0.00***

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: Cresent Hill WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A!

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 10/9/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	CREW MH	CREW LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
04 Reaction Basin Weirs Opt 1 & 2B METALS									
	Unit Costs---->		E3	0.080	4.91	0.30		5.21	7.76
Demo Existing Weirs and Lintels	2,699.00 LF		61.41	216	$13,260	$803		$14,062	**$20,947**
	Unit Costs---->	3.10	E3	0.030	1.84	0.11		5.05	7.53
Instal New 4 x 4 x 3/8" Angle Stainless Steel	26,450.20 LB	$81,996	61.41	794	$48,730	$2,949		$133,675	**$199,121**
	Unit Costs---->	22.00	E3	0.070	4.30	0.26		26.56	39.56
FRP V Notch Weir	2,699.00 LF	$59,378	61.41	189	$11,602	$702		$71,683	**$106,778**
Subtotal		$141,374			$73,592	$4,454		$219,419	
Markups using GC-MK		$69,216			$36,031	$2,181			$107,428
TOTAL 05000 METALS		**$210,590**		**1,198**	**$109,622**	**$6,635**		**$219,419**	**$326,847**
1.00 LS									
1.00 LS									***$0.00***

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	CREW MH	CREW LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
04 Reaction Basin Weirs Opt 1 & 2B FINISHES									
039206000150	Unit Costs---->	2.10	CEFI	0.030	1.27			3.37	5.02
Patching concrete at Weir , small area, epoxy grout	2,699.00 LF	$5,668	42.43	81	$3,436			$9,104	**$13,561**
	Unit Costs---->						1.50	1.50	2.23
Coating Concrete At Weir	899.67 SF						$1,350	$1,350	**$2,010**
Subtotal		$5,668			$3,436		$1,350	$10,453	
Markups using GC-MK		$2,775			$1,682		$661		$5,118
TOTAL 09000 FINISHES		**$8,443**		**81**	**$5,118**		**$2,010**	**$10,453**	**$15,571**
1.00 LS									
1.00 LS									***$0.00***

LWC 3041

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: Cresent Hill WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A!

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 10/9/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
05 Reaction Basin Weirs Opt 2A CONCRETE									
050903400400	Unit Costs---->	0.16	CARP	0.167	7.83			7.99	11.90
Drilling, layout,, 4" deep, 5/8" dia, conc, for Dowels	4,049.00 Ea.	$648	46.87	676	$31,695			$32,342	**$48,177**
090601200700	Unit Costs---->		A1A	0.036	1.70	1.40		3.11	4.63
Concrete, scarify skin	1,808.33 S.F.		47.32	65	$3,081	$2,536		$5,616	**$8,366**
033100203050812	Unit Costs---->	288.49	CONC06	24.740	1069.52	528.52		1886.53	2810.17
Concrete Cap Cast-in-Place, 4,000psi, 8" Wide x 5" Deep	29.54 CY	$8,522	43.23	731	$31,594	$15,612		$55,728	**$83,013**
Subtotal		$9,170			$66,369	$18,148		$93,687	
Markups using GC-MK		$4,490			$32,494	$8,885			$45,869
TOTAL 03000 CONCRETE		**$13,659**		**1,472**	**$98,863**	**$27,033**		**$93,687**	**$139,556**
1.00 LS									
1.00 LS									***$0.00***
05 Reaction Basin Weirs Opt 2A METALS									
	Unit Costs---->		E3	0.080	4.91	0.30		5.21	7.76
Demo Existing Weirs and Lintels	4,632.00 LF		61.41	371	$22,756	$1,377		$24,134	**$35,949**
	Unit Costs---->	3.10	E3	0.030	1.84	0.11		5.05	7.53
Instal New 4 x 4 x 3/8" Angle Stainless Steel	45,393.60 LB	$140,720	61.41	1,362	$83,630	$5,061		$229,411	**$341,731**
	Unit Costs---->	22.00	E3	0.070	4.30	0.26		26.56	39.56
FRP V Notch Weir	4,632.00 LF	$101,904	61.41	324	$19,912	$1,205		$123,021	**$183,252**
Subtotal		$242,624			$126,298	$7,644		$376,566	
Markups using GC-MK		$118,789			$61,835	$3,742			$184,366
TOTAL 05000 METALS		**$361,413**		**2,057**	**$188,133**	**$11,386**		**$376,566**	**$560,932**
1.00 LS									
1.00 LS									***$0.00***

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: Cresent Hill WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A!

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 10/9/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
05 Reaction Basin Weirs Opt 2A FINISHES									
039206000150	Unit Costs---->	2.10	CEFI	0.030	1.27			3.37	5.02
Patching concrete at Weir , small area, epoxy grout	4,632.00 LF	$9,727	42.43	139	$5,896			$15,624	**$23,273**
	Unit Costs---->						1.50	1.50	2.23
Coating, Concrete Cap	6,948.00 SF						$10,422	$10,422	**$15,525**
Subtotal		$9,727			$5,896		$10,422	$26,046	
Markups using GC-MK		$4,762			$2,887		$5,103		$12,752
TOTAL 09000 FINISHES		**$14,490**		**139**	**$8,783**		**$15,525**	**$26,046**	**$38,798**
1.00 LS									
1.00 LS									***$0.00***

LWC 3043

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: Cresent Hill WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A!

