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May 11, 2023

FILED VIA ELECTRONIC FILING

Rosemary Chiavetta, Secretary
Pennsylvania Public Utility Commission
Commonwealth Keystone Building
400 North Street
Harrisburg, PA 17105-3265

In re: In re: Application of Pennsylvania-American Water Company under Section 1102(a) and 1329 of the Pennsylvania Public Utility Code, 66 Pa C.S. §§ 1102(a) and 1329, for approval of (1) the transfer, by sale, to Pennsylvania-American Water Company, of substantially all of the assets, properties and rights related to the wastewater collection and conveyance system owned by Borough of Brentwood, (2) the rights of Pennsylvania-American Water Company to begin to offer or furnish wastewater service to the public in the Borough of Brentwood in Allegheny County, Pennsylvania

Docket No: A-2021-3024058

Dear Secretary Chiavetta:

Enclosed for filing are the Updated Responses of Pennsylvania-American Water Company ("PAWC") to the 66 Pa. C.S. Section 1329 Application Completeness Review of Pennsylvania-American Water Company – Wastewater Division Acquisition of the Borough of Brentwood's Assets at Docket No. A-2021-3024058 Missing Application Information, dated April 18, 2023.

Copies are being served upon the statutory advocates in accordance with the attached Certificate of Service and in accordance with the Commission's *Final Supplemental Implementation Order* entered February 28, 2019 at Docket No. M-2016-2543193.

PAWC respectfully requests that the Secretarial Letter conditionally accepting the Application for filing provide a due date for protests and notices of intervention, which is required on the form of notice approved by the Commission in *Application of Pennsylvania-American Water Company Pursuant to*

Sections 1102 and 1329 of the Public Utility Code for Approval of its Acquisition of the Water System Assets of the Steelton Borough Authority, Docket No. A-2019-3006880 (Opinion and Order entered Oct. 3, 2019) and found at Application Appendix A-18-d.

Thank you for your attention to this matter. Please do not hesitate to contact me if you have any questions.

Sincerely,



Erin K. Fure

Enclosures

cc: Sean Donnelly, Bureau of Technical Utility Services (*via electronic mail*)
All Parties on the attached Certificate of Service (*via electronic mail*)

**BEFORE THE
PENNSYLVANIA PUBLIC UTILITY COMMISSION**

In re: Application of Pennsylvania-American Water Company under Section 1102(a) of the Pennsylvania Public Utility Code, 66 Pa C.S. § 1102(a), for approval of (1) the transfer, by sale, of substantially all of Borough of Brentwood's assets, properties and rights related to its wastewater collection and conveyance system to Pennsylvania-American Water Company, and (2) the rights of Pennsylvania-American Water Company to begin to offer or furnish wastewater service to the public in the Borough of Brentwood, Allegheny County

Docket No. A-2021-3024058

In re: Application of Pennsylvania-American Water Company under Section 1329 of the Pennsylvania Public Utility Code, 66 Pa. C.S. § 1329, for approval of the use for ratemaking purposes of the lesser of the fair market value or the negotiated purchase price of Borough of Brentwood's assets related to its wastewater collection system.

Docket No. A-2023-

Petition of Pennsylvania-American Water Company, related to its acquisition of the Borough of Brentwood wastewater collection system, for approval under Section 1329 of the Pennsylvania Public Utility Code, 66 Pa. C.S. § 1329, to (i) collect a distribution system improvement charge, (ii) for book and ratemaking purposes, accrue Allowance for Funds Used During Construction for post-acquisition improvements not recovered through the distribution system improvement charge, (iii) for book and ratemaking purposes, defer depreciation related to post-acquisition improvements not recovered through the distribution system improvement charge, and (iv) include, in its next base rate case, a claim for transaction and closing costs.

Docket No. P-2023-

In re: Filing by Pennsylvania-American Water Company under Section 507 of the Pennsylvania Public Utility Code, 66 Pa. C.S. § 507, of (a) the Asset Purchase Agreement and First Amendment to the Asset Purchase Agreement Between Pennsylvania-American Water Company and Borough of Brentwood; (b) Streets Run Sewer Joint Management Agreement between Boroughs of Brentwood, Baldwin and Whitehall and the Western Mifflin Sanitary Sewer Authority dated July 19, 2000 and (c) Agreement between Borough of Brentwood and City of Pittsburgh dated October 14, 1936 and (d) Cooperation and Allocation of Responsibilities Agreement between Borough of Brentwood and Pennsylvania-American Water Company dated March 2, 2023

Docket Nos. U-2023-_____, *et al.*

CERTIFICATE OF SERVICE

I hereby certify that I have this 11th day of May served a true copy of the foregoing Responses regarding the acquisition of the Borough of Brentwoods's wastewater collection and conveyance system upon the parties, listed below and in the manner below in accordance with the requirements of 52 Pa. Code §1.54 (relating to service by a party).

SERVED VIA ELECTRONIC MAIL ON MAY 11, 2023

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66 Pa. C.S. Section 1329 Application Completeness Review
Pennsylvania-American Water Company – Wastewater Division Acquisition of
Brentwood Borough Wastewater System Assets at Docket No. A-2021-3024058

5. Checklist Item No. 22.b. – The Application’s Appendix A-22-b provided a copy of the ALCOSAN Summary of the Pennsylvania Act 537 Comprehensive Sewage Facilities Plan (1996 Act 537 Plan), dated July 1996. However, ALCOSAN appears to have completed subsequent Act 537 Special Studies amending the 1996 Act 537 Plan that included the affected municipalities. Please provide copies of any Act 537 Special Studies complete by ALCOSAN that include the affected municipalities along with copies of resolutions from the Boroughs of Brentwood, Baldwin and Whitehall adopting the 1996 Act 537 Plan and any subsequent special studies.

Response: In July 2018, ALCOSAN completed an Act 537 Special Study for the Regional Conveyance Facilities of the Interim Wet Weather Plan. A copy of this Special Study is provided in **Second Amended Appendix A-22-b**. Please refer to **Amended Appendix A-22-a** for Brentwood’s resolution adopting the 1996 ALCOSAN Act 537 Plan and these Special Studies.

**Application of Pennsylvania-American Water Company for Acquisition of
the Wastewater Assets of the Borough of Brentwood**

66 Pa. C.S. § 1329

Application Filing Checklist – Water/Wastewater

Docket No. A-2021-3024058

22. Other requirements. Demonstrate compliance with the following:
- b. For **wastewater** system acquisitions, provide a copy of the DEP-approved Act 537 Official Sewage Facilities Plans for the affected municipalities.

SECOND AMENDED RESPONSE:

- b. Please see **Second Amended Appendix A-22-b** for the July 2018 ALCOSAN Act 537 Special Study for the Regional Conveyance Facilities of the Interim Wet Weather Plan.

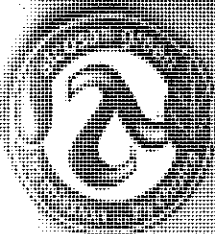
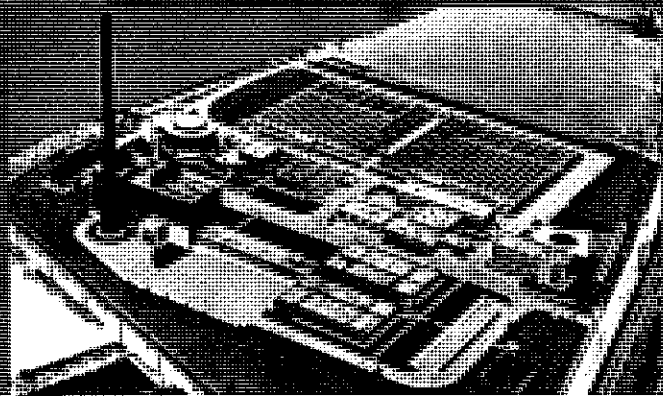
SECOND AMENDED APPENDIX A-22-B

**JULY 2018 ALCOSAN ACT 537 SPECIAL STUDY FOR THE REGIONAL
CONVEYANCE**

FACILITIES OF THE INTERIM WET WEATHER PLAN

ALCOSAN

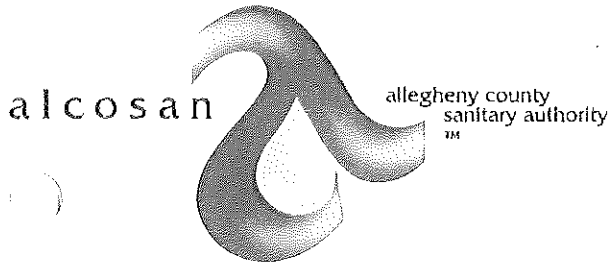
Act 537 Special Study



RIVERS
PROUD

Clean Water Program

July 2011



July 24, 2018

Donald J. Leone, P.E.
Environmental Engineer Manager
Pennsylvania Department of Environmental Protection
Bureau of Clean Water
400 Waterfront Drive
Pittsburgh, PA 15222

Subject: Act 537 Special Study

Dear Mr. Leone:

Enclosed are three hard-copies and one flash drive containing an electronic version of the Act 537 Special Study along with the required City of Pittsburgh Resolution and Environmental Assessment Checklist (Appendix A), for your review and approval.

As you know, the purpose of the Special Study was to supplement the 1996 Act 537 Plan and to reflect ALCOSAN's current strategy for the expansion of wet weather treatment capacity at the Woods Run Wastewater Treatment Plant.

If you have any questions please feel free to contact Kim Kennedy, Director of Engineering & Construction, at 412-734-6254.

Sincerely,

ALLEGHENY COUNTY SANITARY AUTHORITY

Arletta Scott Williams
Executive Director

Enclosure

Copies:

K. Kennedy, ALCOSAN
A. Tamilia, ALCOSAN
M. Moskorisin, ACHD
T. Dupuis, CDM Smith

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Appendix C – Pilot Plant Testing Technical Memorandum (Appendix B from the April 2010 Draft Bypass Justification Report)

Appendix D – November 2010 Letter from ALCOSAN to USEPA Concerning Affordability

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Abbreviations and Acronyms

ACHD	Allegheny County Health Department
ACT	Alternative Costing Tool
ADF	Average Daily Flow
ALCOSAN	Allegheny County Sanitary Authority
BOD	Biochemical Oxygen Demand
BOD ₅	5 day Biochemical Oxygen Demand
BPC	Basin Planning Committee
BWWF	Base Wastewater Flow
CBOD	Carbonaceous Biochemical Oxygen Demand
CC	Chartiers Creek
CD	Consent Decree
CEPT	Chemically Enhanced Primary Treatment
CIP	Capital Improvements Program
CIP	Cast-in-Place
CMAC	Customer Municipality Advisory Committee
CMMS	Computerized Maintenance Management System
COD	Chemical Oxygen Demand
CSO	Combined Sewer Overflow
CWA	Clean Water Act
DCS	Distributed Control System
DEP	Department of Environmental Protection
DO	Dissolved Oxygen
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FST	Final Settling Tank
FSWG	Feasibility Study Working Group
ft	Foot/Feet
FWS	Fish and Wildlife Service
FY	Fiscal Year
GIS	Geographic Information System
GPD	Gallons per Day
GPM	Gallons per Minute
GRJSA	Girty's Run Joint Sewer Authority
GSI	Green Stormwater Infrastructure
GW	Groundwater Infiltration

H&H	Hydrologic and Hydraulic
HRC	High Rate Clarification
HRT	Hydraulic Retention Time
I/I	Inflow and Infiltration
IWWP	Interim Measures Wet Weather Plan
LNA	Lower Northern Allegheny
LOC	Level of Control
LON	Lower Ohio North
LOS	Lower Ohio South
LOGR	Lower Ohio – Girty's Run
LTCP	Long Term Control Plan
LTPF	Long Term Average Per-Capita Flow
LTPO	Long Term Average Per-Capita Organic Loading
MG	Million Gallons
MGD	Million Gallons per Day
MHI	Median Household Income
MLSS	Mixed Liquor Suspended Solids
MR	Main Rivers
NPDES	National Pollutant Discharge Elimination System
O&M	Operations and Maintenance
PA	Pennsylvania
PaDEP	Pennsylvania Department of Environmental Protection
PE	Primary Effluent
PNDI	Pennsylvania Natural Diversity Inventory
POC	Point of Connection
POTW	Publicly Owned Treatment Works
PWSA	Pittsburgh Water and Sewer Authority
RAS	Return Activated Sludge
RDII	Rainfall Dependent Inflow and Infiltration
RTB	Retention Treatment Basin
SBR	Sequencing Batch Reactor
SCS	Soil Conservation Service
SF	Square Foot
SMR	Saw Mill Run
SOR	Surface Overflow Rate
SPC	Southwest Pennsylvania Commission

SRT	Solids Retention Time
SSO	Sanitary Sewer Overflow
SST	Satellite Sewage Treatment
SWD	Side Water Depth
TC	Turtle Creek
TDH	Total Dynamic Head
TKN	Total Kjeldahl Nitrogen
TMDL	Total Maximum Daily Load
TRC	Total Residual Chlorine
TSS	Total Suspended Solids
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UV	Ultraviolet
VSS	Volatile Suspended Solids
WAS	Waste Activated Sludge
WWP	Wet Weather Plan
WWTP	Wastewater Treatment Plant

1.0 INTRODUCTION

1.1 Study Purpose

The purpose of this Special Study is to amend the Allegheny County Sanitary Authority (ALCOSAN)'s 1996 Act 537 Sewage Facilities Plan to reflect ALCOSAN's current strategy for the expansion of wet weather treatment capacity at its Woods Run Wastewater Treatment Plant (WWTP). This wet weather capacity expansion will be key element of ALCOSAN's Interim Measures Wet Weather Plan (IWWP). ALCOSAN submitted its current Act 537 plan to the Pennsylvania Department of Environmental Protection (PaDEP) in 1996 and the plan was approved in October of 1999. The geographic scope of ALCOSAN's service area, which will not be affected by the treatment plant upgrades described herein, is shown on Figure 1-1.

1.2 Study Scope

The scope of this Special Study is limited to Act 537 planning requirements that directly relate to the expansion of wet weather treatment capacity at the Woods Run WWTP. The 1996 Act 537 plan outlined two treatment plant expansions. Phase 1 involved the expansion of the primary and secondary treatment capacities, odor control, the conversion of the disinfection system to sodium hypochlorite and various other capital improvements. Phase 2 was to expand the secondary treatment capacity to 275 million gallons per day (mgd) and the primary treatment capacity to 600 mgd, for a total wet weather treatment capacity of 875 mgd. The primary treatment capacity expansion was intended for wet weather treatment in conformance with the provision in the 1994 Combined Sewer Overflow (CSO) Control Policy that permittees with combined sewer systems should maximize the treatment of wet weather flows at existing Publicly Owned Treatment Works (POTWs) by utilizing primary treatment capacity that exceeds secondary capacity.¹⁻¹

Since 1996, new approaches to stormwater management practices focusing on green infrastructure integrated with urban redevelopment have emerged and have found public and regulatory acceptance. This Special Study details and provides technical and regulatory justification for ALCOSAN's current wet weather treatment strategy that is a blend of green and gray technologies. ALCOSAN's updated plan for the upgrading and expansion of the Woods Run Wastewater Treatment Plant supports the greener approaches identified ALCOSAN's *Starting at the Source* strategy which was developed in coordination with the Pittsburgh Water and Sewer Authority's *Green First Plan*. Upon PaDEP approval, this Special Study will amend the 1996 Act 537 Plan.

ALCOSAN has coordinated with PaDEP on the aspects of the Act 537 planning requirements that are relevant to the expansion of wet weather treatment capacity at the Woods Run WWTP. A copy of PaDEP's 537 instructions and checklist guide (form 3800-FM-BPNSM0003 dated 10/2012) is provided in Appendix A to this Special Study. The PaDEP checklist has been modified to gray out the requirements that are not applicable for this amendment, and the locations at which the specific checklist requirements are addressed are cross referenced.

¹⁻¹ 59 FR 18693

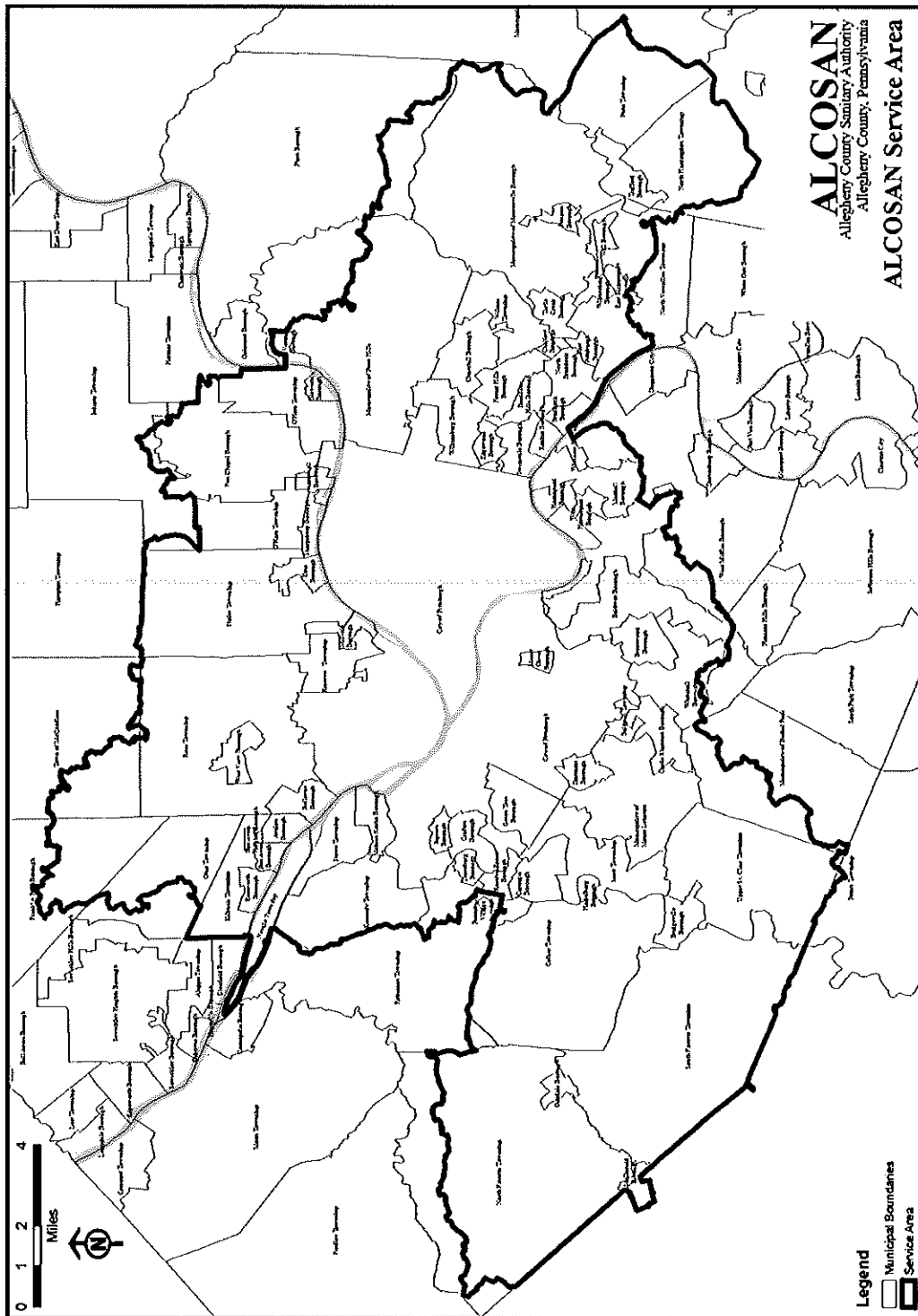


Figure 1-1:
 ALCOSAN Service Area

ALCOSAN ACT 537 Plan Special Study
Section 1 - Introduction

ALCOSAN provided copies of a draft of this Special Study to the Allegheny County Department of Economic Development, Allegheny County Health Department, the City of Pittsburgh Department of Planning, and the Southwestern Pennsylvania Planning Commission. Comments were received from the Allegheny County Health Department; no comments were provided by the other agencies. Drafts were also sent to the Pittsburgh Water and Sewer Authority and each of the ALCOSAN customer municipalities for review and comment. This current version of the Special Study reflects received comments.

ALCOSAN also held two public meetings on January 30, 2018 on the Special Study, prepared a three-page summary document, and sent copies of the draft and summary document to the public libraries within the service area. Public notice of the draft document's availability for review and comment was published in the Pittsburgh Post-Gazette and the New Pittsburgh Courier newspapers on February 5th and 7th 2018 respectively. Documentation of ALCOSAN's municipal and public outreach including comments received and ALCOSAN's response is provided as Appendix G of this document.

1.3 Plan Summary

Under its Interim Measures Wet Weather (IWWP), ALCOSAN proposes to expand the wet weather treatment capacity at its Woods Run Wastewater Treatment Plant. Primary treatment capacity will be expanded to 480 mgd initially and 600 mgd ultimately. Secondary treatment capacity will be expanded to 295 mgd. The expansion of wet weather treatment capacity to 480 mgd and related adjustments to regulator structures is expected to result in a 3 billion gallon per year reduction in ALCOSAN overflow volume. This represents a 33% reduction relative to projected future (2046) flow conditions.

The long-term plan includes a 120 mgd expansion of the total raw wastewater pumping capacity to facilitate the ultimate expansion to 600 mgd of wet weather treatment capacity. While different options to achieve this pumping capacity will be evaluated, this report assumes that a 120 mgd Wet Weather Pump Station will be constructed.

The IWWP includes several adaptive management provisions. One or more of these provisions involves obtaining municipal source reduction information from customer municipalities and assessing whether municipal flow reduction commitments in those studies would merit the downsizing or modification of the Wet Weather Pump Station. This provision and several others will be finalized when the ongoing negotiations culminate in a modification to ALCOSAN's Consent Decree (CD). Moreover, ALCOSAN has undertaken advanced facilities planning for the wet weather capacity improvements at the Woods Run WWTP which could potentially modify the capacity expansion strategy outlined above. Should this occur, ALCOSAN would coordinate an additional modification of its approved Act 537 Plan with PaDEP.

1.4 Estimated Treatment Plant Expansion Costs

The current estimated costs of the Woods Run wastewater treatment plant improvements detailed in Section 6.4 of this document along with related required capital projects such as the new Vehicle Maintenance Garage and O&M Building are shown on Table 1-1. The costs for completed projects are in actual dollars while the estimated costs for the wet weather capacity expansion are in 2010 dollars.

ALCOSAN ACT 537 Plan Special Study
Section 1 - Introduction

ALCOSAN anticipates using combinations of pay-as-you-go funding utilizing accumulated reserve funds and revenue bond financing owing to ALCOSAN's strength in the municipal bond market to implement the treatment plant expansion. As of July 2016, ALCOSAN has a rating of 'A' long-term (with a stable outlook) from Standard & Poor's Rating Services and A1 from Moody's Investors Services.

Table 1-1
ALCOSAN Woods Run Wastewater Treatment Plant
Wet Weather Treatment Capacity Expansion and Related Capital Improvements

Capital Improvements	Estimated Capital Cost (millions)
Operation & Maintenance Building (completed)	\$37
New Vehicle Maintenance Garage (completed 2017)	\$11
Expand main pump station capacity (completed)	\$31
Subtotal	\$79
Wet Weather Treatment Capacity Expansion	
Wet Weather Headworks	\$267
Disinfection	
Wet Weather Disinfection	
Primary Treatment Sedimentation Basins and Secondary Treatment	\$81
Wet Weather Pump Station (Phase 2)	\$148
Total	\$575

1.5 Municipal Commitments

ALCOSAN will implement the expansion of the Woods Run Wastewater Treatment Plant on behalf of its 83 customer municipalities. The municipalities have adopted ALCOSAN's 1996 537 Plan as their respective municipalities. As the host municipality to the wastewater treatment plant, the City of Pittsburgh has accepted this Special Study as an amendment to the 1996 plan through Resolution No. 381. A certified copy of this resolution is provided as Appendix H.

1.6 Implementation Schedule

The anticipated schedule for the expansion of the wet weather capacity at ALCOSAN's Woods Run Wastewater Treatment to 480 mgd is shown in Figure 1-2. The dates shown should be considered to be preliminary and are subject to refinement as ALCOSAN undertakes detailed facilities planning and preliminary design for the plant expansion project.

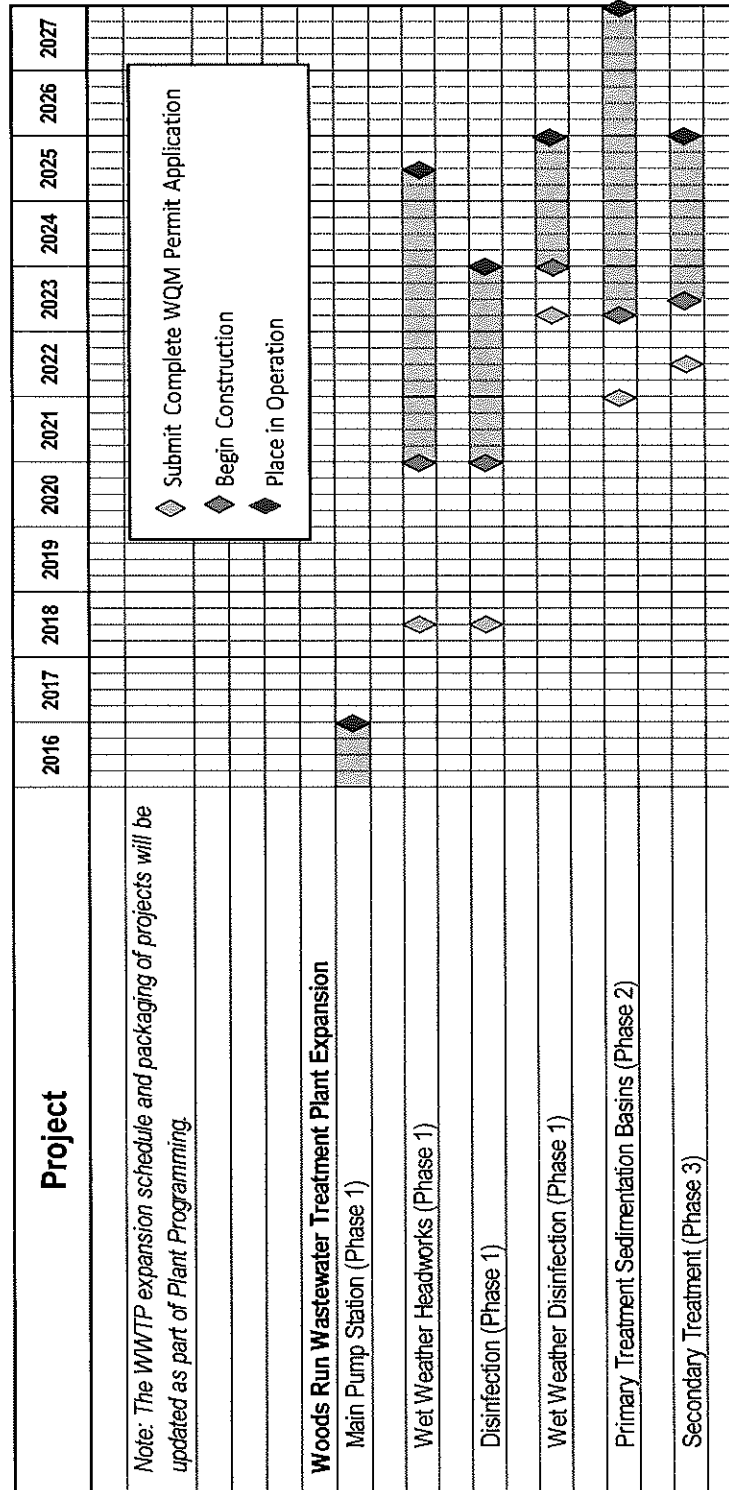


Figure 1-2:
 Woods Run WWTP Wet Weather Expansion Schedule

2.0 PREVIOUS WASTEWATER PLANNING

This section outlines the previous planning and engineering studies performed by ALCOSAN in support of the proposed expansion of the Woods Run WWTP for wet weather treatment.

2.1 Act 537 Facilities and Wet Weather Planning

2.1.1 1996 ACT 537 Sewage Facilities Plan

In fulfillment of the requirements of the Pennsylvania Sewage Facilities Act of 1965 (Act 537), and in accordance with the 1994 Federal Clean Water Act and in response to directives received from the PaDEP, the Board of Directors of ALCOSAN authorized the completion of a Comprehensive Sewage Facilities Plan during 1994. The scope of this planning effort included the following topics:

1. Elimination of odors detectible off-site from the ALCOSAN WWTP.
2. Expansion of secondary treatment capacity to site limits for anticipated growth, redevelopment and increased wet weather capacity.
3. Maximization of flows to the treatment plant during wet weather to reduce the discharge of sewage to the rivers and streams of southwestern Pennsylvania.
4. Assumption of broader technical and institutional roles in managing wet weather flows in the member communities.
5. Institution of a long-range comprehensive plan that uses funds efficiently for capital improvements and operations.
6. Provision of wastewater treatment capacity for communities in watersheds with inadequate collection and treatment facilities, as well as communities serviced by WWTPs with operational problems.

The Act 537 Plan was finalized and submitted to PaDEP during 1996 and was subsequently approved by PaDEP on October 4, 1999. Based on the recommendations of the Act 537 Plan, ALCOSAN structured a two-phase Capital Improvements Program (CIP) for the WWTP as follows:

CIP Phase I: Expansion of primary and secondary treatment capacity, addition of odor control systems, conversion to sodium hypochlorite disinfection, expansion and upgrade of solids handling facilities, and upgrade of plant electrical supply and distributed control systems. Phase I design and permitting was completed in 1997; and the construction of new facilities was completed in 2004. Under Phase 1, secondary treatment capacity was to be increased to 275 mgd.

CIP Phase II: Under Phase 2 of the CIP as described in the 1996 Act 537 Plan included the upgrading of the main pump station, expansion of the plant headworks, and wastewater conveyance and routing controls for conventional and split-flow bypass schemes. The Phase II capital improvements are the subject of this current facilities planning update. The operational strategies for wet weather treatment as proposed in the Act 537 Plan are shown in Figure 2-1 and described below.

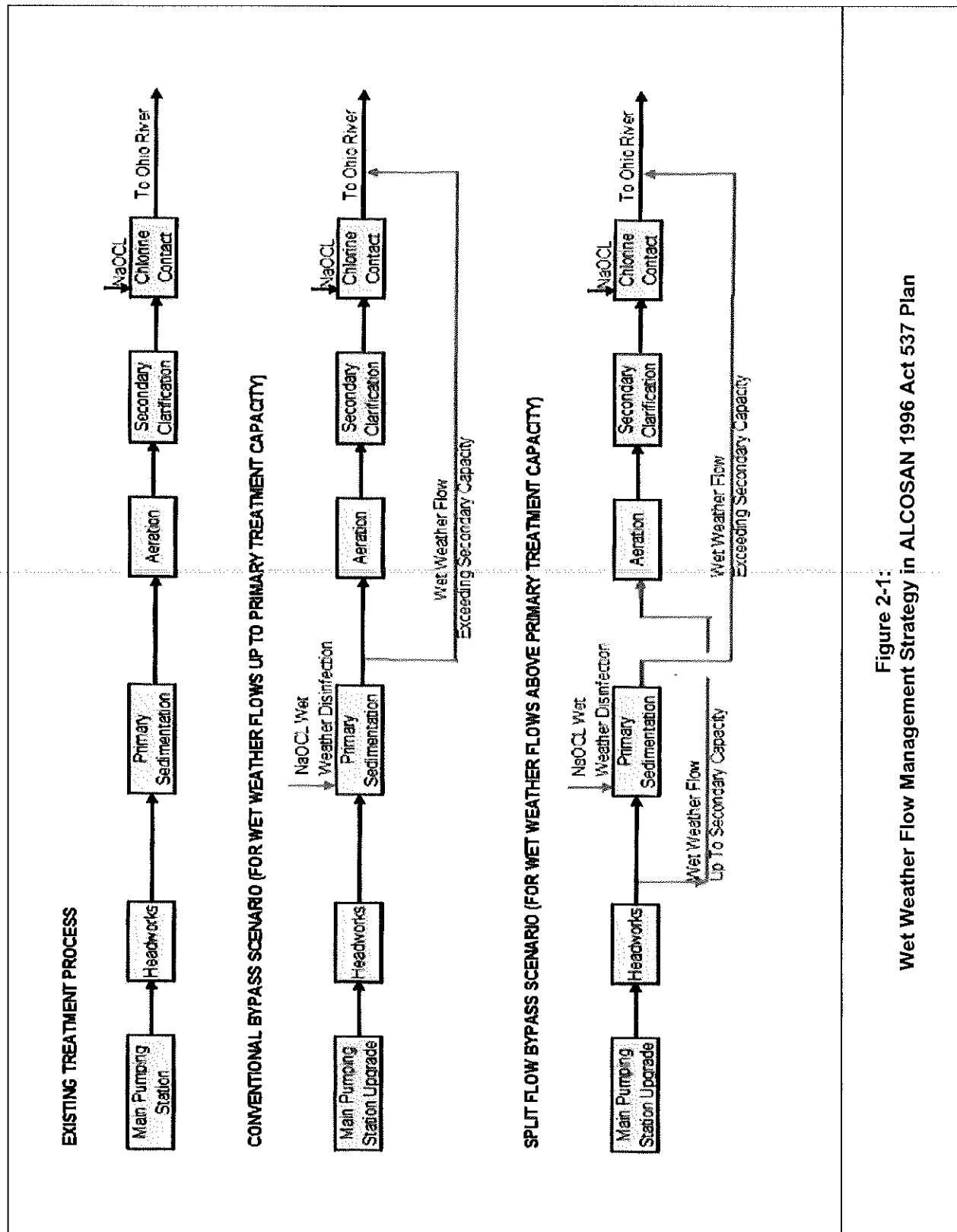


Figure 2-1:
 Wet Weather Flow Management Strategy in ALCOSAN 1996 Act 537 Plan

- *For flows up to secondary treatment capacity:* Primary and secondary treatment of all flow, followed by disinfection prior to discharge.
- *For wet weather flows up to primary treatment capacity:* Primary treatment of all flows, with primary effluent flows in excess of secondary capacity bypassing the secondary process and mixing with the secondary effluent. Wet weather disinfection of bypassed flow would occur in the primary sedimentation tanks. This operational scheme is referred to as a conventional bypass.
- *For flows above primary treatment capacity:* A split-flow bypass is initiated where headworks flow up to the capacity of secondary treatment bypasses primary treatment and is routed directly to secondary treatment. The remaining headworks flow receives primary treatment and disinfection in the primary sedimentation tanks.

The primary and secondary treatment capacities envisioned in the Act 537 Plan were 600 mgd and 275 mgd, respectively. However, hydraulic stress testing of the primary sedimentation tanks performed in 2005 and 2006 concluded the unit capacity is 60 mgd, which relates to a 540 mgd total capacity and 480 mgd firm capacity (one tank out of service) for the primary treatment process.

2.1.2 1999 Regional Long Term Wet Weather Control Concept Plan

ALCOSAN proactively established its CSO Control Program in 1992, well before the 1994 CSO Control Policy. It began comprehensive system characterization efforts including field verifying and digitizing the system maps, long term flow monitoring and the development of a hydrologic and hydraulic (H&H) model of the conveyance and treatment system. ALCOSAN completed four regulatory deliverables pursuant to its then current NPDES permit:

- System Characterization Report (1995)
- Hydrologic and Hydraulic Characterization Report (1996)
- Documentation of the Implementation of the Nine Minimum Controls (1996)
- Regional Long Term Wet Weather Control Concept Plan (1999)

In 1997 USEPA threatened federal enforcement action against 52 municipalities for sanitary sewer overflows (SSO)s. ALCOSAN proposed to expand the scope of its CSO long term control plan to include the elimination of SSOs at the points of connection between the sanitary sewer municipalities and the ALCOSAN interceptor system; the threat of federal enforcement abated. As a result, the 1999 Concept Plan provided for 85% wet weather capture on an average annual basis per the CSO Policy and for elimination of SSOs at the points of connection between the municipal collection systems and ALCOSAN. The Concept Plan involved the expansion of the Woods Run WWTP per the 1996 Act 537 Plan and distributed storage and wet weather treatment facilities.

2.1.3 Implementation of the Act 537 Plan

Construction of the Phase 1 capacity expansion at the Woods Run Wastewater Treatment Plant commenced in 1997 and ran through 2003. The permitted plant capacity was expanded to 250 mgd along with other improvements in disinfection (change from gaseous chlorine to sodium hypochlorite), odor control (covering the primary sedimentation basins and other improvements), and improvements to the solids handling system (e.g. installation of centrifugal dewater units).

2.2 Primary Treatment Stress Testing

As explained above, the originally proposed routing for flows of 600 to 875 mgd at the ALCOSAN plant was as follows: secondary treatment of 275 mgd of headworks flow and primary treatment of the remaining headworks flow (276 to 600 mgd), with the primary effluent and secondary effluent being combined after disinfection and then discharged.

The expansion of primary treatment capacity to 600 mgd was planned to be achieved by the combination of additional primary sedimentation tanks and operating the process at high surface overflow rates (SOR) approaching 4,000 gpd/ft². The expansion of primary treatment capacity was completed in 2004 under Phase I of ALCOSAN's CIP. However, there was a need to establish the capacity of the expanded primary sedimentation tanks at projected wet weather wet flow conditions. For this purpose, full-scale testing of primary settling was conducted.

2.2.1 Stress Testing Objectives

The objectives of the stress testing program were as follows:

- Determine the hydraulic capacity of the ALCOSAN primary sedimentation tanks.
- Conduct a wastewater sampling and laboratory analyses program to characterize the wastewater and monitor the performance of primary sedimentation tanks.
- Evaluate the performance of the primary sedimentation tanks at elevated surface overflow rates as proposed for future wet weather treatment at the Woods Run WWTP.
- Evaluate the wet weather performance of the primary sedimentation tanks without the influence of waste activated sludge co-settling, because it is proposed to eliminate co-settling when wet weather treatment is initiated in the future.

2.2.2 Stress Testing Procedure

The stress testing program began on April 18, 2005, and ran continuously through October 5, 2005. Testing resumed on November 16, 2005 and ran continuously through August 31, 2006. Performance of the primary treatment process was evaluated based on the percent removal and effluent concentrations of Total Suspended Solids (TSS) and 5-day Biochemical Oxygen Demand (BOD₅) using the collected samples of primary influent and primary effluent. The samples were collected on a daily basis. The data collected during the primary stress testing program allowed for the characterization of primary influent and primary effluent TSS and BOD concentrations under dry and wet weather conditions. Daily composite samples of primary influent and primary effluent were characterized as either "In CSO" (wet weather) or "Out of CSO" (dry weather) by the occurrence of a CSO event at the treatment plant. An ALCOSAN CSO event is determined to begin and end based on the wastewater elevation in the Main Pumping Station wet well at the Woods Run WWTP. Additional details about the primary stress testing are provided in Appendix B of this document. Appendix B consists of backup information (appendix A) to the April 2010 ALCOSAN Phase 2 Facilities Planning for the Woods Run WWTP – Draft Bypass Justification Report.

2.2.3 Stress Testing Results

The first objective of this study was to determine the hydraulic capacity of each primary sedimentation tank, which was observed to be approximately 60 mgd. Therefore, with all nine

primary sedimentation tanks in operation the total hydraulic capacity of the primary treatment process would be 540 mgd which is 10 percent less than the 600 mgd that had been projected for wet-weather operation.

The second objective of this study was to characterize primary influent and primary effluent and to monitor primary treatment performance during dry and wet-weather. For purpose of this study, wet-weather was defined as when the plant was "In CSO" as a function of the water level in the Main Pumping Station wet well. Dry weather was defined as when the plant was "Out of CSO".

The third objective of this study was to evaluate the performance of the primary sedimentation tanks at elevated surface overflow rates as proposed for future wet weather treatment at the Woods Run WWTP. Within the period and extent of monitoring conducted, the primary sedimentation tanks performed efficiently in comparison with regulatory standards and design practice, despite high sustained surface overflow rates. Over the entire testing period the SOR averaged nearly 2,000 gpd/ft² and the primary treatment process achieved on average 66 percent TSS removal and 48 percent BOD removal based on the evaluation of daily composite samples.

The variation of surface overflow rates from 1,000 to 3,100 gpd/ft² in the primary sedimentation tanks did not have a discernible effect on TSS and BOD percent removals during the primary stress testing program. The TSS and BOD percent removals each remained relatively constant throughout the monitored range of SORs except for when the primary influent concentrations were dilute. The primary influent TSS and BOD concentrations were observed to influence primary treatment process performance, wherein, higher TSS and BOD percent removals occurred as influent concentration increased. These trends were similar during both dry and wet-weather conditions.

Wastewater temperature also appears to have an influence on the primary treatment process performance within the wastewater temperature range observed (49 to 78 degrees Fahrenheit). As the wastewater temperature increased so did the percent removals of TSS and BOD. These trends were similar during both dry and wet-weather conditions. However, the influence of primary influent TSS and BOD concentrations and wastewater temperature are often concurrent. The months with the lowest percent TSS and BOD removals in the primary treatment process are also the months of lowest wastewater temperature and lowest primary influent TSS and BOD concentrations.

Analysis of discrete (hourly composite) samples of primary influent and primary effluent during wet-weather events exhibited TSS concentration spikes in the primary influent early in the storm, typical of a "first flush" condition, that were subsequently diluted in a matter of hours. Spikes in the primary influent BOD concentration were experienced, but typically at a lower magnitude or not at all compared to the TSS concentrations. TSS and BOD percent removals remained relatively consistent for smaller storm events, but did exhibit some reduction during larger and longer storm events when primary influent TSS and BOD concentrations were diluted below average conditions.

It can be concluded that the findings of the primary stress testing program support the concept of using the primary sedimentation tanks for wet-weather treatment at flows up to the

hydraulic capacity of each process unit (60 mgd/tank), which equates to a surface overflow rate of approximately 3,100 gpd/ft². This study shows without co-settling of waste activated sludge in the primary sedimentation tanks, primary effluent TSS and BOD concentrations observed during wet-weather remain similar to the concentrations observed during dry weather.

2.3 Secondary Treatment Pilot Testing

Because there were no known large treatment plants using the "split-flow" approach for wet weather treatment, pilot testing was used to determine the feasibility of such a treatment scheme. The objectives, approach and results of the pilot testing are summarized below. Additional details about the secondary treatment pilot testing are provided in Appendix C of this document. Appendix C consists of backup information (appendix B) to the April 2010 ALCOSAN Phase 2 Facilities Planning for the Woods Run WWTP – Draft Bypass Justification Report.

2.3.1 Secondary Treatment Pilot Testing Objectives

Two phases of pilot testing were performed, each with specific objectives as follows:

- Phase 1 was designed to (1) demonstrate the ability of the secondary treatment process to meet discharge permit requirements when treating 275 mgd of screened and degrittied primary influent during wet weather flow conditions and (2) demonstrate the ability of the secondary treatment process to treat a constant flow rate of 275 mgd of primary effluent for extended periods of time when the plant flow is in the range of 275 to 600 mgd.
- Phase 2 was designed to (1) demonstrate the ability of the secondary treatment process to meet discharge permit requirements during the relatively rapid conversions expected from treating primary effluent to treating primary influent during wet weather events and (2) assess the use of chemical treatment to enhance final settling tank efficiency during wet weather events.

2.3.2 Secondary Treatment Pilot Testing Procedures

Phase 1 testing was performed from February 25, 2005 to May 26, 2005, while Phase 2 testing was performed from January 16, 2006 to April 2, 2006. Two pilot trains (east and west) were used during both phases, and each train consisted of a scum and grit tank, four bioreactors (one for stabilization and three for contact processes), one secondary clarifier, a return activated sludge (RAS) pump, a waste activated sludge (WAS) pump, and a WAS holding tank. Flow through both pilot trains was identical.

During the pilot testing, both the east and west trains were operated based on targeted mixed liquor suspended solids (MLSS) concentrations. MLSS concentration in the pilot trains was controlled by changing the rate of activated sludge wasting. Pilot plant influent and effluent BOD, TSS, and Volatile Suspended Solids (VSS) were sampled and measured during testing. Settleability tests (i.e., zone settling and sludge volume indices) were also run.

2.3.3 Secondary Treatment Pilot Testing Results

The first phase of the pilot plant testing program demonstrated that the plant's existing activated sludge process, operating under steady state conditions and at normal mixed liquor

concentration of 1,500 to 2,000 mg/L range and Sludge Retention Times (SRTs) of two to four days would be adequate for achieving effluent requirements during wet weather flows. Based on the pilot study results, the full-scale secondary treatment system would be expected to reduce the biodegradable content of the plant's clarified wastewater during the extended period of time when the activated sludge process is receiving a constant primary sedimentation tanks effluent flow of 275 mgd (nominal secondary treatment capacity). The full-scale secondary treatment system would also be expected provide adequate treatment when the activated sludge process is receiving a constant primary influent flow of 275 mgd. These capabilities were demonstrated by the Phase 1 pilot testing effort with wastewater of higher strength than would be expected during full scale wet weather and high flow conditions.

The first phase pilot plant testing also demonstrated that the activated sludge process operation had very good bulk settling characteristics. The second phase testing program was intended to determine performance of the process when the loading to the activated sludge process was rapidly changed from primary effluent to primary influent at the initiation of a wet weather event, as well as to demonstrate the use of polymers to enhance clarification. The use of polymers to enhance clarification was effective at the bench scale. However, it was inconclusive in the pilot plant application due to limitations in mixing and inherent difficulties in mimicking full-scale clarification. The testing did demonstrate adequate reduction of biodegradable content for the limited number of low intensity wet weather events occurring during the test period.

2.4 2012 Wet Weather Plan

2.4.1 1999 – 2012: ALCOSAN's Ongoing Wet Weather Program

After completion of the 1999 Concept Plan, ALCOSAN moved forward while a regulatory decision on the Concept Plan was pending. Key activities included:

- The evolution of the H&H model into the next (and subsequent) generations of the USEPA SWMM model;
- Ongoing long-term flow monitoring;
- The development and implementation of the county-wide synoptic RADAR-raingauge system;
- Continued evolution and refinement of the system geographic information system (GIS) including refinement of the service area sewershed delineations;
- a comprehensive field verification of the critical dimensions, etc. of the regulator structures and other appurtenances;
- The establishment with ACHD of the 3 Rivers Wet Weather program and the successful pursuit of more than \$40 million in federal and state funding for stream removal, collection system rehabilitation and green stormwater infrastructure projects; and
- The treatment process stress testing and pilot testing detailed in sub-sections 2.2 and 2.3 above.

It is noteworthy that since the 1996 Act 537 Study and the 1999 Regional Wet Weather Concept

Plan, the estimated wet weather overflows have been reduced due to refinement of computer modeling, GIS, and redevelopment of the service area.

2.4.2 2008 Consent Decree

As a “major” permittee (daily wastewater flows exceeding one million gallons), United States Environmental Protection Agency (USEPA)’s CSO Control Policy²⁻¹ requires that ALCOSAN’s schedule for CSO controls be placed in a judicial order such as a Federal Consent Decree (CD).

ALCOSAN entered into a federal CD on January 23rd, 2008. Key elements of the CD include:

- The development of a comprehensive Wet Weather Plan (WWP) for the elimination of sanitary sewer overflows (SSOs), the control of CSOs such that applicable water quality requirements are met, and to provide conveyance and treatment capacity for projected municipal flows within the ALCOSAN service area through 2046;
- Implementation of the WWP by September 30th, 2026; and
- Various documentation as to ALCOSAN’s operation and maintenance of the regional conveyance interceptor system.

2.4.3 Wet Weather Plan

Pursuant to the 2008 CD, ALCOSAN developed a comprehensive plan to achieve full compliance with water quality and other regulatory requirements. Based on new information including the field testing of the treatment plant processes and the performance of the plant expansion since 2007, the 2012 WWP revised the previous plant expansion plans to a hydraulic wet weather capacity of 600 MGD with a conventional bypass of secondary treatment. Secondary treatment capacity would be increased to 295 MGD.

The estimated capital costs for this full compliance plan were \$3.1 billion for ALCOSAN system improvements and \$500 million for municipal collection system improvements. ALCOSAN determined that the implementation of the \$3.1 billion plan for compliance with the CD would impose an unacceptable financial burden under the 2026 time frame. To moderate the financial burden, ALCOSAN instead proposed a phased course of wet weather controls that would provide significant sanitary sewer overflow controls and water quality benefits and would be technically feasible and affordable. This strategy was termed the Recommended Plan. The approximate locations of the proposed Recommended Plan improvements that were included in the 2013 WWP are shown on Figure 2-2.

ALCOSAN’s Draft Wet Weather Plan (WWP) was released for public and municipal comment on July 31 2012 and submitted to the agencies in January 2013, along with all the comments received. In brief, the most prominent public comment was for ALCOSAN to incorporate more GSI into the plan, while the comments received from the 83 customer municipalities were more focused on additional time to coordinate their improvements with ALCOSAN’s, particularly from a scheduling perspective.

²⁻¹ 59 Fed. Reg. 18688, April 19, 1994

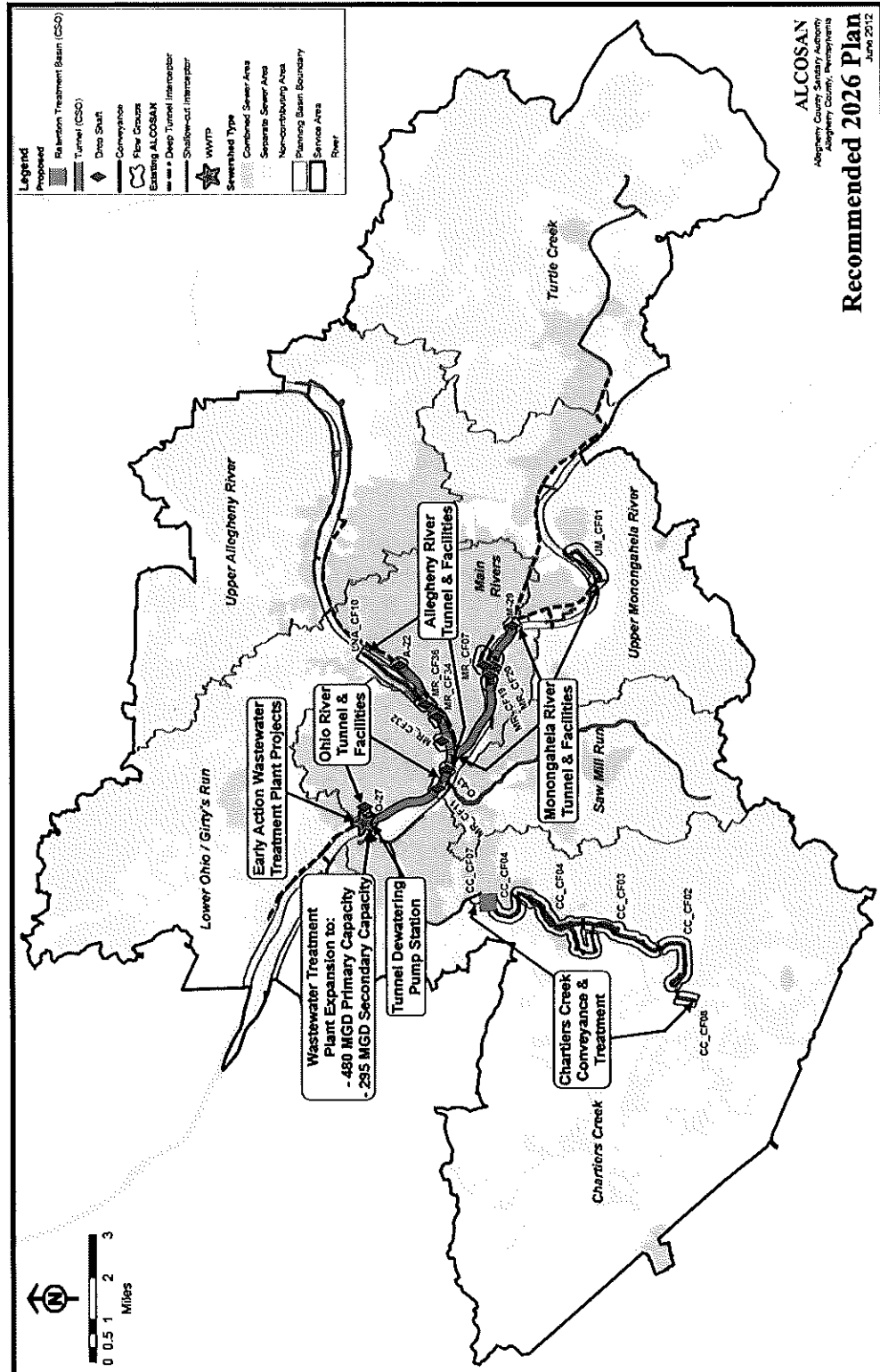


**Figure 2-2:
ALCOSAN Recommended Plan**

Upon review of the ALCOSAN Draft WWP, USEPA called it a first-rate proposal and expressed support for the \$3.6 billion tunnel based control strategy but acknowledged the affordability constraints. Since the Wet Weather Plan recommended only a \$2 billion plan that did not fully meet the requirements of the consent decree by 2026, the agencies could not approve the Plan. The agencies neither approved nor disapproved of the Plan; suggesting instead an alternative approach that included modifying the Consent Decree to provide for phased implementation and to extend the 2026 deadline.

ALCOSAN's original CD did not fully embrace United States Environmental Protection Agency's (USEPA) evolving acceptance and encouragement of GSI as a combined sewer overflow (CSO) control measure. The 2008 CD required ALCOSAN to plan, design and construct for the volumetric equivalent of all wet weather flow generated in the service area unless the customer municipalities contributing flows to a point of connection were under an enforceable commitment to reduce or treat their flows. As a result, ALCOSAN's 2013 WWP identified a control strategy based on customer municipalities conveying most of their flows to the ALCOSAN interceptor system and included limited use of flow reduction solutions such as GSI and I/I reduction.

In light of the comments received and the 2008 CD framework, ALCOSAN requested additional time to more thoroughly address the use of flow reduction (GSI and I/I reduction) in coordination with its customer municipalities. ALCOSAN initiated a regional study, *Starting at the Source: How Our Region Can Work Together for Clean Water*, that identified numerous opportunities to include flow reduction measures in the WWP. The municipalities are currently undertaking their own local studies to assess flow reduction as a part of their municipal orders. These efforts include the recently released report by the Pittsburgh Water and Sewer Authority entitled: The Green First Plan – A City-Wide Green Infrastructure Assessment.