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 10/9/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
06 Softening Basin 1 Sluice Gate CONCRETE									
022203600820	Unit Costs---->	0.47	B89B	0.210	8.31	6.09		14.87	22.15
Saw cutting, concrete walls, rod reinforcing, 2"inch of depth	40.00 L.F.	$19	39.55	8	$332	$244		$595	**$886**
022203101450	Unit Costs---->		B9C	0.571	20.86	2.10		22.96	34.20
Cutout demo, conc walls, bar reinf	29.25 C.F.		36.53	17	$610	$61		$672	**$1,000**
039206000150	Unit Costs---->	6.20	CEFI	0.080	3.39			9.59	14.29
Patching conc 1/4" thick, small area, epoxy grout	23.40 S.F.	$145	42.43	2	$79			$225	**$334**
Subtotal		$164			$1,022	$305		$1,491	
Markups using GC-MK		$80			$500	$149			$730
TOTAL 03000 CONCRETE	**1.00 LS**	**$244**		**27**	**$1,522**	**$455**		**$1,491**	**$2,221**
	1.00 LS								***$0.00***

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
06 Softening Basin 1 Sluice Gate EQUIPMENT									
112852800206060	Unit Costs---->	23299.66	L5	95.600	5649.29	954.63		29903.58	
Sluice Gate, Cast-Iron, 304 SST Stem, 12" Wall Thimble, 60" x 60" w/Elect Oper	1.00 EA	$23,300	59.09	96	$5,649	$955		$29,904	**$44,544**
Subtotal		$23,300			$5,649	$955		$29,904	
Markups using GC-MK		$11,407			$2,766	$467			$14,641
TOTAL 11000 EQUIPMENT	**1.00 LS**	**$34,707**		**96**	**$8,415**	**$1,422**		**$29,904**	**$44,544**
	1.00 LS								***$0.00***

LWC 3044

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: Cresent Hill WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A!

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 10/9/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
07 Slow Mix Basin Conc Cap CONCRETE									
050903400400	Unit Costs---->	0.16	CARP	0.167	7.83			7.99	11.90
Drilling, layout,, 4" deep, 5/8" dia, conc, for Dowels	5,656.00 Ea.	$905	46.87	945	$44,274			$45,179	**$67,298**
090601200700	Unit Costs---->		A1A	0.036	1.70	1.40		3.11	4.63
Concrete, scarify skin	2,828.00 S.F.		47.32	102	$4,818	$3,965		$8,783	**$13,083**
033100203050812	Unit Costs---->	288.52	CONC06	24.742	1069.64	528.58		1886.74	2810.49
Concrete Cap Cast-in-Place, 4,000psi, 8" Wide x 5" Deep	54.99 CY	$15,866	43.23	1,361	$58,820	$29,066		$103,752	**$154,549**
Subtotal		$16,771			$107,911	$33,032		$157,714	
Markups using GC-MK		$8,211			$52,833	$16,172			$77,217
TOTAL 03000 CONCRETE	**1.00 LS**	**$24,982**		**2,407**	**$160,744**	**$49,204**		**$157,714**	**$234,930**
	1.00 LS								***$0.00***

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
07 Slow Mix Basin Conc Cap FINISHES									
	Unit Costs---->						1.50	1.50	2.23
Coating, Concrete Cap	5,656.00 SF						$8,484	$8,484	**$12,638**
Subtotal							$8,484	$8,484	
Markups using GC-MK							$4,154		$4,154
TOTAL 09000 FINISHES	**1.00 LS**						**$12,638**	**$8,484**	**$12,638**
	1.00 LS								***$0.00***

CH2MHILL Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: Cresent Hill WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A!

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 10/9/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
08 Low Pressure 60" PCCP SITEWORK									
	Unit Costs---->						1000.00	1000.00	1489.60
60" Dia PCCP lincluding Restraints, Excavation and Backfill	2,150.00 LF						$2,150,000	$2,150,000	**$3,202,639**
	Unit Costs---->						11600.00	11600.00	17279.35
60" Dia PCCP 90 Deg Ell lincluding Restraints, Excavation and Backfill	7.00 EA						$81,200	$81,200	**$120,955**
	Unit Costs---->						135000.00	135000.00	
60" Gate Valve with Actuator Including, Vault, Excavation and Backfill	1.00 EA						$135,000	$135,000	**$201,096**
Subtotal							$2,366,200	$2,366,200	
Markups using GC-MK							$1,158,490		$1,158,490
TOTAL 02000 SITEWORK	**1.00 LS**						**$3,524,690**	**$2,366,200**	**$3,524,690**
	1.00 LS								***$0.00***

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
08 Low Pressure 60" PCCP CONCRETE									
	Unit Costs---->						1600.00	1600.00	2383.36
Wall Penetrations for 60" Dia Pipe Including Patching	4.00 EA						$6,400	$6,400	**$9,533**
Subtotal							$6,400	$6,400	
Markups using GC-MK							$3,133		$3,133
TOTAL 03000 CONCRETE	**1.00 LS**						**$9,533**	**$6,400**	**$9,533**
	1.00 LS								***$0.00***

LWC 3046

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: Cresent Hill WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A!

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 10/9/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
0200060" CLDI Pipe SITEWORK 60" RJDIP Water Main									
023154162200	Unit Costs---->	5.92	B47	1.091	42.86	49.37		98.15	146.20
Drilling & blasting, trenches, up to 1500 CY	192.62 CY	$1,140	39.28	210	$8,255	$9,510		$18,905	**$28,161**
023154626130	Unit Costs---->		HVCW3	0.123	5.12	15.55		20.68	30.80
Excavating, Up to 20' Deep 3-1/2 CY Hyd Cat 345 Excavator Clay, Hard Pan, Rock	192.62 CY		41.66	24	$987	$2,996		$3,983	**$5,932**
022405001000A	Unit Costs---->		B10I	0.126	5.34	0.87		6.21	9.25
Sock Dewatering	30.00 LF		42.34	4	$160	$26		$186	**$277**
023159013010210	Unit Costs---->	17.10	B6	1.735	67.02	12.54		96.66	143.98
Bedding, crushed stone 3/4" to 1/2"	22.01 CY	$376	38.62	38	$1,475	$276		$2,127	**$3,169**
023152005000	Unit Costs---->	4.51	B6	1.736	67.02	12.54		84.07	125.23
Backfill, select granular fill, shovel, 1 CY bucket	27.22 CY	$123	38.62	47	$1,824	$341		$2,288	**$3,409**
023159003020	Unit Costs---->		B10R	0.067	2.83	1.08		3.91	5.82
Backfill trench, Common Earth, FE loader, whl mtd, 1 CY bkt, min haul	143.39 CY		42.35	10	$405	$155		$560	**$835**
023153108200	Unit Costs---->		A1F	0.041	1.49	0.19		1.68	2.51
Compaction, rammer tamper, 8" lifts, 2 passes Notes: *Assume 15% Swell*	192.62 CY		36.13	8	$288	$37		$324	**$483**
022257303080	Unit Costs---->		B17	0.145	5.54	2.51		8.05	11.99
Haul Excess, loading & trucking, machine load truck Notes: *Assume 15% Swell*	56.62 CY		38.08	8	$314	$142		$456	**$679**
150600110503060	Unit Costs---->	381.07	PIPE04	0.602	30.33	13.83		425.24	633.43
CLDI, Lok-Ring Joint Pipe, CL-250, 60" Dia	30.00 LF	$11,432	50.42	18	$910	$415		$12,757	**$19,003**
150000000000060	Unit Costs---->						11.25	11.25	16.76
Bag Pipe & Tape Joints	30.00 LF						$338	$338	**$503**
020807900500	Unit Costs---->	6.20	LABR	0.057	1.00			7.20	10.74
Underground Marking Tape, Detectable	0.30 CLF	$2	17.65					$2	**$3**
023705501000	Unit Costs---->	0.29	CLAB	0.010	0.36			0.65	0.97
Erosion control, silt fence, polypropylene, 3' high, ideal conditions	30.00 LF	$9	36.13		$11			$20	**$29**
Subtotal		$13,082			$14,629	$13,898	$338	$41,947	
Markups using GC-MK		$6,405			$7,162	$6,805	$165		$20,537
TOTAL 16 60" RJDIP Water Main *1.00 LS*		**$19,487**		**367**	**$21,792**	**$20,703**	**$503**	**$41,947**	**$62,484** *$0.00*

LWC 3047

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: Cresent Hill WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A!

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 10/9/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
0200060" CLDI Pipe SITEWORK 60" Fittings and Gate Valve									
150600130610401	Unit Costs---->	13733.78	PIPE04	18.998	957.83	436.76		15128.37	22535.21
60" CLDI 90 Deg Elbow, Lock Ring Joint, C153	3.00 EA	$41,201	50.42	57	$2,873	$1,310		$45,385	**$67,606**
150600140102060	Unit Costs---->	4289.92	PIPE01	31.600	1589.26	223.37		6102.55	9090.36
60" Meg-a-Lug Series 1100 Kit For DIP	6.00 EA	$25,739	50.29	190	$9,536	$1,340		$36,615	**$54,542**
	Unit Costs---->						135000.00	135000.00	
60" Gate Valve with Actuator Including, Vault, Excavation and Backfill	1.00 EA						$135,000	$135,000	**$201,096**
Subtotal		$66,941			$12,409	$2,651	$135,000	$217,000	
Markups using GC-MK		$32,774			$6,075	$1,298	$66,096		$106,243
TOTAL 60" Fittings and Gate Valve *1.00 LS*		**$99,715**		**247**	**$18,485**	**$3,948**	**$201,096**	**$217,000**	**$323,244** *$0.00*

LWC 3048

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: Cresent Hill WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A!