While ALCOSAN and the municipalities proceeded with their evaluations of flow reduction opportunities, ALCOSAN and the regulatory agencies proceeded with negotiating an amended CD that fully embraces the use of GSI and I/I reduction and recognizes the infeasibility of completing all CD requirements by 2026. The agencies directed moving forward with an interim wet weather plan that provides opportunities to integrate GSI and other source reduction practices, while prioritizing the regionalization of inter-municipal trunk sewers and key grey infrastructure projects. In particular, after reviewing the three affordable alternatives presented in the Draft WWP and the comments received on the Draft WWP, the agencies identified an *Interim Measures Wet Weather Plan* (IWWP) that modified the Water Quality Priority Alternative presented in the 2012 Draft WWP and provided flexibility for replacing grey infrastructure projects with green. This control strategy was based on input from the municipal Feasibility Studies developed pursuant to the municipal Consent Order and Agreements (PaDEP) or Consent Agreements (ACHD), municipal flow monitoring data and consultation with the municipalities. ALCOSAN will continue to coordinate its efforts with the municipalities, which could result in future modifications to the IWWP.

3.0 WOODS RUN WWTP CURRENT CONDITIONS

3.1 General Process Train Description

All wastewater treatment provided by ALCOSAN occurs at the plant located on the North Side of the City of Pittsburgh near Woods Run. The Woods Run WWTP was originally constructed to provide primary treatment and commenced operation in 1959. Secondary treatment was added in the early 1970's.

A variety of plant improvements occurred during the late 1990s and early 2000s under the Phase One plant expansion CIP, including an increase of permitted plant capacity to 250 mgd. A simplified schematic showing the flow of wastewater and biosolids treatment processes through the WWTP is provided in Figure 3-2. A current Plan View of the plant is provided as Figure 3-3.

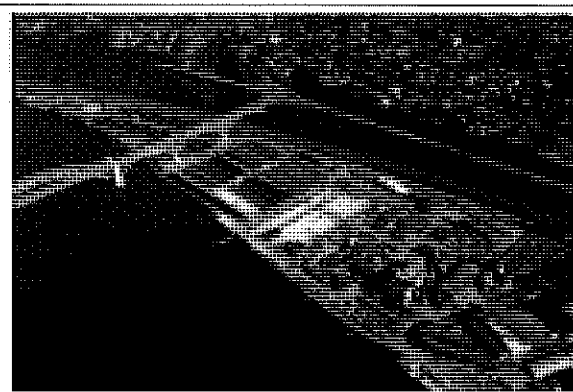


Figure 3-1:
 ALCOSAN's 250 mgd Wastewater
 Treatment Plant

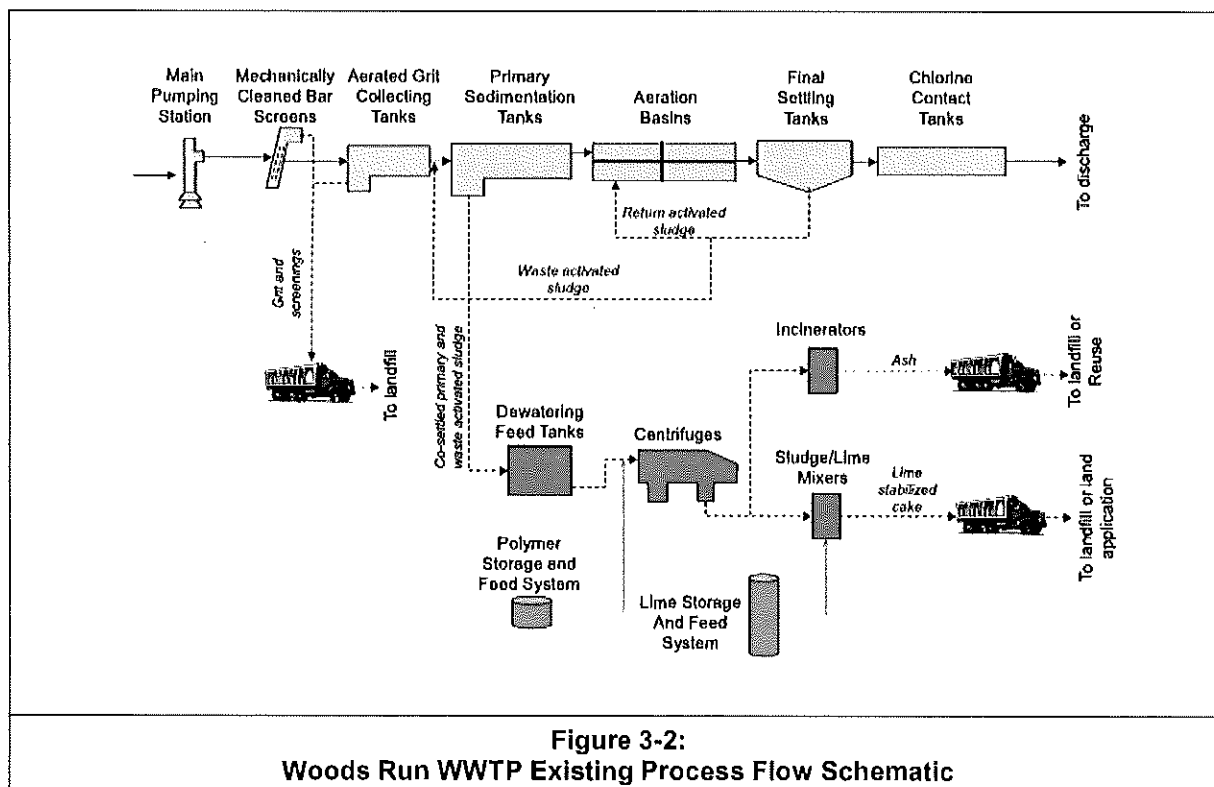


Figure 3-2:
 Woods Run WWTP Existing Process Flow Schematic

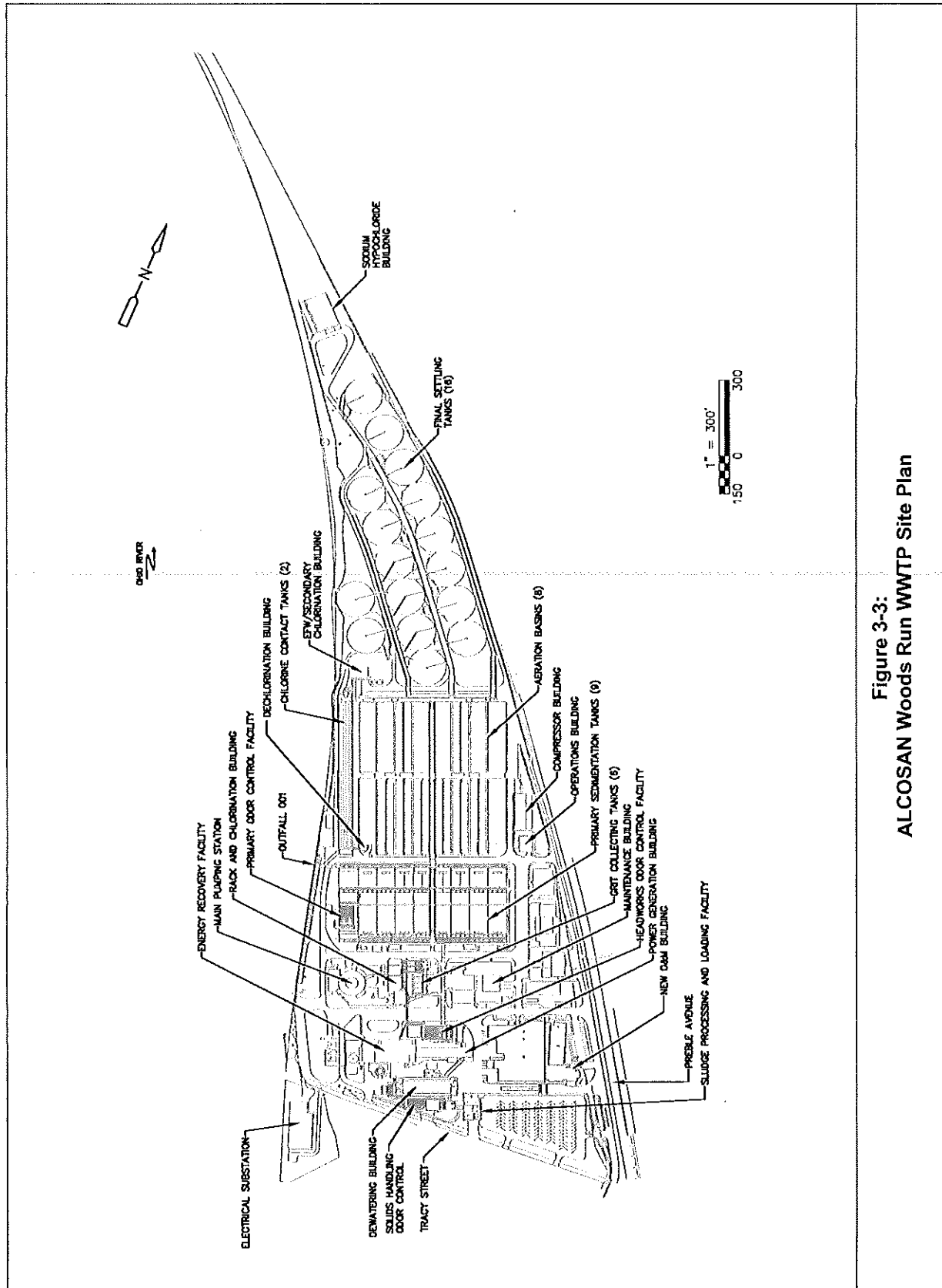


Figure 3-3:
 ALCOSAN Woods Run WWTP Site Plan

3.2 Process Equipment Types and Capacities

3.2.1 Main Pump Station

The Main Pumping Station includes a 40-foot diameter wet well that is 102-feet deep and receives wastewater via three main interceptors (Upper Ohio, Lower Ohio and Chartiers Creek). There are six variable speed pumps located in the circular dry well around the outside perimeter of the wet well.

Early planning efforts during the preparation of the Act 537 Plan considered the potential to expand the total capacity (all six pumps) of the Main Pumping Station to 875 mgd through replacement of the existing pumps with larger pumps. Subsequent evaluation of the pumping station has lowered expectations for expansion of the existing pumping station for the following reasons:

- Concern for adverse hydraulic conditions in the wet well and pump intakes;
- Consideration of firm pumping capacity based on four of the six pumps in service;
- Expectations of lower wet well operating level necessary to maximize conveyance capacity to the plant.

ALCOSAN proceeded with design and construction of upgrades to the Main Pumping Station due to concern with potential failure of aging equipment. ALCOSAN has installed six new 120 mgd pumps resulting in a firm capacity of 480

mgd for the Main Pumping Station. New motors, pump drives and suction piping were installed. The project included new power feeds to the station, additional waterline service, refurbishing the elevator, and a new cooling system for the electrical equipment.

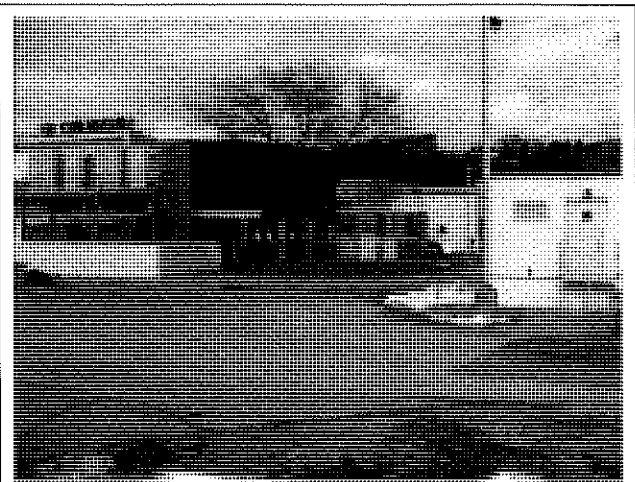


Figure 3-4:
ALCOSAN WWTP Main Pump Station

3.2.2 Headworks

The headworks include the preliminary wastewater treatment processes of screenings removal and grit removal. Wastewater pumped from the Main Pumping Station enters the Rack and Chlorination Building through an underground conduit where it is split between six bar screen channels. Each mechanically-cleaned bar screen has a stationary rack of steel bars spaced $\frac{3}{4}$ inches apart and is cleaned by a front-mounted multi-rake system. Screenings are conveyed via a belt conveyor to a roll-off, compacting dumpster in the adjacent Screenings Garage.

Screenings are continuously weighed in the dumpster and transported for landfill disposal. After passing through the bar screen channels the wastewater enters a common effluent channel which functions to distribute flow between the in-service grit collecting tanks.

In 2007, ALCOSAN completed construction of the Interim Grit and Screenings project that added two bar screens and two grit settling tanks to the WWTP's original four process trains. The primary objective of this project was to increase the redundancy and reliability of the preliminary treatment process and provide a firm capacity of 250 mgd with four of the six process trains in service. With five of the six process trains in service the peak flow capacity of 275 mgd can be achieved.

The aerated grit collecting tanks are sized to provide a hydraulic detention time of approximately three minutes at a peak flow of 62.5 mgd per tank. Grit removed from the tanks is conveyed via two belt conveyors to the adjacent Grit Garage and loaded into a tri-axle dump truck and transported for landfill disposal.

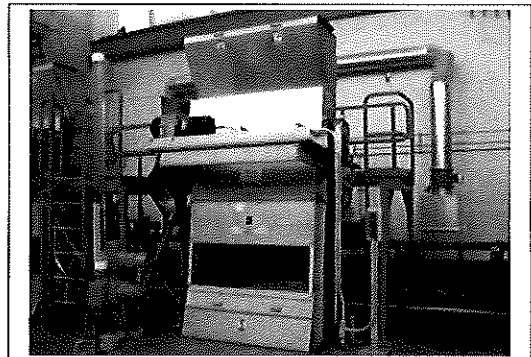


Figure 3-5:
Bar Screen Rack No. 5 (typical)

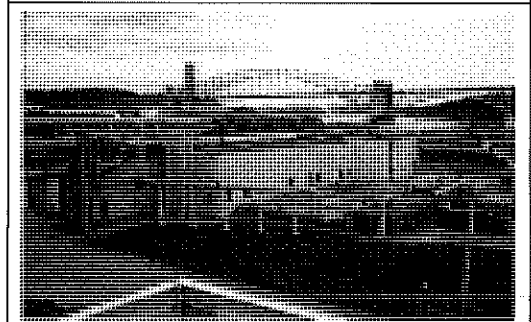


Figure 3-6:
Aerated Grit Basins

There are also provisions to add sodium hypochlorite in the raw sewage conduit between the Main Pumping Station and Rack and Chlorination Building. Referred to as the pre-chlorination application point, sodium hypochlorite was previously added for odor control prior to the construction of the Headworks and Primary Odor Control Facilities. ALCOSAN no longer uses pre-chlorination on a routine basis. Sodium Hypochlorite can also be added to the Main Pumping Station overflow structures to provide some disinfection capability in the event of an emergency pumped overflow to the Ohio River.

The capacity of the headworks is limited by hydraulic controls. The weirs at the effluent end of the primary sedimentation tanks control the water surface elevation in the primary sedimentation tanks and in the headworks. ALCOSAN has developed a hydraulic model of the treatment plant that predicts with six or more primary sedimentation tanks in-service and with at least five of the six bar screens and grit collecting tanks process trains in-service the peak flow capacity through the headworks is approximately 275 mgd.

3.2.3 Primary Sedimentation

The primary treatment process includes nine rectangular primary sedimentation tanks arranged side-by-side and separated into five west-side tanks and four east-side tanks. Following preliminary treatment, the wastewater is conveyed via an underground conduit that splits flow between the east and west primary influent channels, which are aerated to keep solids in suspension until entering the primary sedimentation tanks. Each primary sedimentation tank

includes four longitudinal chain and flight sludge collecting mechanisms arranged in separate bays. A cross collection screw conveyor is located in a trough along the influent end of each tank which conveys settled sludge to a sump from where it is pumped to the Dewatering Feed Tanks. There are four primary sludge pumping stations with a total of 13 recessed impeller centrifugal pumps.

Waste activated sludge from the aeration basins is currently pumped to the primary influent channels and co-settled in the primary sedimentation tanks. Scum is removed from the primary sedimentation tanks using the chain and flight mechanisms and motor-operated tipping troughs. The collected scum is then pumped to the Dewatering Feed Tanks where it is blended with the co-settled sludge.

Effluent from the primary sedimentation tanks overflows v-notched weir troughs into a common aerated effluent channel. There are separate primary effluent pipes extending from the primary effluent channel to the influent channels of the eight aeration basins. Flow distribution between the aeration basins can be controlled using the flow meters and regulating valves in the primary effluent piping contained in underground Flow Regulating Chambers. The flow meters in these chambers are also used to monitor and report the total plant flow.

The primary sedimentation tanks are covered for odor control by cast-in-place concrete covers and equipment access buildings. A two-stage counter-current odor control facility is located on top of the western-most sedimentation tank (Tank No. W-4) and in conjunction with a network of fiberglass ducts and make-up air units evacuates and treats foul air from under the tank covers and within the access buildings. The physical design parameters of the primary sedimentation tanks are summarized in Table 3-1.

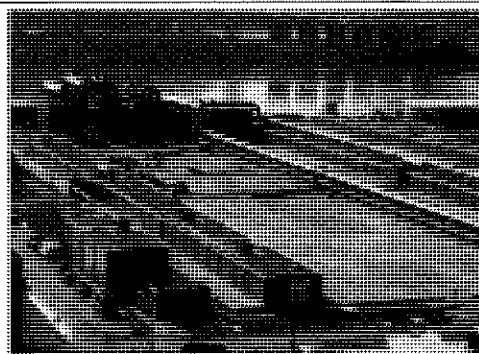


**Figure 3-7:
ALCOSAN Primary
Sedimentation Tanks**



**Figure 3-8:
Close-up of Primary Sedimentation
Tank Covers and Mechanical Access
Building**

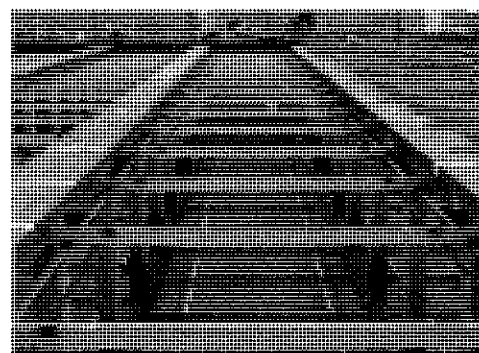


**Figure 3-9:
Primary Sedimentation Tank Interior**

Table 3-1: Primary Sedimentation Tanks Physical Design Parameters

Tank No.	Length (feet)	Width (feet)	Side Water Depth (feet)	Surface Area (square feet)	Volume (million gallons)	Weir Length (feet)
W-4	280	70	15	19,600	2.2	252
W-3	280	67	15	18,760	2.1	244
W-2	280	67	15	18,760	2.1	244
W-1	280	67	15	18,760	2.1	244
W-0	280	61	14	17,080	1.8	212
E-0	280	61	14	17,080	1.8	212
E-1	280	67	15	18,760	2.1	244
E-2	280	67	15	18,760	2.1	244
E-3	280	67	15	18,760	2.1	244
Totals				166,320	18.4	2,140
Averages				18,480	2.0	238

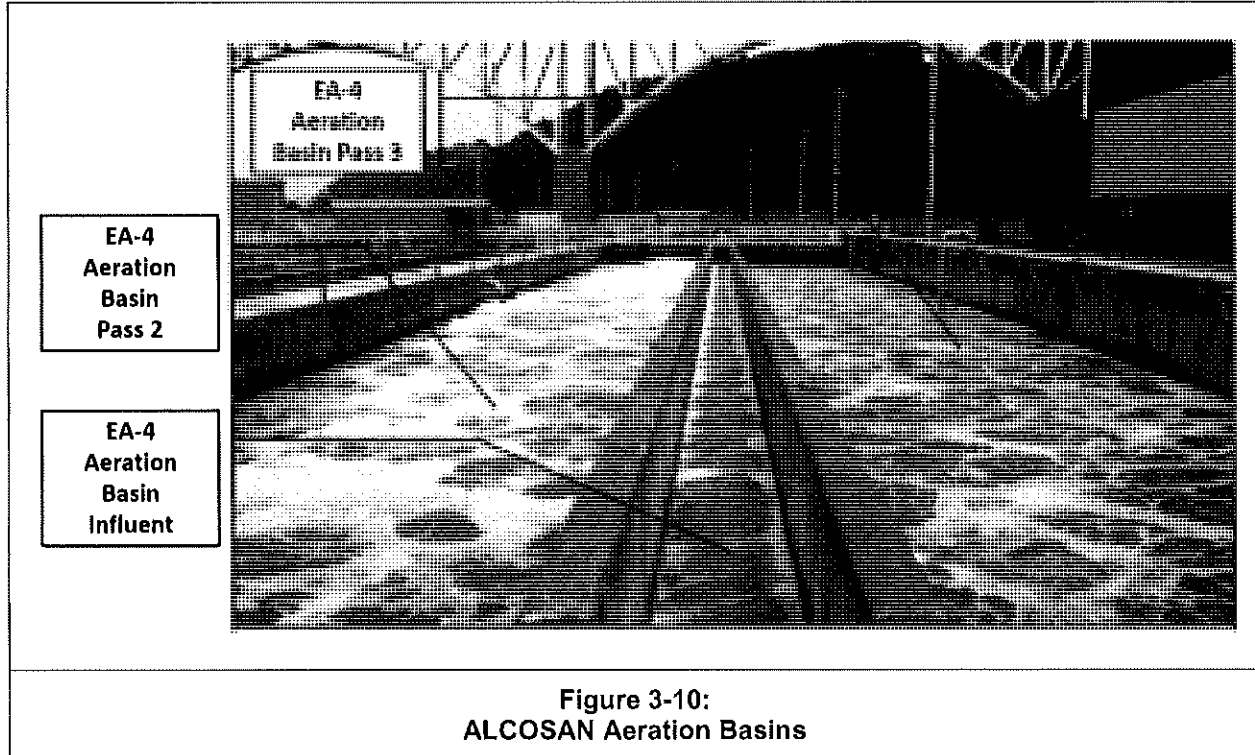
Currently the primary treatment process is operated with a minimum of six tanks in service which at a peak flow of 250 mgd results in an average surface overflow rate (SOR) of 2,250 gallons/day/ square foot (gpd/ ft²). Although this SOR exceeds the DEP guideline (Maximum peak hourly SOR of 1,500 gpd/ ft² in primary tanks that co-settle sludges) the ALCOSAN primary treatment process historically achieves TSS and BOD removal rates of approximately 70% and 50%, respectively.

The wet weather treatment concept proposed in the Act 537 Plan included high rate operation of the current nine primary sedimentation tanks at a peak SOR of 4,000 gpd/ ft² to achieve a total capacity of 600 mgd. In addition, the current practice of co-settling waste activate sludge would be changed through the addition of a separate WAS thickening process. During 2005 and 2006, full-scale primary stress testing was conducted to monitor performance of the primary treatment process under the proposed high rate operation and without WAS co-settling. It was determined by field testing that the approximate hydraulic capacity of each existing primary sedimentation tanks is 60 mgd, which results in a total primary treatment capacity of 540 mgd and firm capacity of 480 mgd (one tank out of service). The stress testing program also demonstrated acceptable primary treatment performance in terms of TSS and BOD removals at the 60 mgd / tank flow rate, which is equivalent to a SOR of approximately 3,100 gpd/ft² of surface area. For a full report of the stress testing program conducted at the ALCOSAN WWTP refer to Appendix A in Draft Bypass Justification Report (April 2010).

The addition of chemically-enhanced primary treatment (CEPT) in the primary sedimentation tanks is not considered necessary to achieve effective primary treatment up to the hydraulic capacity of the existing tanks and, if implemented, would increase operational complexity.

3.2.4 Secondary Treatment Process

The current secondary treatment facilities consist of eight aeration basins and 16 final settling tanks. The dimensions of the existing aeration basins, including six original basins and two newer basins constructed as part of the Phase I plant expansion, are shown in Table 3-2.



The four-pass aeration basins are operated in a contact stabilization mode as follows: return activated sludge (RAS) is pumped to Pass 1 then flows to Pass 2, where it is combined with primary effluent (PE). Combined RAS and PE then flow through Passes 2, 3, and 4 for treatment and then through two aerated mixed liquor channels to the final settling tanks.

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Table 3-2: Aeration Basin Dimensions

	Original Basins (EA-1, EA-2, EA-3, WA-1, WA-2, WA-3)				Newer Basins (EA-4, WA-4)			
	Pass 1	Pass 2	Pass 3	Pass 4	Pass 1	Pass 2	Pass 3	Pass 4
Unit Dimensions (ft.)								
Length	279	300.67	300.67	279	279	255.67	255.67	279
Width	31.25	29	29	31.25	31.25	29	29	31.25
SWD	14.8	14.7	14.7	14.5	14.8	14.7	14.7	14.5
Volumes (million gallons)								
Each Pass	0.965	0.959	0.959	0.947	0.965	0.815	0.815	0.947
Each Basin	3.83, including Pass 1 2.86, excluding Pass 1				3.54, including Pass 1 2.58, excluding Pass 1			
Mixed-Liquor Channel Aerated Total Volume	1.2							
Total Aeration Volume, MG	31.2, including Pass 1 23.5, excluding Pass 1							

The design flows and loads used for the ALCOSAN Phase I CIP improvements to the aeration basins are shown in Table 3-3. BOD and total Kjeldahl nitrogen (TKN) loads are shown. Note that these flows and loads correspond to Phase II conditions reported in the 1996 Act 537 Plan. At maximum month flow, the design hydraulic retention time (HRT) in the aeration basins is 2.7 hours.

Table 3-3: Design Flows and Loads to Secondary Treatment Process

Parameter	Flow (mgd)	BOD Load (lbs./day)	TKN Load (lbs./day)
Average	241	165,473	30,150
Maximum Month	278	223,389	54,270
Maximum Week	290	248,210	57,285
Maximum Day	--	297,851	60,300

The design oxygen demand and airflow rates are shown in Table 3-4.

Table 3-4: Design Oxygen Demand and Airflow Rates

	Carbonaceous Oxygen Demand (lbs/day)	Nitrogenous Oxygen Demand (lbs/day)	Total Oxygen Demand (lbs/day)	Airflow (scfm)
Average	152,235	69,345	221,580	86,559
Maximum Month	205,518	124,821	330,339	136,410
Maximum Week	228,353	131,756	360,109	150,760
Maximum Day	274,023	138,690	412,713	176,709

The aeration system was designed to meet maximum day air requirements with all eight aeration basins in service.

There are sixteen, 141-ft diameter final settling tanks (FSTs), each with a side water depth (SWD) of 14.3 ft. Final settling tank design data are summarized in Table 3-5.

Table 3-5: Final Settling Tank Basis of Design Data

Parameter	Value
Number of Tanks	16
Tank Dimensions	
Diameter (ft)	141
Side Water Depth (ft)	14.3
Unit Area (ft ²)	15,615
Design Flows Wastewater (MGD)	
Average Daily Flow (ADF)	241
Maximum Month ADF*	278
Surface Overflow Rates (gpd/ ft ²), all tanks in service	
At Average Daily Flow	965
At Maximum Month (ADF)	1100
Surface Overflow Rates (gpd/ ft ²), one tank out of service	
At Average Daily Flow	1030
At Maximum Month ADF	1175
Solids Loading Rates (lb/day/ ft ²), all tanks in service MLSS = 2,340 mg/L and Return = 50%	
At Average Daily Flow	28.3
At Maximum Month ADF	43.2

*Plant could sustain peak flow rates of 275 mgd for short durations.

There are four RAS pumping stations, each containing three RAS pumps with a capacity of 9,200 gpm at 34 feet of total dynamic head (TDH). At each RAS pump station; two of the three pumps are normally in service with one pump on standby. Total RAS pumping capacity, then, is 158 mgd, while firm capacity with one pump out of service at each RAS pumping station is 106 mgd.

3.2.5 Effluent Disinfection System

The effluent disinfection process at ALCOSAN includes two, three-pass chlorine contact tanks that have total channel length of 1,910 feet, a channel width of 7.5 feet and side water depth of 14.5 feet. Sodium hypochlorite is introduced and mixed with secondary effluent flow in an aerated inlet channel from where it is split between the two chlorine contact tanks. Chemical addition is automatically paced through the plant-wide Distributed Control System (DCS) based on the plant flow rate. Effluent from the chlorine contact tanks combines in an effluent structure where it overflows weirs into an outlet trough and conduit leading to the plant outfall (No. 001). Defoaming chemicals can be added to the effluent prior to the outfall when necessary.

In early 2009 ALCOSAN completed construction of dechlorination facilities that modified the chlorine contact tanks to include a post aeration zone and a dechlorination zone. The last pass of each tank includes a post aeration zone wherein low pressure process air can be introduced through diffusers to raise the effluent dissolved oxygen (DO) concentration prior to discharge. The last 65 feet of channel length in each chlorine contact tank was modified to function as a dechlorination zone, wherein liquid sodium



Figure 3-11:
ALCOSAN Final Settling Tanks

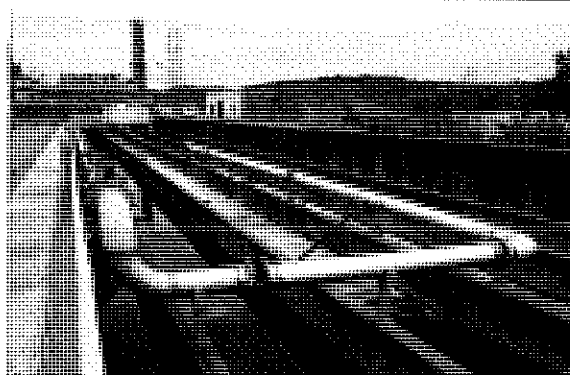


Figure 3-12:
Course Bubble Diffusers in the Chlorine Contact Tank



Figure 3-13:
Dechlorination Zone in the Chlorine Contact Tanks

bisulfite is injected into the aerated mixing zone to reduce the effluent Total Residual Chlorine (TRC) concentration prior to discharge. These modifications were made to meet NPDES permit discharge limitations for DO and TRC following the plant capacity increase to 250 mgd.

Liquid sodium bisulfite is received by tanker truck and transferred to two, 3,000-gallon capacity fiberglass storage tanks located in the Dechlorination Facility building. This building also contains two chemical feed pumps that control the rate of sodium bisulfite addition. Chemical addition is automatically paced through the plant-wide DCS based on the plant flow rate and effluent TRC concentration.

The current chlorination/dechlorination process has a peak flow capacity of 275 mgd based on the DEP-required 15 minutes detention time at peak flow for chlorine disinfection.

3.2.6 Solids Handling System

Currently waste active sludge is co-settled in the primary sedimentation tanks and the settled solids are then pumped to one of the two dewatering feed tanks. Scum removed from the primary sedimentation tanks is also blended with co-settled sludge in the dewatering feed tanks. Sludge is pumped from the dewatering feed tanks at a concentration of 3 to 5 percent total solids to the dewatering centrifuges. A polymer solution is injected in the dewatering feed lines for sludge conditioning prior to entering the centrifuges. The dewatering centrifuges produce a sludge cake in excess of 30 percent total solids that is split between incineration and lime stabilization processes.

During 2016 ALCOSAN disposed of approximately 36,200 dry tons of biosolids, of which 8,700 dry tons was lime stabilized then landfilled, 8,600 dry tons was lime stabilized for beneficial reuse and 18,900 dry tons were incinerated (reference: ALCOSAN 2016 Wasteload Management Report). The lime stabilized biosolids meet Class B beneficial reuse requirements and ALCOSAN is currently permitted in the State of Ohio for land application. Each of the seven dewatering centrifuges has a throughput capacity of 4,200 lbs./hour (i.e., 50.4 dry tons/day) and the facilities were designed to meet a future peak



Figure 3-14:
Sludge Dewatering Centrifuge

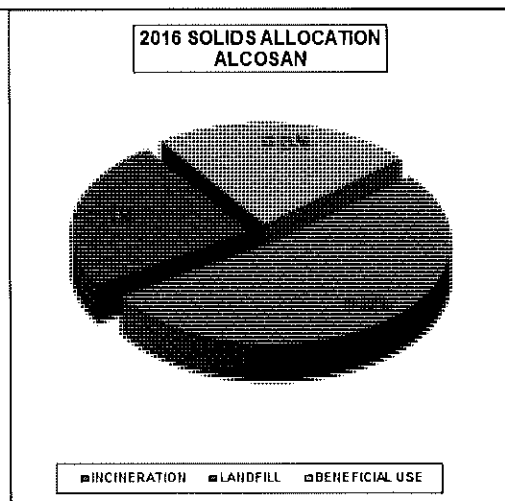


Figure 3-15:
ALCOSAN 2016 Solids Disposal Method Allocation

weekly solids loading of 252 dry tons/day. There is space available for one additional centrifuge.

The two fluidized bed incinerators were each designed for a capacity of 78.5 dry tons/day of sludge. The lime stabilization process was designed for a peak capacity of 100 dry tons solids/day and lime addition up to 30 percent by dry weight.

The addition of waste activated sludge thickening facilities was one component of ALCOSAN's Phase I CIP that was postponed until needed during Phase II (wet weather expansion). Co-settling of WAS in the primary sedimentation tanks can continue until that time when ALCOSAN is ready for high rate operation of the primary treatment process. Then, co-settling will no longer be the normal practice and WAS will be separately thickened prior to blending with primary sludge in the dewatering feed tanks. It is anticipated that a mechanical thickening process (gravity belt thickeners or centrifuges) will be used for future WAS thickening.

ALCOSAN's Energy Recovery Facility produces approximately 7,000 tons per year of ash. In addition to landfill disposal of the material, ALCOSAN has the ability to beneficially use 100% of the material through a local outlet. ALCOSAN obtained the first General Permit in Pennsylvania to recycle sewage sludge ash in 2005. The ash can be blended into compost or topsoil at a rate of 5% or produce specialty athletic field blends that uses up to 30% ash.

3.3 Current Wastewater Plant Operation

3.3.1 Dry Weather Operation

ALCOSAN's WWTP facility has a current maximum sustainable plant capacity of 250 mgd. The average annual dry weather flow is approximately 176 mgd. This allows for an average of 74 mgd for treatment of wet weather flow. No unusual actions need to be taken at the treatment plant relative to wet weather events, nor would any such actions result in improved or increased treatment. The plant continuously meets its National Pollutant Discharge Elimination System (NPDES) permit limits over the full range of dry and wet weather flow, except during extreme flood events during periods that the Ohio River level is elevated, in accordance with its approved Sewage Treatment Plant Operating Plan for Wet Weather Flow Events (Wet Weather Operating Plan).

ALCOSAN's Operations Department is provided the necessary support from both Maintenance and Instrumentation to assure that all equipment is maintained in good working order. Ongoing analysis of the treatment process by ALCOSAN's on-site Laboratory confirms the treatment system performance is within acceptable parameters.

ALCOSAN's DCS for preliminary and primary treatment is used to monitor and control the main pumping station, the screening handling system, the grit handling system, primary sedimentation, aeration basins, final settling tanks and chlorine contact tanks and the scum and grease handling system. The DCS allows the operator to review historical trending of a variety

of process parameters in order to properly maintain plant performance. ALCOSAN's Operations Department includes four crews of 14 persons each plus shift superintendents and shift supervisors. The crews work rotating shifts of six days on and two days off to operate the plant 24 hours per day, 365 days per year. The crews are divided into three process areas: Liquid Process, Dewatering and Energy Recovery.

In addition, there are daylight Operations employees, including Mobile Equipment and Tri-Axle Operators, Truck Processors and Dispatchers. There is a Process Superintendent who oversees the daily operations. A manager heads the Operations Department. The Director of Operations and Maintenance ensures cooperation among those responsible for operating the plant and those responsible for maintaining it. ALCOSAN uses a computerized maintenance management system (MP-2®) (CMMS). This CMMS stores information regarding each piece of major equipment in the plant, including repair history. This information assists in determining root cause failure analysis and equipment downtime which is essential to the plant's ability to perform at maximum capacity during wet weather flows. Scheduled preventative maintenance of processing equipment ensures equipment is in good operating condition prior to wet weather seasons. In addition, manufacturers' equipment manuals are catalogued and retained in on-site libraries.

To maintain flow capacity in the ALCOSAN's deep-tunnel system, regularly scheduled draw-downs of the wet well are performed to increase flow velocities, thereby assisting in the removal of solids which settle in the deep tunnels during normal operations.

3.3.2 Wet Weather Operation

When wet weather flows are predicted, ALCOSAN's Wet Weather Operating Plan is followed to optimize flows to the wastewater treatment plant. The plan is designed to maintain normal biological treatment and minimize the risk of damage to plant equipment.

At the treatment plant, the pumping rates of ALCOSAN's influent pumps can be increased to available treatment capacity in response to higher wastewater elevations in the wet well.

The operating strategy for the influent pumps is based on control of the wastewater elevation within the wet well. Pump control is managed through a computerized DCS where the wet well elevations are monitored continuously; the data are fed into the DCS, which controls the pump actuation and pumping rates. ALCOSAN currently maintains an operational elevation of 670 feet in the wet well but operates with the wet well at 660 feet at times.

ALCOSAN's Wet Weather Operating Plan includes steps to be taken prior to, during, and after a wet weather event or the cumulative effect of events could result in the elevation of river levels causing flooding conditions.

The ALCOSAN WWTP hydraulic capacity is also influenced by the Ohio River pool elevation. At the normal pool elevation of 710 feet (controlled by the Emsworth Dam) the plant discharge

is not hydraulically restricted and is defined by the limitations of the treatment process units. However, if the river pool elevation reaches a flood elevation of 720 feet the plant discharge is hydraulically restricted. Under these conditions the plant cannot operate at full capacity and is reduced to a pumped flow-through capacity of approximately 50 to 100 mgd. The river elevation at the Point exceeded 720 feet twice during the period of 2007 through 2016.

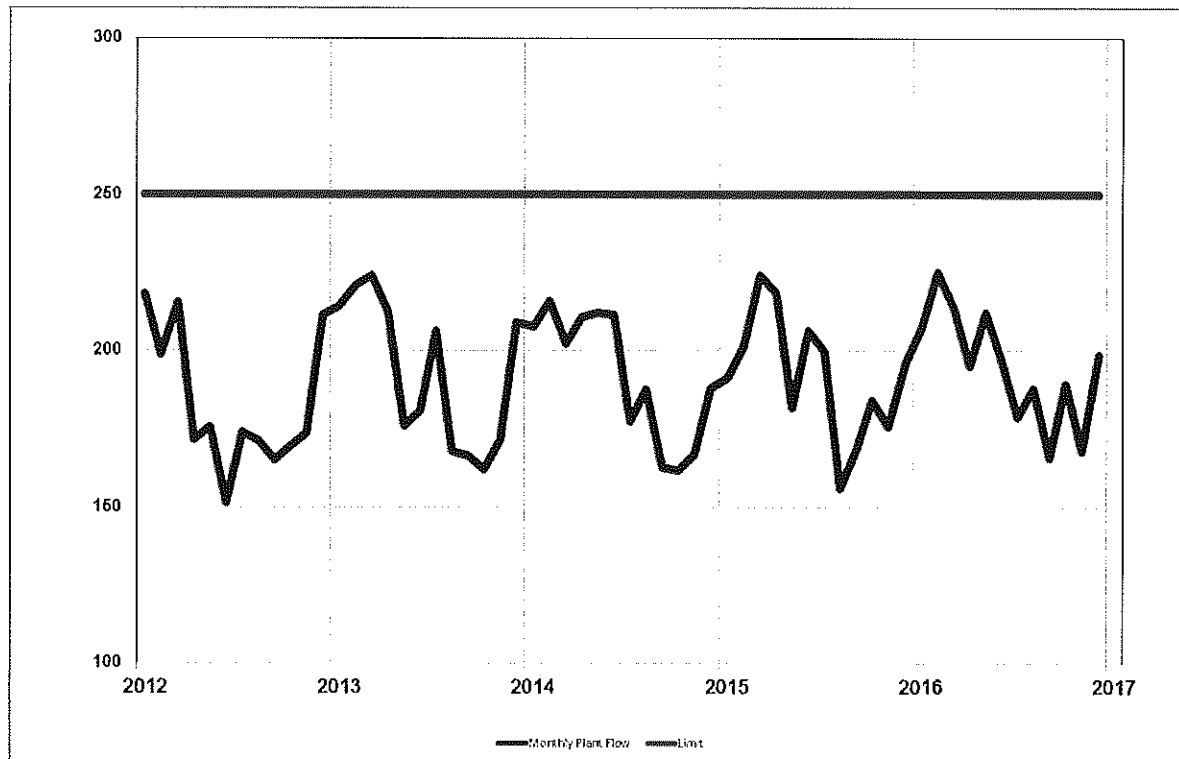
3.4 Current Wastewater Plant Performance

3.4.1 Hydraulic and Organic Plant Loadings

Hydraulic Loadings

For the five-year period of 2012 through 2016 the annual average monthly flow ranged from 183 to 195 mgd and the overall average was 191,³⁻¹ or approximately 76% of the average daily flow under the current NPDES permit³⁻² limit of 250 mgd. The averaged Maximum Month Average Day plant flow for the period was around 234 mgd. Monthly plant flows are shown graphically on Figure 3-16 and are detailed on Table 3-6.

Figure 3-16:
Monthly WWTP Flows 2012 – 2016
In Million Gallons per Day



3-1 Source: ALCOSAN 2016 Wasteload Management Report.
3-2 PA 0025984

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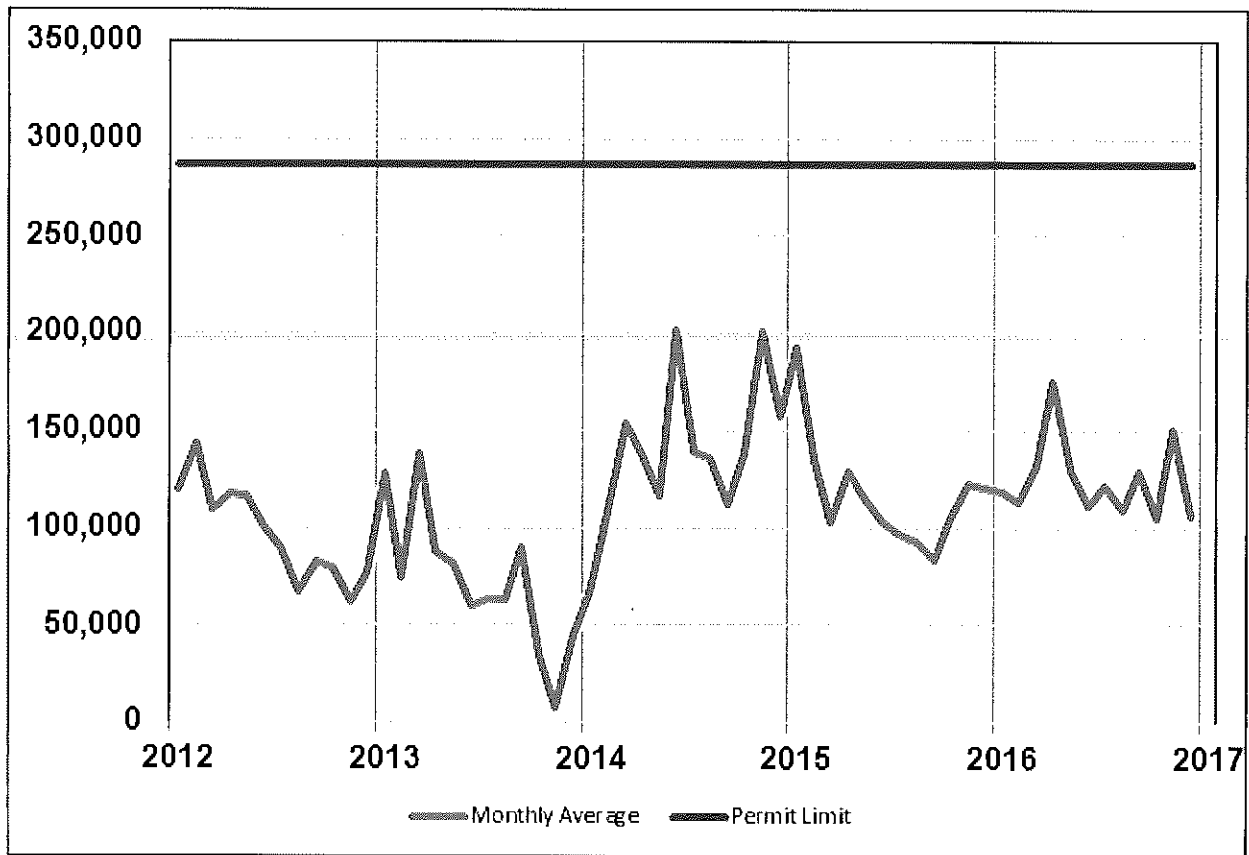
Table 3-6:
ALCOSAN Woods Run WWTP Monthly Average Plant Flows
(Million Gallons per Day)

Month	2012	2013	2014	2015	2016
January	218	214	208	191	207
February	199	221	216	202	225
March	216	224	202	224	214
April	172	213	211	219	195
May	176	176	212	182	212
June	151	181	212	206	197
July	174	206	177	200	179
August	171	168	188	156	188
September	165	166	163	168	166
October	169	162	162	184	189
November	174	172	167	176	168
December	212	209	188	196	198
Limit	250	250	250	250	250
Avg. Annual	183	193	192	192	195
Max Month	218	224	216	224	225
Ratio: Max Month to Annual Average	1.19	1.16	1.12	1.17	1.15

Organic Loadings

Monthly organic loading to the Woods Run Wastewater Treatment Plant averaged approximately 102,400 pounds of BOD per day for the period of 2012 through 2016³⁻³. The averaged Maximum Month Average Day plant organic loading was around 170,000 pounds of BOD per day. Monthly plant organic loadings are shown graphically on Figure 3-17 and are detailed on Table 3-7.

Figure 3-17:
Monthly Plant Loads 2012 – 2016
(lbs. BOD per Day)



3-3 Source: ALCOSAN 2016 Wasteload Management Report.

Table 3-7:
ALCOSAN Woods Run WWTP Monthly Average Plant Loads (Pounds of BOD₅ per Day)

Month	2012	2013	2014	2015	2016
January	119,604	127,623	66,413	191,975	118,336
February	143,319	74,355	107,939	135,438	113,365
March	109,514	137,731	153,257	102,848	132,195
April	117,834	87,867	138,534	129,354	175,348
May	116,140	82,213	116,757	115,613	130,144
June	100,205	59,731	201,437	103,194	111,434
July	90,271	62,984	139,143	97,172	121,708
August	67,389	63,281	136,447	92,876	109,011
September	82,603	89,869	112,550	83,698	129,159
October	79,485	34,648	138,487	105,269	105,529
November	62,538	7,988	200,994	122,412	150,420
December	76,222	45,109	158,035	120,490	106,159
Limit	287,010	287,010	287,010	287,010	287,010
Avg. Annual	97,094	72,783	139,166	116,695	125,234
Max Month	143,319	137,731	201,437	191,975	175,348
Ratio: Max Month to Annual Average	1.5	1.9	1.4	1.6	1.4

3.4.2 NPDES and CD Compliance

Based on historical plant data as reported in the Chapter 94 Reports, for the ten-year period of January 2007 through 2016, the treatment plant effluent met all pollutant concentrations and mass loadings with no exceptions to permit limits reported. The quality of the water discharged from ALCOSAN's Woods Run Wastewater Treatment Plan readily exceeds the regulatory requirements (i.e. the pollutants remaining in the water are considerably lower than the permit limits).

The level of performance is evidenced through the monthly average effluent quality shown on Table 3-8. The average monthly concentration limits for organic pollutants (CBOD₅) are 25 milligrams per liter (mg/l) during November through April and 20 mg/l during the May through October river recreational season. For 2016, the average Carbonaceous Biochemical Oxygen Demand (CBOD) effluent concentration was 8 mg/l. The year-round average monthly

effluent concentration limit for TSS is 30 mg/l while the 2016 average effluent concentration was 11 mg/l.

Table 3-8:
ALCOSAN Treatment Plant Performance 2016
30-day average concentrations in milligrams per liter

Month	Carbonaceous Biochemical Oxygen Demand		Total Suspended Solids	
	Effluent	Limit	Effluent	Limit
January	11	25	13	30
February	9	25	11	30
March	8	25	10	30
April	10	25	10	30
May	8	20	17	30
June	7	20	8	30
July	6	20	9	30
August	5	20	10	30
September	6	20	9	30
October	6	20	10	30
November	6	25	8	30
December	10	25	13	30
Average	8	23	11	30

3.4.3 Primary Treatment Performance

Wastewater characteristics at the Woods Run WWTP are monitored by daily 24-hour composite and grab samples and analysis in the ALCOSAN Laboratory for biochemical oxygen demand (BOD), total suspended solids (TSS), volatile suspended solids (VSS), and ammonia nitrogen (NH₃-N), among other parameters. Prior to 2008 plant influent BOD was derived from COD measurements then using a historical COD to BOD ratio of 2:1. After 2007 the plant influent BOD was directly monitored using the BOD₅ testing procedure.

A study was performed in 2007 to assess performance of the primary treatment process under then current and proposed wet weather operating conditions. For the purpose of this study, daily plant monitoring data for a 36-month period from January 2004 through December 2006 were used to characterize the wastewater at the Woods Run WWTP. Primary influent and primary effluent pollutant characteristics were analyzed to facilitate evaluation of alternative scenarios for expansion of the WWTP for wet weather treatment.

Primary influent and primary effluent daily flows and loading data for the Woods Run WWTP for this time period are summarized in Table 3-9 and Table 3-10, respectively. Primary influent and primary effluent TSS, BOD and NH₃-N concentrations are summarized in Table 3-11 and Table 3-12, respectively. Maximum month flows and loads (BOD and TSS) correspond to the 98th percentile value of the rolling 30-day average daily flow and load data, while maximum

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week flows and loads correspond to the 98th percentile value of the rolling 7-day (NH₃-N) average of daily flow and load data. Maximum month and maximum week ammonia loadings are based on calendar months and weeks since primary effluent samples are typically tested 5 days/week for ammonia. Maximum day values correspond to the 98th percentile value of all daily flow and load data. During this time period the reported BOD was based on daily COD testing of primary influent and primary effluent samples and the historical COD:BOD ratio of 2:1.

Table 3-9:
Primary Influent Flows and Loads, 2004 through 2006

Parameter	Flow (mgd)	BOD (lbs/day)	TSS (lbs/day)	NH ₃ -N (lbs/day)
Average Daily	191	156,694	224,167	10,303
Maximum Month	220	278,117	314,944	13,951
Maximum Week	224	281,460	366,248	16,061
Maximum Day	225	308,046	501,548	19,910

Table 3-10:
Primary Effluent Flows and Loads, 2004 through 2006

Parameter	Flow (mgd)	BOD		TSS		NH ₃ -N	
		(lbs/day)	% Removal	(lbs/day)	% Removal	(lbs/day)	% Removal
Average Daily	191	79,018	50%	66,925	70%	9,332	9%
Maximum Month	220	117,736	58%	100,130	68%	14,432	-3%
Maximum Week	224	130,900	53%	126,830	65%	16,675	-4%
Maximum Day	225	164,290	47%	148,032	70%	19,751	1%

Table 3-11:
Primary Influent Concentrations, 2004 through 2006

Parameter	BOD (mg/L)	TSS (mg/L)	NH ₃ -N (mg/L)
Average	96	142	6.7
Maximum Day (98 th percentile)	208	309	14.0

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Table 3-12:
Primary Effluent Concentrations, 2004 through 2006

Parameter	BOD (mg/L)	TSS (mg/L)	NH ₃ -N (mg/L)
Average Daily	50	42	6.1
Maximum Day (98 th percentile)	105	100	14.4

Analysis of the three-year loadings data indicates the primary sedimentation tanks achieved removals of 50% BOD, 70% TSS and 9% Ammonia on average daily basis.

A more recent evaluation of plant flows and loads was performed for the time-period of August 2014 to July 2016. Table 3-13 provides a comparison of current plant data with that reported above from 2004 to 2006.

Table 3-13
Comparison of Current and 2004-2006 Plant Flow and Loading Data³⁻⁴

Condition	Date Range	Flow	BOD		TSS		NH ₃ -N	
		MGD	mg/L	lb/day	mg/L	lb/day	mg/L	lb/day
Average Day	Current	191.5	72	115,000	113	181,000	9	15,000
	2004-2006	191.0	98	156,694	141	224,167	6	10,303
Dry Weather ADF	Current	181.6	77	116,000	114	172,000	10	15,000
Max Month (30-d)	Current	237.0	-	138,000	-	260,000	-	21,000
	2004-2006	220.0	-	278,117	-	314,944	-	13,951
Max Week (7-d)	Current	246.9	-	171,000	-	375,000	-	29,000
	2004-2006	220.0	-	281,460	-	366,248	-	16,061
Peak Day	Current	250.0	-	297,000	-	857,000	-	44,000
	2004-2006	225.0	-	308,046	-	501,548	-	19,910

This comparison indicates the current average day, maximum month and maximum week BOD loads have decreased from 2004-2006 levels, though peak day BOD loads are similar. Average day and maximum month TSS loads have decreased from 2004-2006 levels, while maximum week and peak day TSS loads have increased. Ammonia-nitrogen loads have increased for all flow conditions.

³⁻⁴ Source: Technical Memorandum: Data Evaluation and Preliminary Process Technical Memorandum dated January 19, 2017. Prepared by ARCADIS Design & Consultancy.

Analysis of the current period primary influent and primary effluent sampling and laboratory data indicates the primary sedimentation tanks achieved removals of 56% BOD, 66% TSS and negligible ammonia removal on an average daily basis. In comparison, the removals achieved during 2004-2006 were 50% BOD, 70% TSS and 9% ammonia.

To evaluate the feasibility of high rate operation of the primary sedimentation tanks during wet weather a primary stress testing program was performed during 2005 and 2006. This full-scale stress testing program investigated the performance of the primary treatment process at surface overflow rates up to 3,100 gpd/ft² (limited by tank hydraulic capacity as explained in Section 9.2.2). The wastewater sampling and testing conducted as part of this stress testing also provided the opportunity to further characterize primary influent and primary effluent during dry and wet weather without the influence of co-settled WAS. Co-settling of WAS in the primary sedimentation tanks is the current operating practice, however, separate WAS thickening facilities are proposed for future wet weather operations at the WWTP. Table 3-14 summarizes the average primary influent and primary effluent TSS, BOD and ammonia concentrations during dry vs. wet weather.

Table 3-14:
Average Daily TSS and BOD Concentrations during Primary Stress Testing

Weather Conditions	Primary Influent			Primary Effluent		
	BOD, mg/L	TSS, mg/L	NH ₃ -N, mg/L	BOD, mg/L	TSS, mg/L	NH ₃ -N, mg/L
Out of CSO (dry weather)	109	183	8.0	50	53	7.9
In CSO (wet weather)	90	153	5.5	46	50	5.9
Overall	104	174	7.2	49	53	7.3

The distinction between dry weather conditions (Out of CSO) and wet weather conditions (In CSO) shown in Table 3-14 is based on the occurrences of CSO events defined as days when the water level in the Main Pumping Station at the WWTP exceeds an elevation of 685 feet. Above this wet well level some CSO regulators in the regional conveyance system begin to overflow. The TSS, BOD and ammonia average characteristics of the primary influent exhibited some dilution in concentration during wet weather. Also noted was the primary effluent TSS and BOD concentrations remained approximately 50 mg/L during dry and wet weather. No ammonia removal was observed during the stress testing program. The average BOD removals during dry and wet weather were 50% and 44%, respectively. The average TSS removals during dry and wet weather were 68% and 61%, respectively. For further information on the primary stress testing program refer to the primary treatment description in Section 2.2.

4.0 CAPITAL IMPROVEMENTS PROGRAM

This section describes ALCOSAN's Capital Improvements Program (CIP) and is intended to provide an overview of ALCOSAN's near term capital construction and improvement needs. The scope and schedule of projects described herein are subject to change as conditions evolve.

4.1 Current Capital Improvement Program

ALCOSAN maintains a comprehensive capital budget, the Capital Improvements Program (CIP). The CIP is updated and approved by the Board of Directors annually. The projects contained in the CIP can be broadly categorized as:

- Major repairs and rehabilitation work necessary to maintain the capacities of the current works in place;
- System upgrades and improvements intended to enhance the capacities or operating efficiencies of the conveyance interceptor system and treatment plant; and
- Long term capital improvements pursuant to ALCOSAN's Consent Decree as described in sections 2 and 4 of this report. These projects go towards the requirements that combined sewer overflows from the ALCOSAN conveyance interceptor system be controlled and that sanitary sewer overflows from the conveyance interceptor system be eliminated.

ALCOSAN's CIP addresses the ongoing implementation of its Comprehensive Sewage Facilities Plan which was prepared in 1996 in accordance with Pennsylvania Act 537. Many of the identified improvements have been implemented and completed under the 537 Plan; however, some capital improvements associated with the 537 Plan remain to be completed and may be refined prior to design and construction pursuant to the Wet Weather Plan.

There are currently 32 projects listed on ALCOSAN's 2017 CIP as approved by the Board of Directors with a total estimated cost of \$279 million. These projects are listed on Table 4-1. Approximately \$28 million had been expended on these projects through 2016. The estimated cost to complete the 2017 CIP as of December, 2016 was \$251 million. Capital expenditures for 2017 are projected to be \$75 million; resulting in remaining expenditures of \$176 million beyond 2017. Projected annual capital expenditures for 2017 through and beyond 2020 are summarized in Table 4-2.

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Table 4-1
ALCOSAN Capital Improvements Program

Project Number	Description	Current Estimated Costs	Expended Through 2016	Remaining	Projected Capital Expenditures				
					2017	2018	2019	2020	Beyond 2020
S404	Sheridan Park WRDA Sec 206	\$801,700	\$741,000	\$60,700	\$60,700	\$0	\$0	\$0	\$0
S408	Biosolids Strategic Plan	\$1,525,600	\$4,400	\$1,521,200	\$507,200	\$507,100	\$506,900	\$0	\$0
S419	Mobile Equipment 2017	\$1,118,800	\$0	\$1,118,800	\$1,118,800	\$0	\$0	\$0	\$0
S420	Grt Chambers	\$1,805,900	\$398,300	\$1,407,600	\$763,600	\$644,000	\$0	\$0	\$0
S421	New Vehicle Maintenance Garage	\$11,000,000	\$10,603,700	\$396,300	\$396,300	\$0	\$0	\$0	\$0
S423	Plant Energy Efficiency Upgrades	\$2,319,000	\$1,003,900	\$1,315,100	\$750,000	\$565,100	\$0	\$0	\$0
S424	PennDot Bridge & Highway Improvements	\$2,191,000	\$1,140,300	\$1,050,700	\$1,050,700	\$0	\$0	\$0	\$0
S427	Squaw Run FM Replacement & Bypass Pumping Connection	\$1,710,400	\$263,600	\$1,446,800	\$1,446,800	\$0	\$0	\$0	\$0
S429	Sewer Rehabilitation (Library Rd & Verona PS)	\$8,892,000	\$319,400	\$8,572,600	\$6,000,000	\$2,572,600	\$0	\$0	\$0
S430	Wet Weather Plant Expansion (Program Costs)	\$14,000,000	\$1,025,600	\$12,974,400	\$4,400,000	\$2,200,000	\$1,400,000	\$600,000	\$4,374,400
S432	Preliminary Planning	\$12,500,000	\$672,800	\$11,827,200	\$4,000,000	\$4,000,000	\$3,827,200	\$0	\$0
S437	Ravine Street Stream Removal & Sewer Separation	\$3,095,000	\$20,100	\$3,074,900	\$1,000,000	\$2,000,000	\$74,900	\$0	\$0
S438	Four Mile Run Regulator(M-29) & Outfall Improvements	\$3,599,000	\$184,900	\$3,414,100	\$200,000	\$2,500,000	\$714,100	\$0	\$0
S439	Source Control-Municipal Inflow & Infiltration / Regionalization	\$38,340,400	\$98,900	\$38,241,500	\$7,624,000	\$5,220,000	\$5,300,000	\$6,000,000	\$14,097,500
S440	Source Control-Municipal Green Infrastructure Projects	\$47,683,600	\$63,700	\$47,619,900	\$9,493,000	\$6,120,000	\$6,200,000	\$7,000,000	\$18,806,900
S441	ERF Demineralization System Replacement	\$3,200,000	\$600,300	\$2,599,700	\$2,599,700	\$0	\$0	\$0	\$0
S442	Energy Recovery Facility Improvements 2016-2017	\$2,500,000	\$100,000	\$2,400,000	\$2,400,000	\$0	\$0	\$0	\$0
S443	Plant And Safety Upgrade (2016 - 2017)	\$3,400,000	\$1,706,900	\$1,693,100	\$1,693,100	\$0	\$0	\$0	\$0
S444	Flap Gates (2016 - 2017)	\$2,769,000	\$40,200	\$2,728,800	\$2,400,000	\$328,800	\$0	\$0	\$0
S445	Conveyance, Rehabilitation & Enhancements (2016 - 2017)	\$3,330,000	\$329,400	\$3,000,600	\$1,000,000	\$2,000,600	\$0	\$0	\$0
S446	Regionalization	\$49,635,000	\$6,501,100	\$43,133,900	\$15,000,000	\$15,000,000	\$13,133,900	\$0	\$0
S447	Municipal Source Control Evaluation Program	\$11,637,000	\$85,900	\$11,551,100	\$1,733,400	\$1,734,000	\$1,740,000	\$1,800,000	\$4,563,700
S448	Interim Wet Weather Planning Compliance	\$22,750,000	\$2,150,000	\$20,600,000	\$2,800,000	\$3,000,000	\$3,300,000	\$3,500,000	\$8,000,000
S449	Demolition of Old Operations & Maintenance Facility	\$2,100,000	\$0	\$2,100,000	\$100,000	\$2,000,000	\$0	\$0	\$0
S450	Sewer Improvements (2017 - 2018)	\$952,000	\$0	\$952,000	\$450,000	\$502,000	\$0	\$0	\$0
S451	Property Acquisitions	\$3,880,000	\$0	\$3,880,000	\$1,000,000	\$1,000,000	\$1,000,000	\$680,000	\$0
S452	Sonar Investigations	\$1,845,000	\$0	\$1,845,000	\$500,000	\$1,000,000	\$345,000	\$0	\$0
S453	Delafield Storm Separation	\$4,549,600	\$0	\$4,549,600	\$143,000	\$2,550,000	\$1,410,000	\$446,600	\$0
S454	Parther Hollow DSI	\$8,006,600	\$0	\$8,006,600	\$342,000	\$2,050,000	\$3,800,000	\$1,814,600	\$0
S455	Green Infrastructure Program Manager	\$3,687,000	\$0	\$3,687,000	\$984,000	\$650,000	\$668,000	\$687,000	\$698,000
S456	Program Management Information System (PMIS)	\$2,295,000	\$0	\$2,295,000	\$975,000	\$620,000	\$300,000	\$200,000	\$200,000
S000	2017 Low Cost Capital Improvements	\$2,115,000	\$0	\$2,115,000	\$2,115,000	\$0	\$0	\$0	\$0
Total		\$279,233,500	\$28,034,400	\$251,199,200	\$75,046,300	\$58,764,200	\$43,720,000	\$22,928,200	\$50,740,500

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Table 4-2:
Projected Near-Term Capital Costs

Item	Projected Capital Expenditures
Current Estimated Costs	\$279,233,600
Expended through 2016	(\$28,034,400)
Remaining to Expend	\$251,199,200
Projected Annual Expenditures	
2017	(\$75,046,300)
2018	(\$58,764,200)
2019	(\$43,720,000)
2020	(\$22,928,200)
Beyond 2020	(\$50,740,500)
Total	(\$251,199,200)

The estimated costs to complete the ten largest projects on the 2017 CIP comprise \$207 million or 82% of the post 2016 projected capital expenditures. Synopses of these projects are provided on Table 4-3.

Table 4-3:
2017 CIP Largest Ten Capital Projects
 (Arranged by Estimated Capital Costs)⁴⁻¹

	Project Number	Remaining Costs	Description	Synopsis ⁴⁻¹
1	S440	\$47,619,900	Source Control-Municipal Green Infrastructure Projects	ALCOSAN is establishing a Source Reduction Agreement program to provide financial incentives to ALCOSAN customer municipalities and related authorities to implement green stormwater infrastructure and other wet weather source control projects.

⁴⁻¹ Summarized from the Consulting Engineer's 2016 Annual Report, December 2015 prepared by Chester Engineers, Pages 6 through 18.

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	Project Number	Remaining Costs	Description	Synopsis ⁴⁻¹
2	S446	\$43,133,900	Regionalization	ALCOSAN is working with its customer municipalities to transfer ownership and maintenance responsibility for approximately 200 miles of inter-municipal trunk sewers to ALCOSAN. The projected capital costs are for the inspection of and repairs to the trunk sewers.
3	S439	\$38,241,500	Source Control- Municipal Inflow & Infiltration / Regionalization	ALCOSAN is working with the customer municipalities and other stakeholders towards the regionalization of inter-municipal trunk sewers into the ALCOSAN Regional Conveyance System.
4	S448	\$20,600,000	Interim Wet Weather Planning Compliance	The implementation of the IWWP will require the management of the municipal flows, using adaptive management strategies, and incorporating the results from municipal source reduction projects and the incorporation of the regionalized trunk sewers into the ALCOSAN system.
5	S430	\$12,974,000	Wet Weather Plant Expansion (Program Costs)	Provision of engineering and technical program management services relating to the expansion of the ALCOSAN treatment plant and implementation of the Wet Weather Plan.
6	S432	\$11,872,000	Wet Weather Advanced Facilities Plan (AFP) & Program Support	Develop the basis and criteria for the individual design projects needed to construct all above-ground and under-ground regional conveyance facilities upstream of the plant and to optimize the existing Basin Facilities Plans.
7	S447	\$11,571,100	Municipal Source Control Evaluation Program	This program will quantify dry and wet weather wastewater flow in municipal collection systems. In addition, the program will furnish, install, and operate all equipment necessary to obtain nighttime flow isolation weir readings.

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	Project Number	Remaining Costs	Description	Synopsis ⁴⁻¹
8	S429	\$8,572,600	Sewer Rehabilitation (Library Rd & Verona PS)	This project includes the evaluation and Cured-in-Place-Pipe (CIPP) lining in upwards of 17,000 linear feet of ALCOSAN interceptor sewers. The project also includes the installation of four access ports on the Monongahela Subaqueous Interceptor to facilitate maintenance
9	S454	\$8,006,600	Panther Hollow Direct Stream Inflow Removal	The Panther Hollow watershed includes parts of Squirrel Hill, Oakland, and Schenley Park. This stream conveys sediment and debris to the deep tunnel and restricts the capacity of the interceptor system. In 2010, the Pittsburgh Water and Sewer Authority submitted an analysis for removing stream flow from the combined sewer system. The report indicates that removing Panther Hollow Lake provides a cost-effective option to reducing combined sewer overflows from M-29.
10	S453	\$4,549,600	Delafield Storm Separation	Re-routing of a stream originating in Fox Chapel Borough that flows via an Allegheny County storm sewer in O'Hara Township into Aspinwall Borough's combined sewer system. ALCOSAN and the municipalities are working cooperatively to obtain funding for the re-routing of the stream from the combined sewer system and into the Allegheny River.
Total		\$207,096,800		

These capital projects will be funded with ALCOSAN's existing funds supplemented by any additional borrowings that ALCOSAN may determine to be appropriate through 2020. It should be noted that ALCOSAN intends to self-fund municipal source reduction projects rather than utilize bond proceeds for projects in which it will not retain full ownership.

4.2 Future Capital Program

4.2.1 General Capital Improvements

ALCOSAN's CIP is updated annually based upon current project progress, ongoing interceptor system inspections and treatment plant renewal and replacement scheduling. In addition to future expenditures related to the implementation of ALCOSAN's Interim Wet Measures Weather Plan (IWWP) pursuant to the federal consent decree, it can be anticipated that ALCOSAN will continue to re-invest in the existing interceptor system and treatment plant at a

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rate of approximately \$33 million annually beyond 2020. This assumption will be refined as ALCOSAN develops subsequent annual Capital Improvement Program budgets.

4.2.2 ALCOSAN's Wet Weather Plan

The long term total costs of ALCOSAN's IWWP (described in Section 2.4.2) remain to be determined pending completion of ongoing regulatory negotiations. The current estimated costs of the Woods Run wastewater treatment plant improvements detailed in Section 6.4 of this document along with related required capital projects such as the new Vehicle Maintenance Garage are shown on Table 4-4.

Table 4-4:
ALCOSAN Woods Run Wastewater Treatment Plant
Wet Weather Treatment Capacity Expansion and Related Capital Improvements

IWWP Capital Improvements	Estimated Capital Cost (millions)
Operation & Maintenance Building (completed)	\$37
New Vehicle Maintenance Garage (completed 2017)	\$11
Expand main pump station capacity (completed)	\$31
Subtotal	\$79
Wet Weather Treatment Capacity Expansion (net of Main PS)	
Main Pump Station (Phase 1)	
Wet Weather Headworks (Phase 1)	
Disinfection (Phase 1)	
Wet Weather Disinfection (Phase 1)	\$267
Primary Treatment Sedimentation Basins (Phase 2) and Secondary Treatment (Phase 3)	\$81
Wet Weather Pump Station (Phase 2)	\$148
Total	\$575

5.0 FUTURE PLANT BASE FLOW AND LOADING CONDITIONS

5.1 Current ALCOSAN Service Population

ALCOSAN serves all or portions of the City of Pittsburgh and eighty-two other municipalities within Allegheny, Washington and Westmoreland Counties. The ALCOSAN-served portions of municipalities range in size from 8 acres (Pleasant Hills Borough) to 37,300 acres (Pittsburgh). The municipal populations served by ALCOSAN range from 95 people (Pleasant Hills) to 302,000 people (Pittsburgh) (Figure 5-1).

Nearly one third of the 83 Municipalities in the ALCOSAN service are only partially served by ALCOSAN. In such areas, the municipal wastewater collection systems flow into other wastewater treatment plants or on-lot private wastewater treatment systems such as septic systems are used. Tables 5-1 and 5-2 show the number of fully and partially served municipalities with their 2010 census ALCOSAN service populations and number of households.

Table 5-1:
Municipal Acreage and Population Distribution

Municipal Acreage Distribution					
Acreage	<100	100 to 500	500 to 2,000	2,000 to 10,000	10,000+
Number of Municipalities	2	29	30	18	4
Municipal Population Distributions					
Population	<1,000	1,000 to 5,000	5,000 to 20,000	20,000 to 50,000	100,000+
Number of Municipalities	12	38	27	5	1

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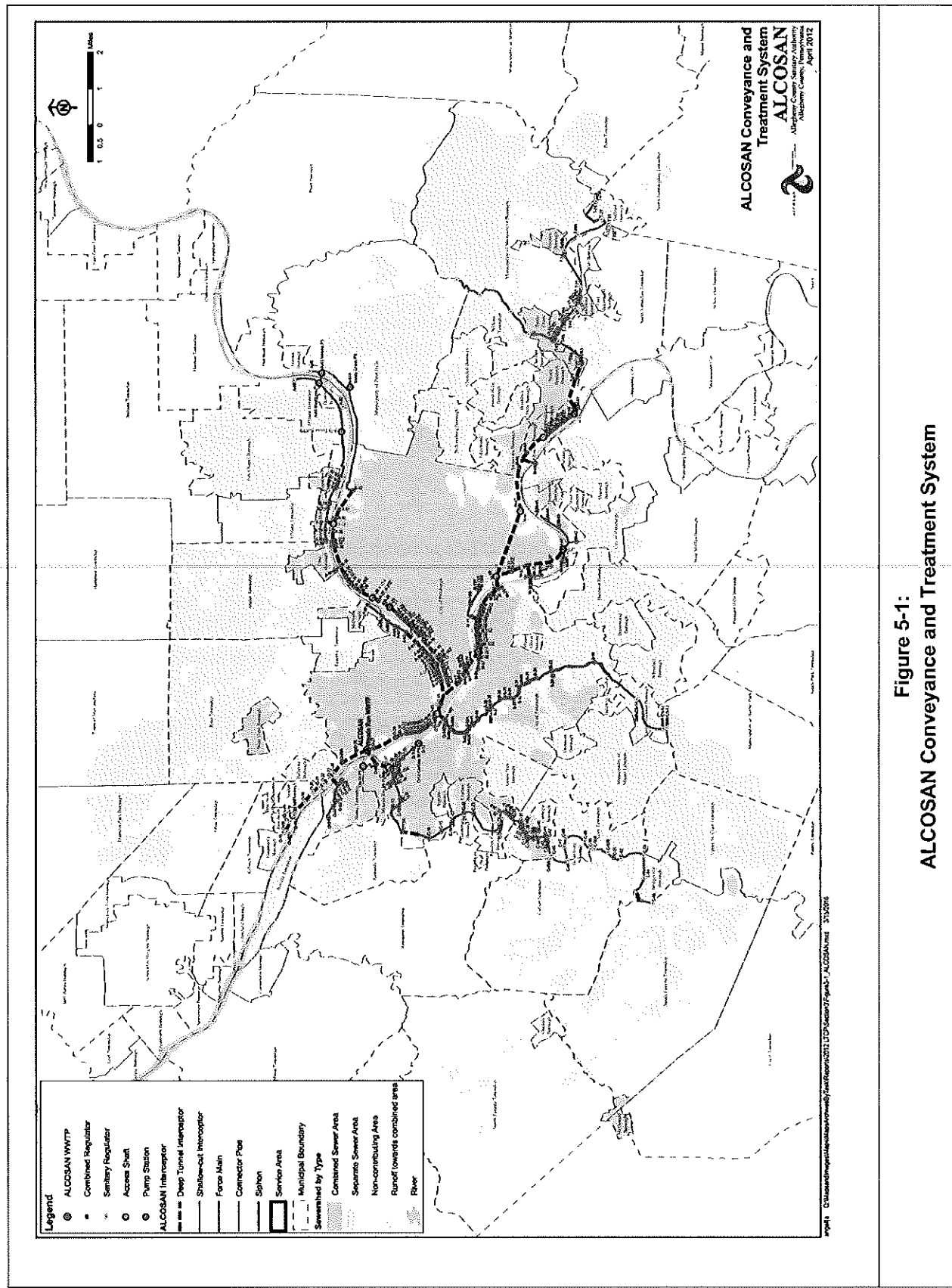


Table 5-2: 2010 Service Area Municipal Population⁵⁻¹
(Rounded to the Nearest Thousand)

Entire municipality within ALCOSAN Service Area	
Number of Municipalities	60
Population Served	658,000
Households Served (Census)	287,000
Municipality partially within ALCOSAN Service Area	
Number of Municipalities	23
Population Served	178,000
Households Served (Census)	64,000
Total Municipalities	83
Total Population Served	837,000
Total Households Served	351,000
Total Residential Accounts Served	301,000
Total Accounts	314,000

5.2 Municipal Population Projections

For ALCOSAN to develop a regional WWP for its service area, planning information was needed from each of the 83 customer municipalities who own and operate their respective wastewater collection systems. The ALCOSAN CD designated 2046 as the planning horizon for the development of the WWP and addressed specific municipal information and data ALCOSAN was required to request⁵⁻². The CD also set milestone dates for ALCOSAN to request the specified information and for the municipalities to submit this information to ALCOSAN⁵⁻³. This section summarizes the municipal planning information obtained to estimate future condition wastewater flow for 2046 and the activities ALCOSAN conducted to obtain the information and coordinate with the municipalities. This section also summarizes the means used to estimate service population and sewershed area growth projected through 2046, the analyses that were conducted to estimate future wastewater flow under dry and wet weather conditions, and the planned projects that will impact future wastewater flow. More

⁵⁻¹ 2010 Census Summary File 1 Pennsylvania /prepared by the U.S. Census Bureau, 2011.

⁵⁻² ALCOSAN CD paragraph 70; Appendix P paragraph 7; and Appendix R paragraphs 3, 7, and 8.

⁵⁻³ ALCOSAN CD paragraph 70

detailed information on municipal coordination requirements, goals and activities is provided in Section 2 of the WWP.

5.2.1 Municipal Planning Information Obtained

This subsection summarizes the CD requirements and the activities ALCOSAN conducted to request and obtain the municipal planning information and data needed to develop the regional WWP and meet CD requirements. The subsection includes a summary of the various coordination activities ALCOSAN used to facilitate the collection of needed planning information from its customer municipalities.

Applicable Consent Decree Requirements: The CD contains certain requirements regarding the collection and coordination of municipal planning information that would be utilized in the preparation of the WWP⁵⁻⁴. The CD requires ALCOSAN to make the planning assumption that control facilities will need to be designed and constructed with sufficient size and capacity to capture and treat all the dry and wet weather flow the customer municipalities convey to the ALCOSAN system, unless certain conditions are met⁵⁻⁴. Municipal flow may be excluded if existing municipal trunk sewers have insufficient hydraulic capacity to convey all the flow to the ALCOSAN system, and/or the municipality decides not to increase the pipe capacity, and/or the municipality elects to provide its own facilities or to use other alternative means to control its wastewater flow.

The CD contains the operational requirement that the ALCOSAN system continue to capture sufficient wastewater flow and provide sufficient treatment to meet established water quality goals for at least 20 years after completing the construction and implementation of the Wet Weather Plan remedial controls and activities⁵⁻⁵. Under the current CD schedule, implementation of the WWP would be completed in 2026 and this requirement would necessitate WWP facilities, programs, and activities to provide a sufficient level of wastewater control for projected flow increases through 2046. To meet this CD requirement, ALCOSAN coordinated with its customer municipalities to develop and quantify wastewater estimates for planning year 2046. Section 2 of the WWP provides detailed documentation of the activities conducted by ALCOSAN to implement its municipal coordination and public participation programs and how the information obtained was used by ALCOSAN in developing the WWP. This WWP section summarizes the information required to develop the WWP and the activities conducted to obtain the information; specifically, municipal information needed to project future sewershed area growth, population and wastewater flow.

The CD lists information and data that ALCOSAN is required to request from each of its customer municipalities and to consider and integrate in developing the regional WWP⁵⁻⁶. The following are CD requirements which relate directly to the information needed to project future flows from customer municipalities at both a municipal and sewershed (point of connection) level.

- The most recent maps of the configuration of the municipal collection systems

⁵⁻⁴ ALCOSAN CD paragraphs 17 and 18

⁵⁻⁵ ALCOSAN CD paragraphs 19 and 20

⁵⁻⁶ ALCOSAN CD paragraph 70

- Available flow monitoring data to characterize wastewater flow generated by the municipalities and routed to the ALCOSAN system
- Forecasts of the total future flow and volume that each point of connection will contribute to the ALCOSAN system when the WWP is implemented and the associated total future service population
- A characterization of the flows from combined and separate municipal collection systems for each point of connection to the ALCOSAN system, a description of how the characterization was prepared, and a description of how these flows will be managed in the future by the municipality
- Hydraulic capacity evaluations and system hydraulic characterizations of the municipal wastewater collection systems to determine if peak wet weather flow can be successfully conveyed to the ALCOSAN system
- Description of the municipal program(s) that will be used to manage wastewater flow so system capacities are not exceeded and established water quality goals are met

The CD also includes a requirement to create an ALCOSAN Customer Municipal Advisory Committee with representation from each of the designated watershed planning basins⁵⁻⁷. A plan of action was described in the CD for ALCOSAN follow-through should a customer municipality fail to provide some or all of the requested information.

Mechanisms for Obtaining Municipal Information: To obtain the required planning information, ALCOSAN issued a series of certified letters, with return receipt acknowledgements, to each of the customer municipalities with formalized requests for information. The ALCOSAN letters included due dates for submitting the requested information. For larger sewershed points of connection to the ALCOSAN system where multiple municipalities contribute flow and needed to coordinate flow contributions and control strategies, customer municipalities were requested to provide draft feasibility studies by July 2012. This would allow better integration of municipal information into the WWP. After each of the municipal submissions was received, ALCOSAN conducted an assessment to verify the completeness and reliability of the information for integration into the development of the WWP. Responses to the most recent request for draft feasibility studies are expected to be reviewed after submission of the draft WWP, and this updated information is expected to be incorporated into the final WWP.

Mechanisms for Coordinating Municipal Information: There were several means that ALCOSAN utilized to provide the needed coordination associated with the information requested from its customer municipalities. A list of the coordination workgroups is provided below. Detailed descriptions of the workgroups and how they functioned to provide the required coordination are provided in WWP Section 2, *Municipal Coordination and Public Participation*.

- A Customer Municipal Advisory Committee (CMAC)
- Seven Basin Planning Committees (BPCs)
- A Feasibility Study Working Group (FSWG)

⁵⁻⁷ ALCOSAN CD paragraph 79

Meetings were also conducted on an as needed basis between ALCOSAN, the seven Basin Planner teams, and individual municipalities to discuss and resolve apparent discrepancies between future flow projections developed by ALCOSAN and those developed by the municipalities.

5.2.2 Projections for Population Growth

In order to estimate future 2046 wastewater flows for the development of the WWP, projections for future population and sewershed area growth were needed. Two sources of information were used to quantify population growth: projections from the Southwestern Pennsylvania Commission (SPC) and projections provided by the customer municipalities. This subsection describes the activities and analyses ALCOSAN conducted to obtain, compile, and analyze this information.

Future population projections for the ALCOSAN service area were obtained from the SPC. The SPC is the regional planning agency serving the 10-county area surrounding Pittsburgh and directs the use of all state and federal transportation and economic development funds allocated to the region. SPC is the region's designated Local Development District and Economic Development District by the US Department of Commerce and in this role, SPC establishes regional economic development priorities and provides a wide range of planning services to the region. SPC analysis data provide population projections through 2040. This available information was used as reasonable surrogate data for the 2046 planning year required by the CD. Census data were obtained to provide 2010 populations.

The population data provided by the census and by SPC include people living within areas served by combined and separate sewer systems and people living within areas that are served by individual on-lot treatment systems and do not contribute flow to the ALCOSAN system. For customer municipalities that have sewershed areas where wastewater treatment is provided by another sewer authority, only the population within sewershed areas served by ALCOSAN was included.

The customer municipalities were asked to provide ALCOSAN with future population projections. At the time the municipal projections were being developed, 2010 census data were not available and municipalities used various versions of extrapolated 2000 census data to estimate existing condition population. In addition, at the time the customer municipalities were developing their future population projections, the SPC projections only extended through 2035. It was the 2035 population projections that were discussed with the customer municipalities. The ALCOSAN planning basin teams shared these SPC projections with each of the customer municipalities. The municipalities either agreed with the SPC projection or provided their own population growth projections. The ALCOSAN basin planner teams conducted the municipal coordination and documented the municipal responses. Subsequently, the SPC extended their population projections through 2040 at the request of the ALCOSAN municipalities. The projections from the customer municipalities were incorporated into the hydrologic and hydraulic (H&H) models and used for the development of the WWP.

In Table 5-3, the existing planning basin populations are compared to the SPC future projections and the population projections compiled by the Basin Planners based on municipal input. The information is organized and totaled by each of the seven planning basins that comprise the ALCOSAN service area. In Table 5-4, the existing population from the 2010 census and the

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population projections from SPC and the municipalities are provided for each of the customer municipalities as compiled by the Basin Planners based on municipal input.

For customer municipalities that have sewershed areas where wastewater treatment is provided by another sewer authority, only the population within sewershed areas served by ALCOSAN was included in the numbers reported in Tables 5-3 and 5-4. Population projections were also obtained for the portion of Cecil Township which has a minor contributing population but is not a direct ALCOSAN customer municipality. Cecil Township customers contribute flow to ALCOSAN via sewer connections and a service agreement to the adjacent downstream neighbor, South Fayette Township.

Table 5-3:
Comparison of SPC and Municipal Population Projections by Planning Basin Area

Planning Basin Area⁽²⁾	2010 Census Population⁽¹⁾	SPC Population Projections⁽²⁾ Percent Change	Basin Planner Projected Percent Change
Chartiers Creek	154,566	19.1%	26.3%
Lower Ohio - Girty's Run	92,061	17.6%	11.8%
Main Rivers	164,070	15.3%	6.2%
Saw Mill Run	106,722	7.4%	6.6%
Turtle Creek - Thompson Run	89,370	23.0%	26.5%
Upper Allegheny River	112,957	15.4%	3.7%
Upper Monongahela River	116,809	16.9%	10.3%
Total ALCOSAN Service Area	836,556	16.3%	13%

(1) Note: Census and SPC populations include areas served by combined sewers, areas served by separate sewers and non-contributing areas that are served by individual on-lot treatment systems.

(2) Note: Only municipal populations within the ALCOSAN service area were included.

Projected population growth varies greatly from municipality to municipality. As can be seen from the table information, there were some customer municipalities with relatively aggressive projected growth rates over the analysis period. In contrast, there also were several municipalities where the population within the ALCOSAN service area was projected to decrease during the analysis period.

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Table 5-4:
Comparison of SPC and Municipal Population Projections by Customer Municipality

Customer Municipality	2010 Census Population ⁽¹⁾	SPC Population Projections ⁽¹⁾ Percent Change	Basin Planner Projections Percent Change
Aspinwall Borough	2,804	15%	0.0%
Avalon Borough	4,703	14%	0.0%
Baldwin Borough	12,319	0%	11%
Baldwin Township	1,988	10%	5.2%
Bellevue Borough	8,371	7%	8.6%
Ben Avon Borough	1,777	24%	13%
Ben Avon Heights Borough	371	-5%	57%
Bethel Park, Municipality of	11,444	8%	1.7%
Blawnox Borough	1,399	16%	0.0%
Braddock Borough	2,117	29%	30%
Braddock Hills Borough	1,880	11%	27%
Brentwood Borough	9,637	13%	7.6%
Bridgeville Borough	5,137	10%	0.45%
Carnegie Borough	7,962	4%	9.8%
Castle Shannon Borough	8,303	9%	-0.04%
Chalfant Borough	790	-9%	-25%
Churchill Borough	3,005	16%	-5.8%
Collier Township	7,081	55%	126%
Crafton Borough	5,932	7%	18%
Dormont Borough	8,591	-8%	2.6%
East McKeesport Borough	1,548	31%	-18%
East Pittsburgh Borough	1,819	12%	8.9%
Edgewood Borough	3,120	-44%	-0.74%
Emsworth Borough	2,445	12%	6.2%
Etna Borough	3,450	22%	0.0%
Forest Hills Borough	6,518	14%	-19%
Fox Chapel Borough	5,195	25%	11%
Franklin Park Borough	4,718	33%	10%
Green Tree Borough	4,431	13%	14%

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Table 5-4:
Comparison of SPC and Municipal Population Projections by Customer Municipality

Customer Municipality	2010 Census Population⁽¹⁾	SPC Population Projections⁽¹⁾ Percent Change	Basin Planner Projections Percent Change
Heidelberg Borough	1,246	14%	3.3%
Homestead Borough	3,157	38%	28%
Indiana Township	881	-34%	0.0%
Ingram Borough	3,331	18%	0.19%
Kennedy Township	7,661	85%	24%
Kilbuck Township	692	25%	34%
McCandless Township	8,829	-12%	0.0%
McDonald Borough	2,129	12%	0.27%
McKees Rocks Borough	6,104	8%	16%
Millvale Borough	3,733	20%	31%
Monroeville, Municipality of	27,903	15%	25%
Mt. Lebanon, Municipality of	33,138	8%	16%
Mount Oliver Borough	3,399	7%	10%
Munhall Borough	11,355	5%	4.5%
Neville Township	1,077	-33%	4.2%
North Braddock Borough	4,899	27%	47%
North Fayette Township	5,831	148%	263%
North Huntingdon Township	2,033	56%	996%
North Versailles Township	3,885	16%	48%
Oakdale Borough	1,457	-3%	3.6%
O'Hara Township	8,346	54%	0.0%
Ohio Township	3,384	25%	32%
Penn Hills, Municipality of	33,682	14%	10%
Penn Township	4,324	67%	185%
Peters Township	176	2%	149%
Pitcairn Borough	3,294	15%	-14%
Pittsburgh City	305,369	16%	6.4%
Pleasant Hills Borough	95	-49%	12%
Plum Borough	1,625	109%	311%

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Table 5-4:
Comparison of SPC and Municipal Population Projections by Customer Municipality

Customer Municipality	2010 Census Population⁽¹⁾	SPC Population Projections⁽¹⁾ Percent Change	Basin Planner Projections Percent Change
Rankin Borough	2,113	10%	25%
Reserve Township	3,345	27%	6.2%
Robinson Township	900	94%	474%
Ross Township	30,903	13%	20%
Rosslyn Farms Borough	427	54%	189%
Scott Township	17,018	8%	13%
Shaler Township	28,734	11%	0.0%
Sharpsburg Borough	3,445	14%	0.0%
South Fayette Township ⁽²⁾	14,402	36%	107%
Stowe Township	6,361	-2%	6.8%
Swissvale Borough	8,988	10%	7.6%
Thornburg Borough	462	17%	120%
Trafford Borough	3,191	3%	6.7%
Turtle Creek Borough	5,342	17%	-0.14%
Upper St. Clair Township	19,112	11%	24%
Verona Borough	2,383	-9%	0.0%
Wall Borough	577	9%	45%
West Homestead Borough	1,931	28%	18%
West Mifflin Borough	6,245	-3%	18%
West View Borough	6,766	13%	8.7%
Whitaker Borough	1,272	32%	1.8%
Whitehall Borough	13,117	16%	8.0%
Wilkins Township	6,362	18%	4.1%
Wilkinsburg Borough	15,922	18%	6.0%
Wilmerding Borough	2,186	25%	13%
Total ALCOSAN Service Area	836,556	16%	13%

- (1) Note: Census and SPC populations include areas served by combined sewers, areas served by separate sewers and non-contributing areas that are undeveloped or served by individual on-lot treatment systems.
- (2) Note: South Fayette populations include the minor Cecil Township service area.

Figure 5-2 is a Geographic Information Systems (GIS) map showing the projected percentage change between existing and projected 2046 populations served by the ALCOSAN system, as compiled by the Basin Planners based on information provided by the customer municipalities.

5.2.3 Projected Service Area Growth

The ALCOSAN basin planning teams also discussed with the customer municipalities areas where future development was projected to occur. Many of the municipalities reported they are fully built-out and would not anticipate any significant expansion of their existing sewer systems. Any projected population growth within these municipalities would presumably be:

- A result of fill-in construction on empty lots located within existing areas already served by combined or separate wastewater collection systems
- Demolition and redevelopment within existing sewered areas at a higher density
- Via increased population within existing dwelling units.

Other municipalities have undeveloped areas where future population growth is associated with an expansion of the sewershed area for their existing municipal wastewater collection sewer systems.

**Table 5-5:
Projected Future Sewershed Area Growth by Planning Basin Area**

Planning Basin Area	2010 Sewershed Area (miles²)	2040 Sewershed Area (miles²)	Projected Percent Change
Chartiers Creek	47.9	61.2	27.7
Lower Ohio - Girty's Run	27.2	27.2	0.0
Main Rivers	23.0	23.0	0.0
Saw Mill Run	18.3	18.3	0.0
Turtle Creek - Thompson Run	36.0	42.0	16.7
Upper Allegheny River	35.2	35.2	0.0
Upper Monongahela River	26.1	26.1	0.0
Total ALCOSAN Service Area	213.7	233.0	9.0

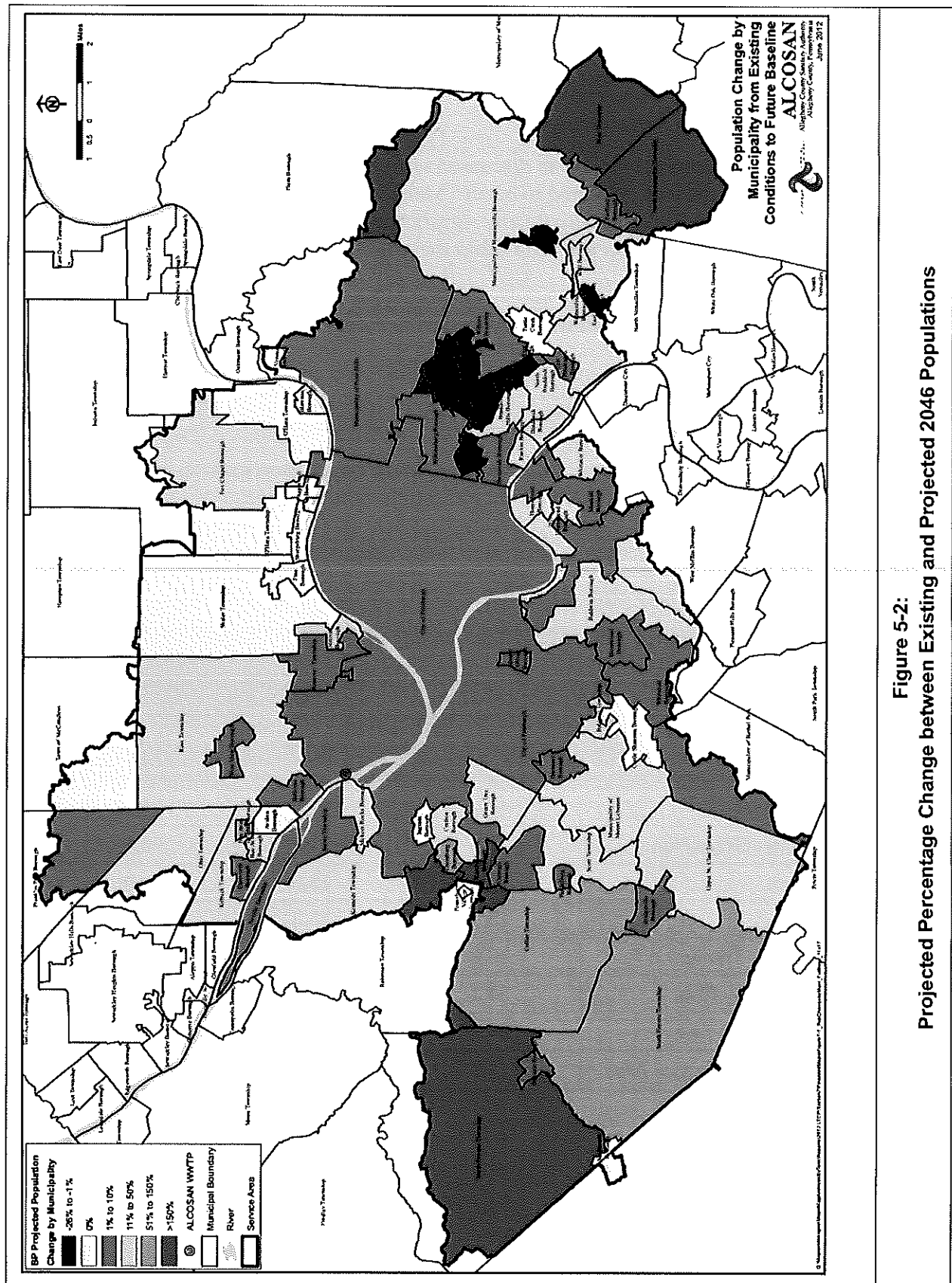


Figure 5-2:
Projected Percentage Change between Existing and Projected 2046 Populations

5.3 Future Wastewater Flow

The ALCOSAN CD required that for the development of the WWP, future baseline condition flows should be utilized and based upon a planning horizon date of 2046, 20 years after the scheduled implementation of the plan⁵⁻⁸. The future population and sewershed area growth projections provided by the customer municipalities, along with other pertinent municipal planning information, were used to calculate dry weather flows. These projected future dry weather flows and new sewershed areas were subsequently incorporated into the H&H models to quantify total future wastewater flows under both dry and wet weather conditions. This section describes the assumptions used for the calculation of future baseline condition flows, summarizes the calculation results, and documents the impacts of these future flows on annual CSO and SSO volumes.

5.3.1 Near-Term Flow and Loading Projections

Per-Capita Flow and Loading Projections per ALCOSAN's 2016 Chapter 94 Report

Hydraulic and organic loading projections are based upon population changes in the ALCOSAN service area. The Southwestern Pennsylvania Commission adopted its Cycle 10a Population Forecast on June 27, 2016, projecting a 1.49% population increase from 2016 through 2021. An annualized rate of 0.3% was used to estimate service area population for this period. Hydraulic and organic loading projections are the product of projected annual population and the long-term average per capita flow (LTPF), or the long-term average per capita organic loading (LTPO), calculated for each month. LTPF values were calculated for the period of 1991 through 2016; LTPO values were calculated for the period of 1998 through 2016. Projected hydraulic and organic per-capita loading values for 2021 are provided on Table 5-6.

Each estimated three-month maximum average is the product of the projected annual average and the long term mean value of the ratios of three-month maxima to annual averages. Monthly average hydraulic and organic loadings are calculated from data for reporting years of 2012 - 2016, inclusive, and monthly projections for the period of 2017 - 2021, inclusive. For planning purposes, all loadings are attributed to customers. More precise projections are not practical, as more than half of flow and an indeterminate amount of organic loading is attributable to storm water and I/I.

⁵⁻⁸ ALCOSAN CD Appendix P, paragraph 7 and Appendix R, paragraphs 3, 7, and 8

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Table 5-6:
Per-Capita Flow and Loading Projections for 2021

Month	Long Term Per Capita Flow (gallons per day)	Long Term Per Capita Organic Loading (pounds per day)
January	227	0.156
February	236	0.159
March	239	0.153
April	231	0.163
May	222	0.158
June	217	0.153
July	207	0.151
August	201	0.135
September	194	0.146
October	193	0.147
November	201	0.153
December	221	0.155
Average Annual	216	0.152

Flow and Loading Projections through 2021

Hydraulic Loadings

Daily flows to the Woods Run Wastewater Treatment Plant are projected to average 189 mgd for the period of 2017 through 2021 or approximately 76% of the average daily flow under the current NPDES permit limit of 250 mgd. The averaged Maximum Month Average Day plant flow for the period is projected to be around 209 mgd. Projected monthly plant flows are shown graphically on Figure 5-3 and are detailed on Table 5-7.

Figure 5-3:
Projected Monthly Average Plant Flows 2017 - 2021
(Million Gallons per Day)

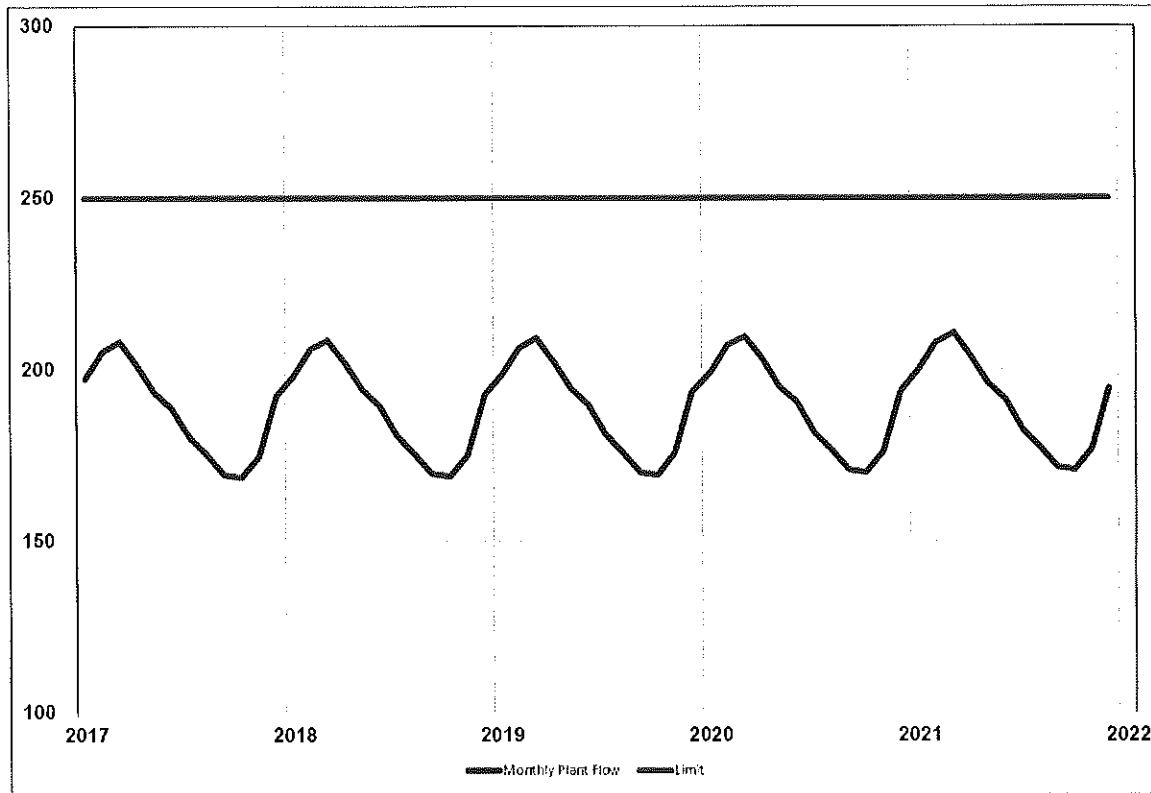


Table 5-7:
ALCOSAN Woods Run WWTP Projected Monthly Average Plant Flows 2017 - 2021
(Million Gallons per Day)

Month	2017	2018	2019	2020	2021
January	198	198	199	199	200
February	206	206	207	207	208
March	208	209	209	210	211
April	202	202	203	203	204
May	194	194	195	195	196
June	189	189	190	190	191
July	180	181	181	182	182
August	175	176	176	176	177
September	169	170	170	171	171
October	169	169	169	170	171

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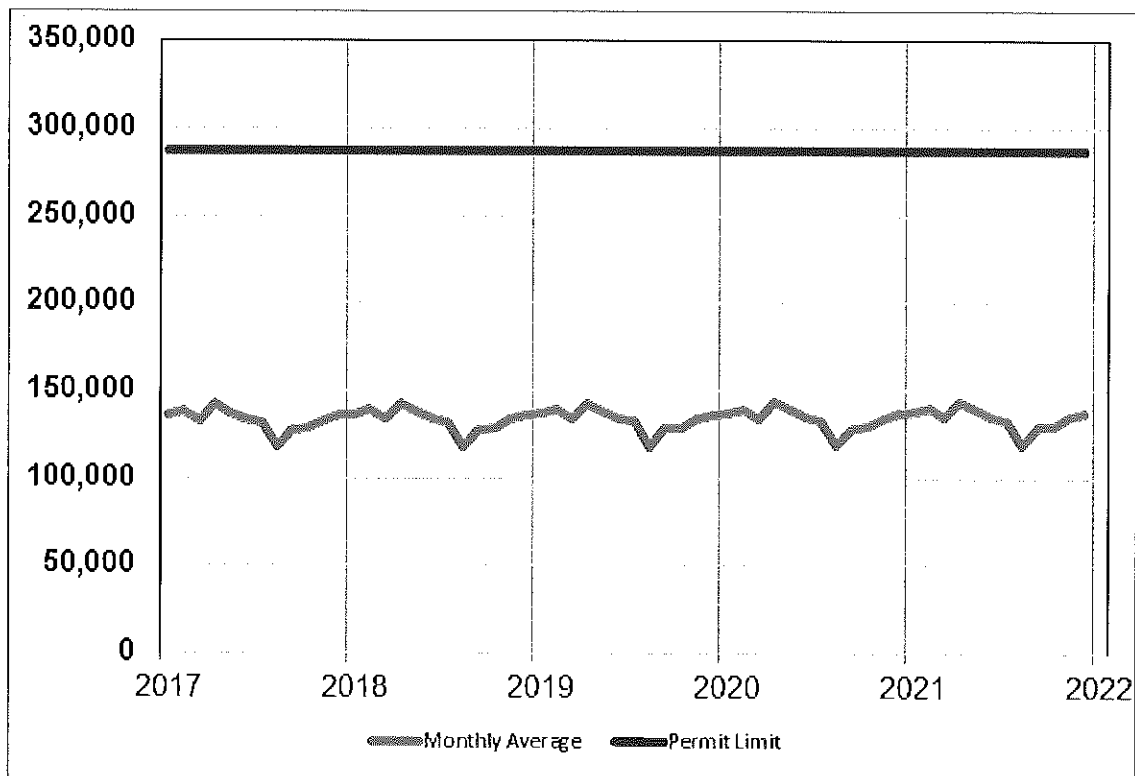
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Month	2017	2018	2019	2020	2021
November	175	175	176	176	177
December	192	193	193	194	195
Limit	250.0	250.0	250.0	250.0	250.0
Avg. Annual	188.0	188.5	189.0	189.5	190.3
Max Month	208	209	209	210	211
% Permitted Daily	83%	83%	84%	84%	84%
Ratio: Max Month to Annual Average	1.11	1.11	1.11	1.11	1.11

Organic Loadings

Monthly organic loading to the Woods Run Wastewater Treatment Plant are projected to average approximately 133,600 pounds for the period of 2017 through 2021. The Maximum Month Average daily organic loading is projected to be 142,700 pounds. Projected monthly plant organic loadings are shown graphically on Figure 5-4 and are detailed on Table 5-8.

Figure 5-4:
Projected Monthly Average Plant Loads 2017 – 2021
Pounds per Day of BOD



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The hydraulic and organic capacities of the treatment plant will not be exceeded within the planning period represented by this report. ALCOSAN submitted its Draft Long Term Wet Weather Control Plan January 29, 2013. The Plan proposes expanded primary and secondary treatment process capacity as part of an integrated strategy to control wet weather discharges.

Table 5-8:
ALCOSAN Woods Run WWTP Projected Monthly Average Plant Loadings 2017 - 2021
(Pounds of BOD₅ per Day)

Month	2017	2018	2019	2020	2021
January	136,006	136,361	136,718	137,079	137,671
February	138,420	138,781	139,145	139,512	140,114
March	133,263	133,610	133,961	134,314	134,894
April	141,951	142,321	142,694	143,071	143,688
May	137,571	137,930	138,292	138,656	139,255
June	133,476	133,824	134,175	134,529	135,109
July	131,543	131,886	132,232	132,581	133,153
August	117,464	117,770	118,079	118,391	118,902
September	127,598	127,930	128,266	128,604	129,159
October	128,222	128,556	128,893	129,233	129,791
November	133,255	133,602	133,953	134,306	134,886
December	135,487	135,840	136,196	136,555	137,145
Limit	287,010	287,010	287,010	287,010	287,010
Avg. Annual	132,855	133,201	133,550	133,903	134,481
Max Month	141,951	142,321	142,694	143,071	143,688
Ratio: Max Month to Annual Average	1.1	1.1	1.1	1.1	1.1

5.3.2 Long Term Flow Projections

As noted in Section 5.2.1, ALCOSAN's consent decree established a planning period through 2046. The ALCOSAN service population is projected to increase from 836,556 in 2010 to 945,308 in 2046. This represents an overall 13% increase from the 2010 Wet Weather Plan base year and works out to an annual growth rate of 0.34%.

Projected service populations and average flows to the Woods Run Wastewater Treatment Plant are shown on Table 5-9. The average flow projections through 2021 are from ALCOSAN's 2016 Chapter 94 report. As may be noted in Table 5-9, slight declines in average daily plant flows are projected for 2017 through 2021 compared with the period of 2010 through 2016.

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Table 5-9:
Projected Service Population and Average Annual Plant Flows Through 2046

Year	Service Population	Annual Average Plant Flow (mgd)	
2010	836,556 *	Actual	185
2011	839,401		202
2012	842,255		183
2013	845,120		193
2014	847,994		192
2015	850,877		192
2016	853,771		195
2017	856,674	Projected	188
2018	859,588		188
2019	862,511		189
2020	865,444		189
2021	868,387		190
~			
2046	945,308		240

* Based on 2010 Census data polygons as correlated with detailed sewershed mapping.

The data presented in Table 5-9 were taken from ALCOSAN's 2016 Chapter 94 Report for consistency with previously submitted information. This Report requires a five-year projection of treatment plant hydraulic loading. Projected loadings are to be calculated by multiplying *long term per capita flow rates by projected population changes within the service area*. To fulfill this requirement, a running average per capita flow rate has been maintained since 1991. The effect of maintaining such a long-term average has been to mask extreme changes in hydraulic loading from year to year, and to tie projections more closely to predicted changes in population.

Three variables contribute to flow projections:

- the volume of wastewater treated during a given year;
- population changes as modeled by Southwestern Pennsylvania Commission; and,
- weather patterns with respect to total precipitation, storm intensity, and distribution of events during a given year.

Volume Treated

The volume treated is limited to the capacity of the plant, with any excess overflowing during +-wet weather. From 1991 to 2010, the permitted capacity was 200 MGD, rising thereafter to 250 MGD. The capacity limitations can artificially suppress a long term per capita flow calculation and projection.

Population Changes

Population data published by the Southwestern Pennsylvania Commission (SPC) for each of the ALCOSAN municipalities is used to estimate changes in service area population over the five year projection period. SPC updates this data (referred to as "cycle reports") periodically with changes to Federal Census studies and other locally acquired information. Population projections from Cycle to Cycle have been inconsistent, alternating between growth and decline within the same projection periods. The inconsistency has contributed to lower than expected average per capita flow and flow projections.