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 10/9/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
10 Basins Tube Settlers Opt1 EQUIPMENT									
Instl 4' Deep Tube Settlers with Integral Weir and Launders	Unit Costs----> 48,608.00 SF						91.60 $4,452,493	91.60 $4,452,493	136.45 **$6,632,430**
Subtotal							$4,452,493	$4,452,493	
Markups using GC-MK							$2,179,938		$2,179,938
TOTAL 11000 EQUIPMENT	**1.00 LS** *1.00 LS*						**$6,632,430**	**$4,452,493**	**$6,632,430** *$0.00*

LWC 3049

CH2MHILL Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: Cresent Hill WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A!

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 10/9/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
11 Basins Tube Settlers Opt 2A & 2B EQUIPMENT									
	Unit Costs---->						91.60	91.60	136.45
Instl 4' Deep Tube Settlers with Integral Weir and Launders	55,552.00 SF						$5,088,563	$5,088,563	**$7,579,920**
Subtotal							$5,088,563	$5,088,563	
Markups using GC-MK							$2,491,357		$2,491,357
TOTAL 11000 EQUIPMENT							**$7,579,920**	**$5,088,563**	**$7,579,920**
	1.00 LS								
	1.00 LS								***$0.00***

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: Cresent Hill WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A!

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 10/9/06

DESCRIPTION	QTY	UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
12 Clear Well Expan. Opt 1 CONCRETE										
Unit Costs---->								1200000.00	1200000.00	1787519.20
Clearwell Expansion 7 MG	7.00	MG						$8,400,000	$8,400,000	**$12,512,634**
Subtotal								$8,400,000	$8,400,000	
Markups using GC-MK								$4,112,634		$4,112,634
TOTAL 03000 CONCRETE								**$12,512,634**	**$8,400,000**	**$12,512,634**
	1.00	**LS**								
	1.00	***LS***								***$0.00***

LWC 3051

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: Cresent Hill WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A!

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 10/9/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
13 Clear Well Expan. Opt 2A & 2B CONCRETE									
	Unit Costs---->						1200000.00	1200000.00	1787519.20
Clearwell Expansion 11 MG	11.00 MG						$*,***,***	$*,***,***	**$19,662,711**
Subtotal							$13,200,000	$13,200,000	
Markups using GC-MK							$6,462,711		$6,462,711
TOTAL 03000 CONCRETE	**1.00 LS**						**$19,662,711**	**$13,200,000**	**$19,662,711**
	1.00 LS								***$0.00***

LWC 3052

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: Cresent Hill WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A!

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 10/9/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
02000High Service Pump Opt 1 SITEWORK Building Sitework									
	Unit Costs---->						42000.00	42000.00	
Excavation, Backfill, Dewatering and Sitework	1.00 LS						$42,000	$42,000	**$62,563**
Subtotal							$42,000	$42,000	
Markups using GC-MK							$20,563		$20,563
TOTAL Building Sitework	***1.00 LS***						**$62,563**	**$42,000**	**$62,563** ***$0.00***
02000High Service Pump Opt 1 SITEWORK 42" DIP Class 150 RJ Water Main									
023159000610	Unit Costs---->		B12B	0.027	1.13	1.22		2.34	3.49
Excavate trench, common earth 6'-10' deep, 1-1/2 CY hyd backhoe	201.00 CY		41.66	5	$226	$245		$471	**$702**
022405001000A	Unit Costs---->		B10I	0.126	5.34	0.87		6.21	9.25
Dewatering Sock Method	120.00 LF		42.34	15	$640	$105		$745	**$1,110**
023159013010210	Unit Costs---->	17.05	B6	0.160	6.18	1.16		24.39	36.33
Bedding, crushed stone 3/4" to 1/2"	59.80 CY	$1,020	38.61	10	$370	$69		$1,458	**$2,172**
023152005000	Unit Costs---->	4.50	B12N	0.017	0.74	1.00		6.24	9.30
Backfill, select granular fill, shovel, 1 CY bucket	70.58 CY	$318	43.68	1	$52	$70		$440	**$656**
023159003020	Unit Costs---->		B10R	0.030	1.27	0.49		1.76	2.62
Backfill trench, Common Earth, FE loader, whl mtd, 1 CY bkt, min haul	49.60 CY		42.35	1	$63	$24		$87	**$130**
023153007500	Unit Costs---->		B10A	0.029	1.23	0.30		1.53	2.28
Compaction, walk behind, vibrating roller 24" W, 6" lifts, 2 passes 15% Swell	207.00 CY		42.34	6	$254	$63		$317	**$472**
022257303080	Unit Costs---->		B17	0.800	30.46	13.82		44.28	65.97
Haul Excess, loading & trucking, machine load truck	151.20 CY		38.08	121	$4,606	$2,090		$6,696	**$9,974**
150600110103042	Unit Costs---->	115.99	PIPE03	0.315	15.77	5.69		137.45	204.75
CLDI Pipe, Fastite Joint, Pressure Class 250, 42" dia	120.00 LF	$13,919	50.07	38	$1,893	$683		$16,494	**$24,570**

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: Cresent Hill WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A!

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 10/9/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
02000 High Service Pump Opt 1 SITEWORK 42" DIP Class 150 RJ Water Main									
150600120202042	Unit Costs---->	54.32	PIPE03	0.158	7.91	2.86		65.09	96.96
DIP, Lok-Ring Bell Adder Per LF, 42" dia	120.00 LF	$6,519	50.07	19	$949	$343		$7,811	**$11,635**
1599001000022	Unit Costs---->						2.25	2.25	3.35
Bag Pipe & Tape Joints	120.00 LF						$270	$270	**$402**
020807900500	Unit Costs---->	9.25	LABR	0.057	1.02			10.27	15.29
Underground Marking Tape, Detectable	1.20 CLF	$11	17.94		$1			$12	**$18**
023705501000	Unit Costs---->	0.29	CLAB	0.010	0.36			0.65	0.97
Erosion control, silt fence, polypropylene, 3' high, ideal conditions	120.00 LF	$35	36.13	1	$43			$78	**$116**
150600130205048	Unit Costs---->	75029.96	PIPE04	200.000	10083.46	4598.00		89711.42	133634.07
Tie-In To Existing 48" Main	2.00 LS	$150,060	50.42	400	$20,167	$9,196		$179,423	**$267,268**
Subtotal		$171,881			$29,265	$12,888	$270	$214,304	
Markups using GC-MK		$84,153			$14,328	$6,310	$132		$104,923
TOTAL 13 42" DIP Class 150 RJ Water Main *1.00 LS*		**$256,033**		**618**	**$43,593**	**$19,198**	**$402**	**$214,304**	**$319,226** *$0.00*

Division Notes: DIP Corisive Soil Placement with Dewatering Required.

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
02000 High Service Pump Opt 1 SITEWORK 72" PCCP Pipe									
023159000130	Unit Costs---->		HVCW3	0.049	2.04	6.21		8.25	12.29
Excavating, Up to 20' Deep 3-1/2 CY Hyd Cat 345 Excavator Common Earth	4,034.42 CY		41.66	198	$8,251	$25,043		$33,293	**$49,594**
022409000700A	Unit Costs---->	4.00	B10I	0.100	4.23	0.69		8.93	13.30
Wellpoints Dewatering	260.00 LF Hdr	$1,040	42.34	26	$1,101	$180		$2,321	**$3,458**
023159013010210	Unit Costs---->	17.05	B6	0.425	16.43	3.07		36.55	54.45
Bedding, crushed stone 3/4" to 1/2"	122.63 CY	$2,091	38.62	52	$2,015	$377		$4,482	**$6,677**
023152005000	Unit Costs---->	4.50	B6	0.342	13.20	2.47		20.17	30.04
Backfill, select granular fill, shovel, 1 CY bucket	151.67 CY	$683	38.62	52	$2,002	$374		$3,059	**$4,556**

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: Cresent Hill WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A!

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 10/9/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
02000 High Service Pump Opt 1 SITEWORK 72" PCCP Pipe									
023159003020	Unit Costs---->		B10R	0.060	2.55	0.98		3.53	5.25
Backfill trench, Common Earth, FE loader, whl mtd, 1 CY bkt, min haul	3,760.12 CY		42.34	226	$9,588	$3,672		$13,260	**$19,753**
023153108200	Unit Costs---->		A1F	0.025	0.89	0.11		1.00	1.49
Compaction, rammer tamper, 8" lifts, 2 passes Notes: *Assume 15% Swell*	4,034.42 CY		36.13	99	$3,578	$458		$4,036	**$6,012**
022257303080	Unit Costs---->		B17	0.219	8.36	3.79		12.15	18.09
Haul Excess, loading & trucking, machine load truck Notes: *Assume 15% Swell*	315.44 CY		38.08	69	$2,636	$1,196		$3,831	**$5,707**
025107203070	Unit Costs---->	239.00	B13B	0.933	35.99	15.86		290.84	433.24
Piping, water dist, PCCP, 150 PSI, 20' L, 72" dia	130.00 L.F.	$31,070	38.57	121	$4,679	$2,061		$37,810	**$56,321**
150000000000060	Unit Costs---->						19.80	19.80	29.49
Bag Pipe & Tape Joints	130.00 LF						$2,574	$2,574	**$3,834**
020807900500	Unit Costs---->	9.25	LABR	0.057	1.01			10.27	15.30
Underground Marking Tape, Detectable	1.30 CLF	$12	17.84		$1			$13	**$20**
023705501000	Unit Costs---->	0.29	CLAB	0.010	0.36			0.65	0.97
Erosion control, silt fence, polypropylene, 3' high, ideal conditions	130.00 LF	$38	36.12	1	$47			$85	**$126**
022504001800	Unit Costs---->	20.00	B40	0.064	2.98	2.76		25.74	38.34
Sheet piling, steel, no wales, 25' excav., 38 psf, left in place	6,500.00 S.F.	$130,000	46.55	416	$19,367	$17,922		$167,288	**$249,193**
024559001100	Unit Costs---->		B19	142.000	6610.74	3479.44		10090.18	
Mobilization, rule of thumb: complete pile driving set up, small	1.00 Ea.		46.55	142	$6,611	$3,479		$10,090	**$15,030**
Subtotal		$164,933			$59,874	$54,762	$2,574	$282,143	
Markups using GC-MK		$80,751			$29,314	$26,812	$1,260		$138,137
TOTAL 16 72" PCCP Pipe ***1.00 LS***		**$245,684**		**1,403**	**$89,188**	**$81,574**	**$3,834**	**$282,143**	**$420,280** ***$0.00***

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: Cresent Hill WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A!