Weather Patterns

The quantity of wastewater treated is significantly influenced by the frequency and distribution of wet weather events over any given year. Less intense but more frequent wet weather events producing lower than average total precipitation can result in higher quantities of wastewater treated. Conversely, more intense but less frequent events producing higher than average total precipitation can result in lower quantities of wastewater treated. With more than half of the wastewater treated attributed to weather induced inflow and infiltration, the correlation of future loadings with population changes is problematic. Averaging per capita hydraulic loading over a 26-year period limits the impact of more recent weather trends and introduces an artificial consistency in future calculations.

To correct for the factors in the Chapter 94 methodology that result in decreased projected average daily plant flows, ALCOSAN also reviewed PaDEP recommended forms for reporting past and future hydraulic loading. Long term per capita loading calculations are limited to a five-year history. As indicated in the following table, this method produces projections for 2017 through 2021 that are more consistent with recent actual plant flow data.

**Table 5-10:
Near Term Projected Average Daily Plant Flows Based on Five Year Plant Flow History**

Year	2016	2017	2018	2019	2020	2021
Flow MGD	194.8	191.4	191.9	192.4	192.9	193.7

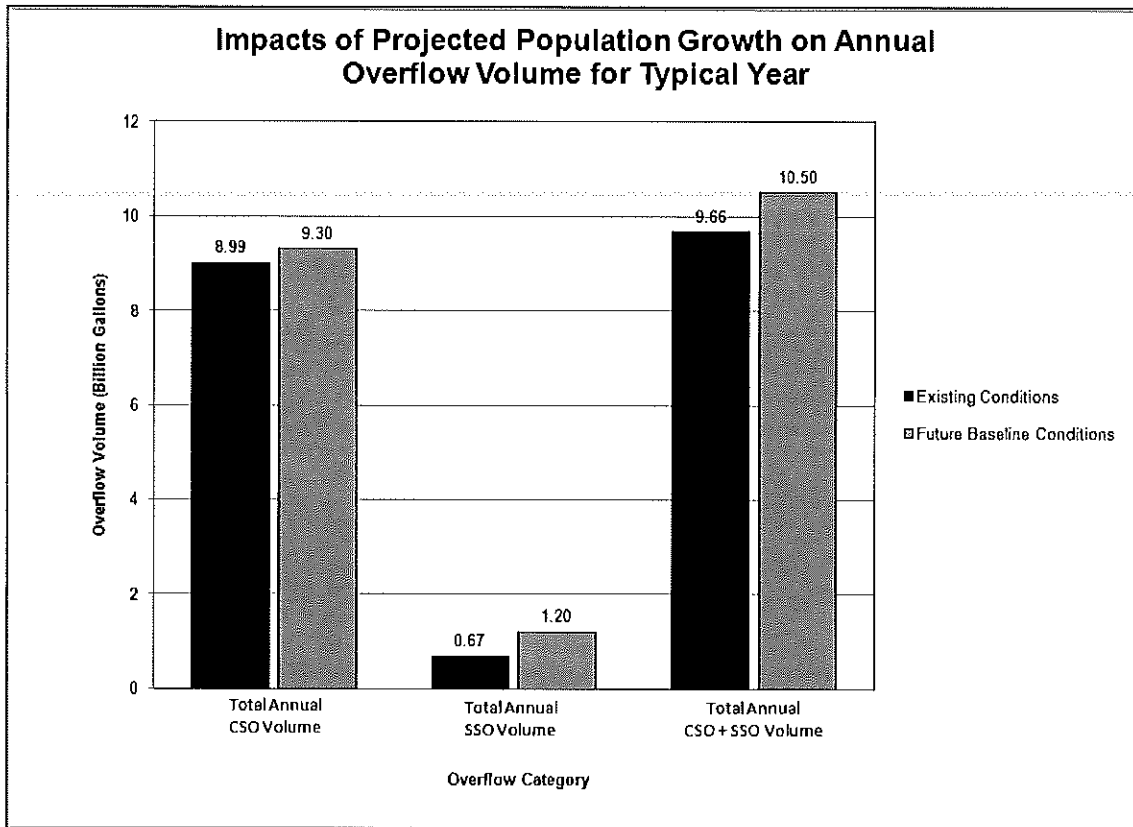
It should also be noted that the purpose for treatment plant expansion is to accommodate surges in flow during wet weather events. As such, population related changes are a consideration and not the primary impetus for the expansion.

The average annual plant flow is projected to be approximately 240 mgd in 2046. This projected 2046 average flow accounts for growth in the base flow resulting from the projected population growth and from the increase in wet weather capture that will result from the implementation of the Interim Wet Weather Plan.

Additional H&H model simulations were conducted during ALCOSAN's WWP development to predict the impacts of future baseline condition flows on the frequency, duration and volume of typical year CSO and SSO discharges from ALCOSAN and municipal outfalls. The model indicated that system-wide, flow increases from future projected population growth would

increase the total annual volume of CSO and SSO discharges by 8 percent to approximately 10.5 billion gallons during a year with average rainfall. Much of the projected future growth is expected to occur within existing and newly constructed separate sewershed areas. The computed increase in the total system-wide volume of SSO discharges would double to approximately 1.2 billion gallons under current conditions. Future growth within combined sewershed areas would result in a total system-wide increase of 3 percent in the total system-wide annual volume of CSO discharges to approximately 9.3 billion gallons. The increases in total annual CSO and SSO discharge volumes resulting from projected future population growth are depicted in Figure 5-5 below. These projected increases will be addressed through the expansion of the Woods Run Wastewater Treatment Plant that is the subject of this special report and through the implementation of the other elements of ALCOSAN's Interim Weather Plan.

Figure 5-5:
Impacts of Projected Population Growth on Annual Discharge Volume



6.0 WOODS RUN WWTP WET WEATHER TREATMENT ALTERNATIVES ANALYSIS

6.1 Context

Since completing the Comprehensive Sewage Facilities Plan in 1996, prepared in compliance with the provisions of the Pennsylvania Sewage Facilities Act of 1965 (Act 537 Plan), ALCOSAN has maintained that maximizing flows to the Woods Run WWTP is a critical component to the ultimate success of a regional wet weather plan.

Following approval in 1999 of the Act 537 Plan by the PaDEP, the ACHD, and the 83 service area communities, ALCOSAN was authorized to proceed with the first phase of a multi-phased CIP at the Woods Run WWTP. Completion of the CIP Phase I construction projects in 2004 and more recently completed interim capital improvements through 2009 resulted in expansion of the full treatment capacity from 200 mgd to 250 mgd (effective Spring 2009). The capital improvements completed under Phase I also included the expansion of primary treatment and sodium hypochlorite storage facilities in anticipation of higher peak wet weather capacity to be implemented under Phase II of ALCOSAN's CIP. Refer to Section 3.1 of this document for an overview of the existing WWTP.

Beginning in 2004, ALCOSAN launched efforts to reevaluate the initially proposed wet weather flow management strategy at the WWTP considering the passing of time since the completion of the Act 537 Plan. In addition, execution of the ALCOSAN Consent Decree and further development of regional conveyance planning has influenced the objectives for WWTP expansion. The results of this preliminary evaluation were shared with EPA, DEP and ACHD in the *Draft Bypass Justification Report* (April 2010). This section provides an update of the WWTP alternatives analysis and bypass demonstration evaluation initially submitted in the *Draft Bypass Justification Report*.

6.2 Wet Weather Flow Routing Scenarios

The potential concepts for future operation of the Woods Run WWTP assume that ALCOSAN will receive regulatory approval of the following operating conditions:

- High-rate operation of the primary sedimentation tanks
- Bypass of secondary treatment for peak wet weather flows entering the WWTP in excess of secondary treatment capacity. All flows bypassing secondary treatment receive preliminary and primary treatment followed by disinfection prior to discharge.

Four potential wet weather flow routing scenarios at the WWTP are summarized in Table 6-1.

The estimated buffer storage noted in Table 6-1 indicates the estimated storage capacity necessary to contain a portion of the initial wet weather peak flow spike in excess of treatment capacity while transitioning into wet weather operating mode at the WWTP. The storage capacity is directly related to the estimated transition time to start-up wet weather treatment facilities.

ALCOSAN ACT 537 Plan Special Study**Section 6 – Woods Run WWTP Wet Weather Treatment Alternatives Analysis**

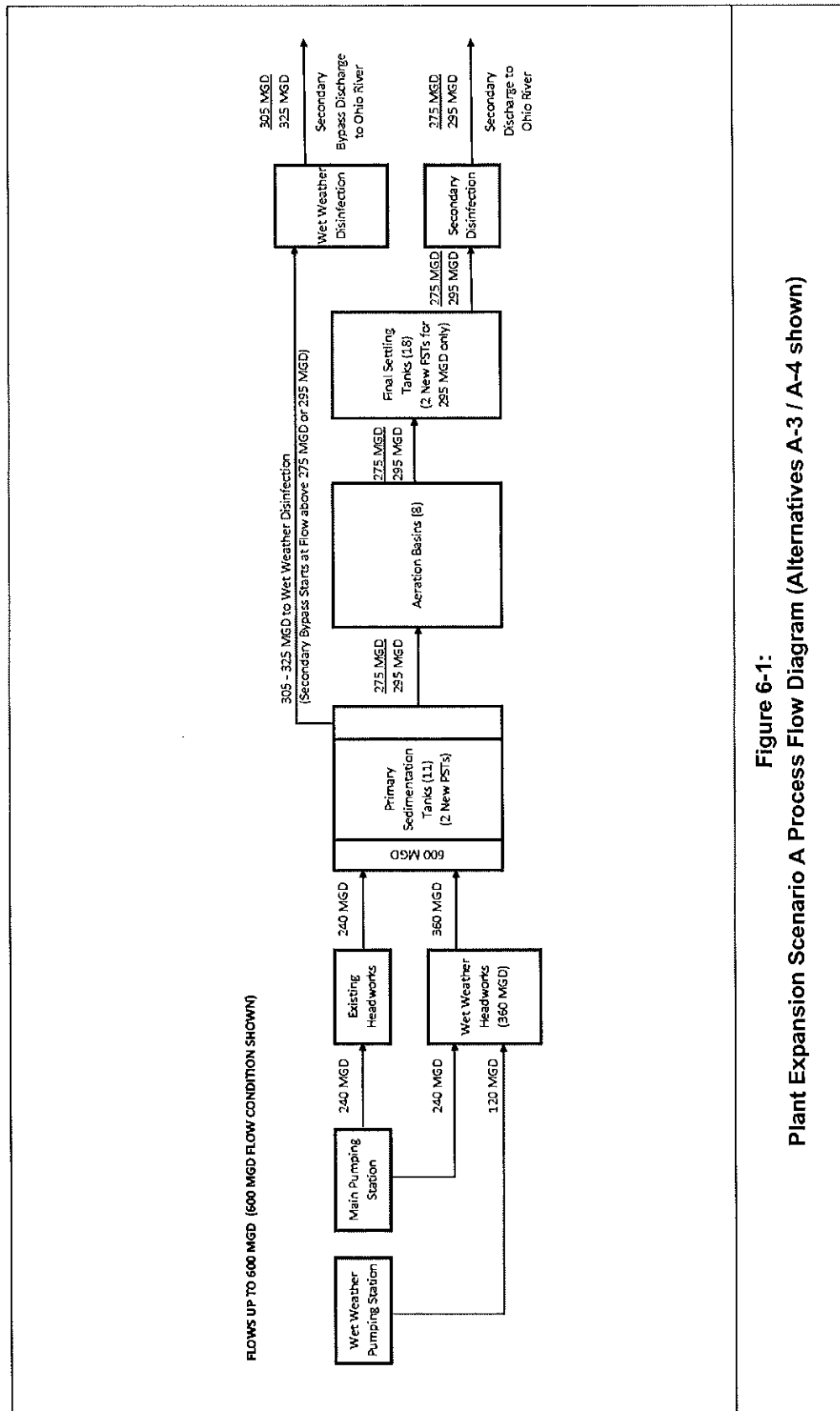
Table 6-1:
Summary of Woods Run WWTP Wet Weather Expansion Scenarios

Scenario	Main Pump Station Capacity (mgd)	New Wet Weather Pump Station Capacity (mgd)	Primary Capacity (mgd)	Secondary Capacity (mgd)	High Rate Clarification (HRC) Capacity (mgd)	Total Wet Weather Treatment Capacity (mgd)	Estimated Buffer Storage Capacity Required (MG)
A-1	400	200	600	275	-	600	9
A-2	400	200	600	295	-	600	9
A-3	480	120	600	275		600	9
A-4	480	120	600	295		600	9
B	420	-	420	295	125	420	18
C	480	-	480	295	-	480	0
D	480	-	480	295	125	480	18

Scenario A – Plant Expansion to 600 mgd with Conventional Bypass: Plant expansion Scenario A provides a peak wet weather treatment capacity at the Woods Run WWTP of 600 mgd. The four alternatives under Scenario A, referred to as A-1, A-2, A-3 and A-4 differ by the Main Pumping Station, Wet Weather Pumping Station and secondary treatment capacities, as shown in Table 6-1 above. ALCOSAN has decided to move forward with a Main Pumping Station upgrade project to provide 480 mgd pumping capacity, therefore, the A-1 and A-2 alternatives are included for comparison purposes only.

Figure 6-1 illustrates the wet weather process flow routing for alternatives A-3 and A-4. Dry weather flows and wet weather peak flows up to 480 mgd are received at the Main Pumping Station and then distributed between the existing plant headworks and new wet weather headworks. Dry weather flows can be routed through the existing headworks alone; or distributed between the existing and new wet weather headworks to keep them both operationally ready for wet weather. When peak flow exceeds the Main Pumping Station capacity, the new wet weather pumping station is started to provide an additional 120 mgd flow to the wet weather headworks.

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All flows up to 600 mgd receive primary treatment and 275 mgd or 295 mgd go on to secondary treatment. Wet weather flows in excess of secondary treatment capacity, up to a maximum additional flow of 305 mgd or 325 mgd are routed around secondary treatment and receive disinfection prior to discharge.

Figure 6-2 illustrates a conceptual layout for the Scenario A wet weather flow routing alternatives which include the following process units:

Main Pumping Station: Existing pumping station is upgraded to provide a minimum firm pumping capacity of 480 mgd (A-3 and A-4).

Wet Weather Pumping Station: A wet weather pumping station is constructed to provide a minimum firm pumping capacity of 120 mgd (A-3 and A-4) so that combined with the Main Pumping Station upgrade the total influent pumping capacity is 600 mgd.

Wet Weather Headworks: New wet weather headworks are constructed with a minimum firm capacity of 360 mgd so that combined with the existing headworks operating at 240 mgd provides a firm preliminary treatment capacity of 600 mgd. (A-1, A-2, A-3, and A-4)

Primary Treatment: Two new primary sedimentation tanks are added to the existing nine tanks to provide a peak flow capacity of 600 mgd with 10 of 11 tanks in service, assuming high-rate operation is acceptable to the regulatory agencies. (A-1, A-2, A-3, and A-4)

Secondary Treatment: Two secondary treatment alternatives considered include the existing process capacity, estimated to be 275 (A-1, A-3) mgd; or a 20 mgd expansion to 295 mgd capacity through the addition of two final settling tanks. (A-2, A-4)

Disinfection: Disinfection of secondary effluent is achieved through chlorination and de-chlorination or through a new ultraviolet (UV) disinfection process with a capacity of 275 mgd or 295 mgd, corresponding to the secondary treatment capacity, followed by post-aeration and discharge via a new plant outfall. (A-1, A-2, A-3 and A-4)

Wet Weather Disinfection: Primary effluent flow exceeding secondary treatment capacity is bypassed to the existing chlorine contact tanks modified for wet weather disinfection. The existing chlorination/dechlorination capacity may be modified and expanded from 275 mgd to 305 mgd or 325 mgd prior to post aeration and discharge at the existing outfall. (A-1, A-2, A-3 and A-4)

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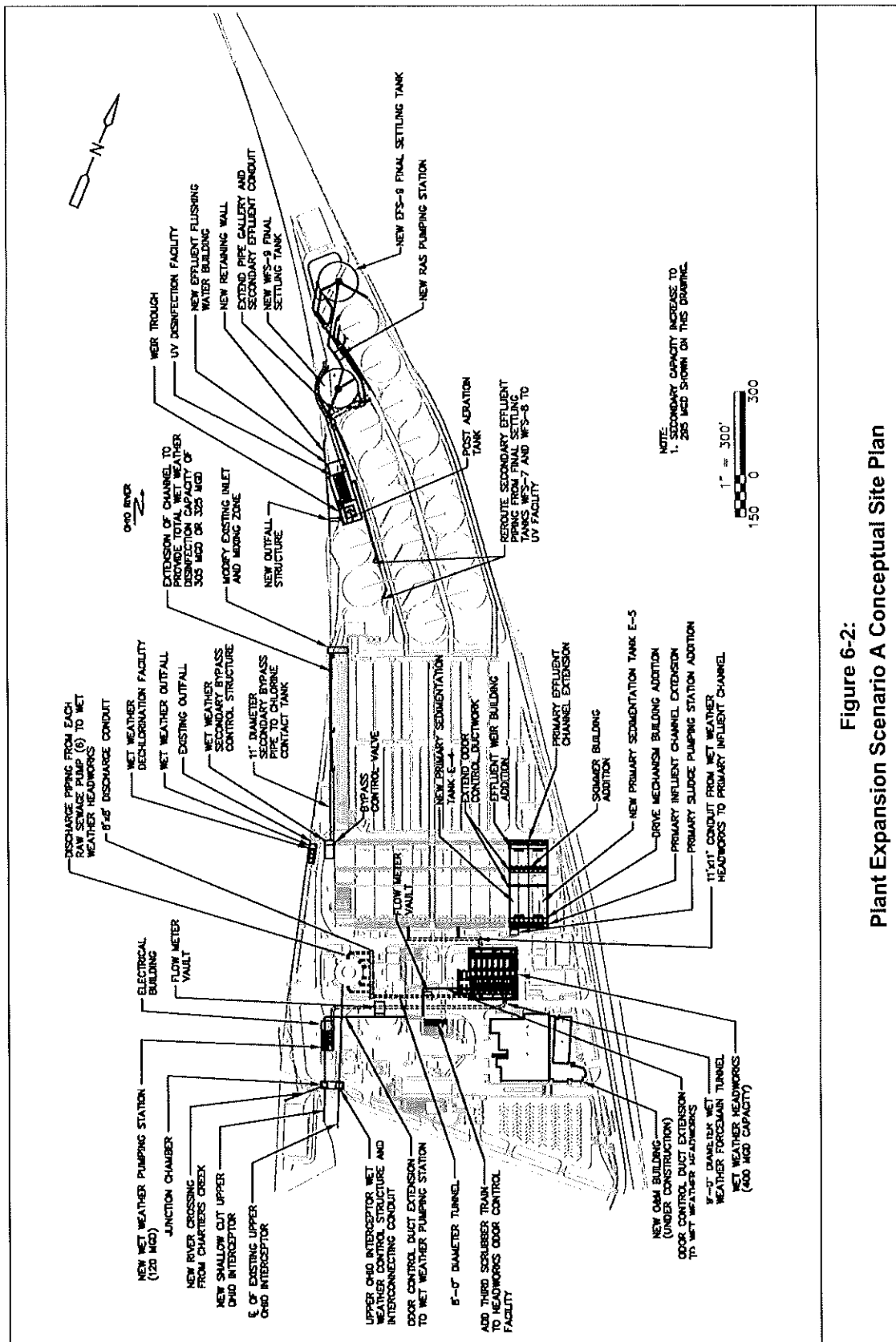


Figure 6-2:
 Plant Expansion Scenario A Conceptual Site Plan

Scenario B – Plant Expansion to 420 mgd with HRC and Conventional Bypass: Plant expansion Scenario B provides a peak wet weather treatment capacity at the Woods Run WWTP of 420 mgd. Figure 6-3 illustrates wet weather process flow routing for Scenario B. Dry weather flows and wet weather peak flows up to 420 mgd are received at the existing Main Pumping Station and then distributed between the existing plant headworks and new wet weather headworks. There would be no Wet Weather Pumping Station under this scenario. Wet weather flows in excess of secondary treatment capacity (295 mgd) are diverted to the high rate clarification (HRC) process up to a maximum additional flow of 125 mgd (420 mgd total).

Figure 6-4 illustrates a conceptual layout for the Scenario B wet weather flow management alternative which includes the following process units:

Main Pumping Station: Existing pumping station is upgraded to provide a minimum firm pumping capacity of 420 mgd.

Wet Weather Headworks: New wet weather headworks are constructed with a minimum firm capacity of 220 mgd so that combined with the existing headworks operating at 200 mgd provides a firm preliminary treatment capacity of 420 mgd. For capital cost estimating purposes, a 295 mgd firm capacity for the new wet weather headworks is assumed in order to maximize preliminary treatment redundancy equal to the secondary treatment capacity.

Primary Treatment: The existing primary sedimentation tanks provide a firm peak flow capacity of 480 mgd with eight of the nine tanks in service, assuming high-rate operation (as demonstrated during stress testing described above) is acceptable to the regulatory agencies.

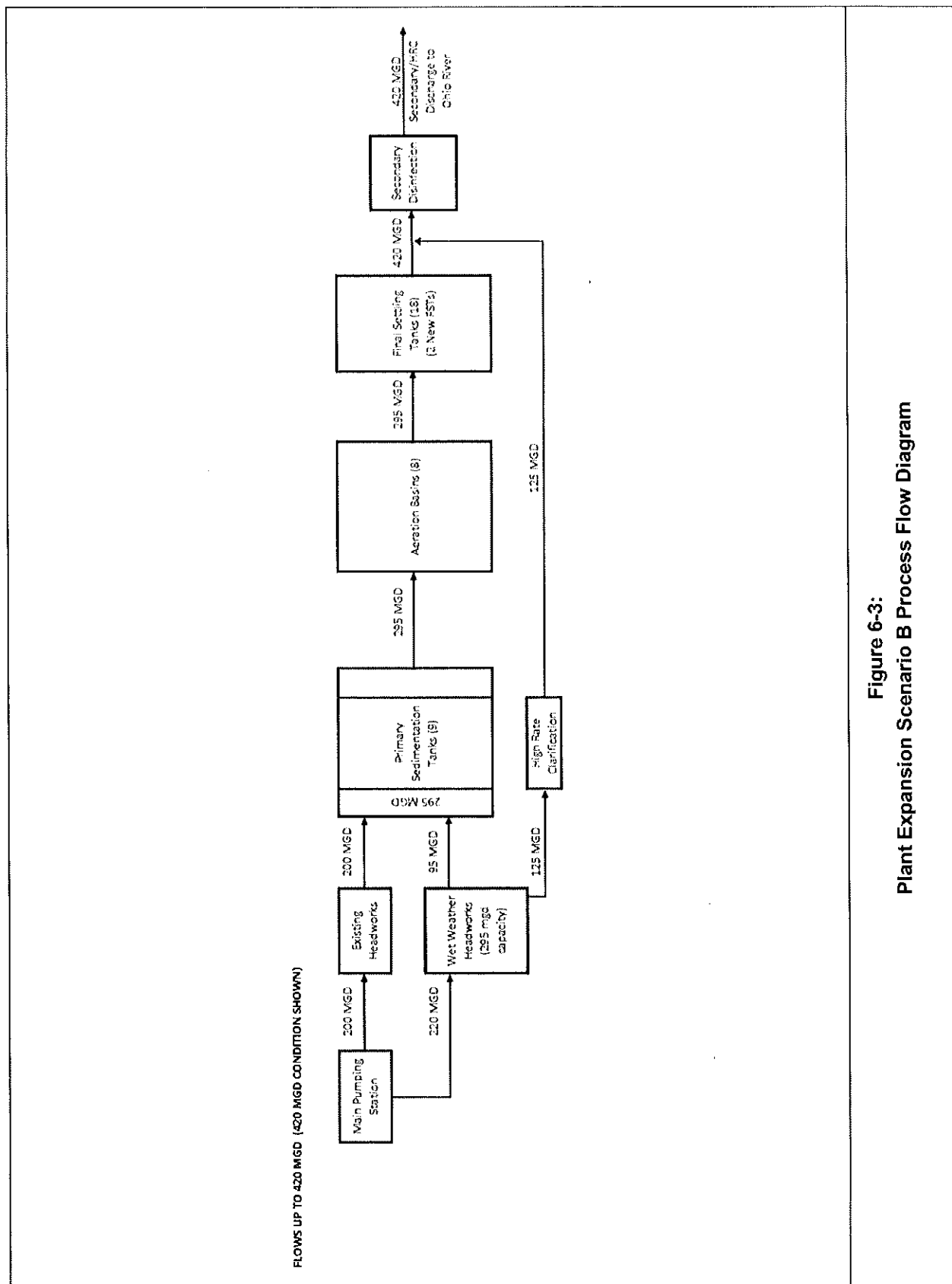
High Rate Clarification: This scenario includes the addition of a 125 mgd HRC process along the east-side of the primary sedimentation tanks. Wet weather flows exceeding the full treatment capacity of 295 mgd are diverted to the HRC process up to 125 mgd. For this scenario it is assumed that treated effluent from the HRC process would be combined with secondary effluent prior to disinfection.

Secondary Treatment: A 20 mgd secondary treatment expansion to 295 mgd capacity is achieved through the addition of two final settling tanks.

Disinfection: Final effluent disinfection for 420 mgd (295 mgd secondary effluent + 125 mgd HRC effluent) is achieved through chlorination and de-chlorination or a new UV disinfection facility.

Wet Weather Disinfection: No additional wet weather disinfection facilities are necessary for this scenario. The existing chlorine contact tanks and chlorination/dechlorination facilities would be available for potential future wet weather treatment under a future expansion program, or as a back-up final effluent disinfection process.

Although Scenario B is feasible, this alternative will not receive further consideration as the EPA Region 3 has rejected the use of high rate clarification for flow treatment as defined in the ALCOSAN CD.



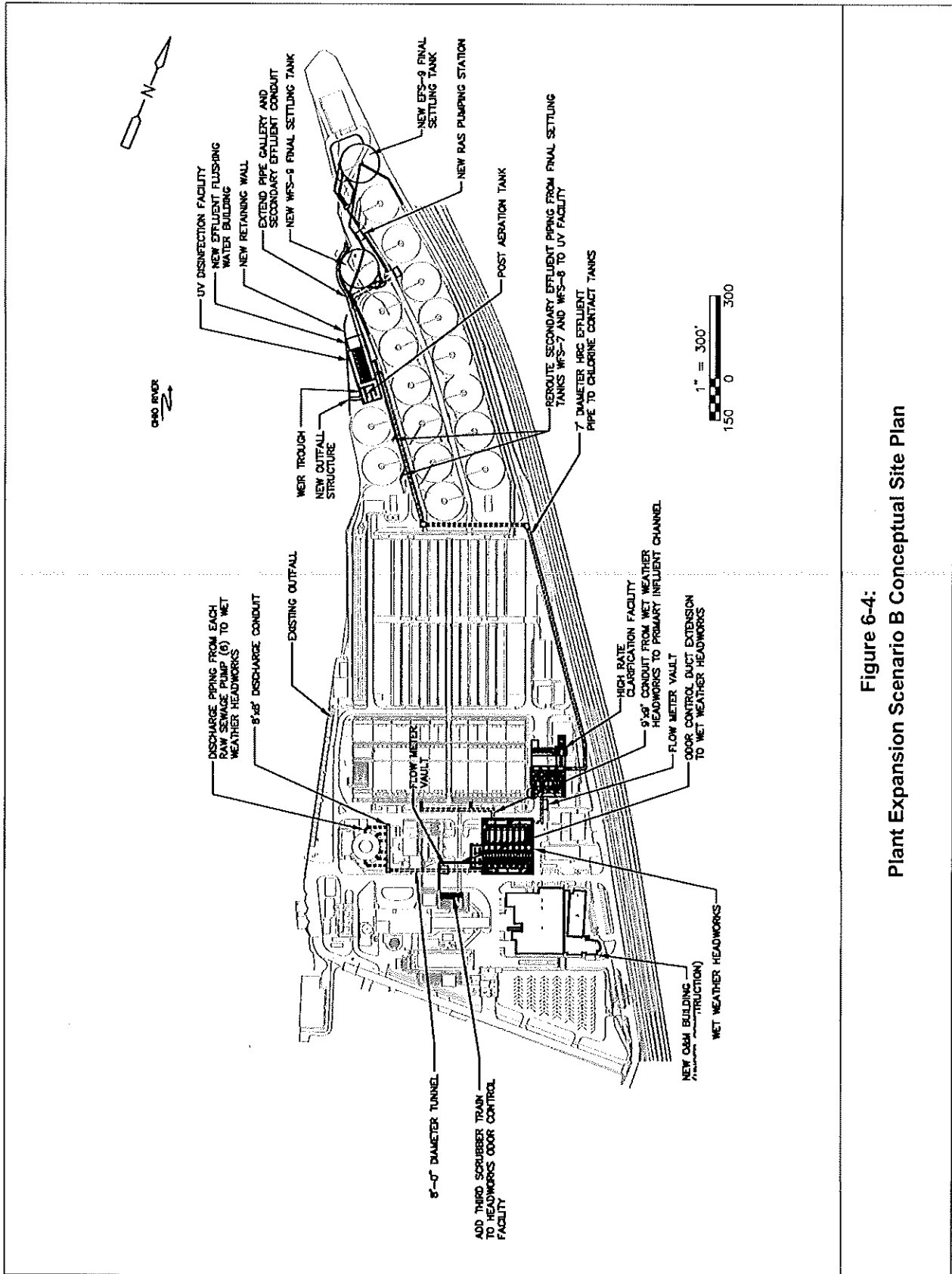


**Figure 6-4:
Plant Expansion Scenario B Conceptual Site Plan**



Scenario C – Plant Expansion to 480 mgd and Conventional Bypass: Plant expansion Scenario C provides a peak wet weather treatment capacity at the Woods Run WWTP of 480 mgd. Figure 6-5 illustrates wet weather process flow routing for Scenario C. Dry weather flows and wet weather peak flows up to 480 mgd are received at the existing Main Pumping Station and then distributed between the existing plant headworks and new wet weather headworks. There would be no Wet Weather Pumping Station under this scenario.

All flows up to 480 mgd receive primary treatment and 295 mgd go on to secondary treatment. Wet weather flows in excess of secondary treatment capacity, up to a maximum additional flow of 185 mgd, are routed around secondary treatment and receives disinfection prior to discharge.

Figure 6-6 illustrates a conceptual layout for the Scenario C wet weather flow management alternative which includes the following process units:

Main Pumping Station: Existing pumping station is upgraded to provide a minimum firm pumping capacity of 480 mgd.

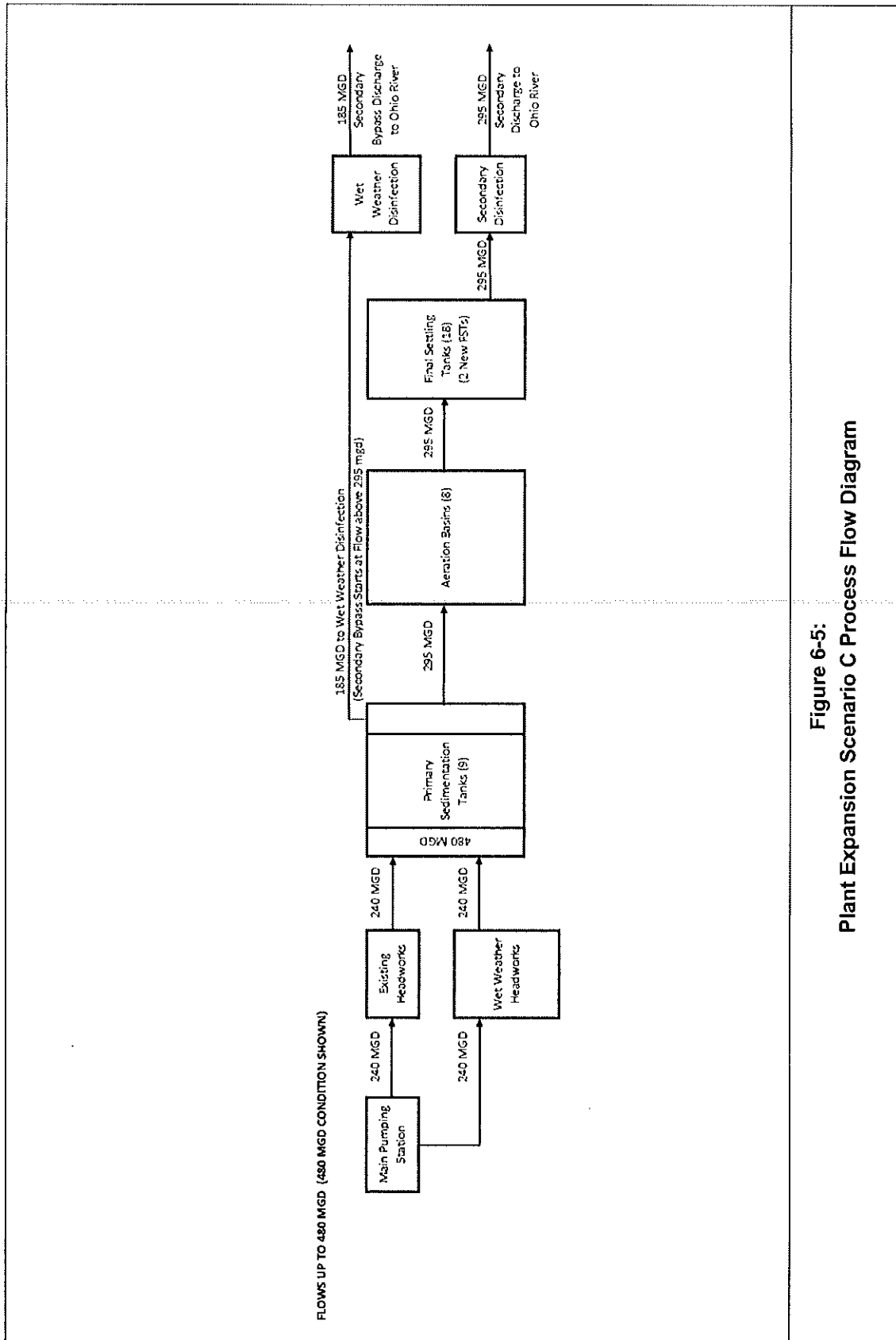
Wet Weather Headworks: New wet weather headworks are constructed with a minimum firm capacity of 240 mgd so that combined with the existing headworks operating at 240 mgd provides a firm preliminary treatment capacity of 480 mgd. For capital cost estimating purposes, a 295 mgd firm capacity for the new wet weather headworks is assumed in order to maximize preliminary treatment redundancy equal to the secondary treatment capacity.

Primary Treatment: The existing primary sedimentation tanks provide a firm peak flow capacity of 480 mgd with eight of the nine tanks in service, assuming high-rate operation is acceptable to the regulatory agencies.

Secondary Treatment: A 20 mgd secondary treatment expansion to 295 mgd capacity is achieved through the addition of two final settling tanks.

Disinfection: Secondary effluent disinfection for 295 mgd is achieved through chlorination and de-chlorination or new UV disinfection facility, followed by post aeration and a new outfall.

Wet Weather Disinfection: The existing chlorine contact tanks and dechlorination process would be modified for wet weather disinfection so that primary effluent flow exceeding secondary treatment capacity when operating in a wet weather bypass would be diverted to the chlorine contact tanks. Initially, the wet weather disinfection capacity needed would be 185 mgd at a peak flow of 480 mgd. However, for planning purposes the critical infrastructure needed to disinfect an additional 120 mgd wet weather flow is included to allow for further plant wet weather capacity expansion to 600 mgd.



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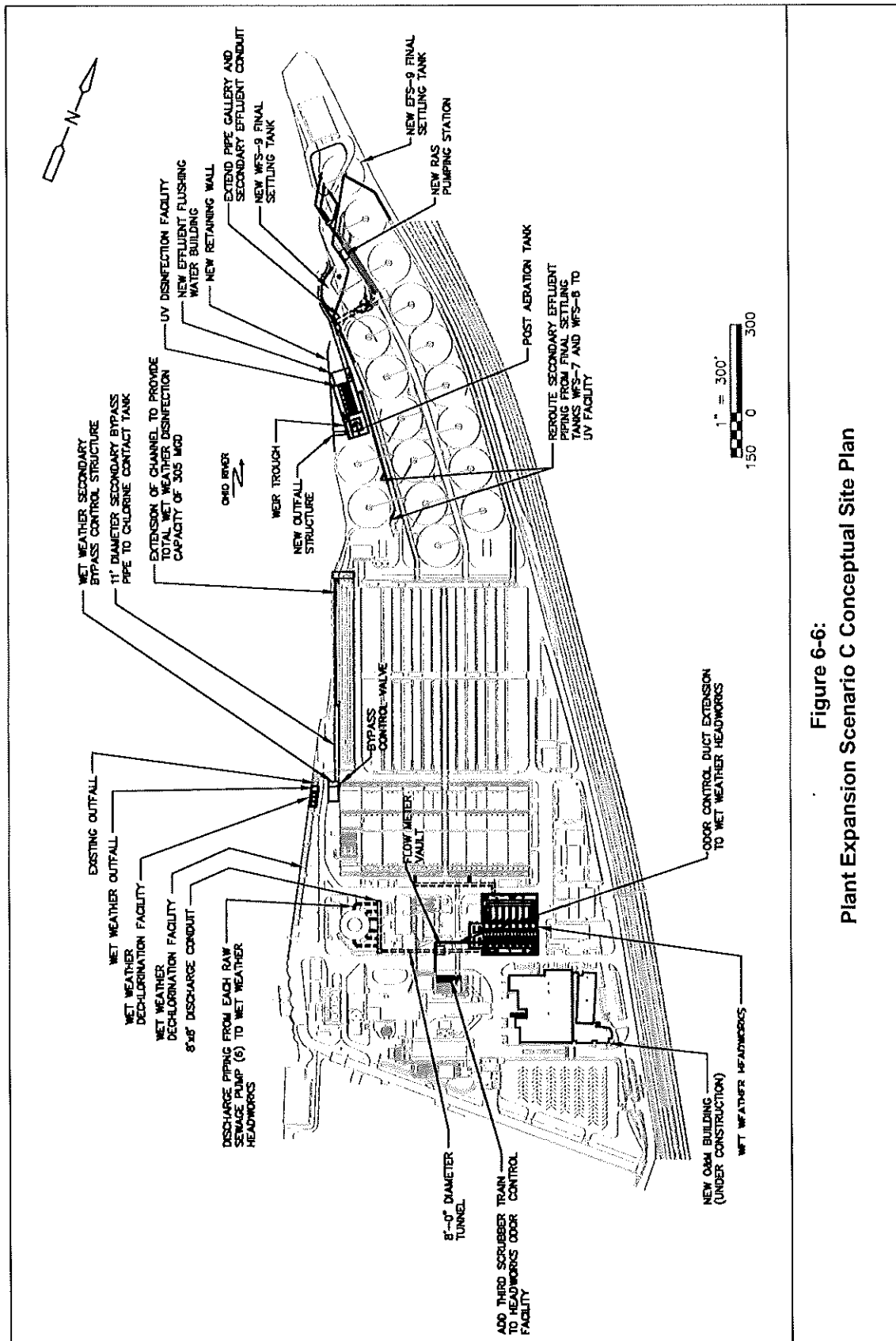


Figure 6-6:
 Plant Expansion Scenario C Conceptual Site Plan

Scenario D – Plant Expansion to 480 mgd with HRC and Conventional Bypass: Plant expansion Scenario D provides a peak wet weather treatment capacity at the Woods Run WWTP of 480 mgd. Figure 6-7 illustrates wet weather process flow routing for Scenario D. Dry weather flows and wet weather peak flows up to 480 mgd are received at the existing Main Pumping Station and then distributed between the existing plant headworks and new wet weather headworks. There would be no Wet Weather Pumping Station under this scenario.

Wet weather flows in excess of secondary treatment capacity (295 mgd) are diverted to the HRC process up to a maximum additional flow of 125 mgd (420 mgd total). Above 420 mgd, up to 60 mgd of primary effluent bypasses secondary treatment to a wet weather disinfection process. Figure 6-8 illustrates a conceptual layout for the Scenario D wet weather flow management alternative which includes the following process units:

Main Pumping Station: Existing pumping station is upgraded to provide a minimum firm pumping capacity of 480 mgd.

Wet Weather Headworks: New wet weather headworks are constructed with a minimum firm capacity of 240 mgd so that combined with the existing headworks operating at 240 mgd provides a firm preliminary treatment capacity of 480 mgd. For capital cost estimating purposes, a 295 mgd firm capacity for the new wet weather headworks is assumed in order to maximize preliminary treatment redundancy equal to the secondary treatment capacity.

Primary Treatment: The existing primary sedimentation tanks provide a firm peak flow capacity of 355 mgd. Note, with eight of the nine tanks in service a peak flow capacity of 480 mgd is available, assuming high-rate operation is acceptable to the regulatory agencies.

High Rate Clarification: This scenario includes the addition of a 125 mgd HRC process along the east-side of the primary sedimentation tanks. Wet weather flows exceeding the full treatment capacity of 295 mgd are diverted to the HRC process up to 125 mgd. For this scenario it is assumed that treated effluent from the HRC process would be combined with secondary effluent prior to disinfection.

Secondary Treatment: A 20 mgd secondary treatment expansion to 295 mgd capacity is achieved through the addition of two final settling tanks.

Disinfection: Final effluent disinfection for 420 mgd (295 mgd secondary effluent + 125 mgd HRC effluent) is achieved through chlorination or de-chlorination or a new UV disinfection facility.

Wet Weather Disinfection: The existing chlorine contact tanks and dechlorination process would be modified for wet weather disinfection so that primary effluent flow exceeding secondary treatment plus HRC capacity would be diverted to the chlorine contact tanks. The wet weather disinfection capacity needed would be 60 mgd at a peak flow of 480 mgd.

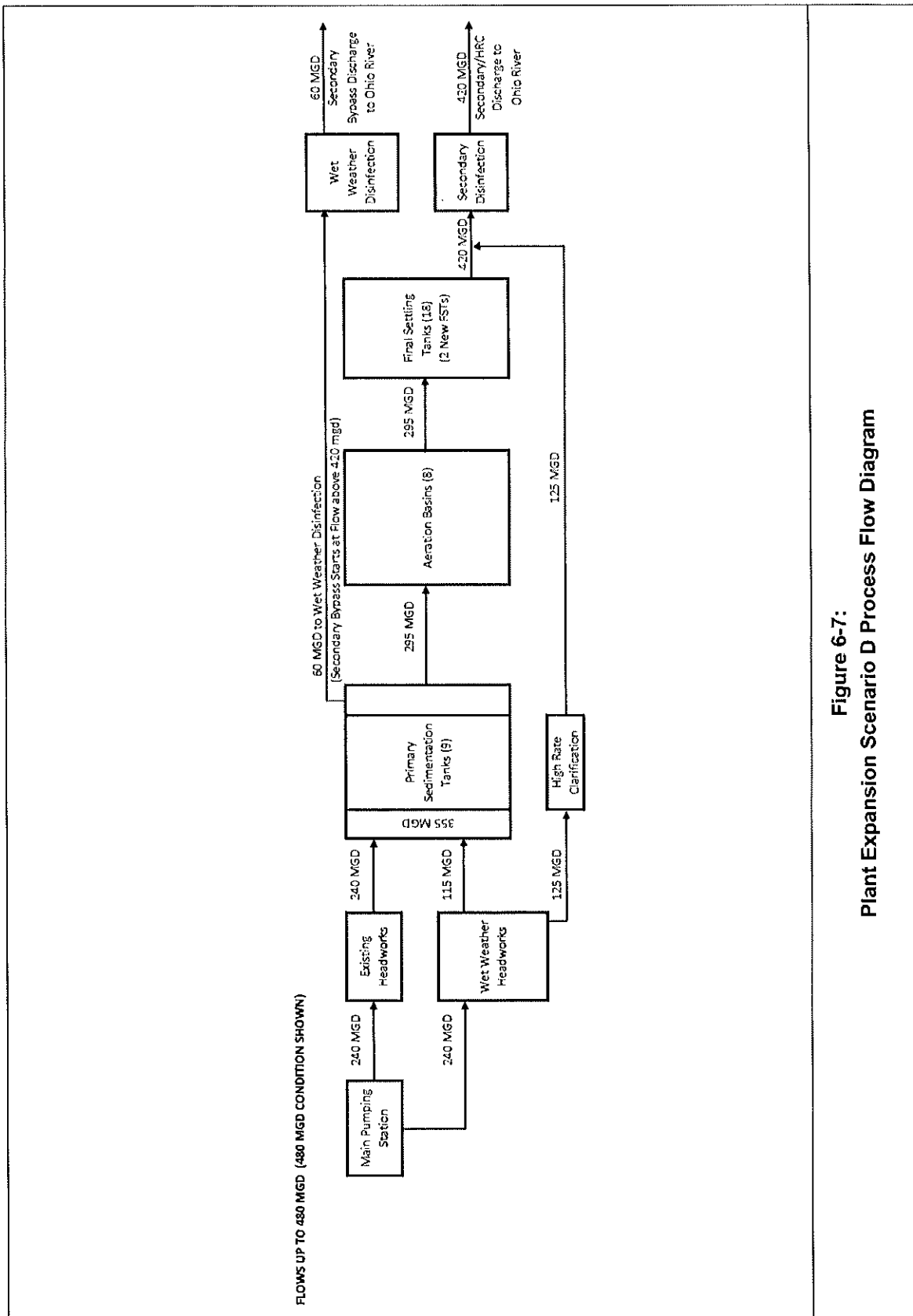


Figure 6-7:
Plant Expansion Scenario D Process Flow Diagram

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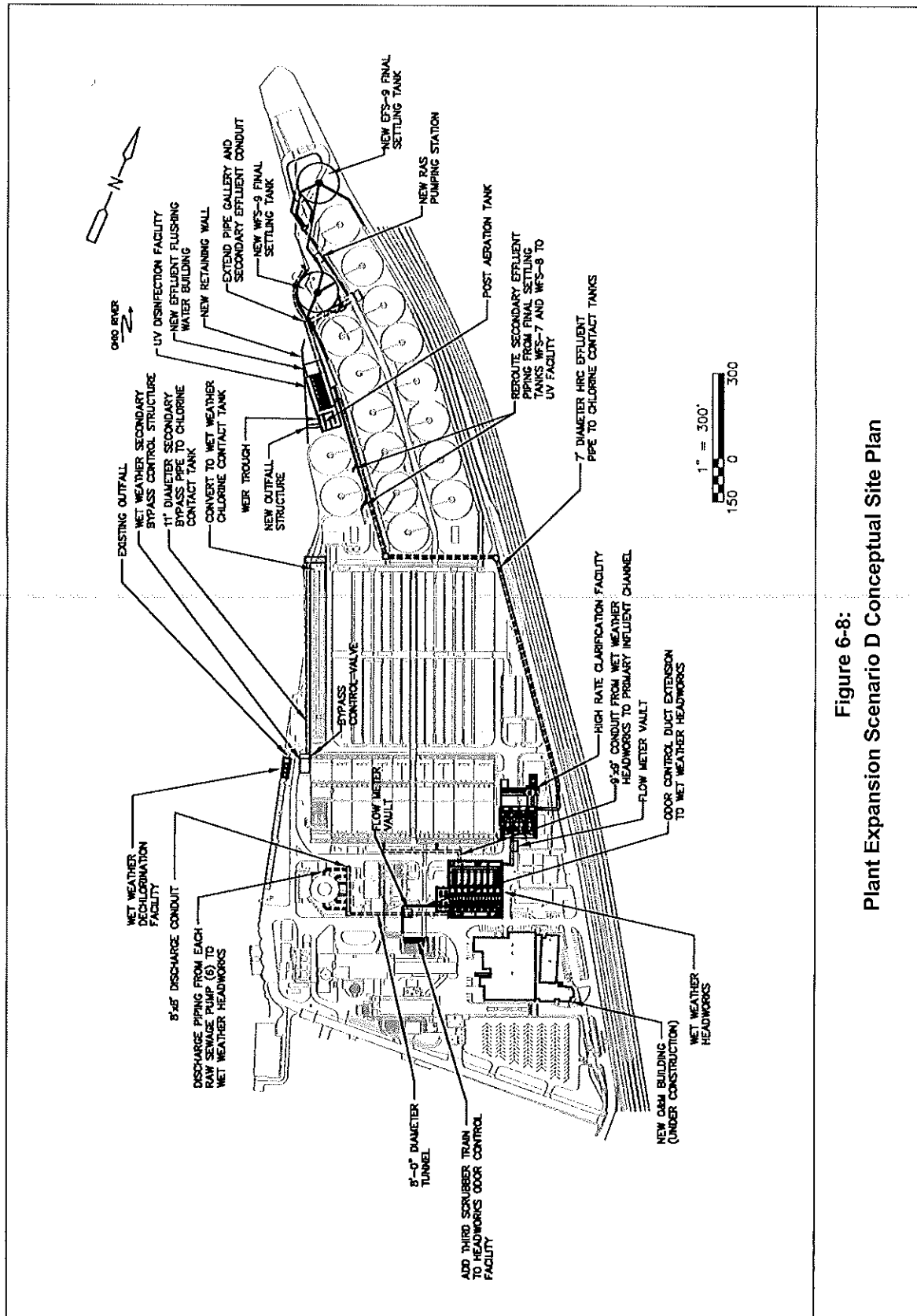


Figure 6-8:
Plant Expansion Scenario D Conceptual Site Plan

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Plant Expansion Lifecycle Costs: The estimated life cycle costs including initial capital costs, annual Operations and Maintenance (O&M) costs and the cost of future purchases for the WWTP plant expansion scenarios are listed below in Table 6-2.

Table 6-2:
Summary of Estimated Lifecycle Costs for Woods Run WWTP Expansion Scenarios

Scenario	Estimated Lifecycle Costs (\$ millions) ¹						
	Initial Capital Cost			Annualized Cost		PW of Future Purchases	Total Present Worth
	Wet Weather Pumping Station ²	Wastewater Treatment	Total	Annual O&M Costs	PW of Annual Costs		
A-1 ³	108	340	448	5.3	81	28	557
A-2 ³	108	374	482	5.4	82	31	595
A-3	101	344	445	5.3	81	27	553
A-4	101	378	479	5.4	82	31	592
B ⁴	0	389	389	6.3	95	29	513
C	0	290	290	5.5	84	27	401
D ⁴	0	418	418	6.3	96	31	545

¹ Life cycle cost estimates based on a planning period of 28 years assuming initiation of operation in 2018; federal discount rate of 4.875% (2008); and ENR CCI Pittsburgh Index (October 2008) of 7862.

² The Wet Weather Pump Station estimated initial capital costs are based on a trench style that assumed the new conveyance to the new wet well would be no deeper than the incoming interceptors. When these WWTP expansion alternatives are coupled with regional improvements that involve a deeper regional conveyance system (later in Section 6) the Wet Weather Pumping Station cost has been replaced with the cost of a different type of pump station: a deep tunnel pumping station.

³ Scenarios A-1 and A-2 are no longer applicable since ALCOSAN is upgrading the Main Pumping Station capacity to 480 mgd, not 400 mgd as included in these scenarios

⁴ Scenarios B and D were eliminated as high rate clarification was included for flow treatment; which has been rejected by EPA Region 3.

Preliminary evaluation of the plant expansion scenarios concluded that Scenarios A-3, A-4 and C are viable options for further consideration and integration into the regional wet weather plan.

6.3 Secondary Treatment

Under its Interim Measures Wet Weather Plan (IWWP), ALCOSAN proposes to expand the secondary treatment capacity to 295 million gallons per day from its currently permitted full treatment capacity of 250 million gallons per day.

Comparison of the actual BOD and ammonia loadings to the aeration basins (2004 to 2006) to design flows and loadings suggest the process has additional treatment capacity. However, the aeration system design was based on all eight tanks being in-service at the time of peak loading conditions. The secondary treatment theoretical capacity was evaluated based on (1) the mass required under aeration for nitrification at the design temperature and (2) the allowable mixed liquor suspended solids (MLSS) based on a solids-flux analysis of the final settling tanks. The results of the theoretical capacity analysis for the existing secondary treatment process are summarized on Table 6-3.

Table 6-3:
Process Capacity of Existing Secondary Treatment Units -
Results of Capacity Analysis

BOD In Secondary Influent (mg/L) ¹	Estimated Capacity (mgd)		Aeration HRT at Total Capacity (hr) ³	FST Overflow Rate at Total Capacity (gpd/ft ²) ³	FST Solids Loading Rate at Total Capacity (lbs/day/ft ²)
	Firm ²	Total			
64	295	335	2.2	1,340	40.2 ^{3,4}

Abbreviations: BOD (Biochemical oxygen demand); HRT (Hydraulic retention time); FST (Final settling tank)

Notes:

1. BOD concentration at maximum month flow and maximum month loading (see Table 9-4).
2. Firm capacity corresponds to one larger aeration basin and two final settling tanks out of service.
3. Assumes all tanks (8 aeration and 16 FSTs) are in service.
4. Based on return ratio = 0.5 and MLSS = 2,400 mg/L.

One concern with the above analysis of theoretical capacity is it results in surface overflow rates at the final settling tanks above the 1,200 gpd/ft² maximum peak hourly rate recommended by DEP and also historically used for ALCOSAN design purposes. At the firm capacity of 295 mgd stated above it would be necessary to have all 16 final settling tanks in service in order keep the surface overflow rate less than 1,200 gpd/ft². This suggests that a total of 18 final settling tanks (two additional tanks) are needed to provide 295 mgd firm capacity.

6.4 Woods Run WWTP Expansion

6.4.1 Wet Weather Treatment Capacity Expansion

Under its selected alternative (A-4), ALCOSAN proposes to expand the wet weather treatment capacity at its Woods Run Wastewater Treatment Plant. Primary treatment capacity will be expanded to 480 mgd initially and 600 mgd ultimately. Secondary treatment capacity will be expanded to 295 mgd. A process description of the proposed process units follows.

The IWWP includes several adaptive management provisions. One or more of these provisions involves obtaining municipal source reduction information from customer municipalities and assessing whether municipal flow reduction commitments in those studies would merit the downsizing or modification of the future needs. This provision and several others will be finalized when the ongoing negotiations culminate in a modification to ALCOSAN's CD.

The long-term plan includes a 120 mgd expansion of the total raw wastewater pumping capacity to facilitate the ultimate expansion to 600 mgd of wet weather treatment capacity. While different options to achieve this pumping capacity will be evaluated, this report assumes that a 120 mgd Wet Weather Pump Station will be constructed. Figure 6-9 illustrates a conceptual layout for the recommended WWTP expansion which includes the following modified and new treatment process units:

Main Pumping Station - Replacement of the six raw sewage pumps will provide a minimum firm pumping capacity of 480 mgd. This project is complete. Flow meters will be retrofitted in the pump discharge lines during Phase 1 of the expansion. The raw sewage pumps discharge configuration will be modified during implementation to control flow distribution between the existing headworks and the new Wet Weather Headworks.