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 10/9/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
02000 High Service Pump Opt 1 SITEWORK Retaining Wall Penetration									
Retaining Wall Penetration for 72" Dia Pipe	Unit Costs----> 1.00 Ea						12000.00 $12,000	12000.00 $12,000	**$17,875**
Subtotal Markups using GC-MK							$12,000 $5,875	$12,000	$5,875
TOTAL Retaining Wall Penetration *1.00 LS*							**$17,875**	**$12,000**	**$17,875** *$0.00*
14 High Service Pump Opt 1 CONCRETE									
033100201010012 Structural Concrete for pumps and Build. Foundation, Cast-in-Place, 4,000psi	Unit Costs----> 1.00 LS						167000.00 $167,000	167000.00 $167,000	**$248,763**
Subtotal Markups using GC-MK							$167,000 $81,763	$167,000	$81,763
TOTAL 03000 CONCRETE 1.00 LS *1.00 LS*							**$248,763**	**$167,000**	**$248,763** *$0.00*
14 High Service Pump Opt 1 MASONRY									
24' x 24' Vertical Turbune Pump Building, CMU with Brick Veneer	Unit Costs----> 576.00 SF						250.00 $144,000	250.00 $144,000	372.40 **$214,502**

LWC 3056

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: Cresent Hill WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A!

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 10/9/06

DESCRIPTION	QTY	UNIT	MATERIALS	CREW RATE	CREW MH	CREW LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
14 High Service Pump Opt 1 MASONRY										
Subtotal								$144,000	$144,000	
Markups using GC-MK								$70,502		$70,502
TOTAL 04000 MASONRY	1.00	LS						**$214,502**	**$144,000**	**$214,502**
	1.00	*LS*								*$0.00*
14 High Service Pump Opt 1 EQUIPMENT										
112001011000001	Unit Costs---->		250000.00	WELLPMP	500.000	25222.01	5300.00		280522.01	417865.39
Vertical Turbine Pump, 32 MGD, 165'TDH,1200 HP	2.00	EA	$500,000	50.44	1,000	$50,444	$10,600		$561,044	**$835,731**
Notes: *Hudson quote 3/20/02. 8x6-17L 3404 (8100) ITT A-C Pump. Includes inverter duty TEFC motor.*										
Subtotal			$500,000			$50,444	$10,600		$561,044	
Markups using GC-MK			$244,800			$24,697	$5,190			$274,687
TOTAL 11000 EQUIPMENT	1.00	LS	**$744,800**		**1,000**	**$75,141**	**$15,790**		**$561,044**	**$835,731**
	1.00	*LS*								*$0.00*
14 High Service Pump Opt 1 MECHANICAL										
151000011110342	Unit Costs---->		56325.68	PIPE07	35.760	1872.37	321.84		58519.89	87171.19
Valves, Gate Valve, Resilent Seated V100, Flanged, 42" Dia	2.00	EA	$112,651	52.36	72	$3,745	$644		$117,040	**$174,342**
151000210301036	Unit Costs---->		31000.00	PIPE07	24.000	1256.62	216.00		32472.62	48371.19
Valves, Historical Costs, Ball Valve V100, Flanged, 42" Dia	2.00	EA	$62,000	52.36	48	$2,513	$432		$64,945	**$96,742**

CH2MHILL
Estimating Services

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PROJECT: Cresent Hill WTP Modifications
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ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 10/9/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
14 High Service Pump Opt 1 MECHANICAL									
151000220200042	Unit Costs---->	3150.00	PIPE07	8.500	445.05	76.50		3671.55	5469.14
Valves, Historical Costs, Electric Actuator, 42" Dia	4.00 EA	$12,600	52.36	34	$1,780	$306		$14,686	**$21,877**
150600130410012	Unit Costs---->	278.81	PIPE05	4.000	211.44	10.00		500.24	745.16
CLDI Fitting, Flanged, C110, Blind Flange, 250psi, Flat, 12" Dia	2.00 EA	$558	52.86	8	$423	$20		$1,000	**$1,490**
150600110301350	Unit Costs---->	6651.10	PIPE07	40.460	2118.45	364.14		9133.69	13605.54
CLDI Pipe, Class 53, Flg x Flg,42" dia, 10' Spool Piece	2.00 EA	$13,302	52.36	81	$4,237	$728		$18,267	**$27,211**
150600110301346	Unit Costs---->	5766.94	PIPE07	30.860	1615.81	277.74		7660.48	11411.05
CLDI Pipe, Class 53, Flg x Flg,42" dia, 6' Spool Piece	2.00 EA	$11,534	52.36	62	$3,232	$555		$15,321	**$22,822**
150600110301344	Unit Costs---->	5341.65	PIPE07	26.060	1364.48	234.54		6940.67	10338.82
CLDI Pipe, Class 53, Flg x Flg,42" dia, 4' Spool Piece	2.00 EA	$10,683	52.36	52	$2,729	$469		$13,881	**$20,678**
150600110301342	Unit Costs---->	4916.38	PIPE07	21.260	1113.16	191.34		6220.88	9266.61
CLDI Pipe, Class 53, Flg x Flg,42" dia, 2' Spool Piece	2.00 EA	$9,833	52.36	43	$2,226	$383		$12,442	**$18,533**
150600130402042	Unit Costs---->	8715.65	PIPE07	50.700	2654.61	456.30		11826.56	17616.83
CLDI Fitting, Flanged, C110-SR, 45 Deg Elbow, 250psi, 42" Dia	2.00 EA	$17,431	52.36	101	$5,309	$913		$23,653	**$35,234**
150600130406377	Unit Costs---->	10609.63	PIPE07	55.000	2879.76	495.00		13984.38	20831.12
CLDI, Flanged, C110, Reducing Tee, 42" x 12" Dia	2.00 EA	$21,219	52.36	110	$5,760	$990		$27,969	**$41,662**
	Unit Costs---->						1000.00	1000.00	1489.60
ARV Assembly	2.00 EA						$2,000	$2,000	**$2,979**
	Unit Costs---->						10000.00	10000.00	14895.99
Pipe Supports	2.00 LS						$20,000	$20,000	**$29,792**
150600130202042	Unit Costs---->	8784.27	PIPE03	43.100	2158.04	778.82		11721.13	17459.78
42" CLDI 45 Deg Elbow, Mech Jnt, C110	2.00 EA	$17,569	50.07	86	$4,316	$1,558		$23,442	**$34,920**

CH2MHILL
Estimating Services

CH2MHILL ESTIMATE DETAIL REPORT No.1 Ver 3.9

PROJECT: Cresent Hill WTP Modifications
DESIGN STAGE: Conceptual
PROJECT No.: 346133.01.A!

ESTIMATOR: D. Jones / GNV
ESTIMATE No.:
REV No./DATE: Rev. 1 10/9/06

DESCRIPTION	QTY UNIT	MATERIALS	CREW RATE	MH	LABOR	EQUIPMENT	INSTL S/C	TOTAL DIRECT	TOTAL W/MRKUPS
14 High Service Pump Opt 1 MECHANICAL									
150600140102042	Unit Costs---->	3385.69	PIPE01	25.400	1277.45	179.54		4842.69	7213.66
42" Meg-a-Lug Series 1100 Kit For DIP	4.00 EA	$13,543	50.29	102	$5,110	$718		$19,371	**$28,855**
Subtotal		$302,923			$41,379	$7,716	$22,000	$374,018	
Markups using GC-MK		$148,311			$20,259	$3,778	$10,771		$183,119
TOTAL 15000 MECHANICAL	**1.00 LS**	**$451,234**		**798**	**$61,639**	**$11,493**	**$32,771**	**$374,018**	**$557,137**
	1.00 LS								***$0.00***

Appendix E
Sanitary Surveys

Drinking Water Data

Revision Code: #041205

(To be changed by Central Office Staff only)

SANITARY SURVEY CODE: 83
INSPECTOR EMPLOYEE CODE:

PWSID: #0560258A **Plant Name:**Cresent Hill WTP **Plant Contact:**Jack Wang **Plant Type:** C (community) **Plant Class:**IV (>3 MGD)
Distribution Class:IVD-Pop. >50,000 **County:**Jefferson **Phone Number:**502/569-3600 **Fax Number:**502-569-0813 **E- Mail Address:**jwang@lwcky.com
Service Connections:269,488 **System Population Served:**889,310
Total No. Purchasers:9 **Total Population Served:**953,066

Treatment

Primary Source: Ohio River **Secondary Source:** **Maximum Pumping Rate:**166,666gpm
Plant Capacity MGD:240 MGD **Filter Design Rate:** 3gal/min/ft2 **Total Storage Capacity (gallons):**90 MG

Pre-sedimentation Size:110 MG **Aeration Code:**
Sedimentation (Primary) Code:B-Conventional/Baffled Basin **Sedimentation 2 (if 2 different processes) Type:**
Filter (Primary) Code:M-High Rate/Mixed (sand/garnite/anthracite) **Filter 2 (if 2 different filter types) Type:**
Clear well Size (gallons):25 MG (14 chambers)

Chemicals

Pre-Disinfection/Treatment Code:G-Chlorine Gas **Post-Disinfection Code:** A-Chloramines
Primary Coagulant Code:F-Ferric/Lime **Secondary Coagulant (Name):** P-Polymer **Filter Aid Name:**Polydyne
Corrosion Control Code:L-pH adjustment/Lime **Taste and Odor Code:**C-Activated Carbon/Powdered
Softening Code:
Iron (and Manganese) Removal Code: **Fluoride Supplement Code:**A-Hydrofluosilicic Acid
Other Code: **Other Name:**KMnO4 for Zebra Mussel control

Legend – **NA** – Not Applicable **NI** – Not Inspected

. Administrative Requirements

omments:
ompliance Status - No violations observed

I. Operator Certification/Accreditation Requirements

(Check with Certification Section or in TEMPO)