Wet Weather Pumping Station - The long-term plan includes a 120 mgd expansion of the total raw wastewater pumping capacity to facilitate the ultimate expansion to 600 mgd of wet weather treatment capacity. While different options to achieve this pumping capacity will be evaluated, this report assumes that a 120 mgd Wet Weather Pump Station will be constructed. Since the 120 mgd expansion in wet weather pumping capacity will occur as a future project, wastewater flows up to 480 mgd will be received at the Main Pumping Station and pumped to the plant until the Wet Weather Pump Station becomes operational in the future.

Wet Weather Headworks - New wet weather headworks, including screenings and grit removal process equipment, are proposed with a minimum firm capacity of 360 mgd. The existing headworks will remain in service with a capacity of 250 mgd and the flow distribution between the existing and the proposed wet weather headworks will be optimized to provide efficient and reliable operation. The combined total wet weather capacity, with the existing headworks operating at 240 mgd (two raw sewage pumps running), provides a firm preliminary treatment capacity of 600 mgd, which ALCOSAN anticipates as the ultimate treatment capacity in the future. This work is included in the IWWP for constructability and economic reasons. In addition, the proposed process units will provide greater redundancy and operational flexibility to handle peak flows of up to 480 mgd between the existing headworks and new wet weather headworks at the completion of the IWWP.

Section 6 – Woods Run WWTP Wet Weather Treatment Alternatives Analysis

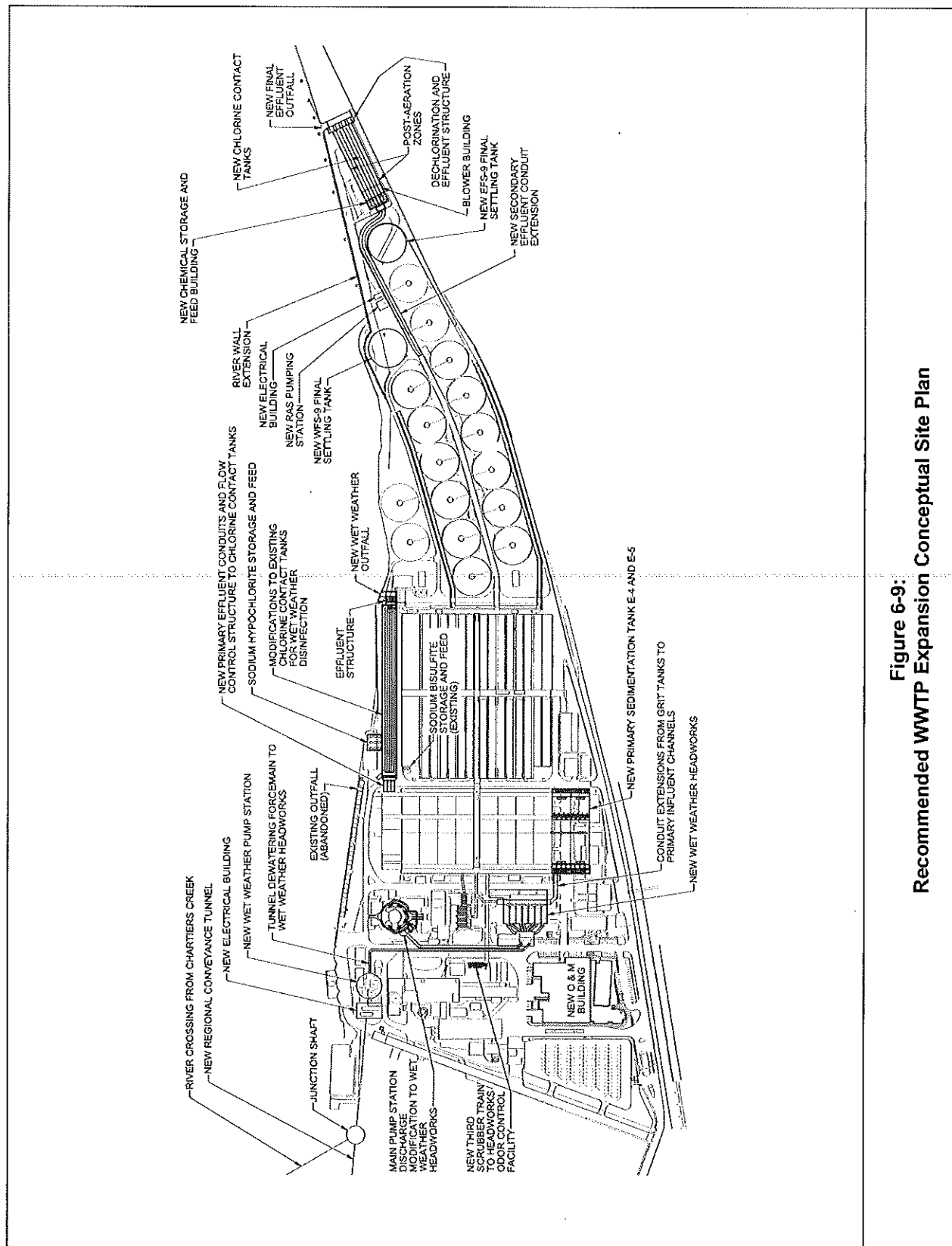


**Figure 6-9:
Recommended WWTP Expansion Conceptual Site Plan**

Primary Treatment - The existing nine primary sedimentation tanks provide a firm capacity of 480 mgd with eight tanks in service at the proposed high-rate operation. Modifications are proposed for wastewater flow routing to the primary sedimentation tanks to allow for future construction of two new tanks which will increase process capacity to 600 mgd.

Secondary Treatment - Two final settling tanks are proposed including plant conveyance modifications and a new return activated sludge (RAS) pumping station to increase firm secondary treatment capacity to 295 mgd.

Disinfection - New secondary effluent chlorination / dechlorination disinfection facilities with a capacity of 295 mgd are proposed followed by post-aeration and discharge via a new plant outfall. Ultraviolet (UV) disinfection was also evaluated as an alternative disinfection process for secondary effluent. Chlorination / dechlorination was selected based on similar life-cycle costs; hydraulic advantages from lower head losses; and operator familiarity when compared to implementing a new UV disinfection process. The secondary disinfection facilities will be constructed during phase 1 of the implementation of the Selected Alternative (A-4).

Wet Weather Disinfection - Primary treated effluent flows exceeding secondary treatment capacity would be routed to the existing chlorine contact tanks which will be used for high rate disinfection. The existing chlorination/dechlorination processes would be modified to provide up to 305 mgd capacity, followed by post aeration and discharge at a new outfall. The existing outfall would be abandoned, since it does not have sufficient hydraulic capacity for a discharge of 305 mgd. Due to the one-time nature of the modifications to the existing chlorine contact tanks the process capacity would be expanded to 305 mgd, necessary to achieve the ultimate 600 mgd of treatment capacity.

ALCOSAN completed a Value Engineering Study in December of 2017 to re-evaluate whether treatment of up to 600 mgd of wet weather flows should be handled at the Woods Run Wastewater Treatment Plant or by using a combination of the WWTP and a satellite treatment facility.

The baseline alternative, detailed in this Special Study emerged from the evaluation as the preferred alternative. The economic analysis showed it to be the lowest cost alternative from both a capital cost and life cycle cost perspective. In addition, the base alternative also had the most favorable scoring from the non-cost criteria standpoint considering community, public health and environmental, operations and maintenance, implementation and construction related issues. The full Value Engineering Study report is provided as Appendix F to this document.

6.4.2 Future Wet Weather Pump Station

Wet Weather Pump Station Conceptual Configuration

ALCOSAN's planning concept for wet weather treatment is to convey captured flow to the Woods Run WWTP for treatment. Therefore, the Wet Weather Pump Station needs to be located at the lower end of the system at or near the WWTP and approximately 150 feet below grade. Pump stations of this depth are typically circular in design configuration and constructed within a vertical shaft.

Ideally, the Wet Weather Pump Station will be located within ALCOSAN's currently owned properties. One potential location within the existing WWTP site is near the Main Pumping Station. This location allows for a direct pumping route to the proposed wet weather headworks. However, this site area currently has several underground utilities, including the Ohio River Interceptor, process drains, and medium voltage electrical duct banks, that conflict with and present challenges to construction of a wet weather pump station. Other locations in the WWTP site and nearby properties will be explored during advanced facilities planning.

The Wet Weather Pump Station as currently conceived will have a firm capacity of 120 mgd to convey flows to the headworks for treatment during wet weather events. This capacity will also provide the additional pumping capacity needed to augment the 480 mgd Main Pumping Station capacity. The combined capacity of the Wet Weather Pump Station and the upgraded Main Pumping Station is 600 mgd which matches the proposed ultimate WWTP expansion in the 2013 WWP. As noted in Section 1, ALCOSAN has undertaken advanced facilities planning for the wet weather capacity improvements at the Woods Run WWTP which could result in the revision to the wet weather pumping approach outlined above.

7.0 ENVIRONMENTAL AND REGULATORY CONSISTENCY REVIEW

7.1 Secondary Treatment Bypass Justification

7.1.1 Bypass Rule Compliance

The ALCOSAN CD Appendix T stipulates “bypass demonstration” requirements to obtain approval for discharge of partially treated wastewater at the WWTP as part of the proposed Wet Weather Plan. Appendix T draws on the requirements of the NPDES bypass rule (40 CFR 122.141(m)), as well as the EPA Combined Sewer Overflow Policy (59 Federal Register 18688) and the DEP interim final Pennsylvania CSO Policy (September 2007). ALCOSAN submitted a Draft Bypass Justification Report to PaDEP in April 2010 held an informational meeting with DEP, ACHD and EPA on 4/29/2010 on this topic.

The NPDES bypass rule has provisions to allow for intentional diversion of waste streams from any portion of treatment facility when it is necessary to perform maintenance to assure efficient operation. Bypasses for any other reason are prohibited, except when;

- A) A bypass is unavoidable to prevent loss of life, personal injury, or severe property damage,
- B) There were no feasible alternative to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime.

Both of these exceptions are applicable to ALCOSAN’s situation. In response to exception (A) above, once wastewater is received at the Main Pumping Station and pumped to the headworks, flow then passes through the rest of the plant by gravity. Attempts to pump peak flows in excess of approximately 275 mgd through the existing WWTP will cause flooding of process units resulting in reduced treatment performance and likely result in NPDES permit violations. Certain specific problem areas include the following:

- Flooding the grit collection tanks potentially resulting in overtopping the walls and causing a wastewater spill.
- Wash-out of activated sludge from the aeration basins and final settling tanks resulting in a loss of solids in the plant effluent.
- Flooding final settling tanks scum baffles causing a loss of floatables to the plant effluent and flooding scum collectors resulting in excessive recycle flow to the head of the plant.

In response to exception (B) above, and the stipulations of the CD Appendix T, the alternative control measures investigated in lieu of the proposed bypass include storage and pump-back and satellite treatment. The evaluation of alternatives summarized in this section concluded that implementing storage and pump-back in lieu of the proposed plant expansion requires excessively large storage facilities with unacceptably long pump-back durations and are,

therefore, technically infeasible. In addition, the storage and pump-back facilities are considered financially infeasible since their estimated life cycle costs far exceed the comparable range of lifecycle costs for Woods Run WWTP expansion.

Satellite treatment facilities, in lieu of the proposed WWTP expansion, include a technical challenge to provide sufficient average daily flow to sustain biological treatment processes. In doing this, flow must be diverted from the Woods Run WWTP, thereby reducing its treatment capacity. The number of satellite treatment facilities and resulting diversion of average daily flow in lieu of the proposed 305 to 325 mgd maximum bypass reduces flow to the existing Woods Run WWTP to levels that significantly reduce capacity. In effect, wastewater treatment would be decentralized at a cost ranging from 2 to 3 times higher than the proposed plant expansion for wet weather treatment. Therefore, it was concluded that the satellite treatment alternatives are not technically or financially feasible alternatives to the proposed plant expansion strategies.

Storage and Pump-Back Facilities: The premise of storage and pump-back remedial measures is that wet weather flow in excess of the ALCOSAN WWTP secondary treatment capacity would be diverted to a new storage facility. Although wet weather overflow storage volume can be provided via storage tanks, surface storage basins, deep tunnels and other innovative means such as vertical shafts and street storage, most operating agencies with large storage volume requirements utilize deep tunnels. Therefore, it is assumed that the “storage” component of the storage and pump-back alternatives would be provided by deep tunnel systems.

Under a storage and pump-back scheme, as peak flows subside to the WWTP the stored wastewater would be pumped back to the WWTP to receive secondary treatment. The quantity of flow that would need to be diverted, then, depends on the secondary capacity of the WWTP. Two storage and pump-back alternatives were considered as follows:

- Alternative SPB-1: Storage and pump-back with 275 mgd secondary treatment capacity at the Woods Run WWTP.
- Alternative SPB-2: Storage and pump-back with 295 mgd secondary treatment capacity at the Woods Run WWTP.

Preliminary planning-level system-wide hydraulic and hydrologic (H&H) models were developed to quantify and characterize the total wet weather flow potentially reaching the WWTP. The general approach employed to model overflow storage and pump-back alternatives was to pump flows from the Woods Run WWTP Main Pumping Station wetwell to the plant headworks that are less than (or equal to) the plant capacity (either 275 or 295 mgd) and divert any excess flows from the wetwell to the storage facility. Pump-back from the storage facility was allowed only when the flow into the wetwell dropped below the treatment capacity at the WWTP. The amount of storage needed to satisfy this flow distribution without causing an overflow at the WWTP is the required storage.

To estimate the storage requirements for the two different plant capacities, it was assumed that four overflows per year would be allowed along the ALCOSAN interceptor system. Therefore, the fifth largest annual wet-weather event –based on the long-term precipitation record for the region– was used as the basis for modeling the storage requirements. Specifically, the period between April 1, 2004 and May 15, 2004 was used to model storage needs because this period contained a wet-weather event (on April 13, 2004) that was characterized by a total rainfall volume close to the median rainfall volume (1.16 inches) of the fifth largest wet-weather event for each of the 60 years in the period of record as well as relatively uniform rainfall distribution over the service area.

The results from the storage estimation analysis for each plant capacity are summarized below.

Alternative SPB-1: Under this alternative, the secondary treatment capacity at the WWTP is assumed to be 275 mgd and all the flow reaching the wetwell that is less than or equal to this value would be pumped to the WWTP. Flows in excess of 275 mgd were assumed to be diverted to storage during the modeling. As long as the flows into the wetwell exceed 275 mgd, they would be diverted to storage and allowed to accumulate there. Once the flows into the wetwell drop below 275 mgd, the pumps in the storage facility would be turned on and pump at a variable rate to utilize all the available capacity in the WWTP up to a maximum of 275 mgd (combined pump-back and incoming flow).

In order to capture all simulated wet weather flows conveyed to the WWTP for the modeled storm event (April 13, 2004), a storage capacity of 102 million cubic feet (765 million gallons) would be necessary. The maximum pump-back rate would be approximately 125 mgd, but it would require over 98 days to drain the storage facility during the simulation due to a series of significant back-to-back storm events prior to and following the April 13 storm. Analysis of the utilization of this storage unit suggests that during the period between January 2004 and March 2005 this storage facility would have been empty 28 percent of the time. It is apparent from this analysis that limiting the plant capacity to 275 mgd would result in the inability to drain a storage facility between a pattern of back-to-back storms and a highly excessive detention time in the storage facility.

Typically, SSO/CSO tunnel storage facilities are designed to pump back stored flows within 48 hours of the storm event to avoid significant solids deposition and odor problems associated with long pump back times. Pump back times of several months under Alternative SPB-1 are clearly technically not feasible.

Alternative SPB-2: Under this alternative, the secondary treatment capacity at the WWTP is assumed to be 295 mgd and all the flow reaching the wetwell that is less than or equal to this value would be pumped to the WWTP. Therefore, flows in excess of 295 mgd were assumed to be diverted to storage during the modeling. As long as the flows into the wetwell exceed 295 mgd, they would be diverted to storage and allowed to accumulate there. Once the flows into the wetwell drop below 295 mgd, the pumps in the storage facility would be turned on and pump at a variable rate to utilize all the available capacity in the WWTP up to a maximum of 295 mgd (combined pump-back and incoming flow).

In order to capture all simulated wet weather flows conveyed to the WWTP for the modeled storm event (April 13, 2004), a storage capacity of 73.5 million cubic feet (550 million gallons) would be necessary. The maximum pump-back rate would be approximately 135 mgd, but it would require close to 18 days to drain the storage facility during the simulation due to a series of significant back-to-back storm events. As noted above for Alternative SPB-1, tunnel pump back times should not exceed 48 hours to avoid significant solids deposition and odor problems associated with long pump back times. Pump back times in excess of two weeks under Alternative SPB-2 are technically not feasible.

Analysis of the utilization of this storage model suggests that during the period between January 2004 and March 2005 this storage facility would have been empty 44 percent of the time. It was also estimated that during this time a period of 28 days was required to empty the storage facility between early September and early October 2004.

Although technically not feasible, the cost of storage and pump back facilities were estimated to assess financial feasibility. The conceptual design of storage and pump-back facilities presented herein is not intended to represent the final system improvements for ALCOSAN's Wet Weather Plan. Rather, they were developed to determine feasibility and estimate the cost of storage and pump-back facilities as an off-site alternative to the proposed wet weather flow management strategy at the WWTP.

Figure 7-1 illustrates a conceptual layout of storage tunnels shown as green lines on the figure. The twin-tunnel alignment along the north shore of the Ohio River and Allegheny River was selected to provide sufficient storage capacity using 30-foot diameter tunnels; to remain within the ALCOSAN service area; and to be capable of filling from a diversion at the Woods Run WWTP; and be self-draining via a dewatering pumping station located at the WWTP. The physical design parameters of the storage tunnels alternatives are summarized in Table 7-1.

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Section 7 – Environmental and Regulatory Consistency Review

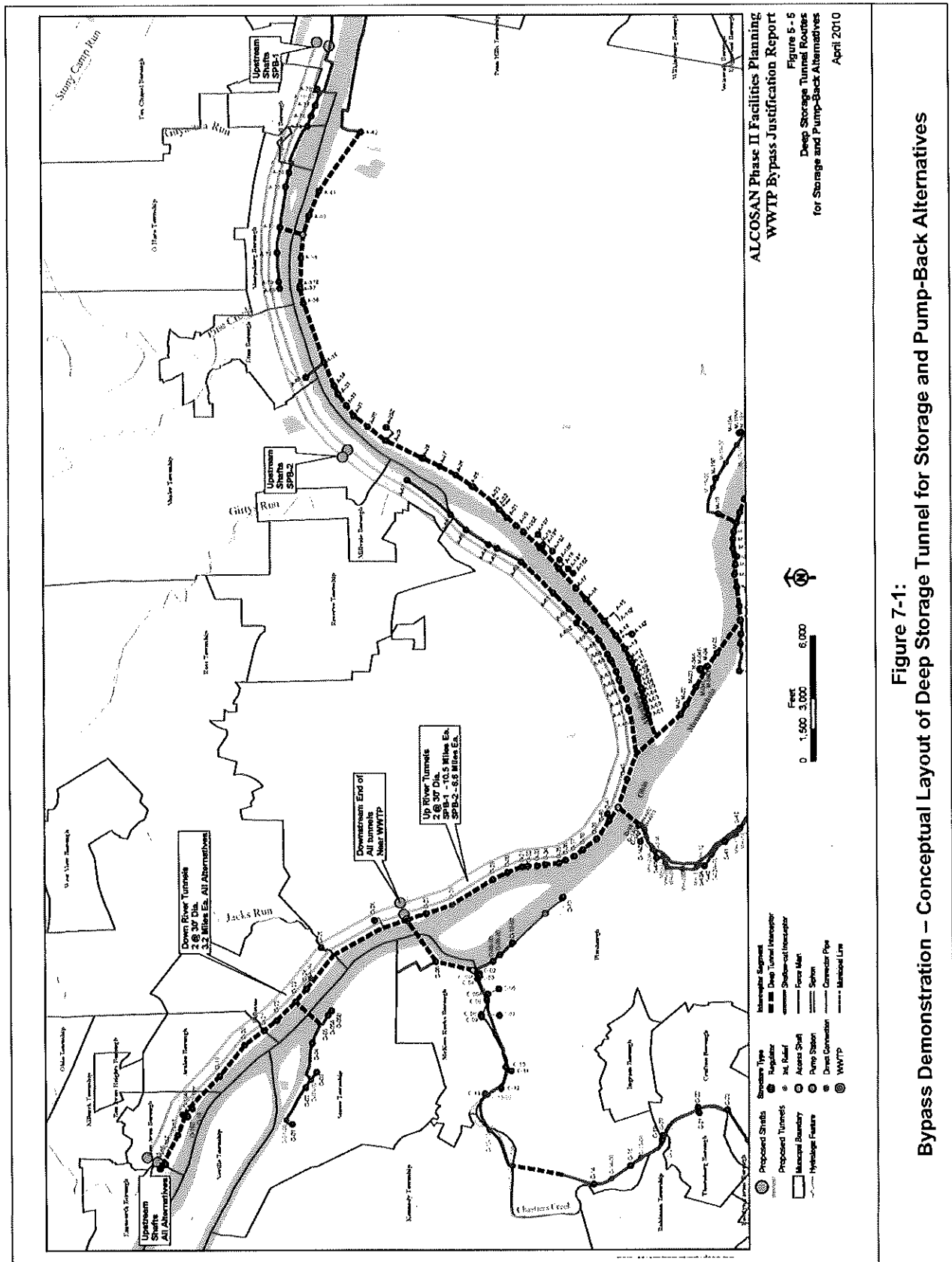


Figure 7-1:
 Bypass Demonstration – Conceptual Layout of Deep Storage Tunnel for Storage and Pump-Back Alternatives

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Section 7 – Environmental and Regulatory Consistency Review

Table 7-1:
Summary of Storage and Pump-Back Alternatives Conceptual Design

Parameter	Units	Storage and Pump-Back Alternative	
		SPB-1	SPB-2
Design Capacities			
WWTP Capacity	mgd	275	295
Required Storage Volume	MG	765	550
Tunnel Dewatering Capacity	mgd	125	135
Tunnels Downriver of WWTP			
Diameter	Feet	30	30
Length – Each	Feet	17,000	17,000
Total Vertical Fall at 0.1% Slope	Feet	17	17
Total Length	Feet	34,000	34,000
Total Storage Volume Provided	MG	180	180
Tunnels Upriver of WWTP			
Diameter	Feet	30	30
Length – Each	Feet	55,340	35,010
Total Vertical Fall at 0.1% Slope	Feet	55	35
Total Length	Feet	110,680	70,020
Total Storage Volume Provided	MG	585	370
Total Tunnel Length & Volume			
Total Length	Feet	144,680	104,020
Total Length	Miles	27.4	19.7
Total Storage Volume Provided	MG	765	550

The capacity analysis of the existing Main Pumping Station concluded that the maximum recommended upgrade of the Main Pumping Station is 480 mgd, based on concerns with the wet well hydraulics and firm capacity of the pumping station. Therefore, in order to bring more than 480 mgd of wet weather flow to the WWTP, several conveyance system improvements were identified for the analysis of expansion alternatives.

Since the storage and pump-back alternatives assume the diversion of flow into storage occurs at the WWTP, it is necessary to include the conveyance system improvements. The conveyance system improvements identified are summarized below

- **Chartiers Creek Interceptor Tunnel and River Crossing:** Construct a 12-foot diameter parallel interceptor tunnel and river crossing. The tunnel would extend approximately 5,000 linear feet (lf) from the Chartiers-Ohio Junction Chamber (O-07) to the WWTP. This tunnel would have a capacity of 415 mgd and an initial capital cost of \$44 million.
- **Lower Ohio Interceptor Tunnel and River Crossing:** Construct an 8-foot diameter parallel interceptor tunnel and river crossing. The tunnel would extend approximately 7,000 lf from the Freemont River crossing (O-05) to the WWTP. This tunnel would have a capacity of 135 mgd and an initial capital cost of \$40 million
- **Shallow-cut Upper Ohio Interceptor:** Construct a 5-foot diameter shallow-cut interceptor from Westhall Street (O-27) to the WWTP. This interceptor would have a capacity of 70 mgd and an initial capital cost of \$2 million.
- **Interconnecting Conduit to Existing Upper Ohio Interceptor:** Construct a control structure and interconnecting conduit from the 10.5-foot diameter Upper Ohio Interceptor to the new junction chamber for the storage tunnels. This interconnection would have a capacity of 250 mgd and an initial cost of \$14 million.

The combined initial capital costs for the conveyance system improvements described above is \$100 million.

Capital costs for the deep tunnels and dewatering pump station were estimated using the Alternatives Costing Tool (ACT) prepared for ALCOSAN's wet weather program. The dewatering pump station cost (including the shaft cost) is based on the Sanks cost curve⁷⁻¹ that has been adjusted based on costs of several planned or actual deep pump stations. Because the curve is based on a national reference, the costs were adjusted over time using the national ENR CCI value for October, 2008 (ENR CCI = 8623), and adjusted for location based on the RS Means overall Location Factor for Pittsburgh (98.7).

The tunnel costs were developed assuming the required storage is provided in a series of 30-foot diameter deep tunnels located completely in sound rock. Costs are provided for both pre-cast segmental and cast-in-place linings as there is not yet sufficient information to determine which approach is most appropriate for this project.

Table 7-2 provides a summary of the estimated capital cost range for each storage and pump back alternative. The "Low Range" of capital costs shown in Table 7-2 is based on using a cast-in-place (CIP) tunnel lining system and the "High Range" is based on a pre-cast segmental lining system. More geotechnical investigations would be necessary to determine which tunnel lining system is most suitable for the Pittsburgh region and actual tunnel alignment. The pre-cast lining system is a one-pass installation method that is more suitable for poor soil/rock

⁷⁻¹ Jones, G., Basserman, B., Sanks, R., Tchobanoglous, G., Pumping Station Design (Third Edition 2006).

conditions and where groundwater is difficult to control. The CIP lining system is a two-pass construction method where the tunnel is excavated and then an interior concrete lining is cast-in-place. The CIP lining system costs less than pre-cast segmental linings, but it is best suited for sound rock conditions with little groundwater intrusion. Therefore, the capital costs for the storage tunnel alternatives are expressed as a range that covers the potential construction costs for varying site conditions and construction methods.

**Table 7-2:
Summary of Storage and Pump-Back Alternatives Estimated Capital Costs**

Alternative	Storage Capacity (MG)	Dewatering Pump Station Capacity (mgd)	Estimated Capital Cost, \$ millions		
			Low Range	High Range	Equipment Replacement
SPB-1	765	125	\$2,300	\$3,200	\$4
SPB-2	550	135	\$1,700	\$2,400	\$5

The O&M costs developed for the storage and pump-back alternatives include materials, labor, and energy costs associated with tunnel and dewatering pump station operation. O&M costs are based on the following.

- Tunnel operating statistics obtained from model simulations of the storage and pump-back alternatives
- Tunnel length
- Average ALCOSAN labor rates for maintenance and operations staff
- An electricity cost of \$0.09/kWh
- Pump station capacity

The annual O&M costs and equivalent present worth over the 28-year planning period for the storage and pump-back alternative are summarized in Table 7-3.

**Table 7-3:
Storage and Pump-Back Alternatives Estimated Annual O&M Costs**

Item	Estimated Annual O&M Costs (\$1,000s)	
	SPB-1	SPB-2
Alternative		
Labor – Operations	\$510	\$380
Labor – Maintenance	\$560	\$470
Electricity	\$630	\$530
Materials	\$110	\$110
Total Annual O&M Cost	\$1,810	\$1,500
Present Worth	\$27 million	\$23 million

Alternative SPB-1 requires no additions to the existing plant process units, but does include the on-site capital improvements listed below to support the storage tunnels dewatering pump station.

- *Odor Control:* The existing Headworks Odor Control Facility would be expanded by the addition of a third scrubber train to provide odor control for the tunnel junction chamber and dewatering pump station.
- *On-site Conveyance:* The capital cost to construct a forcemain between the storage tunnel dewatering pump station and the existing Main Pumping Station is included in on-site capital improvements for this alternative.

The estimated initial capital cost for the improvements to the WWTP for Alternative SPB-1 is \$7.4 million.

Alternative SPB-2 includes expansion of the WWTP secondary treatment capacity by 20 mgd from 275 mgd to 295 mgd including the capital improvements listed below.

- *Odor Control:* The existing Headworks Odor Control Facility would be expanded by the addition of a third scrubber train to provide odor control for the tunnel junction chamber and dewatering pump station.
- *Existing Plant Headworks:* For this analysis it is assumed that the existing screenings and grit removal facilities are adequate for a plant capacity of 295 mgd with five of the six process trains (bar screen followed by a grit collecting tank) in-service.
- *Primary Treatment:* The existing primary sedimentation tanks have sufficient available capacity to operate at 295 mgd.

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- *Secondary Treatment:* The expansion of secondary treatment capacity by 20 mgd includes the addition of two final settling tanks and one Return Activated Sludge (RAS) pumping station.
- *Secondary Disinfection:* For this analysis it is assumed the expansion of the existing chlorine contact tank capacity from 275 mgd to 295 mgd is feasible.
- *On-Site Conveyance:* The capital cost to construct a forcemain between the storage tunnel dewatering pump station and the existing Main Pumping Station is included in on-site capital improvements for this alternative.

The estimated initial capital cost for the improvements to the WWTP for Alternative SPB-2 is \$48 million.

The storage and pump-back alternatives each relate to a specific treatment capacity at the Woods Run WWTP. Table 7-4 provides a summary of the estimated annual O&M costs at the WWTP for the increase in plant treatment capacity and the treatment of stored flows.

Table 7-4:
Estimated Annual O&M Costs at the Woods Run WWTP
for Storage and Pump-Back Alternatives SPB-1 and SPB-2

Item	Estimated WWTP Annual O&M Costs (\$1,000s)	
	SPB-1	SPB-2
Alternative	SPB-1	SPB-2
Labor – Operations	\$72	\$68
Labor – Maintenance	\$46	\$42
Electricity	\$748	\$788
Chemicals	\$1,350	\$1,350
Materials	\$9	\$9
Residuals	\$984	\$984
Total Annual O&M Cost	\$3,209	\$3,241
Present Worth	\$48.5 million	\$48.9 million

The two storage and pump-back alternatives differ by the treatment capacity provided at the Woods Run WWTP and the resulting storage facilities needed to store off-line and pump-back the wet weather flow reaching the WWTP (with some conveyance system improvements) from the fifth largest annual storm event in the ALCOSAN service area as selected by review of the historical rainfall records and as simulated by the ALCOSAN hydrologic and hydraulic models. Table 7-5 provides a present worth cost summary of the storage and pump-back alternatives.

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Table 7-5:
Summary of Storage and Pump-Back Alternatives Present Worth

Parameter	Storage and Pump-Back Alternative Present Worth (\$ millions)	
	SPB-1	SPB-2
Design Data Summary		
WWTP Capacity, mgd	275	295
Storage Tunnel Capacity, MG	765	550
Dewatering Pump Station Capacity, mgd	125	135
Capital Costs		
Storage and Dewatering – High Range	\$3,200	\$2,400
Storage and Dewatering – Low Range	\$2,300	\$1,700
Conveyance System Improvements	\$100	\$100
WWTP Improvements	\$7	\$48
Present Worth of Annual Costs		
Storage and Dewatering	\$27	\$23
WWTP Improvements	\$49	\$49
Present Worth of Future Renewal and Replacement Capital Costs		
Storage and Dewatering	\$4	\$5
WWTP Improvements	\$0	\$1
Total Present Worth – High Range	\$3,387	\$2,626
Total Present Worth – Low Range	\$2,487	\$1,929

Satellite Treatment Facilities: The premise of satellite treatment remedial measures is to provide secondary treatment at satellite wastewater treatment facilities in lieu of the proposed wet weather flow management strategies at the Woods Run WWTP. The satellite treatment capacity needed to avoid bypass of secondary treatment at the Woods Run WWTP is directly related to the wet weather flow routing scenario as shown in Table 7-6.

**Table 7-6:
Summary of Wet Weather Bypass by Plant Expansion Scenario**

Scenario	Total Wet Weather Treatment Capacity (mgd)	Secondary Capacity (mgd)	Peak Rate of Wet Weather Secondary Treatment Bypass (mgd)
A-1	600	275	325
A-2	600	295	305
A-3	600	275	325
A-4	600	295	305
B	420	295	125
C	480	295	185
D	480	295	185

Potential sizes and locations of satellite treatment facilities were identified by performing hydrologic and hydraulic simulations of the ALCOSAN collection system using rainfall records from 2001 through 2004 to determine average and peak wet weather flows delivered to different points in the interceptors. These simulations were performed with the same model used for the storage and pump-back analysis described above. Historic flow monitoring records were also used for investigating potential sites at locations not specifically identified in the models. Eight sites were identified as potential locations for satellite treatment facilities as shown on Figure 7-2 including: Chartiers Creek, Saw Mill Run, Turtle Creek, Upper Allegheny North Shore and South Shore, Upper Ohio, Streets Run and Lowries Run.

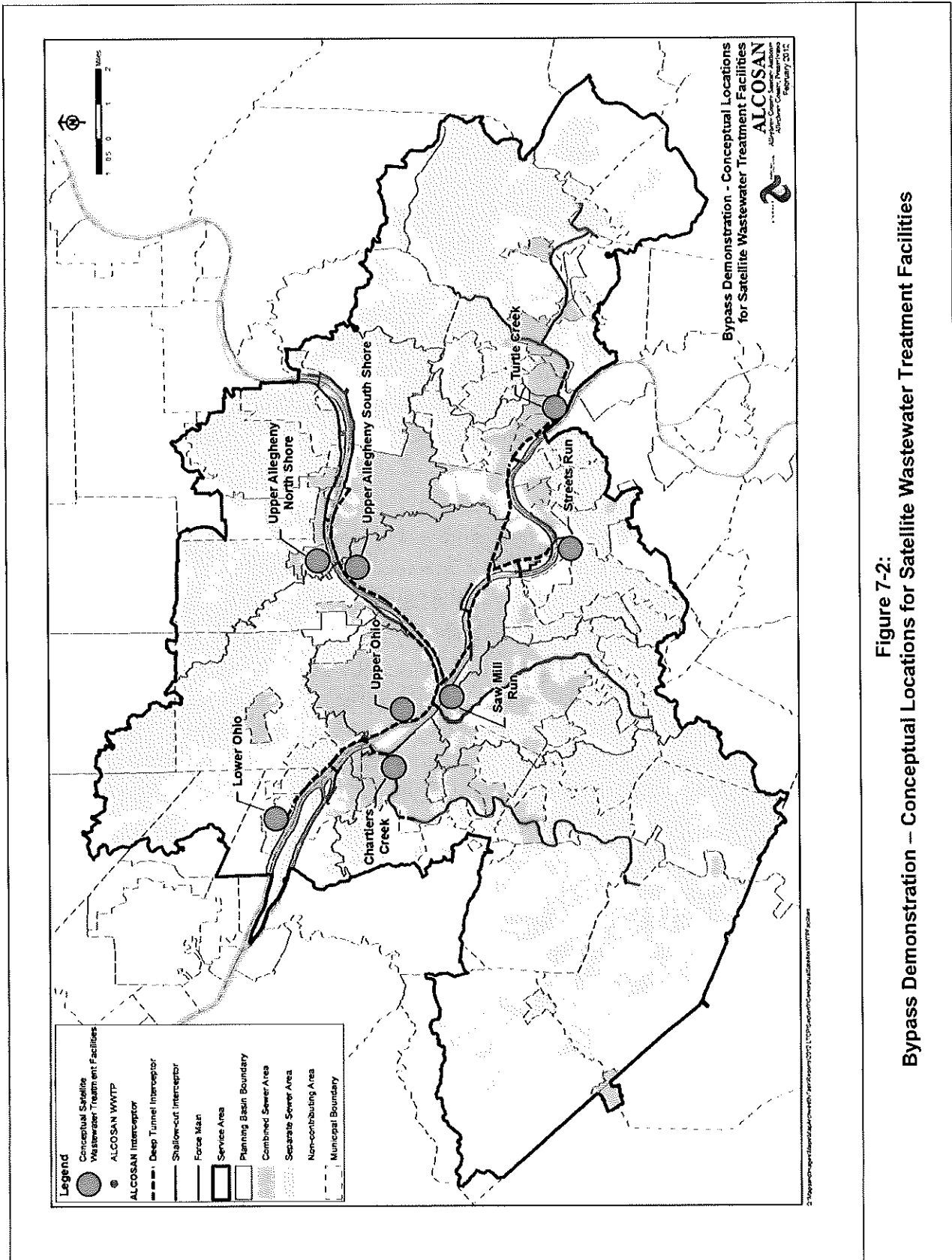


Figure 7-2:
Bypass Demonstration – Conceptual Locations for Satellite Wastewater Treatment Facilities

It should be noted that the identification of potential satellite treatment locations was not based on the feasibility of procuring the land required for the treatment facilities, or likelihood of local approval, but rather on the ability to convey flows to the treatment facilities and provide sufficient land area to construct the facilities.

The Chartiers Creek site is a triangular parcel located on the west shore of the Ohio River near Brunot Island. The site is 25 acres and bordered on the north by Robb Road, on the east by River Road and the Ohio River, on the south by River Road and Chartiers Creek and on the west by railroad tracks. Flow to a Chartiers Creek satellite treatment facility could be diverted from the vortex and junction chamber O-07.

The Turtle Creek site is a rectangular parcel located on the north shore of the Monongahela River near the Thomson Steel Works, across the river from Kennywood Park. The site is 15 acres and is bordered on the northeast by railroad tracks, on the southeast by 11th Street, on the southwest by the Monongahela River, and on the northwest by Seventh Street. Flow to a Turtle Creek satellite treatment facility could be diverted from the deep-tunnel interceptor, downstream of regulator structure M-60.

The Upper Allegheny – South Shore site is a rectangular parcel located on the south shore of the Allegheny River downstream of the 62nd Street Bridge. The site is 13 acres and is bordered on the north by the Allegheny River, on the east by 57th Street, on the south by railroad tracks, and on the west by a privately-owned parcel. Flow to the Upper Allegheny satellite treatment facility could be diverted from the deep-tunnel interceptor, close to regulator structure A-35.

The Upper Ohio site is a collection of parcels located along the east shore of the Ohio River between the Woods Run WWTP and the West End Bridge. The overall site is 39 acres and is currently owned by a number of private, commercial, and governmental parties. The site is bordered on the north by Branchport Street to the east by Metropolitan Street, to the south by North Avenue, and to the west by railroad tracks and the Ohio River. Preble Avenue bisects the site. Flow to an Upper Ohio satellite treatment facility could be diverted from the deep-tunnel interceptor, downstream of regulator structure O-38.

The Saw Mill Run site is a collection of parcels located along the west shore of the Ohio River near the West End Bridge. The overall site is 14 acres and is currently owned by a number of private, commercial, railroad and government parties. The site is bordered on the north by the West End Bridge, to the south by the entrance to the Duquesne Incline and Station Square properties, to the east by the Ohio River and to the west by Carson Street. Flow to a Saw Mill Run satellite treatment facility would be diverted from the 48-inch diameter interceptor just upstream of regulator structure O-14 and the river crossing.

The Streets Run site is vacant property located along the south shore of the Monongahela River near the Glenwood Bridge. The site is approximately 23 acres and bordered on the north by the Monongahela River, to the south and west by railroad tracks and to the east by Sandcastle. Flow to the Streets Run satellite treatment facility would be diverted from the 96-inch Homestead Trunk Sewer and 33-inch Streets Run Trunk Sewer just upstream of the river crossing drop shaft structure A-42A.

The Upper Allegheny – North Shore site is a rectangular parcel located on the north shore of the Allegheny River near the 62nd Street Bridge. The site is approximately 12 acres and includes four privately-owned and developed commercial properties. It is bordered on the north by Pine Creek and Route 28, on the east by private property, on the south by railroad tracks and the Allegheny River, and on the west by Pine Creek. Flow to the Upper Allegheny – North Shore satellite treatment facility would be diverted from the shallow cut interceptor, close to regulator structure A-68.

The Lowries Run site is a collection of parcels located along the north shore of the Ohio River near the Emsworth Lock and Dam. The overall site is approximately 8 acres including several privately-owned residential, commercial and light manufacturing properties. The site is bordered on the north by Route 65, to the south by railroad tracks and the Ohio River, to the east by Lowries Run and to the west by abutting privately-owned properties. Flow to a Lowries Run satellite treatment facility would be diverted from the 24-inch Lowries Run interceptor and 12-inch sewer from Emsworth upstream of the Lower Ohio Interceptor near regulator structure O-15.

Based on review of flow records, conveyance system models and existing site conditions the average daily and peak wet weather flow capacities of the eight potential satellite treatment sites are summarized in Table 7-7.

In order to develop satellite treatment facility alternatives, it is necessary to make several planning-level assumptions as to the level of treatment required and the treatment processes used. For this analysis, the following wastewater treatment assumptions were made.

- Since the satellite facilities are located along the main rivers it was assumed they would have NPDES discharge limitations similar to those at the Woods Run WWTP
- Primary treatment followed by secondary treatment using an activated sludge process would be provided for the two larger (Chartiers Creek and Upper Ohio) facilities (i.e., average daily flow greater than 20 mgd)
- Secondary treatment for the smaller satellite treatment facilities (average daily flow = 20 mgd, or less) would be provided using a sequencing batch reactor process without primary treatment
- UV disinfection would be used at all facilities
- Sludge thickening, dewatering and lime stabilization solids handling processes would be provided at all but the Upper Ohio site
- At the Upper Ohio site, sludge would be pumped to the Woods Run WWTP solids handling process due to its close proximity

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Table 7-7:
Potential Satellite Treatment Plant Locations and Treatment Capacities

Facility Name/Location	Nearest ALCOSAN Interceptor Structure	Average Daily Flow (mgd)	Peak Wet Weather Flow (mgd)
Chartiers Creek	O-07	40	120
Saw Mill Run	O-14	10	40
Turtle Creek	M-60	17	68
Upper Allegheny – South Shore	A-35	20	80
Upper Ohio	O-38	73	217
Streets Run	M-42A	10	40
Upper Allegheny – North Shore	A-68	5	20
Lowries Run	O-15	5	15
Totals		180	600

For planning purposes, it was assumed the satellite treatment facilities would be comprised of the following major unit processes:

- Influent pumping station
- Mechanical bar screens
- Aerated grit chambers
- Primary clarifiers (Chartiers Creek and Upper Ohio sites only)
- Aeration tanks and secondary clarifiers (Chartiers Creek and Upper Ohio sites) or sequencing batch reactors (Saw Mill Run, Streets Run, Turtle Creek, Lowries Run and Upper Allegheny sites)
- UV disinfection
- Cascade post-aeration
- Sludge holding tanks and sludge pumping station (Upper Ohio site only)

- Onsite sludge processing, including gravity belt thickeners for waste activated sludge thickening, centrifuge dewatering and lime stabilization (Chartiers Creek, Saw Mill Run, Streets Run, Turtle Creek, Lowries Run and both Upper Allegheny sites)
- Odor control for headworks, primary treatment (where provided) and solids handling facilities using two-stage chemical scrubbers (similar to Woods Run WWTP). Certain areas may require additional odor control provisions due to location in sensitive areas; however, the need for higher levels of odor control was not evaluated in this analysis.

Conceptual design criteria for each unit process are described in detail below. Most of the design criteria are based on requirements published in the 1997 DEP *Domestic Wastewater Facilities Manual*. Many of these design criteria are similar to what is outlined in the *Recommended Standards for Wastewater Facilities* 2004 edition (generally referred to as the “10 State Standards”).

Note that a peaking factor (for peak-wet-weather-to-average flow) of 3.0 is used for sizing the Chartiers Creek and Upper Ohio satellite facilities. This peaking factor, which is higher than what is typically used for design of secondary treatment facilities, assumes that the biological process would be operated in conventional plug-flow mode during average flows and contact stabilization/step-feed mode during peak wet-weather flows. Preliminary analyses suggest that making this conversion could potentially increase the plant’s capacity during wet weather flows to three times its average dry weather capacity.

The Upper Allegheny, Turtle Creek, Saw Mill Run, Streets Run and Lowries Run satellite facilities were sized using a peaking factor of 4.0 which is at the high end of the peak flow range for an SBR facility. A peaking factor of 3.0 was used for the Lowries Run SBR facility based on the flow monitoring records in the Lowries Run interceptor.

The cost evaluation for satellite treatment was based on a present worth analysis including estimated capital costs for initial construction; the present worth of future renewal and replacement capital costs and the present worth of annual operation and maintenance cost over the planning period of 2018 through 2046.

The capital costs for the satellite treatment alternatives include the sum of the estimated construction costs and the estimated non-construction costs. Preliminary quantity takeoffs were made for the following items:

- Buildings (on a square foot basis)
- Process tankage, channels, and major structures (quantity takeoff of site work and concrete)
- Major equipment (e.g., unit rates based on vendor planning quotes for pumps, screens, grit handling equipment, conveying equipment etc.)
- Property values based on Allegheny County assessment records

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- Demolition of existing structures (on a square foot basis)

Unit costs and allowances for the planning-level construction cost estimates were developed for this project. The capital costs of alternatives are expressed in base year 2008 US dollars. For the purposes of present worth calculations, capital costs are not inflated to the anticipated mid-point of construction. Each non-construction cost is calculated as a percentage of the estimated construction cost. Estimated capital costs are shown in Table 7-8.

Table 7-8:
Summary of Satellite Treatment Estimated Capital Costs

Plant Names	Design Flows, mgd		Estimated Capital Costs, \$ millions	
	Average Daily	Peak Wet Weather	Treatment Plant	PW of Future Renewal and Replacement
Chartiers Creek	40	120	\$508	\$17
Turtle Creek	17	68	\$250	\$14
Upper Allegheny – South Shore	20	80	\$289	\$16
Upper Ohio	73	217	\$697	\$17
Saw Mill Run	10	40	\$214	\$12
Streets Run	10	40	\$193	\$12
Upper Allegheny – North Shore	5	20	\$144	\$9
Lowries Run	5	15	\$141	\$9

The O&M costs developed for the satellite treatment alternatives include materials, labor, electricity, and chemical costs associated with building use and equipment operation for all liquid treatment and solids handling processes. Residual disposal costs are also estimated for landfill disposal of screenings and grit and for landfill or land application of stabilized biosolids as currently conducted at the Woods Run WWTP.

Unit costs for satellite treatment plant O&M estimates are:

- Maintenance and operations staff: average ALCOSAN labor rates;
- Electricity: \$0.09/kWh;
- Caustic for odor control: \$0.40/lb; sodium hypochlorite for odor control: \$0.66/lb;
- Maintenance materials cost: 20 percent of maintenance labor costs.

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The annual O&M costs and equivalent present worth over the 28-year planning period for the satellite treatment alternatives are summarized in Table 7-9.

Table 7-9:
Summary of Satellite Treatment Facilities Present Worth

Satellite Plant	Design Data Summary		Satellite Treatment Present Worth (\$ millions)			
	Average Daily Flow, mgd	Peak Capacity, mgd	Initial Capital Cost	PW of Annual Costs	PW of Future Renewal & Replacement	Total Present Worth
Chartiers Creek	40	120	\$508	\$119	\$17	\$644
Turtle Creek	17	68	\$250	\$59	\$14	\$323
Upper Allegheny South Shore	20	80	\$289	\$66	\$16	\$371
Upper Ohio	73	217	\$697	\$211	\$17	\$925
Saw Mill Run	10	40	\$214	\$38	\$12	\$264
Streets Run	10	40	\$193	\$39	\$12	\$244
Upper Allegheny North Shore	5	20	\$144	\$29	\$9	\$182
Lowries Run	5	15	\$141	\$29	\$9	\$179

Plant Expansion Scenarios A-1 to A-4 includes maximum secondary treatment bypass of 305- to 325- mgd at the Woods Run WWTP. In lieu of this wet weather bypass there are four possible combinations of satellite facilities to provide a total peak flow capacity of 305- to 325-mgd as shown in Table 7-10. These combinations of satellite treatment facilities, referred to a Scenario SST-600, result in estimated PW lifecycle costs ranging from \$1.4- to \$1.6-billion. The satellite treatment alternatives are approximately three times the Scenario A lifecycle PW cost range of \$550 to \$590 million.

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Table 7-10:
**Scenario SST-600 Combinations of Satellite Treatment Facilities
and Present Worth Costs**

Satellite Plant Combinations*	Design Data Summary		Satellite Treatment Present Worth (\$ millions)			
	Average Daily Flow mgd	Peak Capacity mgd	Initial Capital Cost	PW of Annual Costs	PW of Future Purchases	Total Present Worth
UO, TC, & UANS	95	305	\$1,091	\$299	\$40	\$1,430
UO, UASS & LR	98	312	\$1,127	\$306	\$42	\$1,475
UO, UASS & UANS	98	312	\$1,130	\$306	\$42	\$1,478
CC & UO	113	337	\$1,205	\$330	\$34	\$1,569
UO, UASS, UANS, & LR	103	332	\$1,271	\$335	\$51	\$1,657

*CC = Chartiers Creek, TC = Turtle Creek, UASS=Upper Allegheny South Shore, UO=Upper Ohio, SMR=Saw Mill Run, SR=Streets Run, UANS=Upper Allegheny North Shore, LR=Lowries Run

Plant Expansion Scenario B includes a maximum secondary treatment bypass of 125 mgd at the Woods Run WWTP. This is approximately equal to the peak flow capacity of the Chartiers Creek conceptual satellite treatment plant (120 mgd). The estimated PW lifecycle cost of the Chartiers Creek satellite plant is \$644 million compared to the Scenario B estimated PW lifecycle cost of \$513 million.

Plant Expansion Scenarios C and D include a maximum secondary treatment bypass of 185-mgd at the Woods Run WWTP. Scenario D is not considered a feasible wet weather flow management strategy for the same reasons noted above for Scenario B regarding EPA rejection of high-rate clarification. In lieu of the Scenario C wet weather bypass, the four lowest-cost possible combinations of satellite facilities to provide a total peak flow capacity of 185-mgd are shown in Table 7-11. These combinations of satellite treatment facilities, referred to as SST-480, result in PW lifecycle costs ranging from \$925- to \$967-million. The satellite treatment alternatives are more than double the Scenario C lifecycle PW cost of \$401 million.

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Table 7-11:
**Scenario SST- 480 Combinations of Satellite Treatment Facilities
and Present Worth Costs**

Satellite Plant Combinations*	Design Data Summary		Satellite Treatment Present Worth (\$ millions)			
	Average Daily Flow mgd	Peak Capacity mgd	Initial Capital Cost	PW of Annual Costs	PW of Future Purchases	Total Present Worth
UO	73	217	\$697	\$211	\$17	\$925
TC, UASS & SR	47	188	\$732	\$164	\$42	\$938
TC, UASS & SMR	47	188	\$753	\$163	\$42	\$958
CC & TC	57	188	\$758	\$178	\$31	\$967

*CC = Chartiers Creek, TC = Turtle Creek, UASS=Upper Allegheny South Shore, UO=Upper Ohio, SMR=Saw Mill Run, SR=Streets Run, UANS=Upper Allegheny North Shore, LR=Lowries Run

Bypass Justification: The planning efforts conducted to evaluate the technical and financial feasibility of providing full treatment in lieu of the proposed bypass of partially-treated wet weather flows at the Woods Run WWTP included extensive use of the ALCOSAN H&H models. These models were used to simulate and quantify estimated wet weather flows to the Woods Run WWTP achieved through maximum use of the existing regional conveyance systems. Conceptual designs were developed for deep tunnel storage and pump-back facilities which included consideration of historical rainfall records including critical time periods with back-to-back storm events. Through use of the H&H models and flow monitoring records strategic sites for potential satellite treatment facilities were identified based on the distribution of wastewater flow in the collection system. Basic design criteria and costing tools were developed to provide a consistent and comparable method of conceptually sizing facilities and estimating capital and annual costs for numerous planning alternatives.

Through the concept development efforts, it became apparent that storage and pump-back facilities needed to eliminate the proposed bypass of partially-treated wet weather flow at the WWTP are technically not feasible. They are extremely large and require excessively long pump-back time periods for full treatment. Even at an expanded full-treatment capacity of 295 mgd at the WWTP (Scenario SPB-2) the storage tunnel dewatering time approaches one month for the targeted design storm event. Typically, the holding/dewatering time for storage facilities is no more than one to two days in order to reduce the potential for wastewater to turn septic or to settle-out suspended solids in the storage facility. Septic wastewater pumped from a storage facility can have a significant impact on the operation of a WWTP as well as emission of foul odors. In addition, excessive settlement of solids in the storage facility can generate operational challenges associated with cleaning, maintaining full storage capacity and control of odors from the storage facility.

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Satellite treatment facilities in lieu of the proposed WWTP expansion scenarios inherently include a technical challenge to provide sufficient average daily flow to sustain biological treatment processes. In doing this, flow must be diverted from the Woods Run WWTP, thereby reducing its treatment capacity. For example, Satellite Treatment Scenario SST-600 requires diversion of approximately 100 mgd of average daily flow from the Woods Run WWTP to eliminate the wet weather secondary bypass of 305 mgd to 325 mgd of wet weather flow under plant expansion Scenarios A-3 and A-4. This diversion of average daily flow from the WWTP would severely limit the capacity of the existing facility. Satellite Treatment Scenario SST-480 requires diversion of between 47 mgd to 73 mgd of average daily flow from the WWTP to eliminate a wet weather secondary bypass of 185 mgd under plant expansion Scenario C. This diversion of average daily flow from the WWTP reduces capacity of the existing facility, but is potentially feasible. However, plant expansion Scenario C limits the wet weather treatment capacity at the WWTP to 480 mgd which increases the magnitude of regional conveyance improvements necessary to compensate for the reduced capacity at the WWTP.

The financial feasibility of providing storage and pump back or satellite treatment in lieu of the plant expansion scenarios was also evaluated. Table 7-12 provides a comparative summary of the estimated life cycle present worth costs of the viable plant expansion scenarios with the storage and pump back and satellite treatment alternatives.

Table 7-12:
Summary of WWTP Expansion, Storage and Pump Back
and Satellite Treatment Alternatives Present Worth Costs

Alternative	Life Cycle Present Worth Cost (\$ millions)			
	Initial Capital Cost	PW of Annual Costs	PW of Future Purchases	Total Present Worth
Plant Expansion Scenario A-3	\$445	\$81	\$27	\$553
Plant Expansion Scenario A-4	\$479	\$82	\$31	\$592
Plant Expansion Scenario C	\$290	\$84	\$27	\$401
Storage and Pump Back Scenario SPB-1	\$2,407 - \$3,307	\$76	\$4	\$2,487 - \$3,387
Storage and Pump Back Scenario SPB-2	\$1,848 - \$2,348	\$72	\$4	\$1,929 - \$2,626
Satellite Treatment Scenario SST-600	\$1,091 - \$1,271	\$299 - \$335	\$40 - \$51	\$1,430 - \$1,657
Satellite Treatment Scenario SST-480	\$697 - \$758	\$211 - \$178	\$17 - \$31	\$925 - 967

A comparison of the life cycle present worth costs indicates that the storage and pump-back alternatives are three to five times more costly than comparable plant expansion alternatives. Similarly, the present worth costs of satellite treatment scenarios exhibits two to three times higher cost than the plant expansion alternatives.

This life cycle cost comparison clearly demonstrates the significantly higher cost for either alternative to the proposed plant expansion scenarios, but taken by itself does not demonstrate financial infeasibility. However, when put in the context of the overall wet weather plan as presented in Section 11 of the WWP, it is demonstrated that a plant expansion (or alternative to secondary bypass) with present worth costs in excess of approximately \$600 million is financially not feasible.

7.1.2 Satellite Sewage Treatment Plant Alternatives

Satellite sewage treatment (SST) plants were considered as one alternative for treatment of SSOs and CSOs, in lieu of partial treatment at the Woods Run WWTP as summarized in Section 9.2.5. A preliminary evaluation of potential SST plants included the conceptual design and cost estimating for eight SST plants ranging in size from 5 mgd to 73 mgd annual average daily flow (ADF) located along the main rivers (see Section 9.2.5). Through this evaluation, it was determined that SST plants include a technical challenge to provide sufficient ADF to sustain biological treatment processes. In doing this, flow must be diverted from the Woods Run WWTP, thereby reducing its ADF and peak treatment capacity. In effect, wastewater treatment would be decentralized at a higher cost than the proposed plant expansion for wet weather treatment.

Following the preliminary evaluation, each of the ALCOSAN Basin Planners reviewed the sites presented in the preliminary evaluation and analyzed the potential of an SST alternative within their respective planning basin. The process for analyzing the viability of SST plants as a basin alternative varied slightly for each of the seven basins. However, it was common to screen the technology in the Basin Planner prepared *Screening of Controls and Sites* reports, which provided basic considerations of the technical and financial feasibility of carrying forward an SST control technology through the basin planning process. The analyses also included assessing the available land, set back requirements, access, site difficulties, permitting requirements and prior cost estimates from the preliminary evaluation. The PM provided standard guidance for evaluation of the SST technology.

The SST sites considered by the Basin Planners are shown on Figure 7-3. In many cases, SST was eliminated as a viable technology for concerns over technical limitations and/or cost effectiveness. However, there were cases where SST was considered for further evaluation. A summary of SST consideration in each planning basin follows.

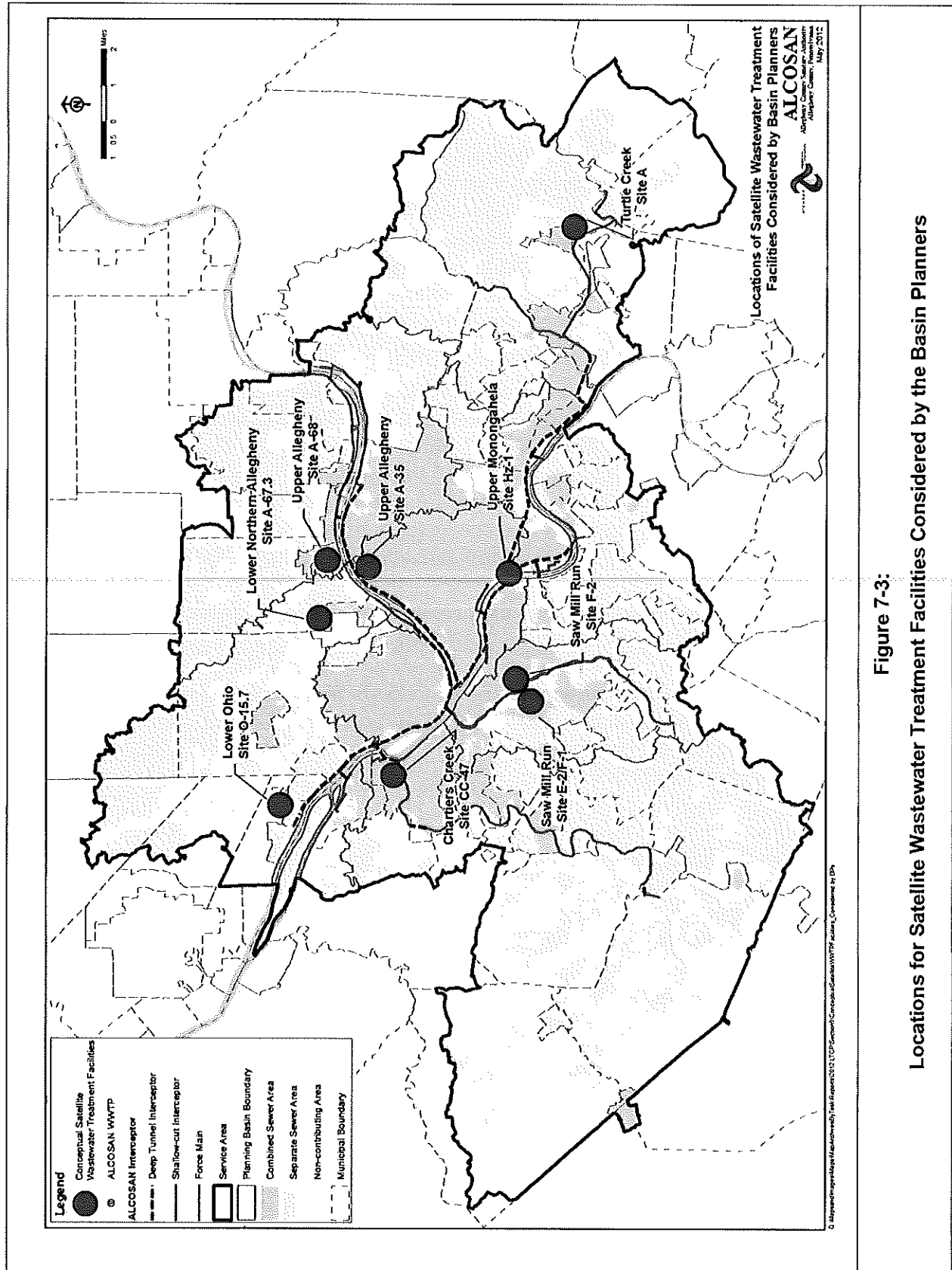


Figure 7-3:
 Locations for Satellite Wastewater Treatment Facilities Considered by the Basin Planners

Chartiers Creek Planning Basin: The implementation of SST in the upper reaches of the Chartiers Creek Planning basin was not considered feasible due to siting limitations, and because discharges to Chartiers Creek would have permit limits based on effluent dominated streams that require more costly advanced treatment technologies. SST was considered among the RBS alternatives for the Chartiers Creek Planning Basin at a site referred to as CC-47 McKees Rock East. This site is at the outlet of the Chartiers Creek interceptor system near ALCOSAN structure O-07-00. A 40 mgd SST facility was considered for this site with a peak wet weather treatment capacity of 120 mgd. This facility would provide secondary treatment prior to discharge in the Ohio River. Five RBS alternatives were evaluated for this SST site which varied by the combination with other control technologies (i.e., treatment, storage and conveyance). One element that each alternative had in common was the Chartiers Creek interceptor system would be disconnected from the Woods Run WWTP and directed to the new SST facility. Wet weather flows in excess of the SST facility capacity would be handled through other CSO treatment, storage and relief sewer facilities up to the associated control levels.

Lower Ohio River - Girty's Run (LOGR) Planning Basin: The upper (northern) portion of the basin has hilly terrain restricting the siting of large treatment facilities. The lower portions of the basin along the Allegheny and Ohio Rivers have flatter areas more suited for treatment facilities, however, the current land use for railroads, major roads and highways limits the available space. Although no SST facilities are recommended in the LOGR Basin; two sites were evaluated for SST including Site O-15.7 in Ohio Township and Site A-67.3 in Millvale Borough as summarized below.

SST was evaluated at Site O-15.7 for the 2-year storm control level for sanitary sewers at the BBS boundary condition. This alternative would convey dry and wet weather flow from the O-15 trunk sewer upstream of Emsworth Borough to Site O-15.7. It was anticipated that the placement of a SST facility at this location would eliminate the need for controls at the O-15-00 outfall and reduce the size of the controls for the other outfalls along the LON. It was determined that overflows would still occur at the O-15-00 structure and the remaining outfalls along the LON were not impacted by removing these flows from the existing ALCOSAN system. This alternative was not carried into the Basin Alternative analysis due to the high cost of the SST; a control facility still being required for control of O-15 overflows; and there was no benefit to sizing of other overflow control facilities along the LON.

In the tributary area to CSO A-67 a storage tank was evaluated for consolidation flow grouping CF11 for the 0, 1, 4, 7, and 20 overflows per year CSO control levels to determine the impact of the size of the facility required at A-67. This consolidation conveys flow from all GRJSA CSOs and SSOs upstream of and including the Millvale SSO to Site A-67.3. A hydraulic assessment determined that if wet weather flows were directed into a storage tank at Site A-67.3 that the overflows at A-67 were not reduced compared to the baseline condition. To further evaluate this option, a simulated bulk head was placed at the Millvale Borough border and all upstream flow was directed to a satellite treatment facility. The resulting overflows at A-67 were then compared to the baseline overflows at A-67. Under this scenario, the overflows at A-67 were not significantly different than the baseline condition. Since an upstream facility at Site A-67.3 would not result in reduced facility size for the control of A-67, a facility at Site A-67.3 was not

carried forward into the Basin Alternative analysis.

The potential site for a SST facility in the LOGR planning basin identified in the bypass demonstration (Section 9.2.5) near the Emsworth Lock and Dam was not considered by the LOGR basin planners since much of the property is currently in use and would not be readily available. In addition, the municipalities provided input as to preferred alternate sites for SST.

Main Rivers Planning Basin: SST was not considered feasible in the MR Planning Basin due to siting issues along the redeveloping river banks and the proximity to the Woods Run WWTP. Nearly all of the flows in the MR basin are from combined sewers within an urban area which is not conducive to siting and operation of SST facilities. There are only two SSOs in the MR Basin, both located in Reserve Township, that are not particularly active based on flow monitoring and modeling efforts. In addition, the limited flow from these SSOs makes SST a less viable control technology.

Saw Mill Run Planning Basin: SST was considered in the SMR Planning Basin as an alternative to off-line storage in the Flow Source CF08 area. This area is located in the central portion of the SMR Basin; wherein, the average daily flows and wet weather flows were suitable for consideration of a 20 mgd SST with a peak capacity of 80 mgd. Two sites were evaluated for SST location referred to as E-2/F-1 and F-2.

The E-2/F-1 site potentially had the available space, however, the location on a hillside well above the parallel sewers and significant operational, implementation and public issues resulted in elimination of this alternative from further consideration. The F-2 site was determined to have insufficient space for SST.

The potential site for an SST facility in the SMR planning basin identified in the bypass demonstration (Section 9.2.5) near the West End Bridge was not considered an appropriate control technology by the SMR basin planners due to excessive cost compared to storage or conveyance alternatives.

Turtle Creek Planning Basin: An SST facility located at Site A and serving the consolidated sewershed areas CF04, CF05 and CF06 was considered the only practical SST site in the TC Basin. Site A is located on park property in Monroeville along the border with Pitcairn, between Turtle Creek and Broadway Boulevard. Since a SST plant at this site would discharge to Turtle Creek, advanced treatment levels would be required. Combined with the need for flow equalization and influent pumping, the SST alternative resulted in present worth costs nearly three times the cost of comparable consolidation and storage alternatives. Therefore, SST was not recommended for this site.

Other sites in the TC Basin were rejected for SST application due to sites being too small to accommodate a complete secondary treatment plant; the high cost for new wet weather conveyance to the downstream sites (i.e., Site B and Site 5); or being located in areas where the ADF was insufficient to accommodate a secondary treatment facility.

Upper Allegheny River Planning Basin: SST was considered in the UA Basin for two types of application, including (1) secondary treatment of dry weather sanitary sewer flows and overflows at SSO locations for SSO control, or (2) secondary treatment of dry weather flows and a portion of wet weather flows at key locations as a means of providing additional capacity on a system-wide basis. An SST was not considered feasible for the SSO areas A-45, A-82 and A-85 because of their remote location, low flows and overall costs compared to that of other alternatives. Two locations were considered potentially feasible for SST near ALCOSAN Structures A-35 and A-68.

The A-35 site is located along the south shore of the Allegheny River near 57th Street. A 20 mgd ADF with peak flow treatment capacity of 80 mgd would provide treatment to all wet weather flows (sanitary and combined) at this location for up to LOC of about 2 to 3 overflows per year. Since the land around this site is not readily available, a SST facility was not considered for further evaluations.

The A-68 site is located on the north shore of the Allegheny River, west of the 62nd Street Bridge between Route 28, Pine Creek and the railroad tracks along the river. The tributary sanitary and combined sewer areas could support a 5 mgd (ADF) SST facility. However, the wet weather flows far exceed the maximum potential peak treatment capacity of 20 mgd for this SST facility considering a peaking factor of four times ADF. In order to achieve even the lowest LOC, additional storage or treatment facilities would be necessary in addition to SST at this site. For example, to achieve a LOC of 4 – 6 overflows/year would require an 80 mgd RTB in addition to the SST plant. The combined cost for SST and RTB exceed the cost of an alternative with a 100 mgd RTB alone by over \$100 million. Given the limited system-wide benefits of a small SST facility at this location and the high cost, SST was not considered for further evaluation.

Upper Monongahela River Planning Basin: The most promising case for the implementation of a SST plant was at the site of the former LTV Steel property in Hazelwood (identified as Site Alternative Hz-1 by the UM Basin Planner). A new pump station would be built to intercept the deep tunnel interceptor and pump all flow to a new SST plant, effectively splitting the Upper Mon and Turtle Creek planning basins from the rest of the ALCOSAN system. The preliminary sizing indicated that the proposed SST would need 45 mgd ADF and 125 mgd peak flow capacities to treat all flows conveyed by the existing deep tunnel interceptor from the Upper Mon and Turtle Creek planning basins. A conceptual site layout determined that more than 20 acres would be required unless high-rate processes are used. As part of the system-wide alternative analysis process, this regional conveyance plus SST alternative was retained for evaluation as System-Wide Alternative 3c.

SST was also considered for three other CSO consolidation site alternatives (Hazelwood, Streets Run and Mon Valley). However, cost analyses of these three SST alternatives resulted in excess of \$500 million higher present worth value than comparable retention treatment basins and were eliminated from further consideration.

7.2 Site Environmental Impacts

In this section, the environmental impacts of carrying out the expansion of the wet weather treatment capacity at the ALCOSAN Woods Run Wastewater Treatment plant site are considered.

7.2.1 County Stormwater Management Plans

Stormwater management activities at the ALCOSAN treatment plant site are regulated under the Pennsylvania Clean Streams Law and the Allegheny County Subdivision and Land Development Ordinance. Publicly owned wastewater treatment plants are categorically included under the statewide general stormwater permitting program. Pending detailed facilities planning and preliminary design work, ALCOSAN anticipates that there will be no net increase to stormwater runoff because of the treatment plant improvements.

Construction activities during the implementation of the treatment plant CIP will be conducted according to Allegheny County stormwater management regulations pursuant to the Storm Water Management Act. During the project design, ALCOSAN will coordinate with the Allegheny County Conservation District as to the need for an Earth Disturbance Permit. An approved Soil Erosion and Sediment Control Plan will be followed during construction.

7.2.2 Wetlands

Wetlands possess three essential characteristics: 1) hydric soils; 2) wetland hydrology; and 3) hydrophytic vegetation. All characteristics must be fulfilled for an area to be classified as a wetland.⁷⁻² The U. S. Fish and Wildlife Service (FWS) has identified wetlands throughout the United States primarily by stereoscopic analysis of high altitude aerial photographs. Wetlands were identified on the photographs based on vegetation, visible hydrology and geography by Classification of Wetlands and Deep Water Habitats of the United States.⁷⁻³

Hydric soils information for both Allegheny and Washington Counties was provided by the U. S. Department of Agriculture's Soil Conservation Service (SCS). The SCS has identified those soils, within each county, with the potential of containing hydric components. These soils are subdivided into soils with major components hydric and soils with inclusions of hydric components. Soils with major hydric components have a high probability of being classified as hydric soils and supporting hydrophytic vegetation. Those soils with inclusions of hydric components have the potential for being classified as hydric soils and must be field checked for an actual determination.

The National Wetlands Inventory wetlands map (Figure 7-4) prepared by the US Fish and Wildlife Service does not show any wetlands on the ALCOSAN Woods Run Wastewater Treatment Plant site. However, the map does identify a Riverine Wetland, the Ohio River, next

⁷⁻² USEPA/USCOE Field Guide for Determining Wetlands, 1989.

⁷⁻³ FWB/OBS 79/31



Figure 7-4:
Woods Run Wastewater Treatment Plant Environmental Base Map.

to the site. Based on soils information provided by the SCS it does not appear that any of the soil types with major hydric components, located within Allegheny County (i.e., Atkins Silt Loam, Brinkerton Silt Loam), appear on the site. The primary soil type on the site is classified as Urban Land, which the SCS has determined has the potential for the inclusion of hydric components.

7.2.3 Waterway Disturbances and Floodplain Impacts

Most of the treatment plant site is located upland of the 100-year flood elevation (725 feet).⁷⁻⁴ Based upon this elevation, the existing Energy Recovery Building, Dewatering Building and related appurtenances are within the 100-year floodplain. As a part of the Part II permit application package for the Phase II treatment plant expansion, ALCOSAN will request a jurisdictional determination as to the applicability of permitting requirements under Section 105 (floodway) or Section 106 (floodway fringe) of the Pennsylvania Administrative Code. Based upon ALCOSAN's current understanding, the plant wet weather capacity expansion activities will not require permitting under Section 105. The applicability of Section 106 is to be determined during the design phase. PaDEP determined that permits were not required for the Phase 1 plant expansion under Sections 105 and 106.

Based upon the FEMA flood profile for the Ohio River, the 100-year flood elevation at the McKees Rocks Bridge is 724 feet. Figure 7-5 shows the irregularly shaped contour of the 724-foot elevation line on the current plant site. Please note that the elevation at the top of the existing flood wall which runs along most of the length of the current plant site is approximately 727.07 feet. The flood wall ends upstream of the process treatment areas, perpendicular to Tracy Street; hence river elevations that exceed 726 feet upstream of the flood wall could result in localized flooding in the areas shown on the site plan.

7.2.4 Rare, Endangered or Threatened Plant and Animal Species

In preparing the 1996 Act 537 Plan, ALCOSAN requested a *Pennsylvania National Diversity Inventory (PNDI)* from the PaDEP Bureau of Forestry. In response, the Bureau affirmed that no rare or endangered species are found at the ALCOSAN treatment plant. Nonetheless, ALCOSAN requested an updated review in March of 2017. A copy of the receipt for this submission is provided in Appendix E. In response, the U.S. Fish and Wildlife Service noted that federally listed mussel species have been identified in the Allegheny River and requested that consideration be given to the potential impacts on listed mussel populations resulting from the expansion of the treatment plant. This was superseded by a December 4, 2017 letter changing the project location from the Allegheny to the Ohio Rivers. A copy of this correspondence from USFWS is also provided in Appendix E.

The Pennsylvania Fish and Boat Commission also noted that an element of a rare, candidate threatened or endangered species under their jurisdiction is known from the vicinity of the project but that no adverse impacts are expected. A copy of this correspondence is provided in Appendix E. ALCOSAN received an email from the Pennsylvania Game Commission on April 6,

7-4 Source: FEMA Flood Boundary and Floodway Map - City of Pittsburgh (Panel No. 420063-0030) 1981.

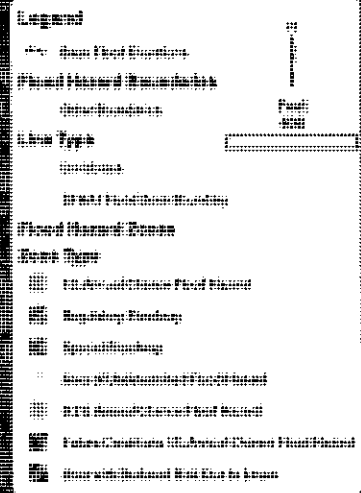


Figure 7-5:

2017 requesting additional information as to the heights of the proposed new secondary disinfection facilities, information as to the types and heights of construction equipment to be used and a construction schedule. ALCOSAN responded to this email and noted that the additional information requested is not available at this stage of the treatment plant expansion program. The Game Commission subsequently sent ALCOSAN a letter dated June 15, 2017 noting that Peregrine falcon are located in the vicinity of the ALCOSAN treatment plant and suggesting that construction activities be avoided between February 15 and July 31. The Commission's response will be valid for two years, after which a request for an update will be required. ALCOSAN intends to coordinate with PaDEP and the Game Commission at a later date when construction plans and specifications have progressed. Copies of the correspondences with the Game Commission are provided in Appendix E. On October 2, 2017 ALCOSAN received a response from the Pennsylvania Department of Natural Resources, Bureau of Forestry documenting that no impacts were anticipated.

7.2.5 Historical and Archaeological Resources Protection

Construction of the ALCOSAN treatment plant began in 1956 and was completed in 1959. Between 1970 and 1972, the plant was expanded and modified to provide secondary wastewater treatment. A brief history of the plant site has been compiled by using historical USGS maps from 1906, 1956, 1960, 1979 and 1993; Sanborne Fire Insurance Maps from 1926 and 1950; and information provided by the Authority.

By 1926 most of the site was owned by three industries: Pressed Steel Car Company, Pittsburgh Forge and Iron Company, and the Pennsylvania Railroad. One small commercial and residential section was also located within the confines of the current property where the primary sedimentation tanks are currently located. Most of the industrial buildings were demolished by 1951. Remaining industrial, residential and commercial buildings were demolished between 1956 and 1958. No structures presently on site predate 1953; and the site disturbance area of the wet weather capacity expansion will occur on previously disturbed portions of the ALCOSAN treatment plant campus.

In preparing the 1996 Act 537 Plan, ALCOSAN requested a site review from the Bureau of Historic Preservation within the Pennsylvania Historical and Museum Commission. Subsequently, the Bureau confirmed that there are no known historic sites and potential impacts on known archaeological and historical sites relevant to the proposed treatment plant improvements as noted on page 5-130 of approved plan. ALCOSAN requested an updated determination from the Bureau in March of 2017. The Bureau's 2017 confirmation that there are no historic properties in the areas to be affected by the treatment plant improvements identified in this study is provided in Appendix E. PaDEP has confirmed to ALCOSAN that a copy of the circa 1995 determination letter from the Bureau is not required for this special study.

7.3 Environmental Assessment

7.3.1 No-Action Alternative

This subsection addresses the water-quality impacts of not implementing the expansion of the wet weather treatment capacity at the Woods Run WWTP as described in Section 6.4 of this study.

Environmental Impacts

The expansion of wet weather treatment capacity to 480 mgd is expected to result in a three billion gallon per year reduction in ALCOSAN overflow volumes, while additional overflow reductions will occur with the future expansion to 600 mgd capacity. This three billion gallons represents a reduction in overflow volumes from nine billion gallons to six million gallons per year for the projected design year (2046), or a 33% reduction. Conversely, if the wet weather treatment capacity expansion program is not implemented, the overflow volumes would be 50% higher without the plant expansion than with it. The wet weather treatment capacity at the Woods Run facility is the central critical component of ALCOSAN's IWWP. Reducing the volume of overflows into the receiving rivers and streams will have positive short and long-term benefits in terms of enhanced river and waterfront recreational opportunities, public health and the protection of public water supplies.

Economic Impacts

The potential economic impacts of not implementing the wet weather capacity expansion described in this study are significant. These include, but are not necessarily limited to:

- The expansion of the wet weather treatment capacity at the Woods Run Wastewater Treatment Plant is a foundational component of ALCOSAN's IWWP and of ALCOSAN's Selected Plan outlined in the 2013 Wet Weather Plan. The \$3.6 billion Selected Plan was determined to be unaffordable under USEPA guidelines. A wet weather control strategy that does not utilize the expansion of the Woods Run plant would impose substantial and widespread economic and social impacts on the Pittsburgh region;
- If ALCOSAN was precluded from expanding the wet weather capacity of the Woods Run plant, it and the customer municipalities would likely be unable to meet their respective wet weather control obligations under the Clean Water Act and the Pennsylvania Clean Streams Law. This could lead to the imposition of sewer-bans and other impediments to economic redevelopment and to unproductive compliance penalties;
- The strong waterfront based economic redevelopment and urban renewal which the City of Pittsburgh and other riverfront municipalities have experienced over the past years could be threatened by the perceived lack of local and state commitment to invest in the area's infrastructure and in the area's environmental assets.
- The delays in addressing the region's CSOs and SSOs resulting from the failure to implement the plant expansion and the cascading impacts on the entire wet weather control strategy would result in additional cost burdens due to the inexorable impacts of construction inflation over time.

7.3.2 Consistency Determinations

PaDEP guidelines require the proposed facility upgrade plan be evaluated for consistency with existing sewerage and water-quality plans. Key existing plans are discussed below:

Pennsylvania Act 537 Comprehensive Sewage Facilities Plan

The expansion of the wet weather treatment capacity at the Woods Run Wastewater Treatment Plant is consistent with ALCOSAN's Act 537 Plan as approved by PaDEP on October 4, 1999. As approved, the 537 Plan proposed to increase the capacity of the Woods Run facility to 250 mgd initially (completed) and up to 275 mgd in Phase II, with wet weather capacity of 800 mgd. Subsequent technical analyses and regulatory considerations have reduced the ultimate wet weather capacity goal. This Special Study documents the reasons for revising the Phase II plant expansion to 600 mgd capacity as a key component of the Interim Wet Weather Plan.

ALCOSAN 2012 Wet Weather Plan (as may be Amended)

As noted above, the expansion of the wet weather treatment capacity is the backbone of ALCOSAN's amended Wet Weather Plan and is incorporated into ALCOSAN's amended consent decree. The phased and adaptive WWP may include a further expansion of wet weather capacities in a subsequent update to the WWP.

Anti-Degradation Policies

Implementing the expansion of wet weather treatment capacity as outlined in this study will enable ALCOSAN to continue complying with current and future NPDES' discharge limits. In addition, the wet-weather treatment strategy is in keeping with USEPA's Combined Sewer Overflow Control Policy (April 1994) which encourages permittees to maximize the use of available treatment facilities for wet weather flows thereby ensuring that combined sewer flows receive at least primary treatment prior to discharge.

8.0 INSTITUTIONAL EVALUATION

8.1 Financial and Debt Status

The purpose of this sub-section is to provide an overview of ALCOSAN's current and near term financial condition. The six-year analytical period of 2016 through 2021 is used with the test year of 2018. This analysis is based on the following documents and data sources: ALCOSAN's operating results through Fiscal Year (FY) 2016, the fiscal 2017 budget as approved by the ALCOSAN Board of Directors, the approved Capital Improvements Program, ALCOSAN investment practices, ALCOSAN metered water consumption and customer account data. ALCOSAN has developed projections of future ALCOSAN expenses and revenues taking into account the data and information described above, assumptions regarding economic conditions, Authority policies and spending practices.

8.1.1 ALCOSAN Financial Summary

ALCOSAN's operating costs, debt service and revenues for 2016 through 2021 are summarized on Table 8-1. Revenues for fiscal 2016 totaled approximately \$151 million and are projected to increase to \$163 million in 2017 and to \$174 million in 2018. These projections are based on the four-year rate increase strategy that was enacted by ALCOSAN's Board of Directors on October 24, 2013. Rates increased by 17% for 2014 and by 11% for 2015 through 2017.

Actual 2016 operating costs totaled \$71 million, reflecting operating efficiencies; the approved operating budget for 2016 was \$80 million. The 2017 approved operating budget is \$88 million. Debt service payments for 2016 were approximately \$53 million and will be \$52 million for 2017 and 2018. The calculated debt service coverage ratio for 2016 was 151% and is projected at 143% for 2017 and 157% for 2018.⁸⁻¹

Table 8-1:
Summary of Revenue and Expenses

Line Item	Actual	Projected				
	2016	2017	2018	2019	2020	2021
Total Revenue	\$150,992,500	\$162,542,100	\$173,843,500	\$185,004,600	\$197,120,800	\$209,523,600
Operating Expenses	(\$70,877,300)	(\$87,986,000)	(\$91,818,500)	(\$95,837,800)	(\$100,054,200)	(\$104,478,500)
Operating Income	\$80,115,200	\$74,556,100	\$82,025,100	\$89,166,800	\$97,066,600	\$105,045,100
Debt Service						
Existing ALCOSAN Debt	\$53,136,100	\$52,240,300	\$52,247,900	\$52,244,100	\$52,248,200	\$52,254,200
Projected Future Debt	\$0	\$0	\$0	\$4,700,800	\$12,535,500	\$12,535,500

⁸⁻¹ The operating ratio is determined by subtracting the operating costs from the revenue, and dividing the remainder by the annual debt service.

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ALCOSAN ACT 537 Plan Special Study
Section 8 – Institutional Evaluation

Line Item	Actual	Projected				
	2016	2017	2018	2019	2020	2021
Total Debt	\$53,136,100	\$52,240,300	\$52,247,900	\$56,944,900	\$64,783,700	\$64,789,700
Net Revenues	\$26,979,100	\$22,315,800	\$29,777,200	\$32,221,900	\$32,282,900	\$40,255,400
Debt Service Coverage Ratio						
Based on Existing Debt	151%	143%	157%	171%	186%	201%
Including Projected Debt	151%	143%	157%	157%	150%	162%
Projected Future Borrowings (For Planning Purposes Only)						
Principal Amount			\$65,971,300	\$109,952,200	\$0	\$119,425,500
Interest Rate			5.82%	5.82%	5.82%	5.82%
Bond Term			30	30	30	30

8.1.2 Historical and Projected Revenues

Revenue

ALCOSAN has four primary sources of revenues: commodity charges, service charges, industrial charges, and non-operating income. The four revenue sources as a percentage of the total amount of revenue in 2016 are shown on Figure 8-1.

The commodity charge is levied on every account based on the amount of billed thousand-gallon water units (T gallons) the residence, business, or public building consumes. The service charge is a fixed rate assessed quarterly on every active user account in the service area. Industrial charges consist of high strength sewage charges, which are based on the biochemical oxygen demand and total suspended solids, and garbage grinder fees, which are assessed to commercial grinders. Non-operating income consists of primarily of interest income and comprise a relatively insignificant amount to total revenues. Tapping fees, state or federal grants constitute incidental revenue which occur from time to time.

Actual and projected revenues from 2016 through 2021 are shown on Table 8-2. Total revenues are projected to increase from approximately \$151 million in 2016 to \$210 million in 2021, for an overall increase of around 39%.

The numbers reported represent revenues in the given calendar years. Revenue increases are the result of projected rate increases needed to meet coverage requirements in the face of projected operating and debt service costs increases. As the table illustrates, the primary revenue sources, the commodity charge and the service charge, are the drivers of revenue growth through 2021. High strength charges and garbage grinder fees are anticipated to remain relatively flat during the forecast period. Interest earnings, as the primary driver of non-operating revenues, remain weak.

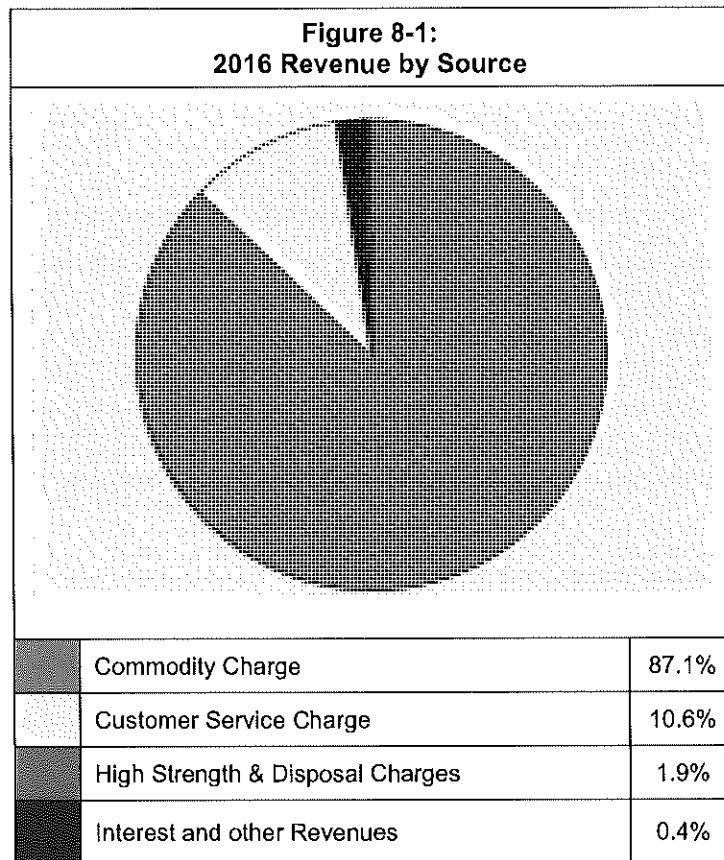


**Table 8-2:
ALCOSAN Actual and Projected Revenue**

Revenue Source	2016	2017	2018	2019	2020	2021
Commodity Charge	\$131,520,100	\$141,779,000	\$151,965,800	\$161,889,200	\$172,460,600	\$183,722,200
Service Charge	\$15,971,000	\$17,471,900	\$18,721,900	\$19,944,400	\$21,246,800	\$22,634,200
High Strength & Disposal Charges	\$2,829,400	\$2,789,000	\$2,751,400	\$2,751,400	\$2,751,400	\$2,751,400
Subtotal Basic & Special Charges	\$150,320,500	\$162,039,900	\$173,439,100	\$184,585,000	\$196,458,800	\$209,107,800
Subtotal	\$150,320,500	\$162,039,900	\$173,439,100	\$184,585,000	\$196,458,800	\$209,107,800
Interest Income	\$273,800	\$227,800	\$404,400	\$419,500	\$662,000	\$415,700
Other Revenue	\$398,200	\$274,400	\$0	\$0	\$0	\$0
Subtotal	\$672,000	\$502,200	\$404,400	\$419,500	\$662,000	\$415,700
Total Revenue	\$150,992,500	\$162,542,100	\$173,843,500	\$185,004,500	\$197,120,800	\$209,523,500

Rate Structure

The customer user charges include a single rate block commodity charge based on metered water consumption and a fixed customer service charge. As shown in Figure 8-1, revenue from customer user charges comprise 98 percent of annual revenues. For 2017 the commodity charge is \$6.91 per thousand gallons and the service charge is \$14.51 per quarterly bill. Users without water meters are billed on the assumption of 20,000 gallons of water use per quarter.

Under the terms of the service contracts between the municipalities and ALCOSAN, the municipalities are ultimately responsible for payment of the costs of services generated by the users within their corporate limits. This responsibility applies both to municipalities in which residents are directly billed and to the wholesale municipalities. Lists of customer accounts that are three months in arrears are provided to the municipalities. The municipalities then pay the arrears to ALCOSAN and obtain repayment through the property lien process. As a result of this arrangement, ALCOSAN does not experience uncollectable user charges.

8.1.3 Expenditures

Operating Expenses

Actual and projected operating expenses from 2016 through 2021 are shown on Table 8-3.

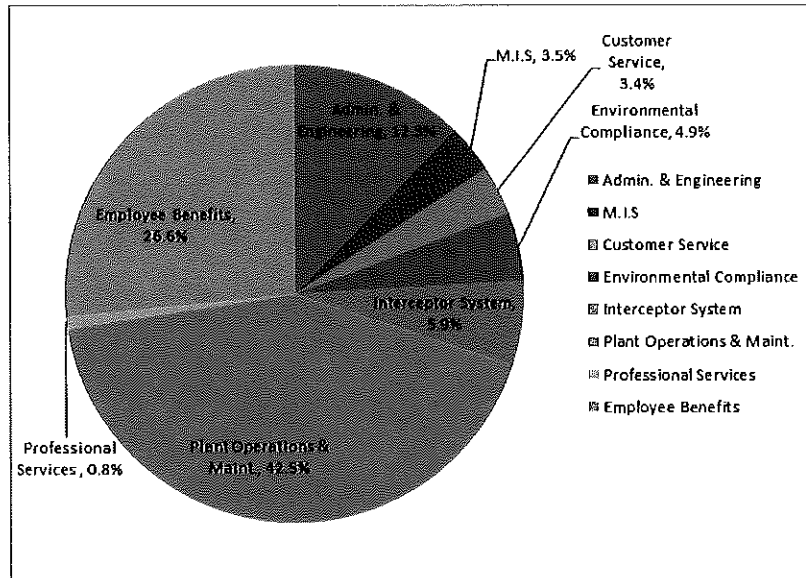
Table 8-3:
ALCOSAN Actual and Projected Operating Expenses

Program Category	2016	Projected				
		2017	2018	2019	2020	2021
Admin. & Engineering	\$8,727,600	\$14,161,100	\$14,656,700	\$15,169,700	\$15,700,700	\$16,250,200
M.I.S	\$2,479,900	\$2,797,600	\$2,895,500	\$2,996,900	\$3,101,700	\$3,210,300
Customer Service	\$2,424,600	\$3,404,800	\$3,524,000	\$3,647,300	\$3,775,000	\$3,907,100
Environmental Compliance	\$3,463,100	\$4,522,800	\$4,681,100	\$4,844,900	\$5,014,500	\$5,190,000
Interceptor System	\$4,205,300	\$9,100,700	\$9,419,200	\$9,748,900	\$10,090,100	\$10,443,300
Plant Operations & Maint.	\$30,143,700	\$31,559,800	\$32,664,400	\$33,807,600	\$34,990,900	\$36,215,600
Professional Services	\$590,800	\$926,000	\$958,400	\$992,000	\$1,026,700	\$1,062,600
Employee Benefits	\$18,842,300	\$21,513,200	\$23,019,100	\$24,630,500	\$26,354,600	\$28,199,400
Total	\$70,877,300	\$87,986,000	\$91,818,400	\$95,837,800	\$100,054,200	\$104,478,500

Benefit costs have been a key in driving operating costs upward in recent years, increasing by approximately 40% since 2011. Average benefit cost increases for the period of 2010 through 2016 rose by seven percent on average. Further, the increased staffing levels needed to meet requirements of the consent decree have driven aggregate wages higher. While these factors are leading to significant near term increases in operating costs, future increases are expected to track closer to the rate of inflation. Benefits have been projected to grow 14% in 2017 and at a

rate of around 7% annually through 2021. Budgeted operating expenses excluding benefits are projected to increase by roughly 10% in 2017. Among other factors, this increase reflects an increase preventive maintenance work in the regional interceptors that is scheduled to continue in 2017. The general cost inflation rate, based on historical ALCOSAN data and other assumptions, is calculated to be 3.5% for 2017 through 2021. Operating cost categories as a percentage of total expenditures are shown in Figure 8-2.

**Figure 8-2:
2016 Operating Expenses by Cost Center**



Debt Service

The anticipated debt service payment schedule through 2021, including existing debt service payments are shown on Table 8-4. All current debt is scheduled to be retired as of December 1, 2045. The timing and size of future bond issuances remain to be determined; therefore additional annual payments resulting from future bonds are not included in Table 8-4.

**Table 8-4:
Projected Annual Debt Service -
Existing Debt**

Fiscal Year	Annual Debt Service
2016	\$53,136,100
2017	\$52,240,300
2018	\$52,247,900
2019	\$52,244,100
2020	\$52,248,200
2021	\$52,254,200

Projected Total Annual Costs

Combined operating and debt service costs for the period of 2016 – 2021 are shown on Table 8-5. Total annual costs are projected to increase from \$124 million in 2016 to approximately \$169 million in 2021, including debt service for a potential \$66 million bond issuance in 2018, \$118 million issuance in 2019 ~ 2020 and \$119 in 2021. It must be noted that these projected borrowings are based on the projected draws on ALCOSAN's Construction Fund; the actual structuring and timing of future ALCOSAN bonds are to be determined.

**Table 8-5:
Projected Total Annual Costs**

Line Item	2016	Projected				
		2017	2018	2019	2020	2021
Operating Expenses	\$70,877,300	\$87,986,000	\$91,818,500	\$95,837,800	\$100,054,200	\$104,478,500
Debt Service	\$53,136,100	\$52,240,300	\$52,247,900	\$56,944,900	\$64,783,700	\$64,789,700
Total Expenses	\$124,013,400	\$140,226,300	\$144,066,400	\$152,782,700	\$164,837,900	\$169,268,200

8.1.4 Annual Revenue Requirements

Coverage Requirements

The Standard Municipal Agreements and the Standard Industrial Agreements authorize ALCOSAN to set the sewage service charges to finance administrative costs, operating expenses, debt service, and additional coverages pursuant to the 1985 and 1997 Trust Indentures. Administrative costs and operating expenses are subtracted from revenues to calculate operating income, which is used to pay the Authority's debt service and meet other obligations of the Indentures.

The indentures specify two debt coverage tests that the authority must meet annually as well as an additional bonds test that must be met to sell additional bonds. The two tests the Authority must meet annually are:⁸⁻²

1. **Test 1** - The beginning balance of the Revenue Fund in any given year must be at least 25% of the projected operating expenses for that fiscal year. The sum of beginning Fund balances in excess of 25% of the projected operating expenses and the operating income must equal at least 110% of the given year's annual debt service.
2. **Test 2** - The authority must have operating income equal to at least 100% of the total debt service due in the year.

Historically ALCOSAN has reliably met the terms of its indenture, raising rates as necessary to meet the coverage obligations.

⁸⁻² Source: Article VII: Rate Covenant and Particular Covenants in ALCOSAN's Sewer Revenue Bonds, Series 1997, First Indenture July 1, 1997.

Second Amended Appendix A-22-b
ALCOSAN ACT 537 Plan Special Study
Section 8 – Institutional Evaluation

Projected Coverage Performance

Test 1: [(Operating Income + Revenue Fund Beginning Balance Excess) / Debt Service ≥ 110%]

The projected values for Test 1 are shown on Table 8-6 the period of 2016 through 2021. Due to the strength of its Revenue Fund balance, ALCOSAN is projected to comply readily with this coverage requirement. The projected Test 1 coverage for the 2018 test year is 262%.

**Table 8-6:
Coverage Test 1**

Line Item	2016	2017	2018	2019	2020	2021
Operating Income	\$80,115,200	\$74,556,100	\$82,025,100	\$89,166,800	\$97,066,600	\$105,045,100
Revenue Fund Beginning Balance Excess	\$55,182,300	\$69,688,300	\$55,091,800	\$55,086,100	\$57,398,300	\$58,477,700
Operating Income plus Rev Fund Excess	\$135,297,500	\$144,244,400	\$137,116,900	\$144,252,900	\$154,464,900	\$163,522,800
Debt Service	\$53,136,100	\$52,240,300	\$52,247,900	\$56,944,900	\$64,783,700	\$64,789,700
Coverage Test	255%	276%	262%	253%	238%	252%

Test 2: [Operating Income / Debt Service ≥ 100%]

The projected values for Test 2 are shown on Table 8-7 for the period of 2016 through 2021. The coverage ratio is projected to comply with the coverage requirement for each year of the period of analysis. The coverage ratio for 2017 is projected to be 143%, readily complying with the coverage requirement of 100%. The 2018 test year coverage ratio is projected to be 157%. The Operating Ratio is projected to increase to 162% for 2021 based on the modeled issuance of new debt to meet the capital needs of the Wet Weather Plan and other capital improvements.⁸⁻³

**Table 8-7:
Coverage Test 2**

Line Item	2016	2017	2018	2019	2020	2021
Operating Income	\$80,115,200	\$74,556,100	\$82,025,100	\$89,166,800	\$97,066,600	\$105,045,100
Debt Service*	\$53,136,100	\$52,240,300	\$52,247,900	\$56,944,900	\$64,783,700	\$64,789,700
Coverage Ratio	151%	143%	157%	157%	150%	162%

⁸⁻³ For wet weather planning and affordability analysis purposes, ALCOSAN's financial planning model assumes future bond issuances as necessary to meet annual capital requirements at a 5.82% interest rate and 30 year terms. The actual timing and structure of future debt will be determined as conditions warrant.

8.1.5 Rate Impact

The coverage ratios shown in the previous section were based on projected operating revenues resultant from user rates calculated to generate operating revenues sufficient to exceed the Trust Indenture requirements. The history of recent rate increases and the enacted future rate increases that were used in the above coverage calculations are shown on Table 8-8. The rates shown in Table 8-8 reflect the four-year rate increase strategies that were enacted by the ALCOSAN Board of Directors on October 24, 2013 and November 16, 2017.

Table 8-8:
ALCOSAN Rate History and Enacted Future Rate Increases
(2011–2021)

Year	Commodity Charge		Quarterly Service Charge	
	Rate	Increase		
2011	\$4.04	0.0%	\$8.48	0.0%
2012	\$4.32	7.0%	\$9.07	7.0%
2013	\$4.32	0.0%	\$9.07	-0.1%
2014	\$5.05	16.9%	\$10.61	17.0%
2015	\$5.61	11.0%	\$11.78	11.0%
2016	\$6.22	11.0%	\$13.08	11.0%
2017	\$6.91	11.0%	\$14.51	10.9%
2018	\$7.42	7.5%	\$15.60	7.5%
2019	\$7.94	7.0%	\$16.69	7.0%
2020	\$8.50	7.0%	\$17.86	7.0%
2021	\$9.10	7.0%	\$19.11	7.0%

8.2 Available Staff and Administrative Resources

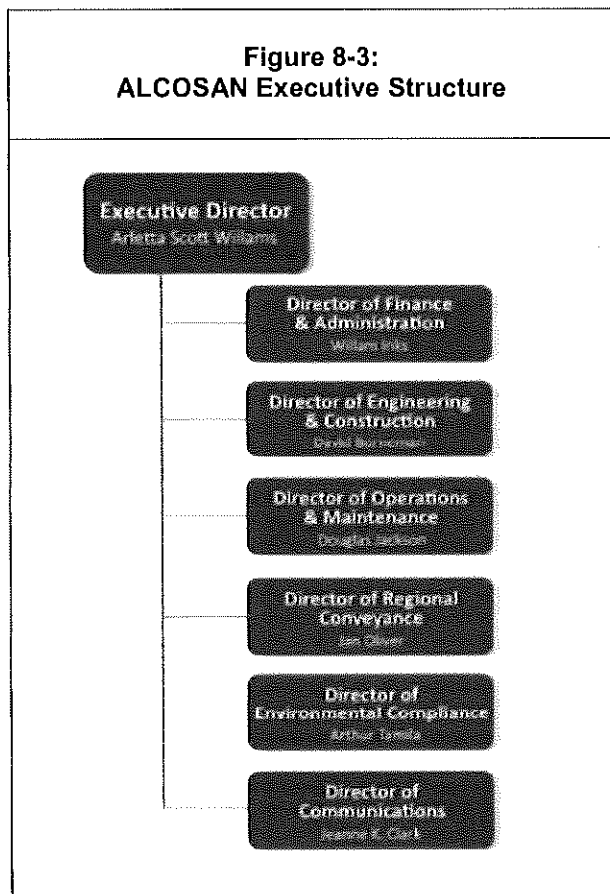
8.2.1 ALCOSAN Executive Staff

ALCOSAN's administrative staff is headed by the Executive Director, who carries out the Board's policies. The Executive Director's senior staff includes the Director of Operations and Maintenance, the Director of Engineering and Construction, the Director of Environmental Compliance, Director of Finance and Administration, and the Director of Regional Conveyance. The current Director of Environmental Compliance is also the Deputy Executive Director. The current organizational structure is shown on Figure 8-3.

Brief descriptions of the backgrounds and qualifications of key executive management are as follows:

Arletta S. Williams – Executive Director

Arletta Scott Williams was appointed to the position of Executive Director on July 23, 1998. Having served previously for three years as Deputy Executive Director, and Director of Operations and Maintenance, Ms. Williams oversaw daily operations of the 200 million gallons per day (mgd) plant and regional interceptor system. Upon joining ALCOSAN in 1984, Ms. Williams served in a variety of positions including Shift Engineer and Solids Process Superintendent. Ms. Williams has a B.S. Degree in Metallurgical Engineering and Materials Science from Carnegie Mellon University.



Arthur M. Tamilia – Deputy Director and Director of Environmental Compliance

Arthur M. Tamilia was appointed to his current position in 1991, after serving as Manager of the Industrial Wastes Department for six years. Prior to that, he served as a chemist in the ALCOSAN Laboratory for six years. Mr. Tamilia earned a B.S. Degree in Chemistry from the University of Pittsburgh in 1979 and a J.D. from the Duquesne University School of Law in 1985. He holds a license to practice law in the Commonwealth of Pennsylvania and in the Federal Court system.

David W. Borneman - Director of Engineering and Construction

David W. Borneman was promoted to the position of Director of Engineering and Construction on December 19, 1996. Mr. Borneman joined the Authority in 1996 as Manager of Construction after serving as Assistant Director for the Pittsburgh Water and Sewer Authority. He received his B.S. in Civil Engineering from Villanova University in 1979. From 1979 to 1984, Mr. Borneman served with

the Pennsylvania Department of Environmental Resources overseeing municipal wastewater programs. Mr. Borneman is a Registered Professional Engineer in Pennsylvania.

William H. Inks - Director of Finance and Administration

William H. Inks, C.P.A., was promoted to the position of Director of Finance and Administration on December 19, 1996. He began his career at the Authority in 1989 in his previous position as Manager of Accounting. Before joining the Authority, Mr. Inks was a Senior Auditor with Touche Ross and Company and served on the audit team for the Authority. Mr. Inks received a B.S. degree in Business Administration from Duquesne University in 1983.

Douglas A. Jackson - Director of Operations and Maintenance

Douglas A. Jackson, P.E., was promoted to the position of Director of Operations and Maintenance on June 2, 2008. Mr. Jackson joined the Authority in 1990 as an Electrical Engineer. He then transitioned to Systems Engineer until his 1997 promotion to Manager of Electrical and Controls Systems Engineering, overseeing all plant electrical and process control improvements. Mr. Jackson earned his B.S. in Electrical Engineering in 1990 and his Master of Science Degree in Electrical Engineering in 1994 from the University of Pittsburgh.

Jan M. Oliver - Director of Regional Conveyance

Jan M. Oliver was promoted to the position of Director of Regional Conveyance on January 2003. She began her career at the Authority in 1990 and since has been responsible for the Authority's Wet Weather Program. Ms. Oliver graduated from Point Park College with a B.S. in Civil Engineering Technology in 1990.

Jeanne E. Clark - Director of Communications

The Director of Communications is the ALCOSAN interface for all external activities associated with the public, elected government officials, news media, social media, right-to-know inquiries and special interest groups. Ms. Clark was the former director of communications for PennFuture and joined ALCOSAN in 2014. She holds a degree in Communications from Boston University.

8.2.2 ALCOSAN Workforce

ALCOSAN employs approximately 394 personnel.⁸⁻⁴ This includes management personnel such as foremen; assistant foremen, professional, supervisory, and confidential employees, as well as approximately 272 employees represented by the Utility Workers Union of America, AFL-CIO, Local 433 (the "Utility Union"). In addition, twelve security guards are represented by the General Teamsters, Chauffeurs and Helpers, Local 249 (the "Teamsters Union") which has been recognized as the sole bargaining representative for the Authority's guards.

Treatment Plant

ALCOSAN's Operations Department includes 4 crews of 14 persons each plus Shift Superintendents and Shift Supervisors. The crews work rotating shifts of six days on and two days off to operate the plant 24 hours per day, 365 days per year. ALCOSAN provides its Operations personnel with the resources necessary to operate the Sewage Treatment Plant. These resources include continuing education and training. Overall, the majority of the maintenance done at the plant would be described as preventive and corrective.

Regional Conveyance Interceptor Sewer System

ALCOSAN has a well-established and effective maintenance program that provides inspections, evaluations, cleaning, rehabilitation, and repairs to the various components of the collection system through ongoing and preventive maintenance.

The Manager of Interceptor Systems oversees inspection, operation, and maintenance activities performed on the ALCOSAN conveyance system and coordinates these O&M activities through

⁸⁻⁴ Source: Appendix B to Consulting Engineer's 2016 Annual Report December 2016 prepared by Chester Engineers.

four Interceptor System Supervisors, who manage the field staff. The Interceptor Systems Department management team is supported by an organized labor force of 38 positions. The department is organized into seven operating units which include four truck crews, a pumping station crew, a boat crew, and a video inspection crew. These operating units are augmented by three land spotters, the five-member combination Jet-Vac truck and water truck crew, and a Regional Conveyance Clerk.

8.3 Existing Legal Authority

ALCOSAN is a body corporate and politic created in March 1946, under Pennsylvania Municipality Authorities Act (Act). The Authority is authorized to collect, transport, treat and dispose of sewage in Allegheny County, and certain adjacent areas. Key powers⁸⁻⁵ under the Act include:

- To have existence for a term of 50 years and for such further period or periods as may be provided in articles of amendment;
- To sue and be sued;
- To acquire, purchase, hold, lease as lessee and use any franchise, property;
- To finance projects by loan, mortgages, security agreements or any other instruments;
- To make bylaws for the management and regulation of its affairs;
- To fix, alter, charge and collect rates and other charges in the area served by its facilities at reasonable and uniform rates;
- To borrow money, make and issue negotiable notes, bonds, refunding bonds and other evidences of indebtedness or obligations;
- To make contracts and to execute all instruments necessary or convenient for the carrying on of its business;
- To pledge revenues of the authority as security for obligations of the authority;
- To have the power of eminent domain;
- To do all acts and things necessary or convenient for the promotion of its business and the general welfare of the authority to carry out the powers granted to it; and
- To contract with any municipality, corporation or a public authority.

Under the Act, ALCOSAN may not pledge the credit or taxing power of the Commonwealth or its political subdivisions; moreover ALCOSAN's financial obligations are not obligations of the Commonwealth or its political subdivisions

⁸⁻⁵ Condensed from 53 Pa.C.S.A. 5607(d).