Plant Class	Plant Capacity (MGD)	Hours operated (annual average)	Shifts Operated (per day)	Operator Class Required Plant Distribution
IVA Plant A (Cresent Hill)	240 MGD	24 hours a day		IVA IVD
IVA Plant B (Payne)	60 MGD	24 hours a day		

Does the plant have operators with the appropriate class certificate? Yes ☒ No ☐
Are the certifications up-to-date? Yes ☒ No ☐
Does the system appear well operated and maintained? Yes ☒ No ☐

List Operators and certification numbers:

Operator Name	Plant Certification #	Distribution Certification #
Charles Snider	IVA 712	
David Austin	IVA 983	
Derrick Carr	IVA 1601	
Jack Wang	IVA 82	IVD 1903
John Fitzgerald	IVA 1174	
Joseph Horrell	IVA 406	
Jeremy Nicheols	IVA 1020	IVD 2917
Richard Smith	IVA 1720	

Comments: Robert Blume IVA 755; Robert Calloway IVA 909/IVD 2788; Shawn Goodlett IVA 575; Tammy Lentz IVA 1045; Timothy Meyer IVA 250; Troy Hainline IVA 1043; William Lannan IVA 1187; Harold Hurt IVD 2679; Mark Campbell IVA 433; Morris Manley IVD 2479; Paul Barker IVA 581; Susan Dougherty IVD 3135; Bradley McBride IVD 12642; Brenda Lucas IIID 9619; Rengao Song IVA 1826; Richard Wheeler IVA 120; Rhonda Thorne IVA 613; Monica Ottens-Settles IVA 161; Roger Tucker IVA 446; Billy Meeks IVD 2642; Eric Ayers IVD 3056; Tom Metcalf IID 3071; Vincent Ilari IVA 961/IVD 2647; Phillip Scott IVA 1168/IVD 3083; Ruth Lancaster IVA 12808; Cynthia Crawford IVA 12691; Dale Hall IVD 13201; Gary Mason IVA 10218; Clifford Buechell IVA 1722/IVD 3709; Donna Harrett IIID 13754; Michael Magee IVD 13635; Angelita Schaftlein IVA 9881

Compliance Status - No violations observed

III. Record Keeping Requirements

Drinking Water Data **Revision Code: #041205**
(To be changed by Central Office Staff only)

SANITARY SURVEY CODE: 83
INSPECTOR EMPLOYEE CODE:

PWSID: #0560258B **Plant Name:**BE Payne WTP **Plant Contact:**Jack Wang **Plant Type:**
C (community) **Plant Class:**IV (>3 MGD)
Distribution Class:IVD-Pop. >50,000 **County:**Jefferson **Phone Number:**502/569-3600 **Fax Number:** **E- Mail Address:**
Service Connections:269,488 **System Population Served:**889,310
Total No. Purchasers:9 **Total Population Served:**953,066

Treatment

Primary Source: Ohio River **Secondary Source:**Riverbank Infiltration Well **Maximum Pumping Rate:**41,666 gpm
Plant Capacity MGD:60 MGD **Filter Design Rate:** 5gal/min/ft2 **Total Storage Capacity (gallons):**90 MG (total)

Pre-sedimentation Size: **Aeration Code:**
Sedimentation (Primary) Code:B-Conventional/Baffled Basin **Sedimentation 2 (if 2 different processes) Type:**
Filter (Primary) Code:M-High Rate/Mixed (sand/garnite/anthracite) **Filter 2 (if 2 different filter types) Type:**
Clear well Size (gallons):6 MG

Chemicals

Pre-Disinfection/Treatment Code:G-Chlorine Gas **Post-Disinfection Code:** A-Chloramines
Primary Coagulant Code:L-Ferric/Lime/Polymer **Secondary Coagulant (Name):** **Filter Aid Name:**
Corrosion Control Code:L-pH adjustment/Lime **Taste and Odor Code:**C-Activated Carbon/Powdered
Softening Code:L-Lime/Soda Ash
Iron (and Manganese) Removal Code: **Fluoride Supplement Code:**A-Hydrofluosilicic Acid
Other Code: **Other Name:**

Legend – NA – Not Applicable **NI** – Not Inspected

I. Administrative Requirements

Comments:
Compliance Status - No violations observed

II. Operator Certification/Accreditation Requirements

(Check with Certification Section or in TEMPO)

Plant Class	Plant Capacity (MGD)	Hours operated (annual average)	Shifts Operated (per day)	Operator Class Required Plant Distribution
IVA Plant A (Cresent Hill)	240 MGD	24 hours a day		IVA IVD
IVA Plant B (Payne)	60 MGD	24 hours a day		IVA IVD

Does the plant have operators with the appropriate class certificate? Yes ☒ No ☐
Are the certifications up-to-date? Yes ☒ No ☐
Does the system appear well operated and maintained? Yes ☒ No ☐

List Operators and certification numbers:

Operator Name	Plant Certification #	Distribution Certification #
See Plant A		

Comments: See Plant A

Compliance Status - No violations observed

III. Record Keeping Requirements