8.3.1 Statutory Framework

ALCOSAN's legal responsibilities and operating environment are governed by a number of federal and state statutes. Principal among these are:

- Federal Clean Water Act (as amended by the Water Quality Act of 1987)
- Pennsylvania Clean Streams Law
- Pennsylvania Sewage Facilities Act (Act 537)
- Pennsylvania Municipality Authorities Act
- Pennsylvania Municipal Code

Federal Clean Water Act

The Clean Water Act (CWA) established a National goal of making all US water bodies safe for fishing and swimming. The CWA requires the implementation of technology-based and water quality-based controls to meet this goal. These requirements include secondary treatment of sewage from sanitary sewered areas and the protection of receiving stream water quality from combined sewer overflows (CSOs) pursuant to the Water Quality Act of 1987. USEPA's CSO Control Policy⁸⁻⁶ attempts to balance the financial capabilities of municipalities with combined sewers with the need to control overflows consistent with the water quality requirements of the Clean Water Act. As a "major" permittee (daily wastewater flows exceeding one million gallons), the Policy requires that ALCOSAN's schedule for compliance with the Policy be placed in a judicial order such as a Federal consent decree. ALCOSAN entered into a federal CD with the USEPA, the PaDEP and the ACHD⁸⁻⁷ in the U.S. District Court for the Western District of Pennsylvania on January 23, 2008.

The CWA also prohibits unpermitted discharges such as SSOs. These are typically ad-hoc discharges through manholes, etc. due to hydraulic constraints in municipal sewerage. Nationally in many larger regional systems such as ALCOSAN, overflows occur from purpose-built hydraulic regulator structures at the points of connection of the regional interceptor system and municipal sanitary sewers. These devices were installed to provide hydraulic relief during wet weather and to reduce potential back-ups and flooding. Overflows from these structures must now be eliminated pursuant to the CWA.

The CD required the development of a WWP for the elimination of SSOs, the control of CSOs and to provide conveyance and treatment capacity for municipal flows generated within the ALCOSAN service area and conveyed to the ALCOSAN interceptor system. ALCOSAN complied with the deadline for the submittal of WWP to the United States Environmental Protection Agency, the Pennsylvania Department of Environmental Protection, and the Allegheny County Health by January 30, 2013.

⁸⁻⁶ 59 Fed. Reg. 18688, April 19, 1994

⁸⁻⁷ Civil Action 7-0737.

Pennsylvania Clean Streams Law

The Clean Streams Law predates the Clean Water Act by 35 years, and was the mechanism leading to the creation of ALCOSAN. Thus, ALCOSAN was, and continues to be, the means through which the member municipalities comply with the Clean Streams Law. Absent ALCOSAN, the responsibilities would revert directly to the municipalities. Requirements of the Clean Streams Law closely parallel those under the federal Clean Water Act. ALCOSAN's NPDES operating permit was issued under both laws.

Sewage Facilities Act

Act 537 requires all municipalities to develop and maintain updated sewage facilities plans to protect public health from water-borne diseases, prevent future sewage disposal problems, and protect water quality. The Act also specifies state policy of efficient resource utilization through the consolidation of wastewater facilities, if warranted. Most ALCOSAN member municipalities adopted a county-wide (circa 1970) 537 plan as the basis for their plans.⁸⁻⁸ Revisions to the municipal plans since 1970 have focused on local collection sewer issues. In 1996 at the PaDEP request, ALCOSAN prepared a 537 Plan addressing the upgrading and expansion of its treatment plant. This plan was subsequently adopted by the ALCOSAN municipalities as an update to the 1970 document. ALCOSAN's 1996 Act 537 Plan was approved by PaDEP in 1999. Upon PaDEP review and approval, this Special Study will constitute an amendment to the Plan.

Pennsylvania Municipal Code

Responsibility for providing the necessary infrastructure was given to local government units, although the regulatory functions rested with the Commonwealth. Therefore, Chapter 12 of the Pennsylvania Municipal Code (Act 39) addresses the rights and responsibilities of local governments for providing sewage treatment capabilities.

Municipalities were given the right to enter onto all public and private lands in order to excavate and lay sewers and drains, making just compensation to the owner. Further, they were empowered to set and collect rates, rentals, or charges for the use of sewers, sewer systems, or sewage treatment works by the owners of these lands. Municipalities also were given the ability to relinquish their responsibility for providing sewage treatment to municipal authorities.

User charges can be calculated in a variety of ways. Three specific methods are described in the code, although they are not meant to preclude any other manner for setting rates. The methods for setting revenues are:

- Revenues can be set to equal operating expenses.
- Revenues can be set to equal operating expenditures plus debt service.
- Revenues can be set to equal operating expenses, debt service, and a ten percent margin of safety.

⁸⁻⁸ The *Comprehensive Sewerage Needs Plan 1970 - 2000* prepared by Green Engineering Company

The Pennsylvania Municipal Code states that "it shall be lawful for any county, city, borough, incorporated town, or township to execute such agreements and contracts ... with an authority" to provide "sewer, sewerage, or sewage treatment service to it or to its inhabitants." Any rights granted to an authority through the municipal code are in addition to the powers and privileges granted to authorities by the Municipality Authorities Act. The municipal code was construed to expand, rather than limit, the powers set forth in the Municipality Authorities Act.

Pennsylvania passed its Municipality Authorities Act in 1945 with the primary purpose of expanding municipal borrowing powers. Authorities are a means of bringing officials who are unburdened with other governmental responsibilities to the administration of projects. Also, authorities are a way to take advantage of economies of scale by providing services to a large area. ALCOSAN is empowered to finance, build and operate facilities required for compliance with other statutes through the Pennsylvania Municipality Authorities Act.

8.3.2 Municipal Service Contracts

ALCOSAN provides wastewater conveyance and treatment to all or portions of eighty-three municipalities within its service area. The municipalities or municipal authorities own and operate their respective collection sewer systems, totaling approximately 4,500 miles of sewers. The municipal systems are diverse, and include 60 sanitary sewered systems, of which 15 are reported to have sanitary sewer overflows. Thirteen of the municipalities have combined sewer systems, of which five are reported to have combined sewer overflows within their respective municipal collection sewerage. The remaining municipal collections systems are classified as "mixed" systems, such as the City of Pittsburgh, of which portions have sanitary sewers and portions have combined systems. There are a ten mixed municipal systems, of which seven are reported to have sanitary or combined sewer overflows or both. The geographic coverage ranges of the systems range from less than one square mile to approximately 55 square miles.

ALCOSAN, the City of Pittsburgh, and certain other municipalities in and around Allegheny County have entered into Standard Municipal Agreements (agreements) under which ALCOSAN is designated the exclusive agent of the respective municipalities to furnish sewage treatment and disposal service, and which provide uniform sewage charges throughout the service area. The Standard Municipal Agreements require the participating municipalities to convey sewage at their own expense, to specified points of connection to ALCOSAN's interceptor sewers. Such agreements cannot be terminated before the expiration of one year after the payment of all Authority indebtedness.

The Standard Municipal Agreement was developed in the 1950s at the time of the construction of the initial interceptor system and treatment plant. ALCOSAN has also entered into an "Upper Allegheny Agreement" with certain communities for which additional expenditures for connecting facilities were required. These include the Boroughs of Verona and Blawnox and the Township of O'Hara and the Municipality of Penn Hills. In addition to the provisions in the Standard Municipal Agreement, the Upper Allegheny Agreement authorizes ALCOSAN to impose an additional service charge to recover additional construction and operating costs related to providing services. Service agreements entered into since 1983 also impose limitations on the type and volume of flows from municipalities, exclude storm water, and impose surcharges for excessive inflow and infiltration.

Each municipality was given the option of either paying the aggregate of all user bills within its jurisdiction or authorizing ALCOSAN to bill the municipality's users directly. If charges are not paid within sixty days, the municipality is required to pay ALCOSAN the delinquent balance sixty days after notification of delinquency by ALCOSAN. The annual municipal budgets are required to include funds that are sufficient to meet its obligation to ALCOSAN. If the entire amount due to ALCOSAN is not paid out of current revenues, the balance must be paid out of the current revenues of the municipality for succeeding years.

In addition to the Standard Municipal Agreement, industrial agreements ("Standard Industrial Agreements") have been executed by the City of Pittsburgh and ALCOSAN with some corporations whose acceptable industrial wastes enter the system's intercepting sewers directly instead of through a municipal sewer.

The sewage service charges authorized to be made by ALCOSAN under the Standard Municipal Agreements and the Standard Industrial Agreements are calculated to yield the amount required to pay the administrative and operating expenses of the Authority, and the amounts required to be paid under the Indenture.

8.4 Financing Plan

This section describes ALCOSAN's strategy for financing future capital improvements including the expansion of the wet weather treatment capacity at ALCOSAN's Woods Run Wastewater Treatment Plant.

8.4.1 Five Year Capital Requirement Projection

The expansion of the wet weather treatment capacity and the other projects on ALCOSAN's Capital Improvements Program are estimated to result in \$251.2 million in new capital expenditures for ALCOSAN through 2020. The projected annual capital requirements are shown on Table 8-9.

Table 8-9:
ALCOSAN Total Projected Capital Expenditures through 2020

Item	Projected Capital Expenditures
Current Estimated Costs	\$279,233,600
Expended through 2016	(\$28,034,400)
Remaining to Expend	\$251,199,200
Projected Annual Expenditures	
2017	(\$75,046,300)
2018	(\$58,764,200)
2019	(\$43,720,000)
2020	(\$22,928,200)
Beyond 2020	(\$50,740,500)
Total	(\$251,199,200)

8.4.2 Capital Funding

Alternative Capital Funding Options: ALCOSAN evaluated alternatives to the municipal revenue bond market as capital sources as suggested in EPA’s LTCP guidance document⁸⁻⁹ and other EPA guidance.⁸⁻¹⁰ As noted in the 1995 *Guidance for Funding Options*:

“Grants will likely play only a limited role in future CSO funding. The reliance on direct federal wastewater construction grants has been replaced with a reliance on SRF loans and other local funding options.”

The Federal funding situation since 1995 has not improved. Moving forward, ALCOSAN has and will continue to work with the region’s state Legislative and Congressional delegations towards workable funding for wet weather controls. Funding that has been obtained to date as USEPA Special Appropriations Projects and from Sections 219 and 206 of the Water Resources Development Act through the Corps of Engineers has been used by ALCOSAN to support projects such as direct stream inflow removals.⁸⁻¹¹

Some options listed in the Guidance are more applicable to the municipalities than to ALCOSAN due to eligibility or funding restrictions. For example, PennVest has a \$20 million limit on total financing by any recipient. The Rural Utilities Services (RUS) provides low interest loans, and limited grants for municipal water and sewer infrastructure. This program would be more applicable to the ALCOSAN municipalities with populations of less than 10,000.

ALCOSAN has worked with the local RUS office towards availing the municipalities of this program.

ALCOSAN’s Capital Financing Strategy: ALCOSAN anticipates using combinations of pay-as-you-go funding utilizing accumulated reserve funds and revenue bond financing owing to ALCOSAN’s strength in the municipal bond market. As of July 2016, ALCOSAN has a rating of ‘A’ long-term (with a stable outlook) from Standard & Poor’s Rating Services and A1 from Moody’s Investors Services.

As a special purpose governmental enterprise established pursuant to the Pennsylvania Municipality Authorities Act, ALCOSAN has no legal authority to establish or levy property tax assessments. Therefore, ALCOSAN cannot issue general obligation bonds. ALCOSAN’s upper-medium grade bond ratings are supported by the current contractual relationship between ALCOSAN and the municipalities wherein ALCOSAN’s revenues flow from the municipalities rather than through retail billings. As a result, ALCOSAN’s revenue bonds are arguably analogous to “double barreled” bonds as described in the EPA guidance documents.

8.4.3 Alternative Revenue Streams

EPA’s 1997 financial capability guidance references four funding mechanisms and sources of funding “if loans and grants are not available or if a need exists to reduce the financial impact of

⁸⁻⁹ Section 4.3.3, *Combined Sewer Overflows - Guidance For Long-Term Control Plan*, EPA 832-0-95-002, September 1995.

⁸⁻¹⁰ *Combined Sewer Overflows Guidance for Funding Options* EPA 832-B-95-007, August 1995

⁸⁻¹¹ See Section 10.2 of the Wet Weather Plan document for additional details on some of these projects.

CSO controls on the users.”⁸⁻¹² The applicability of these revenue sources to ALCOSAN may be summarized as follows.

- *Establish special assessment district* – Unlike municipalities, ALCOSAN as a municipal authority has no legal authority to establish or levy property tax assessments;
- *Increase user fees* – The implementation of ALCOSAN’s WWP is premised on a series of substantial rate increases;
- *Impose/ increase taxes (such as income taxes, sales taxes or property taxes)* – as noted above, ALCOSAN has no statutory authority to impose taxes; and
- *Privatize wastewater treatment* – To date, the option of the privatization of ALCOSAN facilities has not appeared to be viable or advantageous.

Moving forward into the WWP implementation phase, ALCOSAN will evaluate evolving financial instruments as appropriate.

8.4.4 Interim Measures Wet Weather Plan Affordability Analysis

ALCOSAN has documented previously that future capital expenditure by ALCOSAN and the customer municipalities totaling \$2.0 billion or more (current dollars) would result in a service area annual cost per typical household that would equal or exceed two percent of the median household income of the ALCOSAN service area. The annual total wastewater and stormwater costs where applicable as a percent of household income is termed the Residential Indicator (RI) by USEPA. Under USEPA guidelines such as the 1997 Combined Sewer Overflow – Guidance for Financial Capability Assessment and Schedule Development (EPA 832-B-97-004), annual household wastewater costs of 2.0% or greater constitute a high burden.

ALCOSAN’s initial documentation of the \$2.0 billion trigger for the 2.0% RI was provided to USEPA, PaDEP and ACHD in a letter dated November 10, 2010. A copy of this correspondence is provided as Appendix D to this report. ALCOSAN subsequently reaffirmed that the approximately \$2.0 billion Recommended Plan detailed in its 2013 Wet Weather Plan resulting in a regional RI of 2.0%.

ALCOSAN will complete an updated affordability assessment based on the costs and schedule of the elements within the Interim Measures Wet Weather Plan once these are determined through the consent decree negotiation process.

⁸⁻¹² Combined Sewer Overflows – Guidance for Financial Capability Assessment and Schedule Development, EPA 832-B-97-004, Page 48

9.0 IMPLEMENTATION SCHEDULE

The anticipated schedule for the expansion of the wet weather capacity at ALCOSAN's Woods Run Wastewater Treatment is shown in Figure 9-1. The dates shown should be considered to be preliminary and are subject to refinement as ALCOSAN undertakes detailed facilities planning and preliminary design for the plant expansion project.

The IWWP includes several adaptive management provisions. One or more of these provisions involves obtaining municipal source reduction information from customer municipalities and assessing whether municipal flow reduction commitments in those studies would merit the downsizing or modification of future projects, which include the Wet Weather Pump Station. This provision and several others will be finalized when the ongoing negotiations culminate in a modification to ALCOSAN's CD.

Project Schedule for ALCOSAN's Interim Measures Wet Weather Plan

8/4/2017 Revision

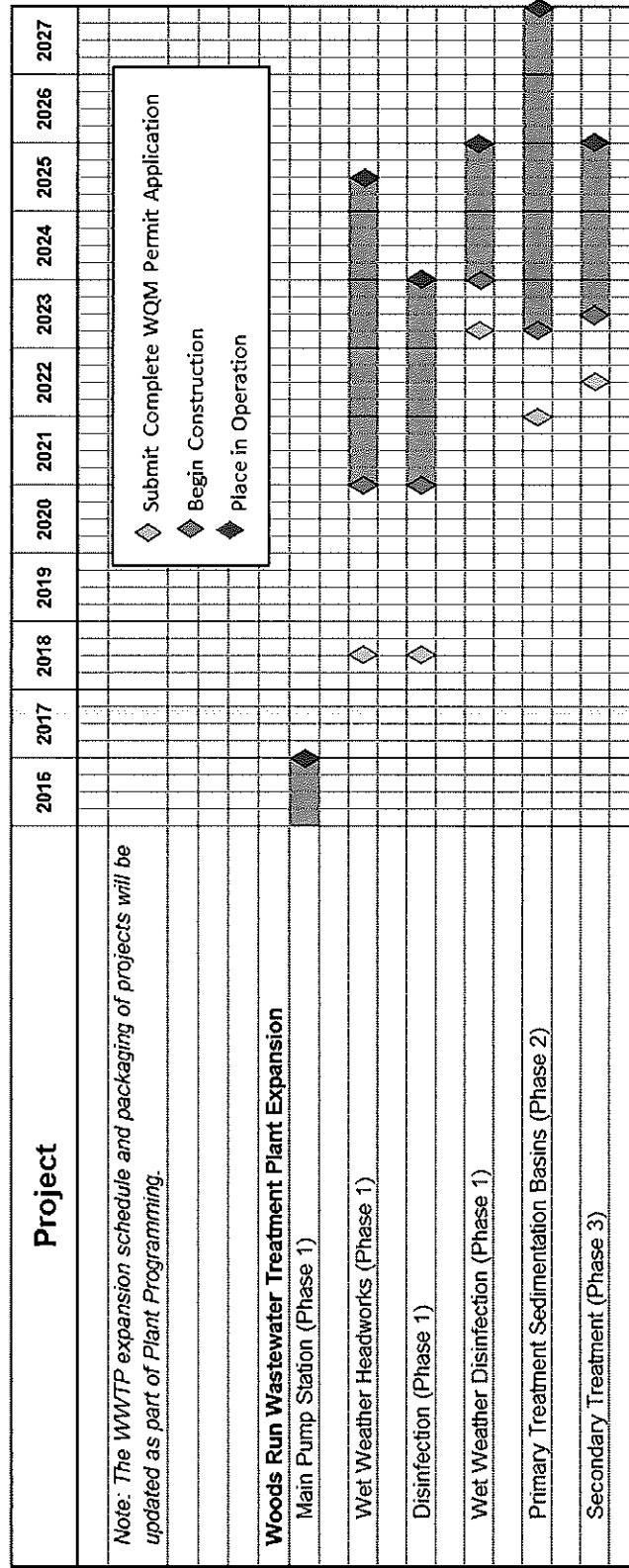


Figure 9-1:
Woods Run WWTP Wet Weather Capacity Expansion Proposed Implementation Schedule

APPENDIX A

ACT 537 Plan Content and Environmental Assessment Checklist

Note: The checklist contained in this appendix has been modified to grey out the requirements that are not applicable for this amendment, and the locations at which the specific checklist requirements are addressed are cross-referenced.

PART 2 ADMINISTRATIVE COMPLETENESS CHECKLIST

DEP Use Only	Indicate Page #(s) in Plan	In addition to the main body of the plan, the plan must include items one through eight listed below to be accepted for formal review by the department. Incomplete Plans will be returned unless the municipality is clearly requesting an advisory review.
_____	_____	1. Table of Contents
_____	_____	2. Plan Summary
_____	<u>1-2</u>	A. Identify the proposed service areas and major problems evaluated in the plan. (Reference - Title 25, §71.21.a.7.i).
_____	<u>1-3</u>	B. Identify the alternative(s) chosen to solve the problems and serve the areas of need identified in the plan. Also, include any institutional arrangements necessary to implement the chosen alternative(s). (Reference Title 25 §71.21.a.7.ii).
_____	_____	C. Present the estimated cost of implementing the proposed alternative (including the user fees) and the proposed funding method to be used. (Reference Title 25, §71.21.a.7.ii).
_____	_____	D. Identify the municipal commitments necessary to implement the Plan. (Reference Title 25, §71.21.a.7.iii).
_____	_____	E. Provide a schedule of implementation for the project that identifies the MAJOR milestones with dates necessary to accomplish the project to the point of operational status. (Reference Title 25, §71.21.a.7.iv).
_____	<u>1-4</u>	3. Municipal Adoption: Original, signed and sealed Resolution of Adoption by the municipality which contains, at a minimum, alternatives chosen and a commitment to implement the Plan in accordance with the implementation schedule. (Reference Title 25, §71.31.f) Section V.F. of the Planning Guide.
_____	_____	4. Planning Commission / County Health Department Comments: Evidence that the municipality has requested, reviewed and considered comments by appropriate official planning agencies of the municipality, planning agencies of the county, planning agencies with area wide jurisdiction (where applicable), and any existing county or joint county departments of health. (Reference Title 25, §71.31.b) Section V.E.1 of the Planning Guide.
_____	_____	5. Publication: Proof of Public Notice which documents the proposed plan adoption, plan summary, and the establishment and conduct of a 30 day comment period. (Reference Title 25, §71.31.c) Section V.E.2 of the Planning Guide.
_____	_____	6. Comments and Responses: Copies of ALL written comments received and municipal response to EACH comment in relation to the proposed plan. (Reference Title 25, §71.31.c) Section V.E.2 of the Planning Guide.
_____	<u>1-4, 9-1</u>	7. Implementation Schedule: A complete project implementation schedule with milestone dates specific for each existing and future area of need. Other activities in the project implementation schedule should be indicated as occurring a finite number of days from a major milestone. (Reference Title 25, §71.31.d) Section V.F. of the Planning Guide. Include dates for the future initiation of feasibility evaluations in the project's implementation schedule for areas proposing completion of sewage facilities for planning periods in excess of five years. (Reference Title 25, §71.21.c). [Section 9]
_____	<u>7-33</u>	8. Consistency Documentation: Documentation indicating that the appropriate agencies have received, reviewed and concurred with the method proposed to resolve identified inconsistencies within the proposed alternative and consistency requirements in 71.21.(a)(5)(i-iii). (Reference Title 25, §71.31.e). Appendix B of the Planning Guide. [Section 7.3.2]

PART 3 GENERAL PLAN CONTENT CHECKLIST

DEP Use Only	Indicate Page #(s) in Plan	Item Required
_____	<u>2-1</u>	I. Previous Wastewater Planning [Section 2.0 in general, 2.1 for previous 537] A. Identify, describe and briefly analyze all past wastewater planning for its impact on the current planning effort:
_____	<u>2-1</u>	1. Previously undertaken under the Sewage Facilities Act (Act 537). (Reference-Act 537, Section 5 §d.1).
_____	<u>NA</u>	2. Has not been carried out according to an approved implementation schedule contained in the plans. (Reference-Title 25, §71.21.a.5.i.A-D). Section V.F of the Planning Guide.
_____	<u>NA</u>	3. Is anticipated or planned by applicable sewer authorities or approved under a Chapter 94 Corrective Action Plan. (Reference-Title 25, §71.21.a.5.i.A&B). Section V.D. of the Planning Guide.
_____	<u>NA</u>	4. Through planning modules for new land development, planning "exemptions" and addenda. (Reference-Title 25, §71.21.a.5.i.A).
_____	_____	II. Physical and Demographic Analysis utilizing written description and mapping (All items listed below require maps, and all maps should show all current lots and structures and be of appropriate scale to clearly show significant information).
_____	_____	A. Identification of planning area(s), municipal boundaries, Sewer Authority/Management Agency service area boundaries. (Reference-Title 25, §71.21.a.1.i).
_____	_____	B. Identification of physical characteristics (streams, lakes, impoundments, natural conveyance, channels, drainage basins in the planning area). (Reference-Title 25, §71.21.a.1.ii).
_____	_____	C. Soils - Analysis with description by soil type and soils mapping for areas not presently served by sanitary sewer service. Show areas suitable for in-ground onlot systems, elevated sand mounds, individual residential spray irrigation systems, and areas unsuitable for soil dependent systems. (Reference-Title 25, §71.21.a.1.iii). Show Prime Agricultural Soils and any locally protected agricultural soils. (Reference-Title 25, §71.21.a.1.iii).
_____	_____	D. Geologic Features - (1) Identification through analysis, (2) mapping and (3) their relation to existing or potential nitrate-nitrogen pollution and drinking water sources. Include areas where existing nitrate-nitrogen levels are in excess of 5 mg/L. (Reference-Title 25, §71.21.a.1.iii).
_____	_____	E. Topography - Depict areas with slopes that are suitable for conventional systems; slopes that are suitable for elevated sand mounds and slopes that are unsuitable for onlot systems. (Reference-Title 25, §71.21.a.1.ii).
_____	_____	F. Potable Water Supplies - Identification through mapping, description and analysis. Include public water supply service areas and available public water supply capacity and aquifer yield for groundwater supplies. (Reference-Title 25 §71.21.a.1.vi). Section V.C. of the Planning Guide.
_____	_____	G. Wetlands-Identify wetlands as defined in Title 25, Chapter 105 by description, analysis and mapping. Include National Wetland Inventory mapping and potential wetland areas per USDA, SCS mapped hydric soils. Proposed collection, conveyance and treatment facilities and lines must be located and labeled, along with the identified wetlands, on the map. (Reference-Title 25, §71.21.a.1.v). Appendix B, Section II.I of the Planning Guide.

III. Existing Sewage Facilities in the Planning Area - Identifying the Existing Needs:

A. Identify, map and describe municipal and non-municipal, individual and community sewerage systems in the planning area including:

1. Location, size and ownership of treatment facilities, main intercepting lines, pumping stations and force mains including their size, capacity, point of discharge. Also include the name of the receiving stream, drainage basin, and the facility's effluent discharge requirements. (Reference-Title 25, §71.21.a.2.i.A).
2. A narrative and schematic diagram of the facility's basic treatment processes including the facility's NPDES permitted capacity, and the Clean Streams Law permit number. (Reference-Title 25, §71.21.a.2.i.A).
3. A description of problems with existing facilities (collection, conveyance and/or treatment), including existing or projected overload under Title 25, Chapter 94 (relating to municipal wasteload management) or violations of the NPDES permit, Clean Streams Law permit, or other permit, rule or regulation of DEP. (Reference-Title 25, §71.21.a.2.i.B).
4. Details of scheduled or in-progress upgrading or expansion of treatment facilities and the anticipated completion date of the improvements. Discuss any remaining reserve capacity and the policy concerning the allocation of reserve capacity. Also discuss the compatibility of the rate of growth to existing and proposed wastewater treatment facilities. (Reference-Title 25, §71.21.a.4.i & ii).
5. A detailed description of the municipality's operation and maintenance requirements for small flow treatment facility systems, including the status of past and present compliance with these requirements and any other requirements relating to sewage management programs. (Reference-Title 25, §71.21.a.2.i.C).
6. Disposal areas, if other than stream discharge, and any applicable groundwater limitations. (Reference-Title 25, §71.21.a.4.i & ii).

B. Using DEP's publication titled *Sewage Disposal Needs Identification*, identify, map and describe areas that utilize individual and community onlot sewage disposal and, unpermitted collection and disposal systems ("wildcat" sewers, borehole disposal, etc.) and retaining tank systems in the planning area including:

1. The types of onlot systems in use. (Reference-Title 25, §71.21.a.2.ii.A).
2. A sanitary survey complete with description, map and tabulation of documented and potential public health, pollution, and operational problems (including malfunctioning systems) with the systems, including violations of local ordinances, the Sewage Facilities Act, the Clean Stream Law or regulations promulgated thereunder. (Reference-Title 25, §71.21.a.2.ii.B).
3. A comparison of the types of onlot sewage systems installed in an area with the types of systems which are appropriate for the area according to soil, geologic conditions, topographic limitations sewage flows, and Title 25 Chapter 73 (relating to standards for sewage disposal facilities). (Reference-Title 25, §71.21.a.2.ii.C).
4. An individual water supply survey to identify possible contamination by malfunctioning onlot sewage disposal systems consistent with DEP's *Sewage Disposal Needs Identification* publication. (Reference-Title 25, §71.21.a.2.ii.B).
5. Detailed description of operation and maintenance requirements of the municipality for individual and small volume community onlot systems, including the status of past and present compliance with these requirements and any other requirements relating to sewage management programs. (Reference-Title 25, §71.21.a.2.i.C).

C. Identify wastewater sludge and septage generation, transport and disposal methods. Include this information in the sewage facilities alternative analysis including:

1. Location of sources of wastewater sludge or septage (Septic tanks, holding tanks, wastewater treatment facilities). (Reference-Title 25 §71.71).
2. Quantities of the types of sludges or septage generated. (Reference-Title 25 §71.71).
3. Present disposal methods, locations, capacities and transportation methods. (Reference-Title 25 §71.71).

IV. Future Growth and Land Development

A. Identify and briefly summarize all municipal and county planning documents adopted pursuant to the Pennsylvania Municipalities Planning Code (Act 247) including:

1. All land use plans and zoning maps that identify residential, commercial, industrial, agricultural, recreational and open space areas. (Reference-Title 25, §71.21.a.3.iv).
2. Zoning or subdivision regulations that establish lot sizes predicated on sewage disposal methods. (Reference – Title 25§71.21.a.3.iv).
3. **All limitations and plans related to floodplain and stormwater management and special protection (Ch. 93) areas. (Reference-Title 25 §71.21.a.3.iv) Appendix B, Section II.F of the Planning Guide. [Section 7.2]**

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B. Delineate and describe the following through map, text and analysis.

1. Areas with existing development or plotted subdivisions. Include the name, location, description, total number of EDU's in development, total number of EDU's currently developed and total number of EDU's remaining to be developed (include time schedule for EDU's remaining to be developed). (Reference-Title 25, §71.21.a.3.i).
2. Land use designations established under the Pennsylvania Municipalities Planning Code (35 P.S. 10101-11202), including residential, commercial and industrial areas. (Reference-Title 25,§71.21.a.3.ii). Include a comparison of proposed land use as allowed by zoning and existing sewage facility planning. (Reference-Title 25, §71.21.a.3.iv).
3. Future growth areas with population and EDU projections for these areas using historical, current and future population figures and projections of the municipality. Discuss and evaluate discrepancies between local, county, state and federal projections as they relate to sewage facilities. (Reference-Title 25, §71.21.a.1.iv). (Reference-Title 25, §71.21.a.3.iii).
4. Zoning, and/or subdivision regulations; local, county or regional comprehensive plans; and existing plans of any other agency relating to the development, use and protection of land and water resources with special attention to: (Reference-Title 25, §71.21.a.3.iv).
 - public ground/surface water supplies
 - recreational water use areas
 - groundwater recharge areas
 - industrial water use
 - wetlands

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5. Sewage planning necessary to provide adequate wastewater treatment for five and ten year future planning periods based on projected growth of existing and proposed wastewater collection and treatment facilities. (Reference-Title 25, §71.21.a.3.v). [Section 5.3]

6-1**V. Identify Alternatives to Provide New or Improved Wastewater Disposal Facilities****A. Conventional collection, conveyance, treatment and discharge alternatives including.** [Note – scope of this special study is limited to wet weather treatment capacity at the ALCOSAN Woods Run WWTP.]

1. The potential for regional wastewater treatment. (Reference-Title 25, §71.21.a.4).
2. The potential for extension of existing municipal or non-municipal sewage facilities to areas in need of new or improved sewage facilities. (Reference-Title 25, §71.21.a.4.i).
3. The potential for the continued use of existing municipal or non-municipal sewage facilities through one or more of the following: (Reference-Title 25, §71.21.a.4.ii). [Section 6.0]
 - a. Repair. (Reference-Title 25, §71.21.a.4.ii.A).
 - b. Upgrading. (Reference-Title 25, §71.21.a.4.ii.B).
 - c. Reduction of hydraulic or organic loading to existing facilities. (Reference-Title 25, §71.71).
 - d. Improved operation and maintenance. Reference-Title 25, §71.21.a.4.ii.C).
 - e. Other applicable actions that will resolve or abate the identified problems. (Reference-Title 25, §71.21.a.4.ii.D).
4. Repair or replacement of existing collection and conveyance system components. (Reference-Title 25, §71.21.a.4.ii.A).
5. The need for construction of new community sewage systems including sewer systems and/or treatment facilities. (Reference-Title 25, §71.21.a.4.iii).
6. Use of innovative/alternative methods of collection/conveyance to serve needs areas using existing wastewater treatment facilities. (Reference-Title 25, §71.21.a.4.ii.B).

B. The use of individual sewage disposal systems including individual residential spray irrigation systems based on:

1. Soil and slope suitability. (Reference-Title 25, §71.21.a.2.ii.C).
2. Preliminary hydrogeologic evaluation. (Reference-Title 25, §71.21.a.2.ii.C).
3. The establishment of a sewage management program. (Reference-Title 25, §71.21.a.4.iv). See also Part "F" below.
4. The repair, replacement or upgrading of existing malfunctioning systems in areas suitable for onlot disposal considering: (Reference-Title 25, §71.21.a.4).
 - a. Existing technology and sizing requirements of Title 25 Chapter 73. (Reference-Title 25, §73.31-73.72).
 - b. Use of expanded absorption areas or alternating absorption areas. (Reference-Title 25, §73.16).
 - c. Use of water conservation devices. (Reference-Title 25, §71.73.b.2.iii).

C. The use of small flow sewage treatment facilities or package treatment facilities to serve individual homes or clusters of homes with consideration of: (Reference-Title 25, §71.64.d).

1. Treatment and discharge requirements. (Reference-Title 25, §71.64.d).
2. Soil suitability. (Reference-Title 25, §71.64.c.i).

3. Preliminary hydrogeologic evaluation. (Reference-Title 25, §71.64.c.2).
4. Municipal, Local, Agency or other controls over operation and maintenance requirements through a Sewage Management Program. (Reference-Title 25, §71.64.d). See Part "F" below.

D. The use of community land disposal alternatives including:

1. Soil and site suitability. (Reference-Title 25, §71.21.a.2.ii.C).
2. Preliminary hydrogeologic evaluation. (Reference-Title 25, §71.21.a.2.ii.C).
3. Municipality, Local Agency or Other Controls over operation and maintenance requirements through a Sewage Management Program (Reference-Title 25, §71.21.a.2.ii.C). See Part "F" below.
4. The rehabilitation or replacement of existing malfunctioning community land disposal systems. (See Part "V", B, 4, a, b, c above). See also Part "F" below.

E. The use of retaining tank alternatives on a temporary or permanent basis including: (Reference- Title 25, §71.21.a.4).

1. Commercial, residential and industrial use. (Reference-Title 25, §71.63.e).
2. Designated conveyance facilities (pumper trucks). (Reference-Title 25, §71.63.b.2).
3. Designated treatment facilities or disposal site. (Reference-Title 25, §71.63.b.2).
4. Implementation of a retaining tank ordinance by the municipality. (Reference-Title 25, §71.63.c.3). See Part "F" below.
5. Financial guarantees when retaining tanks are used as an interim sewage disposal measure. (Reference-Title 25, §71.63.c.2).

F. Sewage Management Programs to assure the future operation and maintenance of existing and proposed sewage facilities through:

1. Municipal ownership or control over the operation and maintenance of individual onlot sewage disposal systems, small flow treatment facilities, or other traditionally non-municipal treatment facilities. (Reference-Title 25, §71.21.a.4.iv).
2. Required inspection of sewage disposal systems on a schedule established by the municipality. (Reference-Title 25, §71.73.b.1.).
3. Required maintenance of sewage disposal systems including septic and aerobic treatment tanks and other system components on a schedule established by the municipality. (Reference-Title 25, §71.73.b.2).
4. Repair, replacement or upgrading of malfunctioning onlot sewage systems. (Reference-Title 25, §71.21.a.4.iv) and §71.73.b.5 through:
 - a. Aggressive pro-active enforcement of ordinances that require operation and maintenance and prohibit malfunctioning systems. (Reference-Title 25, §71.73.b.5).
 - b. Public education programs to encourage proper operation and maintenance and repair of sewage disposal systems.
5. Establishment of joint municipal sewage management programs. (Reference-Title 25, §71.73.b.8).
6. Requirements for bonding, escrow accounts, management agencies or associations to assure operation and maintenance for non-municipal facilities. (Reference-Title 25, §71.71).

G. Non-structural comprehensive planning alternatives that can be undertaken to assist in meeting existing and future sewage disposal needs including: (Reference-Title 25, §71.21.a.4).

1. Modification of existing comprehensive plans involving:
 - a. Land use designations. (Reference-Title 25, §71.21.a.4).
 - b. Densities. (Reference-Title 25, §71.21.a.4).
 - c. Municipal ordinances and regulations. (Reference-Title 25, §71.21.a.4).
 - d. Improved enforcement. (Reference-Title 25, §71.21.a.4).
 - e. Protection of drinking water sources. (Reference-Title 25, §71.21.a.4).
2. Consideration of a local comprehensive plan to assist in producing sound economic and consistent land development. (Reference-Title 25, §71.21.a.4).
3. Alternatives for creating or changing municipal subdivision regulations to assure long-term use of on-site sewage disposal that consider lot sizes and protection of replacement areas. (Reference-Title 25, §71.21.a.4).
4. Evaluation of existing local agency programs and the need for technical or administrative training. (Reference-Title 25, §71.21.a.4).

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H. A no-action alternative which includes discussion of both short-term and long-term impacts on: (Reference-Title 25, §71.21.a.4). [Section 7.3.1]

1. Water Quality/Public Health. (Reference-Title 25, §71.21.a.4).
2. Growth potential (residential, commercial, industrial). (Reference-Title 25, §71.21.a.4).
3. Community economic conditions. (Reference-Title 25, §71.21.a.4).
4. Recreational opportunities. (Reference-Title 25, §71.21.a.4).
5. Drinking water sources. (Reference-Title 25, §71.21.a.4).
6. Other environmental concerns. (Reference-Title 25, §71.21.a.4).

VI. Evaluation of Alternatives

A. Technically feasible alternatives identified in Section V of this check-list must be evaluated for consistency with respect to the following: (Reference-Title 25, §71.21.a.5.i.). [Section 7]

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1. Applicable plans developed and approved under **Sections 4 and 5 of the Clean Streams Law or Section 208 of the Clean Water Act (33 U.S.C.A. 1288)**. (Reference-Title 25, §71.21.a.5.i.A). Appendix B, Section II.A of the Planning Guide. [7.3.2]

2. Municipal wasteload management Corrective Action Plans or Annual Reports developed under PA Code, Title 25, Chapter 94. (Reference-Title 25, §71.21.a.5.i.B). The municipality's recent Wasteload Management (Chapter 94) Reports should be examined to determine if the proposed alternative is consistent with the recommendations and findings of the report. Appendix B, Section II.B of the Planning Guide.

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3. Plans developed under **Title II of the Clean Water Act (33 U.S.C.A. 1281-1299) or Titles II and VI of the Water Quality Act of 1987 (33 U.S.C.A. 1251-1376)**. (Reference-Title 25, §71.21.a.5.i.C). Appendix B, Section II.E of the Planning Guide. [Section 7.3.2]

_____	_____	4. Comprehensive plans developed under the Pennsylvania Municipalities Planning Code. (Reference-Title 25, §71.21.a.5.i.D). The municipality's comprehensive plan must be examined to assure that the proposed wastewater disposal alternative is consistent with land use and all other requirements stated in the comprehensive plan. Appendix B, Section II.D of the Planning Guide.
_____	<u>7-33</u>	5. Antidegradation requirements as contained in PA Code, Title 25, Chapters 93, 95 and 102 (relating to water quality standards, wastewater treatment requirements and erosion control) and the Clean Water Act. (Reference-Title 25, §71.21.a.5.i.E). Appendix B, Section II.F of the Planning Guide.
_____	_____	6. State Water Plans developed under the Water Resources Planning Act (42 U.S.C.A. 1962-1962 d-18). (Reference-Title 25, §71.21.a.5.i.F). Appendix B, Section II.C of the Planning Guide.
_____	_____	7. Pennsylvania Prime Agricultural Land Policy contained in Title 4 of the Pennsylvania Code, Chapter 7, Subchapter W. Provide narrative on local municipal policy and an overlay map on prime agricultural soils. (Reference-Title 25, §71.21.a.5.i.G). Appendix B, Section II.G of the Planning Guide.
_____	<u>7-28</u>	8. County Stormwater Management Plans approved by DEP under the Storm Water Management Act (32 P.S. 680.1-680.17). (Reference-Title 25, §71.21.a.5.i.H). Conflicts created by the implementation of the proposed wastewater alternative and the existing recommendations for the management of stormwater in the county Stormwater Management Plan must be evaluated and mitigated. If no plan exists, no conflict exists. Appendix B, Section II.H of the Planning Guide. [7.2.1]
_____	<u>7-28</u>	9. Wetland Protection. Using wetland mapping developed under Checklist Section II.G, identify and discuss mitigative measures including the need to obtain permits for any encroachments on wetlands from the construction or operation of any proposed wastewater facilities. (Reference-Title 25, §71.21.a.5.i.I) Appendix B, Section II.I of the Planning Guide. [7.2.2]
_____	<u>7-30</u>	10. Protection of rare, endangered or threatened plant and animal species as identified by the Pennsylvania Natural Diversity Inventory (PNDI). (Reference-Title 25, §71.21.a.5.i.J). Provide DEP with a copy of the completed Request For PNDI Search document. Also provide a copy of the response letter from the Department of Conservation and Natural Resources' Bureau of Forestry regarding the findings of the PNDI search. Appendix B, Section II.J of the Planning Guide. [7.2.4]
_____	<u>7-30</u>	11. Historical and archaeological resource protection under P.C.S. Title 37, Section 507 relating to cooperation by public officials with the Pennsylvania Historical and Museum Commission. (Reference-Title 25, §71.21.a.5.i.K). Provide the department with a completed copy of a Cultural Resource Notice request of the Bureau of Historic Preservation (BHP) to provide a listing of known historical sites and potential impacts on known archaeological and historical sites. Also provide a copy of the response letter from the BHP. Appendix B, Section II.K of the Planning Guide. [7.2.5]
_____	_____	B. Provide for the resolution of any inconsistencies in any of the points identified in Section VI.A. of this checklist by submitting a letter from the appropriate agency stating that the agency has received, reviewed and concurred with the resolution of identified inconsistencies. (Reference-Title 25, §71.21.a.5.ii). Appendix B of the Planning Guide.
_____	<u>7-32</u>	C. Evaluate alternatives identified in Section V of this checklist with respect to applicable water quality standards, effluent limitations or other technical, legislative or legal requirements. (Reference-Title 25, §71.21.a.5.iii). [7.1.1, 7.3.1]

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D. Provide cost estimates using present worth analysis for construction, financing, on going administration, operation and maintenance and user fees for alternatives identified in Section V of this checklist. Estimates shall be limited to areas identified in the plan as needing improved sewage facilities within five years from the date of plan submission. (Reference-Title 25, §71.21.a.5.iv).

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E. Provide an analysis of the funding methods available to finance the proposed alternatives evaluated in Section V of this checklist. Also provide documentation to demonstrate which alternative and financing scheme combination is the most cost-effective; and a contingency financial plan to be used if the preferred method of financing cannot be implemented. The funding analysis shall be limited to areas identified in the plan as needing improved sewage facilities within five years from the date of the plan submission. (Reference-Title 25, §71.21.a.5.v). [Section 8.4]

F. Analyze the need for immediate or phased implementation of each alternative proposed in Section V of this checklist including: (Reference-Title 25, §71.21.a.5.vi).

1. A description of any activities necessary to abate critical public health hazards pending completion of sewage facilities or implementation of sewage management programs. (Reference-Title 25, §71.21.a.5.vi.A).

2. A description of the advantages, if any, in phasing construction of the facilities or implementation of a sewage management program justifying time schedules for each phase. (Reference-Title 25, §71.21.a.5.vi.B).

G. Evaluate administrative organizations and legal authority necessary for plan implementation. (Reference - Title 25, §71.21.a.5.vi.D.). [Section 8.2 and 3]

VII. Institutional Evaluation

A. Provide an analysis of all existing wastewater treatment authorities, their past actions and present performance including:

1. Financial and debt status. (Reference-Title 25, §71.61.d.2). [Section 8.1]

2. Available staff and administrative resources. Section 8.2]

3. Existing legal authority to: [Section 8.3]

a. Implement wastewater planning recommendations. (Reference-Title 25, §71.61.d.2).

b. Implement system-wide operation and maintenance activities. (Reference-Title 25, §71.61.d.2).

c. Set user fees and take purchasing actions. (Reference-Title 25, §71.61.d.2).

d. Take enforcement actions against ordinance violators. (Reference-Title 25, §71.61.d.2).

e. Negotiate agreements with other parties. (Reference-Title 25, §71.61.d.2).

f. Raise capital for construction and operation and maintenance of facilities. (Reference-Title 25, §71.61.d.2).

B. Provide an analysis and description of the various institutional alternatives necessary to implement the proposed technical alternatives including:

1. Need for new municipal departments or municipal authorities. (Reference-Title 25, §71.61.d.2).

2. Functions of existing and proposed organizations (sewer authorities, onlot maintenance agencies, etc.). (Reference-Title 25, §71.61.d.2).

3. Cost of administration, implementability, and the capability of the

authority/agency to react to future needs. (Reference-Title 25, §71.61.d.2).

- C. Describe all necessary administrative and legal activities to be completed and adopted to ensure the implementation of the recommended alternative including:
1. Incorporation of authorities or agencies. (Reference-Title 25, §71.61.d.2).
 2. Development of all required ordinances, regulations, standards and inter-municipal agreements. (Reference-Title 25, §71.61.d.2).
 3. Description of activities to provide rights-of-way, easements and land transfers. (Reference-Title 25, §71.61.d.2).
 4. Adoption of other municipal sewage facilities plans. (Reference-Title 25, §71.61.d.2).
 5. Any other legal documents. (Reference-Title 25, §71.61.d.2).
 6. Dates or timeframes for items 1-5 above on the project's implementation schedule.
- D. Identify the proposed institutional alternative for implementing the chosen technical wastewater disposal alternative. Provide justification for choosing the specific institutional alternative considering administrative issues, organizational needs and enabling legal authority. (Reference-Title 25, §71.61.d.2).

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VIII. Implementation Schedule and Justification for Selected Technical & Institutional Alternatives [Section 9.0 for schedule]

- A. Identify the technical wastewater disposal alternative which best meets the wastewater treatment needs of each study area of the municipality. Justify the choice by providing documentation which shows that it is the best alternative based on:

Sec. 6

1. Existing wastewater disposal needs. (Reference-Title 25, §71.21.a.6).
2. Future wastewater disposal needs. (five and ten years growth areas). (Reference-Title 25, §71.21.a.6).
3. Operation and maintenance considerations. (Reference-Title 25, §71.21.a.6).
4. Cost-effectiveness. (Reference-Title 25, §71.21.a.6).
5. Available management and administrative systems. (Reference-Title 25, §71.21.a.6).
6. Available financing methods. (Reference-Title 25, §71.21.a.6).
7. Environmental soundness and compliance with natural resource planning and preservation programs. (Reference-Title 25, §71.21.a.6).

8-15

- B. Designate and describe the capital financing plan chosen to implement the selected alternative(s). Designate and describe the chosen back-up financing plan. (Reference-Title 25, §71.21.a.6) [Section 8.4]

9-1

- C. Designate and describe the implementation schedule for the recommended alternative, including justification for any proposed phasing of construction or implementation of a Sewage Management Program. (Reference – Title 25 §71.31d) [Section 9]

IX. Environmental Report (ER) generated from the Uniform Environmental Review Process (UER)

- A. Complete an ER as required by the UER process and as described in the DEP Technical Guidance 381-5511-111. Include this document as "Appendix A" to the Act 537 Plan Update Revision. Note: *An ER is required only for Wastewater projects proposing funding through any of the funding sources identified in the UER.*

PENNVEST LD. No. _____

ADDITIONAL REQUIREMENTS FOR PENNVEST PROJECTS

Municipalities that propose to implement their official sewage facilities plan updates with PENNVEST funds must meet six additional requirements to be eligible for such funds. See A Guide for Preparing Act 537 Update Revisions (362-0300-003), Appendix N for greater detail or contact the DEP regional office serving your county listed in Appendix J of the same publication.

DEP Use Only	Indicate Page #(s) in Plan	Item Required
_____	_____	1. Environmental Impact Assessment. (Planning Phase) The Uniform Environment Review (UER) replaces the Environmental Impact Assessment that was a previous requirement for PENNVEST projects.
_____	_____	2. Cost Effectiveness (Planning Phase) The cost-effectiveness analysis should be a present-worth (or equivalent uniform annual) cost evaluation of the principle alternatives using the interest rate that is published annually by the Water Resources Council. Normally, for PENNVEST projects the applicant should select the most cost-effective alternative based upon the above analysis. Once the alternative has been selected the user fee estimates should be developed based upon interest rates and loan terms of the selected funding method.
_____		3. Second Opinion Project Review. (Design Phase)
_____		4. Minority Business Enterprise/Women's Business Enterprise (Construction Phase)
_____		5. Civil Rights. (Construction Phase)
_____		6. Initiation of Operation/Performance Certification. (Post-construction Phase)

alcosan



allegheeny county
sanitary authority

ALCOSAN Phase 2 Facilities Planning for the Woods Run WWTP

Draft Bypass Justification Report

April 2010

CDM



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ALCOSAN EPM Project Office
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PHASE II FACILITIES PLANNING TECHNICAL MEMORANDUM ST-1

To: David Borneman, ALCOSAN
Daniel Lockard, ALCOSAN

CC: Jack Rattray, CDM Joe Lagnese, Jr., Consulting Engineer
Al Pincince, CDM Tom Schevchuk, CDM
Anna Mehrotra, CDM File: 5365-41914-CCP.05.04.03

Date: October 29, 2007

From: Scott Cowburn, CDM
Michael Fortune, Cosmos Technologies

Subject: Draft Technical Memorandum ST-1
Final Report on Primary Stress Testing at the ALCOSAN WWTP

BACKGROUND

One component of ALCOSAN's strategy for achieving compliance with the EPA National CSO Policy is the expansion of the Woods Run Wastewater Treatment Plant (WWTP) wet weather capacity. As proposed in the ALCOSAN Act 537 Plan the wet weather treatment facilities would include expansion of preliminary treatment capacity to 875 mgd, expansion of primary treatment capacity to 600 mgd and expansion of secondary treatment capacity to 275 mgd. The wet weather sequence of operation was proposed as follows:

- Wet weather flows up to 600 mgd would receive primary treatment with 275 mgd continuing through secondary treatment and up to 325 mgd of primary effluent would bypass secondary treatment and be discharged after disinfection (conventional bypass).
- Once wet weather flows exceed 600 mgd the aeration basins would be isolated from the primary sedimentation tanks and 275 mgd of screened and degritted wastewater would be diverted around primary treatment directly to secondary treatment (split flow). The primary sedimentation tanks would then continue to provide up to 600 mgd of wet weather primary treatment and disinfection prior to discharge.
- After wet weather flow subsides the normal flow path would be restored.

TECHNICAL MEMORANDUM ST-1: PRIMARY STRESS TESTING

It is likely that the above stated treatment capacities will be adjusted as the planning process continues; however, they are used here to designate the proposed conventional bypass and split flow modes of operation.

The expansion of primary treatment capacity to 600 mgd was planned to be achieved by the combination of additional primary sedimentation tanks and operating the process at high surface overflow rates (SOR) approaching 4,000 gallons-per-day-per-square-foot (gpd/sf). The expansion of primary and secondary treatment capacity was completed in 2004 under Phase 1 of ALCOSAN's Capital Improvements Program (CIP). There is therefore now the need to establish the capacity of the expanded primary sedimentation tanks at projected wet weather wet flow conditions. For this purpose, full-scale testing of primary settling was conducted.

OBJECTIVES AND PROCEDURES

This Technical Memorandum (TM) provides a report on the full-scale testing effort, which is referred to as the primary stress testing program. A summary of the protocol furnished to the Pennsylvania Department of Environmental Protection (PaDEP) prior to initiating the program is contained in Appendix A of this TM. The objectives of the stress testing program were as follows:

- Determine the hydraulic capacity of the ALCOSAN primary sedimentation tanks.
- Conduct a wastewater sampling and laboratory analyses program to characterize the wastewater and monitor the performance of primary sedimentation tanks.
- Evaluate the performance of the primary sedimentation tanks at elevated surface overflow rates as proposed for future wet weather treatment at the ALCOSAN Wastewater Treatment Plant (WWTP).
- Evaluate the wet weather performance of the primary sedimentation tanks without the influence of waste activated sludge cosettling, since it is proposed to eliminate co-settling when wet weather treatment is initiated in the future.

The stress testing program began on April 18, 2005, and ran continuously through October 5, 2005. Testing resumed on November 16, 2005 and ran continuously through August 31, 2006. In all, testing was conducted over a period of 463 days. The number of sedimentation tanks on-line during the time of testing varied as follows:

- 4 tanks on-line from April 18 through May 31, 2005 (44 days)
- 5 tanks on-line from June 1 through August 8, 2005 (69 days)
- 6 tanks on-line from August 9 through September 7, 2005 (30 days)
- 5 tanks on-line from September 8 through September 23, 2005 (16 days)

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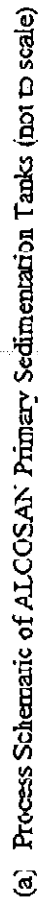
- 7 tanks on-line from September 24 through October 5, 2005 (15 days)
- 5 tanks on-line from November 16 through March 9, 2006 (114 days)
- 6 tanks on line from March 10 through May 18, 2006 (70 days)
- 5 tanks on-line from May 19 through July 9, 2006 (52 days)
- 4 tanks on-line from July 10, 2006 through August 31, 2006 (53 days)

The above variation in the number of tanks in service was a result of the ALCOSAN Operations Department concern for maintaining NPDES permit compliance, especially during the yearly nitrification season extending from May 1 to October 31. This variation of tanks in service provided the opportunity to monitor primary treatment performance over a broad range of surface overflow rates.

The ALCOSAN primary treatment process consists of nine rectangular sedimentation tanks configured as shown on Figure 1 with five west-side tanks (designated W-0 through W-4) and four east side tanks (designated E-0 through E-3). Following preliminary treatment of screening and grit removal the raw wastewater is split between the west and east aerated primary influent channels which distribute flow to the sedimentation tanks. Each tank is approximately 280 feet long, 68 feet wide with a side water depth of 14 feet; except for Tanks W-0 and E-0 which are narrower (62 feet wide) and Tank W-4 which is wider (72 feet). Tanks W-0 and E-0 were originally pre-aeration tanks that were converted to sedimentation tanks. Each tank is separated into four bays with a longitudinal chain and flight sludge collection mechanism in each bay. Settling sludge is pushed into a collection trough at the influent end of the tank, wherein, a cross collecting screw conveyor moves the settled sludge to a sump where is then pumped to the dewatering facilities. Scum is collected using motor-operated tipping troughs and primary effluent overflows a series of V-notched weir troughs into a common aerated primary effluent channel. Primary effluent is conveyed from the primary effluent channel to the aeration basin via eight, 60 inch diameter pipes.

Throughout the duration of the stress testing program, there was no co-settling of waste activated sludge (WAS) in the primary sedimentation tanks, except from March 6 through May 19 of 2006 when co-settling was required to perform maintenance work. Co-settling of primary sludge and waste activated sludge in the primary tanks is ALCOSAN's current operating practice. However, it is proposed to eliminate co-settling when wet weather treatment is initiated in the future. In lieu of co-settling, WAS was pumped directly and exclusively to Primary Sedimentation Tank W-0 and/or Tank E-0 during the testing program. These tanks were isolated from wastewater flow and functioned as WAS thickeners, except during the time period noted above. Since one of the objectives of this program was to monitor performance of the primary treatment process without co-settling of WAS the data collected from March 6 through May 19 of 2006 was not included in the data analyses for this report.

Sampling Locations



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During April and May of 2005, and again during January through March of 2006, the primary stress testing program was performed concurrently with the ALCOSAN secondary pilot plant testing program. The source of primary influent was an existing sample tap in the main wastewater conduit just prior to entering the primary influent channels. An in-line grinder was utilized on the suction side of the primary influent pump to reduce the potential for plugging the sample line. The primary effluent source was obtained by using a small submersible pump suspended below the water surface near the effluent weirs of one primary sedimentation tank. For most of the primary stress testing program the primary effluent was pumped from Tank E-1. The primary effluent pump location was moved to Tank E-2 whenever Tank E-1 needed to be taken out of service for maintenance. The sampling locations used during the primary stress testing program are shown on Figure 1.

Primary influent and primary effluent were continuously pumped from the primary sedimentation tanks to 350 gallon plastic tanks used as wastewater feed tanks for the pilot plant. There were automatic samplers set up to collect samples from the plastic feed tanks.

From April 18 through October 5, 2005, four ISCO refrigerated automatic samplers were used for sample collection. Two of the samplers were set up to collect 100 mL grab samples every 15 minutes into 9.6 L glass bottles for daily composite samples of primary influent and primary effluent. The other two samplers were set up with 24-bottle sample trays. Each of the 1.25 L polyethylene sample bottles received one-hour composite samples, consisting of four grab samples of approximately 250 mL (one grab sample every 15 minutes), which are also herein referred to as "discrete" samples of primary influent and primary effluent. The two samplers that collected discrete samples were eliminated before the testing program was resumed on November 16, 2005. The composite samples used in the study were not flow proportioned.

Performance of the primary treatment process was measured as the percent removal of total suspended solids (TSS) and 5-day carbonaceous biochemical oxygen demand (BOD) using the collected samples of primary influent and primary effluent. The samples were collected on a daily basis and delivered to the ALCOSAN plant laboratory by 8:00 AM. The laboratory analyses performed for the primary stress testing program included TSS, Volatile Suspended Solids (VSS), and BOD. The samples were collected 7 days a week, concurrently with the pilot plant operation, during April and May of 2005 and again during January through March of 2006. Otherwise, samples were collected from Monday through Friday.

In addition to the daily composite samples, discrete samples were saved for laboratory analyses during periods of peak wastewater flow from April 18 through October 5, 2005. Each morning the pilot plant operators reviewed the plant flow history for the preceding 24-hours. If significant peak flows, or wet weather flows were observed, the operator would save the discrete samples for the corresponding time period. Up to six pairs of discrete samples (primary influent and primary effluent) were then saved for laboratory analyses. During dry weather the discrete samples were normally discarded and not saved for laboratory analyses.

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Other related information used in the primary stress testing program is described below:

Plant Flow: ALCOSAN continuously monitors plant flow via eight flow meters in the Flow Regulating Chambers located between the primary sedimentation tanks and aeration basins. Flow data is archived in the plant's distributed control system (DCS).

Main Pumping Station Wet Well Level: Liquid level in the wet well is continuously monitored by an ultrasonic level probe. Wet well level data is archived in the plant's DCS.

CSO Event: An ALCOSAN combined sewer overflow (CSO) event is determined to begin and end based on the wastewater elevation in the Main Pumping Station wet well at the Woods Run WWTP. A CSO event is reported to begin when the wet well elevation rises to 685 feet. At this water level some CSO regulators in the regional conveyance system begin to overflow. The CSO event ends when the wet well elevation drops below 685 feet.

Simulated Wet Weather Plant Flow: ALCOSAN's wet weather program staff developed a hydraulic/hydrologic (H/H) computer model of the regional conveyance system using the US Environmental Protection Agency's (EPA) SWMM software. For this study the H/H model was used to simulate wastewater flow to the plant if treatment capacity was unlimited, thereby, estimating the peak flows generated in the collection system. Radar rainfall data is used as precipitation input to the model.

Sludge Blanket Levels: Sludge blanket levels are monitored twice a shift (six times per day) at the influent end of each sedimentation tank. As blanket levels rise a sludge pump for the tank is started and continues to operate for approximately 15 to 60 minutes until shut down by the operator.

Temperature: Wastewater liquid temperature is measured once per day by ALCOSAN's laboratory technicians.

HYDRAULIC CAPACITY OF PRIMARY SEDIMENTATION TANKS

Prior to considering performance of the primary sedimentation tanks under increasing flow conditions, it was first necessary to determine the maximum flow conditions that could be sustained through the units without causing damage or flooding of the units. The testing was performed by limiting flow to three or four of the nine units. Due to the hydraulic limitations of the existing plant headworks, operation with only three primary sedimentation tanks was not feasible. With four tanks in service the maximum allowable total plant flow was 235 mgd. At higher plant flow rates the rise in water surface elevation resulted in the unseating of the aluminum covers above the grit collecting tanks.

Detailed reports of this hydraulic testing performed in January 2005 and April 2005 are included in Appendices B and C, respectively. As reported therein, the maximum flow that

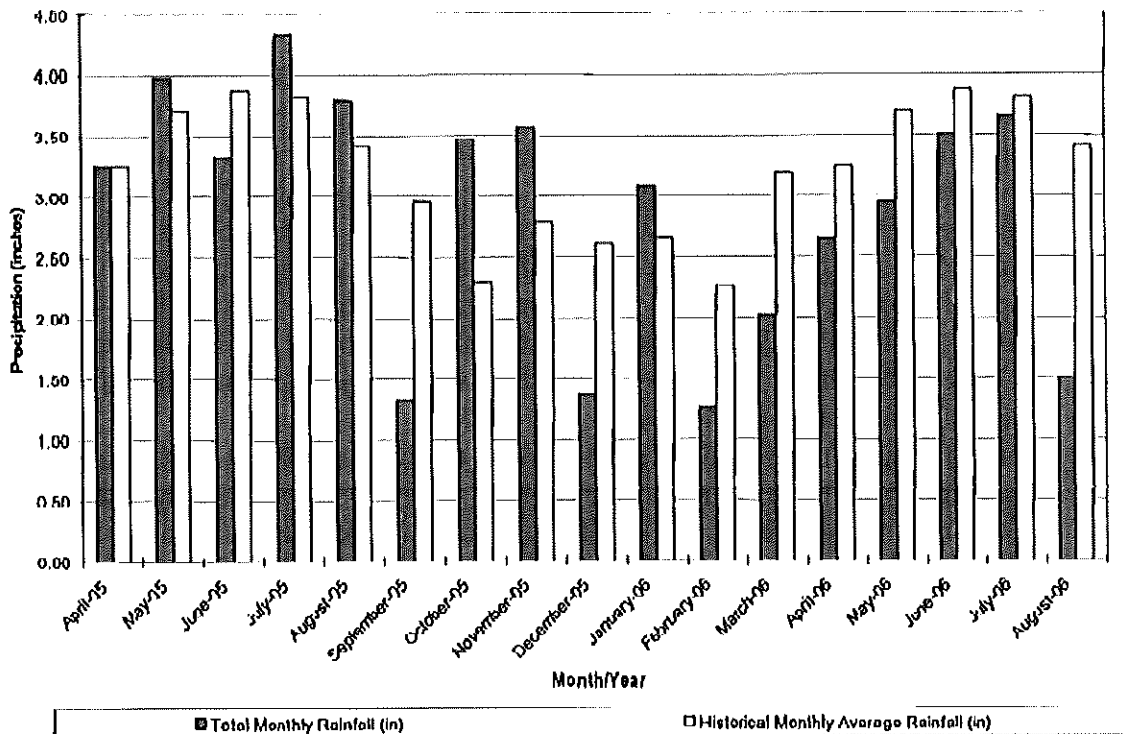
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can be properly accommodated through each sedimentation tank is approximately 60 mgd which equates to a surface overflow rate of approximately 3,100 gpd/sf. At higher unit flow rates several undesirable conditions were observed including submergence of the scum skimming flights and effluent weir troughs, and overflow of wastewater into empty sedimentation tanks resulting from water overtopping slide gates in the primary influent channels. Thus, applying the 60 mgd maximum unit rate to all nine sedimentation tanks, the maximum plant flow that could be accommodated through the existing primary treatment process at the ALCOSAN WWTP would be 540 mgd.

OPERATING CONDITIONS AND TESTING RESULTS

Figure 2 illustrates the total and historic average precipitation as recorded at the Pittsburgh International Airport weather station. The months that typically have the most precipitation are May, June, July and August. During the testing period, October and November of 2005 had notably above average precipitation, while, September and December of 2005, and February, March, and August of 2006 had notably below average precipitation.

Figure 2. Monthly Total and Historic Average Precipitation During the ALCOSAN Primary Stress Testing Program



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A summary of the plant headworks (bar screens and grit collecting tanks) and primary sedimentation tanks in service on a daily basis for the entire testing program is provided in Appendix D. A summary of the raw laboratory data from the sampling program, also provided in Appendix D, includes composite and discrete sampling data, wastewater temperatures, plant flow rates, calculated values of surface overflow rates, and percent removals of TSS and BOD.

A week-by-week description of the plant operating conditions, including weekly time series graphs is provided in Appendix E. Continuous time series graphs were used to compare primary influent and primary effluent constituent data from discrete samples with the plant flow and wet well operating conditions. These time series graphs allow for characterization of primary sedimentation tanks performance under various wet weather conditions.

The wastewater sampling data collected during the primary stress testing program allowed for the characterization of primary influent (PI) and primary effluent (PE) TSS and BOD concentrations under dry and wet weather conditions. Daily composite samples of primary influent and primary effluent were characterized as either "In CSO" (wet weather) or "Out of CSO" (dry weather) by the occurrence of a CSO event at the treatment plant. Figures 3 through 9 below illustrate the cumulative frequency distribution, statistical mean, median and standard deviation of the wastewater sampling data collected during the testing program.

The following wastewater and primary treatment process characterizations are noted from the primary influent and effluent sampling data:

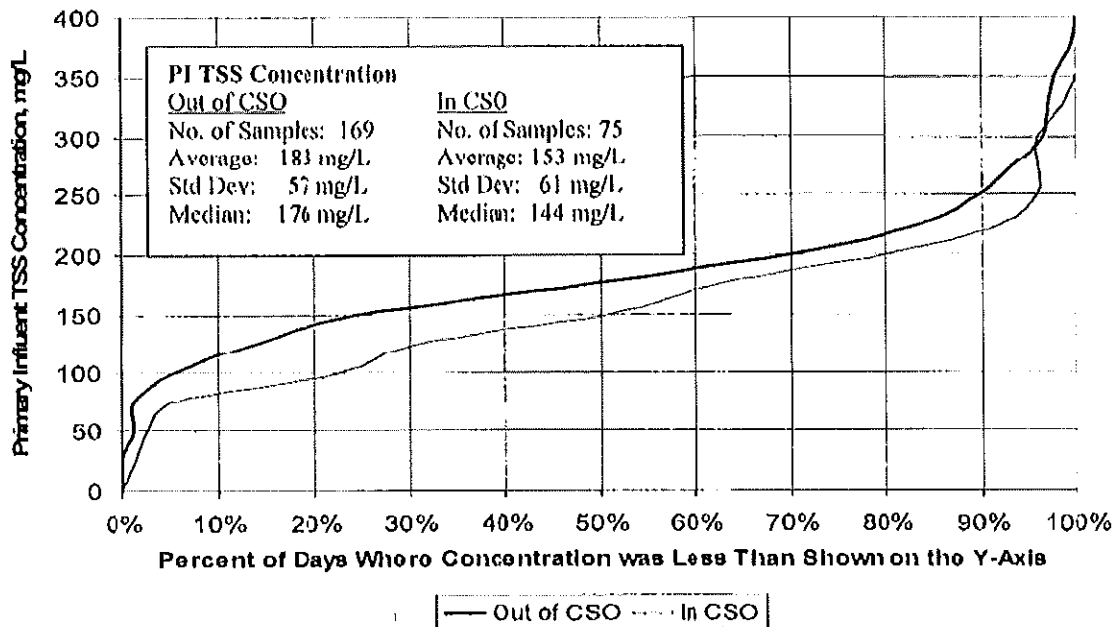
- The primary influent TSS and BOD concentrations exhibited some dilution during wet weather (See Figures 3 and 4). The average primary influent TSS concentration when the plant was operating "Out of CSO" was 183 mg/L with a one standard deviation range of 126 to 240 mg/L, and while operating "In CSO" the average primary influent TSS concentration was 153 mg/L with a one standard deviation range of 92 to 214 mg/L. The average PI TSS concentration during wet weather was approximately 16% less than the average concentration during dry weather. The primary influent BOD concentrations exhibited a similar trend wherein the average BOD concentration during wet weather was 17% less than the average BOD concentration during dry weather.
- The primary effluent TSS and BOD concentrations exhibited similar characteristics for both dry and wet weather (See Figures 5 and 6). The primary effluent average TSS concentration during wet weather (51 mg/L) was nearly the same as during dry weather (53 mg/L). The primary effluent average BOD concentration during wet weather (46 mg/L) was approximately 8% less than during dry weather (50 mg/L).
- It is noteworthy that the average primary effluent TSS and BOD concentrations observed during the primary stress testing program without the co-settling of WAS in the primary sedimentation tanks are relatively dilute and close to meeting secondary treatment standards considering that the ALCOSAN NPDES permit discharge limits for TSS following secondary treatment are 30 mg/L, 45 mg/L and 60 mg/L on a

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average monthly, average weekly and instantaneous maximum basis, respectively. Similarly, the NPDES permit discharge limits for BOD are 20 mg/L, 30 mg/L and 40 mg/L (May 1 to October 31) and 25 mg/L, 37.5 mg/L and 50 mg/L (November 1 to April 30); each on a average monthly, average weekly, and instantaneous maximum basis, respectively.

- During the primary stress testing program the average daily surface overflow rate during wet weather (2,218 gpd/sf) was approximately 19% higher than during dry weather (1,869 gpd/sf) as shown on Figure 7. The minimum and maximum daily average surface overflow rates monitored during the testing program were 1,127 gpd/sf and 3,060 gpd/sf, respectively.
- The average daily TSS removals were approximately 10% lower during wet weather (61%) than during dry weather (68%) as shown on Figure 8.
- The average daily BOD removals during wet weather (44%) were approximately 12% lower than during dry weather (50%) as shown on Figure 9.
- The reduction in average daily TSS and BOD percent removals exhibited during wet weather, shown in Figures 8 and 9, is a function of primary influent dilution during wet weather rather than a change in primary effluent quality. Since, as shown in Figures 5 and 6, the average daily PE TSS concentrations remain similar to dry weather concentrations and the PE BOD concentrations were actually lower during wet weather than during dry weather.

Figure 3. Cumulative Frequency Distribution of Primary Influent TSS Concentration in Daily Composite Samples during the Primary Stress Testing Program.



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Figure 4. Cumulative Frequency Distribution of Primary Influent BOD Concentration in Daily Composite Samples during the Primary Stress Testing Program

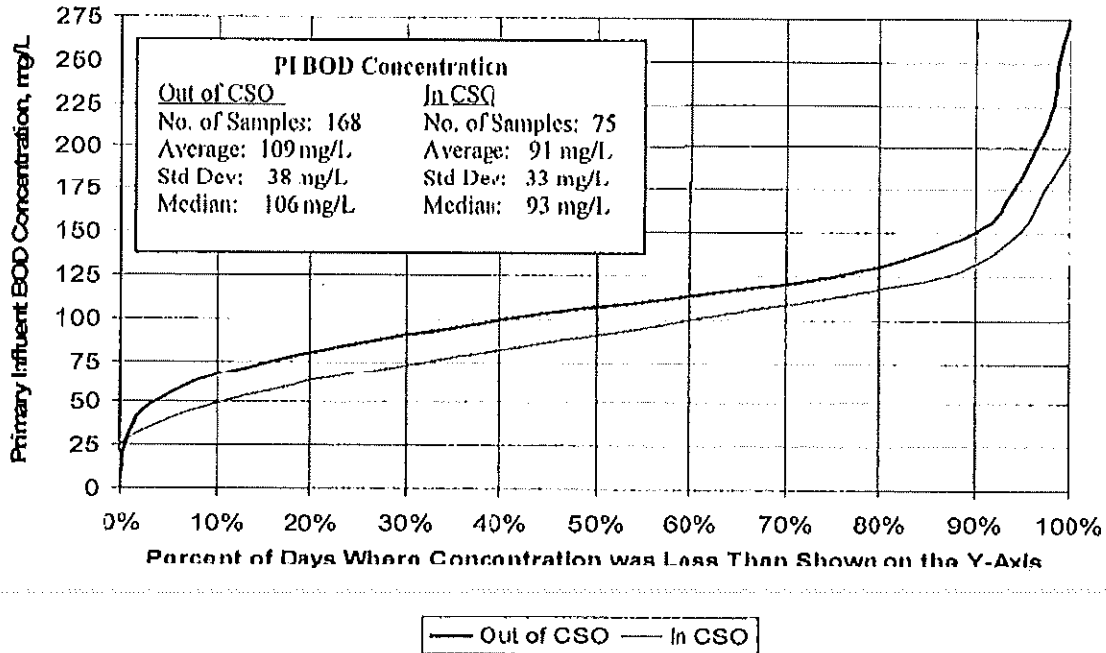
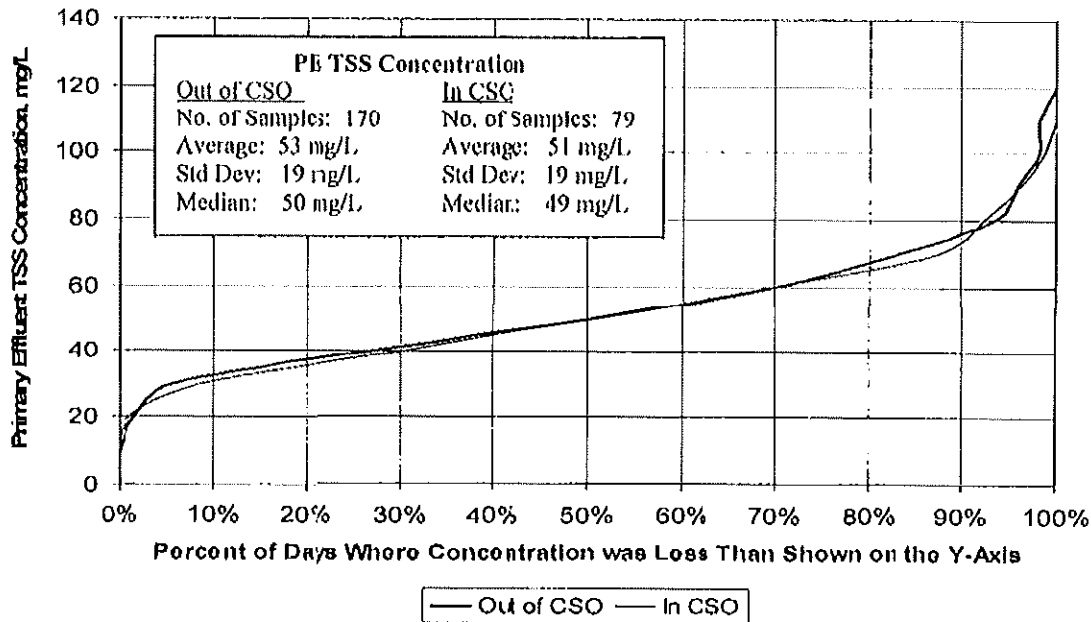
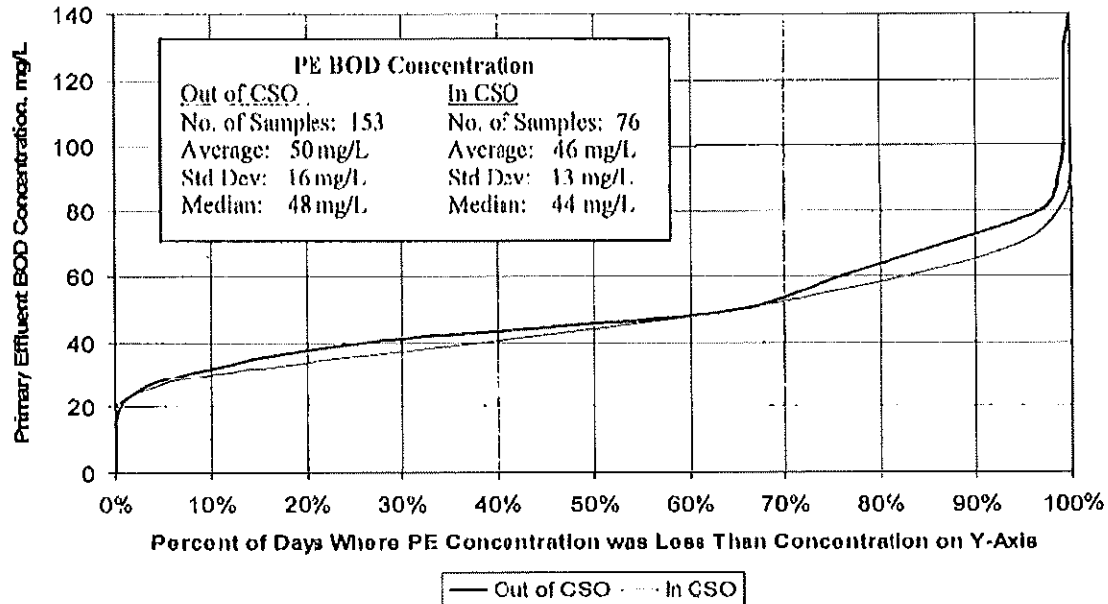
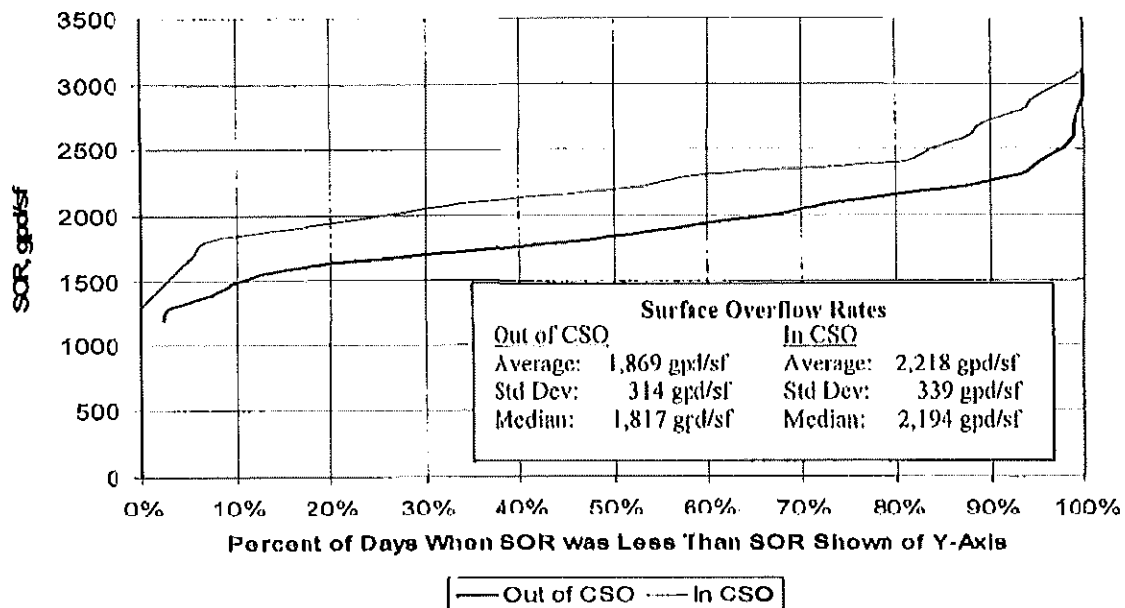


Figure 5. Cumulative Frequency Distribution of Primary Effluent TSS Concentration in Daily Composite Samples during the Primary Stress Testing Program



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Figure 6. Cumulative Frequency Distribution of Primary Effluent BOD Concentration in Daily Composite Samples during the Primary Stress Testing Program**Figure 7. Cumulative Frequency Distribution of Average Daily Surface Overflow Rates during the Primary Stress Testing Program**

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Figure 8. Relative Cumulative Frequency Distribution of Percent TSS Removal Based on Daily Composite Samples during the Primary Stress Testing Program

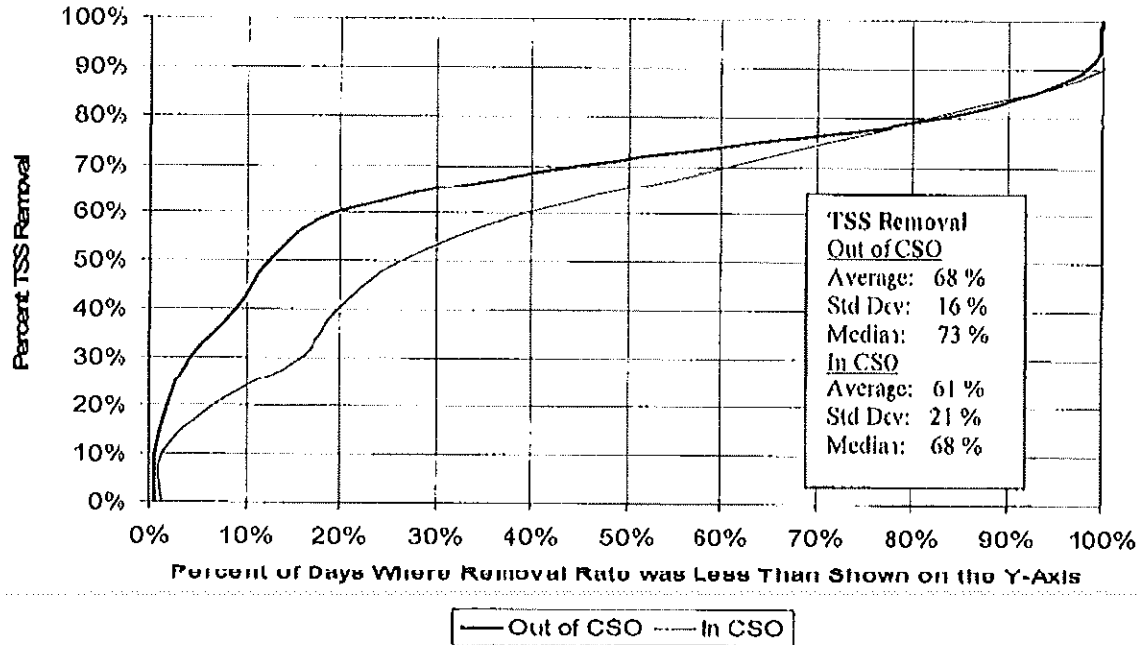
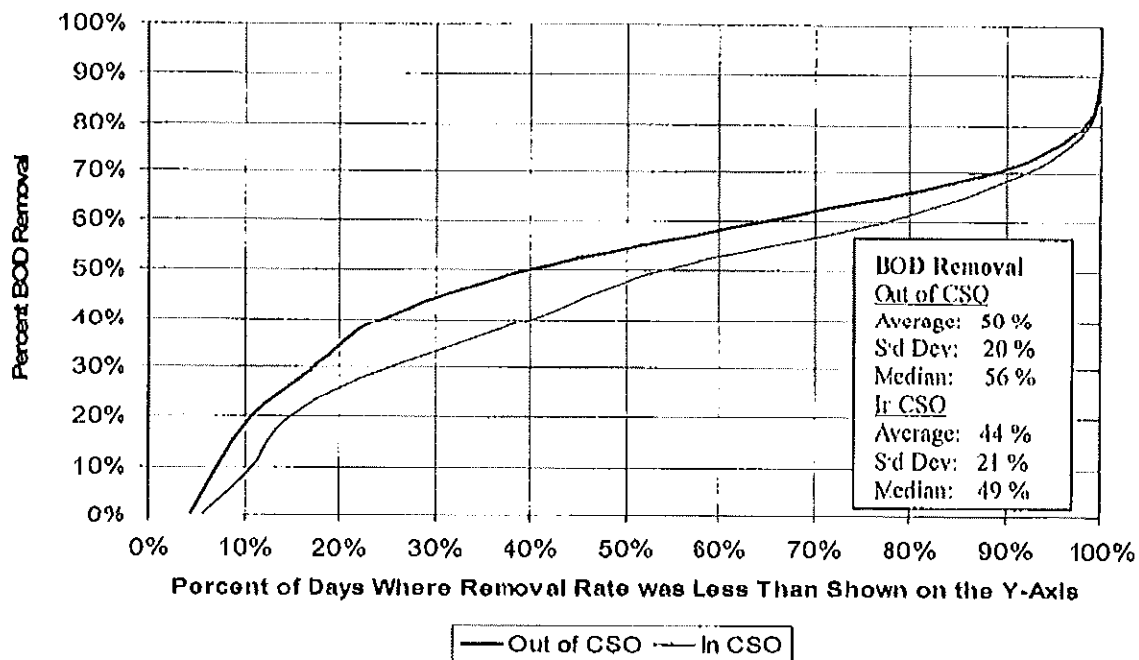


Figure 9. Relative Cumulative Frequency Distribution of Percent BOD Removal Based on Daily Composite Samples during the Primary Stress Testing Program



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The following other general observations of the plant operating conditions were noted during the primary stress testing program:

- Of the 117 separate CSO events during this testing period; 46 events (39%) were 5 hours or less in duration; 26 events (22%) were between 5 hours and 10 hours in duration; 27 events (23%) were between 11 hours and 20 hours in duration; and 18 events (15%) were longer than 20 hours in duration.
- Sludge blanket levels, over the range typically maintained in the primary sedimentation tanks during the testing program, did not appear to have any correlation with TSS and BOD removal rates. However, since blanket measurements are taken at the influent end of each tank above the cross collection screws, this location may not accurately reflect the sludge blanket in the rest of the tank.

During the stress testing program, it was noted by ALCOSAN Regional Conveyance Department that lowering the normal operating wastewater elevation in the Main Pumping Station wet well can reduce the frequency and duration of CSOs in certain areas of the collection system. During the last two weeks of April 2005 and the first four days of May 2005 the normal, dry weather operating water surface elevation in the Main Pumping Station wet well was Elevation 680 feet. On May 5, 2005 the operating level was lowered to 675 feet and remained there through the week of July 23, 2006. During the week of July 30, 2006, the Main Pumping Station operating level was again lowered from 675 feet to 670 feet.

PRIMARY TREATMENT PERFORMANCE ANALYSIS

Since the goal of the primary stress testing program is to evaluate the performance of the primary treatment process during wet weather and at high overflow rates much of the analysis focused on those periods of time where the treatment plant was in CSO conditions resulting from storm events (i.e., CSO events). Performance of the ALCOSAN primary treatment process was measured on the basis of percent removal of TSS and BOD achieved by comparison of daily composite sampling and laboratory analyses of primary influent and primary effluent. This performance data along with the plant operating data allowed comparison of primary treatment performance with respect to the following factors:

- Surface overflow rates
- Primary influent TSS and BOD concentrations
- Wastewater temperature

Surface Overflow Rates (SOR)

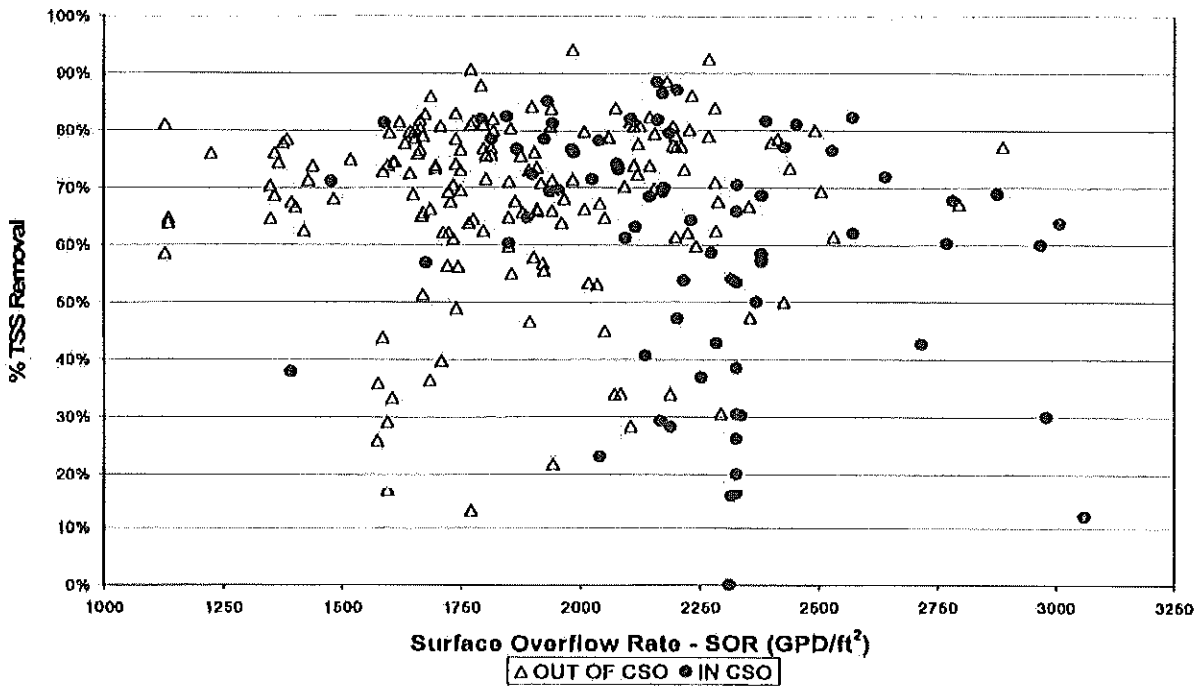
SOR is defined as the rate of flow with respect to the surface area of the process tank and it is typically expressed in gallons per day per square foot (gpd/sf). The PaDEP Domestic Wastewater Facilities Manual (October 1997) indicates that the design surface overflow rates for primary settling tanks that do not co-settle WAS should not exceed 1,000 gpd/sf at

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maximum monthly average flow, or 2,500 gpd/sf for peak hourly flow. It is noteworthy that for the entire testing period the surface overflow rate averaged 1,974 gpd/sf, which is almost twice the PaDEP's recommended maximum month design guideline; the 48% BOD average removal significantly exceeded PaDEP's projected guidance for BOD removal of 30 to 35%. The 66% average removal of TSS is also high within the industry standard range of 50 to 70% TSS removal for primary clarification. This suggests that the ALCOSAN primary sedimentation tanks are more efficient in their performance than normally expected for this unit process.

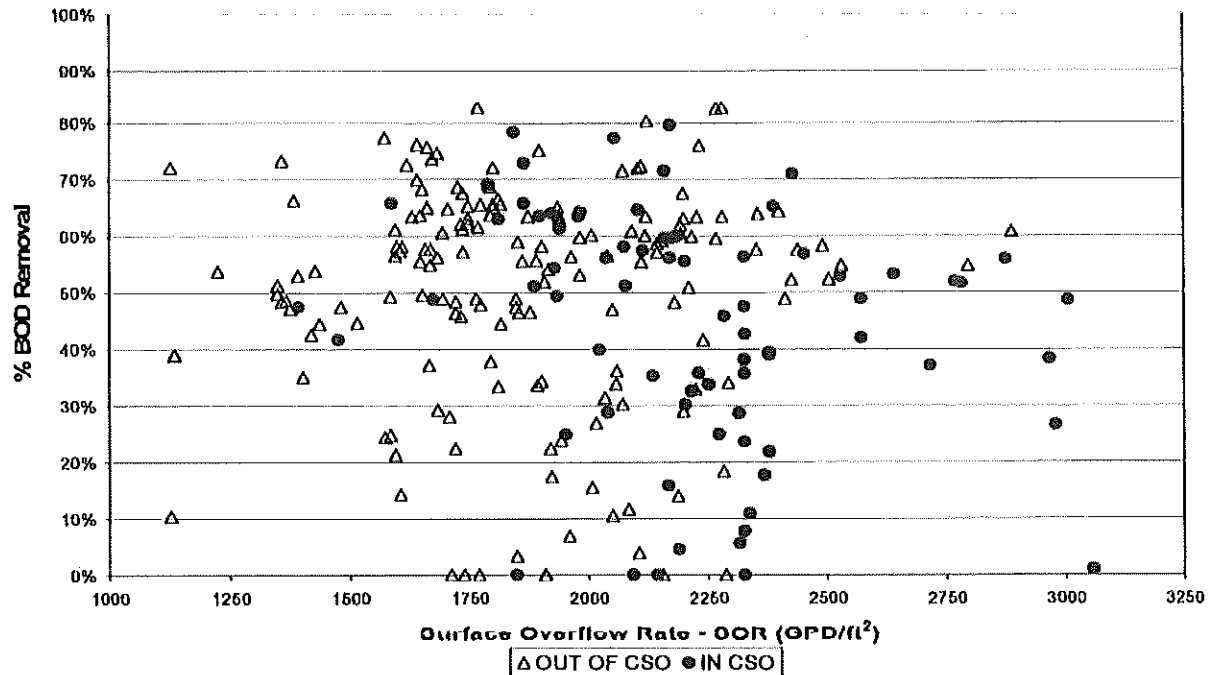
The primary stress testing performed in 2005 and 2006 provided the first opportunity to test the process without co-settling of WAS in the primary sedimentation tank. Figure 10 compares SOR vs. TSS removal during the primary stress testing with the data points also distinguished between "In CSO" and "Out of CSO" conditions. Figure 11 provides a similar comparison of SOR vs. BOD removal. Due to the scatter of data points in Figures 10 and 11 there does not appear to be a direct relationship between the average daily SOR and TSS or BOD removal over the monitored range of SORs.

Figure 10. Average Daily Surface Overflow Rates vs. TSS Removals in Daily Composite Samples



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Figure 11. Average Daily Surface Overflow Rates vs. BOD Removals in Daily Composite Samples



Primary Influent TSS and BOD Concentrations

Sampling data collected showed a relationship between primary influent TSS and BOD concentrations and percent removals. Figure 12 illustrates a comparison of primary influent TSS concentration and percent TSS removal during wet weather CSO events (In CSO) and dry weather conditions (Out of CSO). Figure 13 illustrates a similar comparison of primary influent BOD and percent BOD removal. The following observations are noted from Figures 12 and 13:

- TSS and BOD percent removals increase with higher primary influent concentrations.
- Primary treatment performance is similar when operating "In CSO" or "Out of CSO" conditions with respect to primary influent concentrations.

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Figure 12. Primary Influent TSS Concentration vs. Percent TSS Removal During the ALCOSAN Primary Stress Testing Program

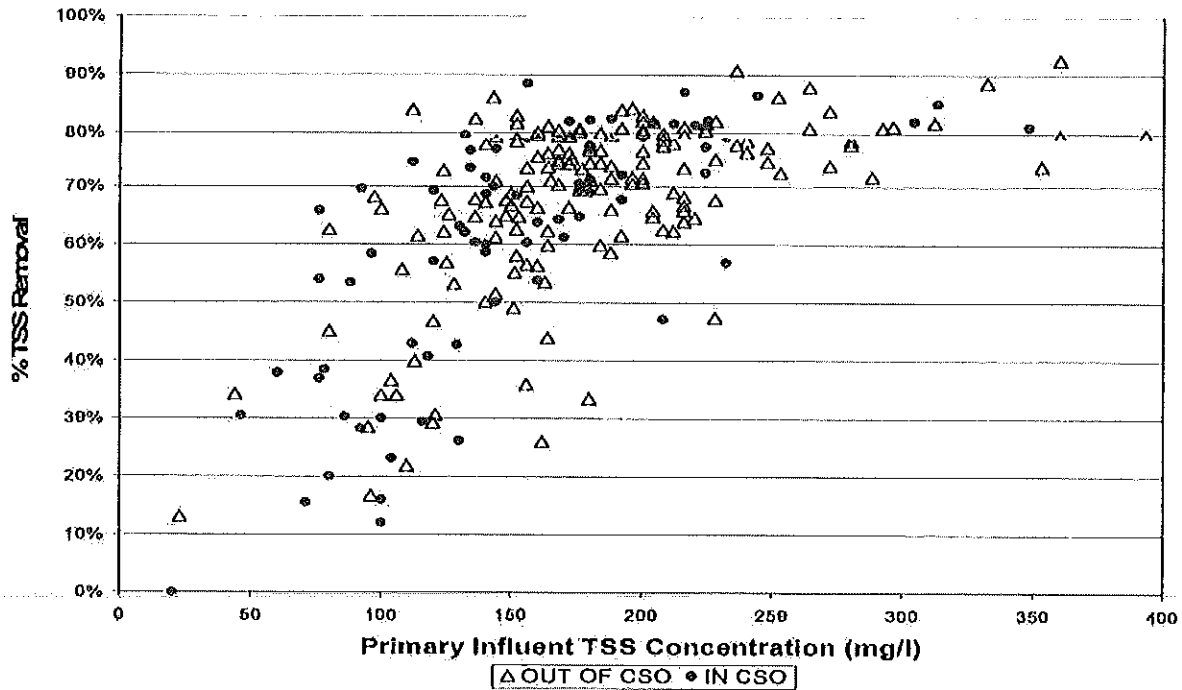
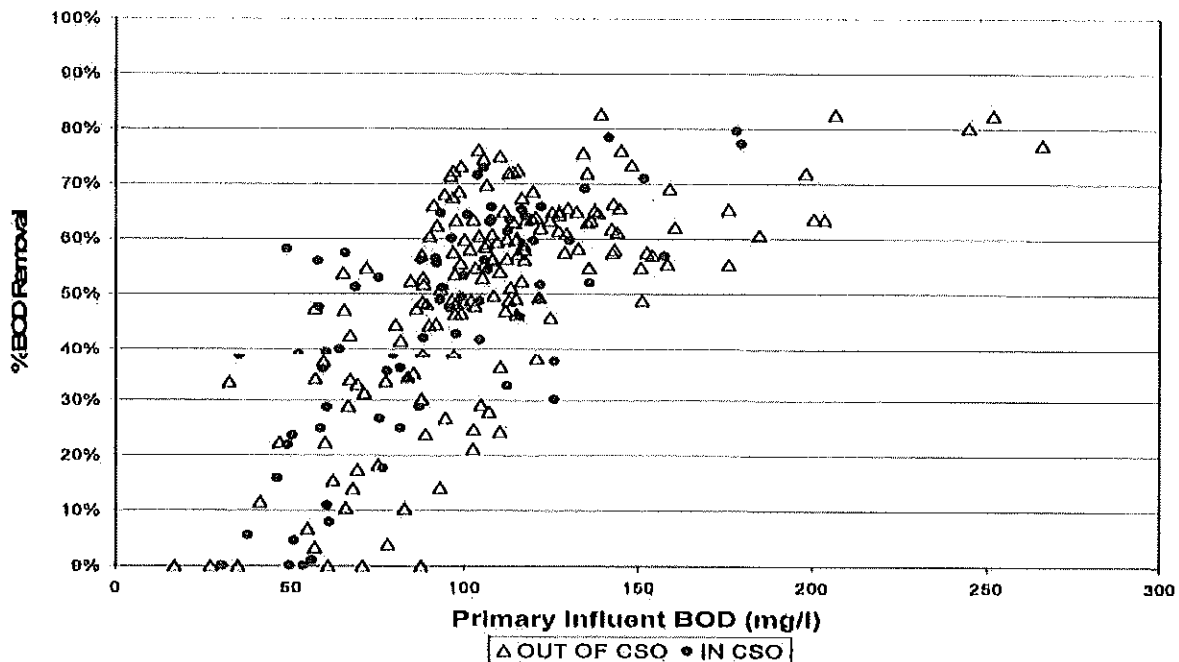


Figure 13. Primary Influent BOD Concentration vs. Percent BOD Removal During the ALCOSAN Primary Stress Testing Program



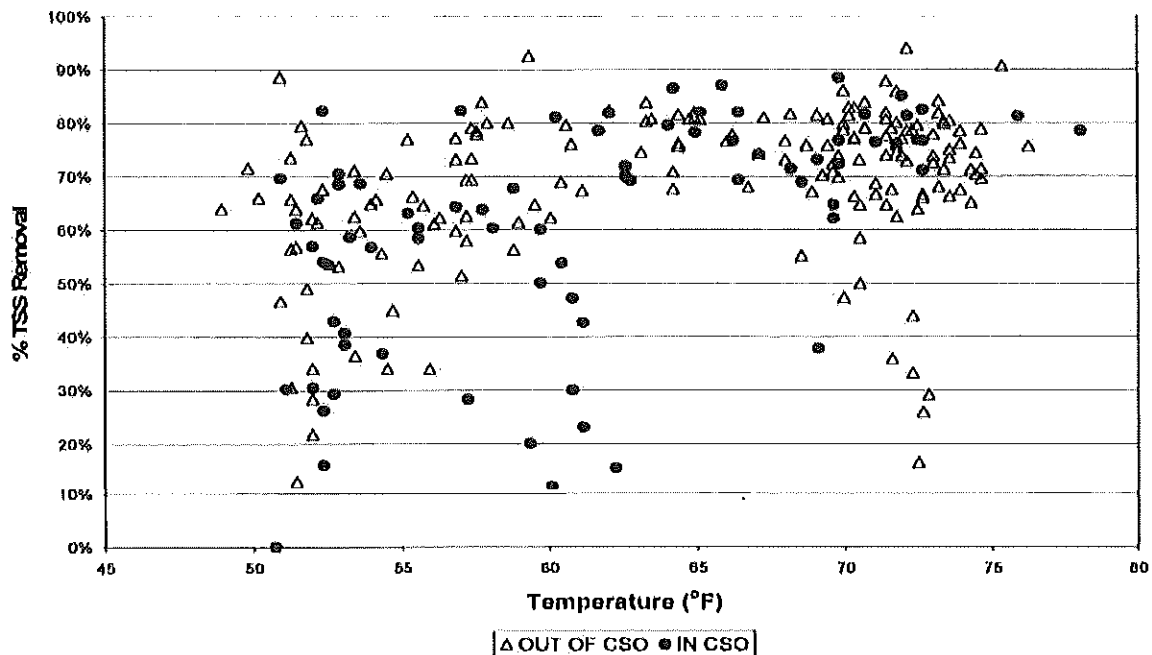
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Wastewater Temperature

The increase in water viscosity resulting from the decrease in temperature slows down particle settling. Literature sources indicate reduced settling performance is experienced at wastewater temperatures below 68-degrees F (M&E Wastewater Engineering Treatment and Reuse, fourth edition, 2003). The relationship observed during the ALCOSAN primary stress testing program between wastewater temperature and TSS and BOD removals is shown in Figures 14 and 15, respectively. Although there is significant scatter in the data, the general trend observed in Figures 14 and 15 suggest the following conclusions:

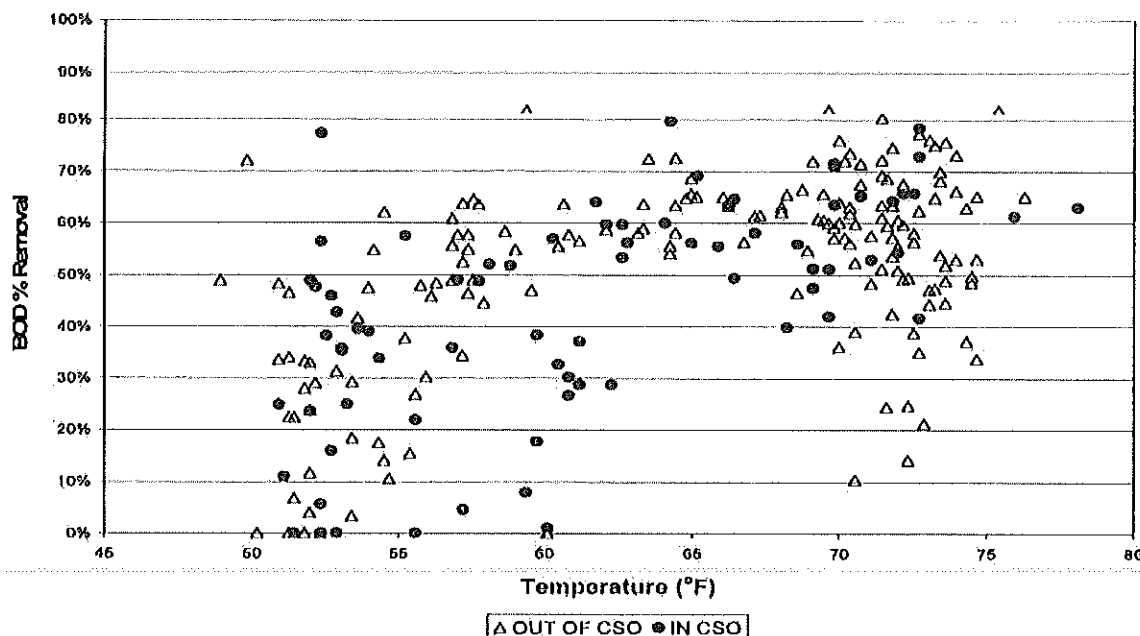
- Wastewater temperatures potentially have an impact on the performance of the primary sedimentation tanks, wherein, as wastewater temperature rises the TSS and BOD percent removals increase.
- The data collected "In CSO" and "Out of CSO" exhibited similar performance results with respect to wastewater temperature.

Figure 14. Wastewater Temperature vs. TSS Removal in Daily Composite Samples During the ALCOSAN Primary Stress Testing Program



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Figure 15. Wastewater Temperature vs. BOD Removal in Daily Composite Samples During the ALCOSAN Primary Stress Testing Program



Two of the three factors that typically affect the performance of primary sedimentation tanks (primary influent TSS and BOD concentrations and wastewater temperature) exhibited recognizable trends during this primary stress testing program. The third anticipated performance factor (surface overflow rates) did not exhibit clear trends over the range of SORs encountered during this study (1,000 to 3,100 gpd/sf).

To further evaluate the possible affect of average daily SOR on performance of the ALCOSAN primary treatment process the collected data was separated into specific ranges of primary influent concentrations. Figure 16 compares the surface overflow rates and percent TSS removal within four ranges of primary influent TSS concentrations, including; less than 150 mg/L, 150 to 199 mg/L, 200 to 250 mg/L and over 250 mg/L. At the three higher ranges of influent concentration shown in Figure 16 (b), (c) and (d) the surface overflow rate appears to have little influence on TSS removal, wherein the percent removals were consistently above 50% during 209 of 217 days across the full range of SORs. However, below 150 mg/L influent TSS the percent removals were inconsistent (0% to 86%) throughout the range of SORs as shown in Figure 16 (a). Figure 17 illustrates a similar comparison of surface overflow rates and percent BOD removal within four ranges of primary influent BOD concentrations, including; less than 100 mg/L, 100 to 149 mg/L, 150 to 199 mg/L and over 200 mg/L. At the three higher ranges of influent concentration shown in Figure 17 (b), (c) and (d) the surface overflow rate appears to have little influence on BOD removal, wherein the percent removals were consistently above 30% during 159 of 170 days

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Figure 16. Average Daily Surface Overflow Rates vs. Percent TSS Removals over Four Primary Influent TSS Concentration Ranges

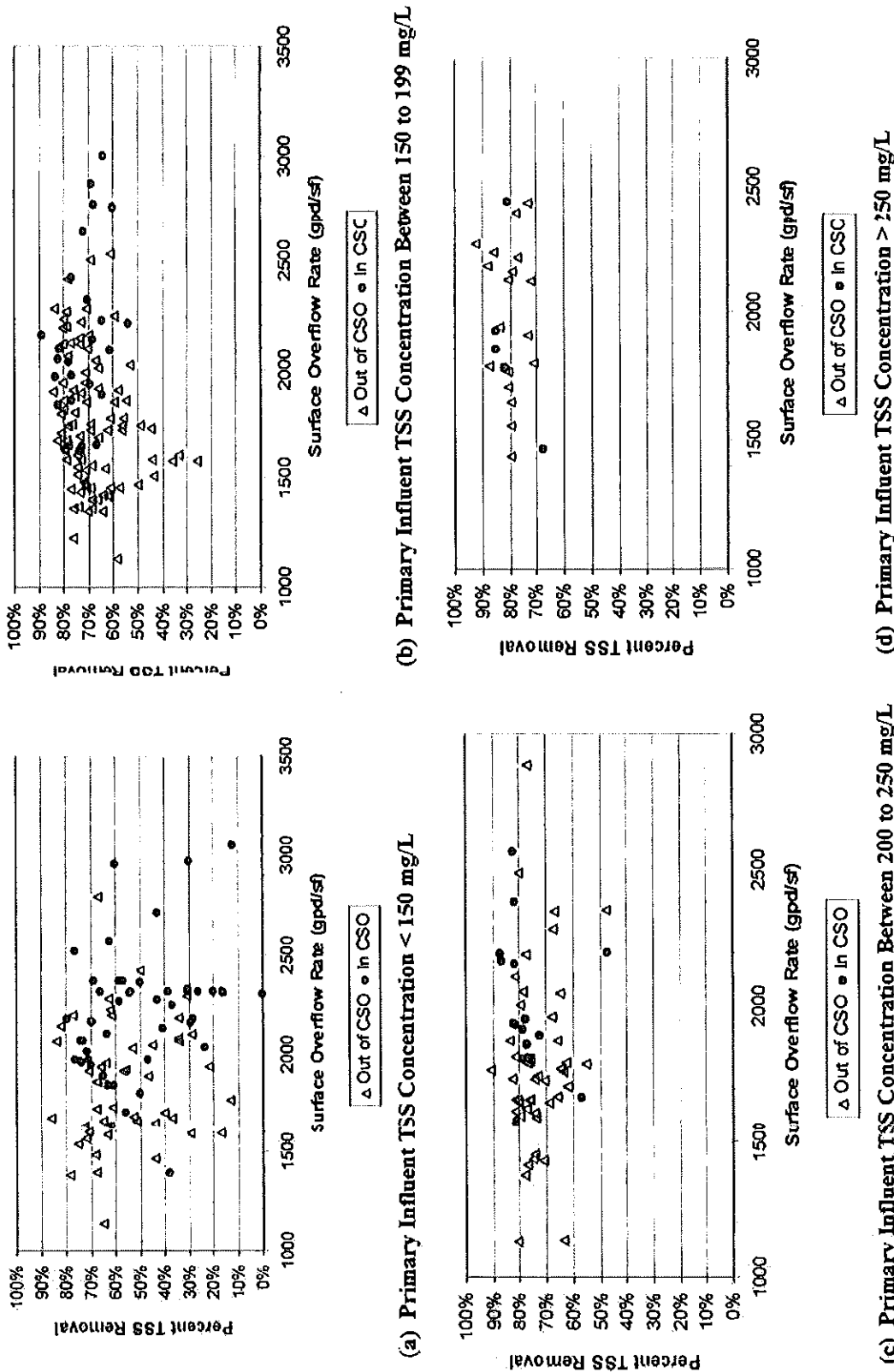
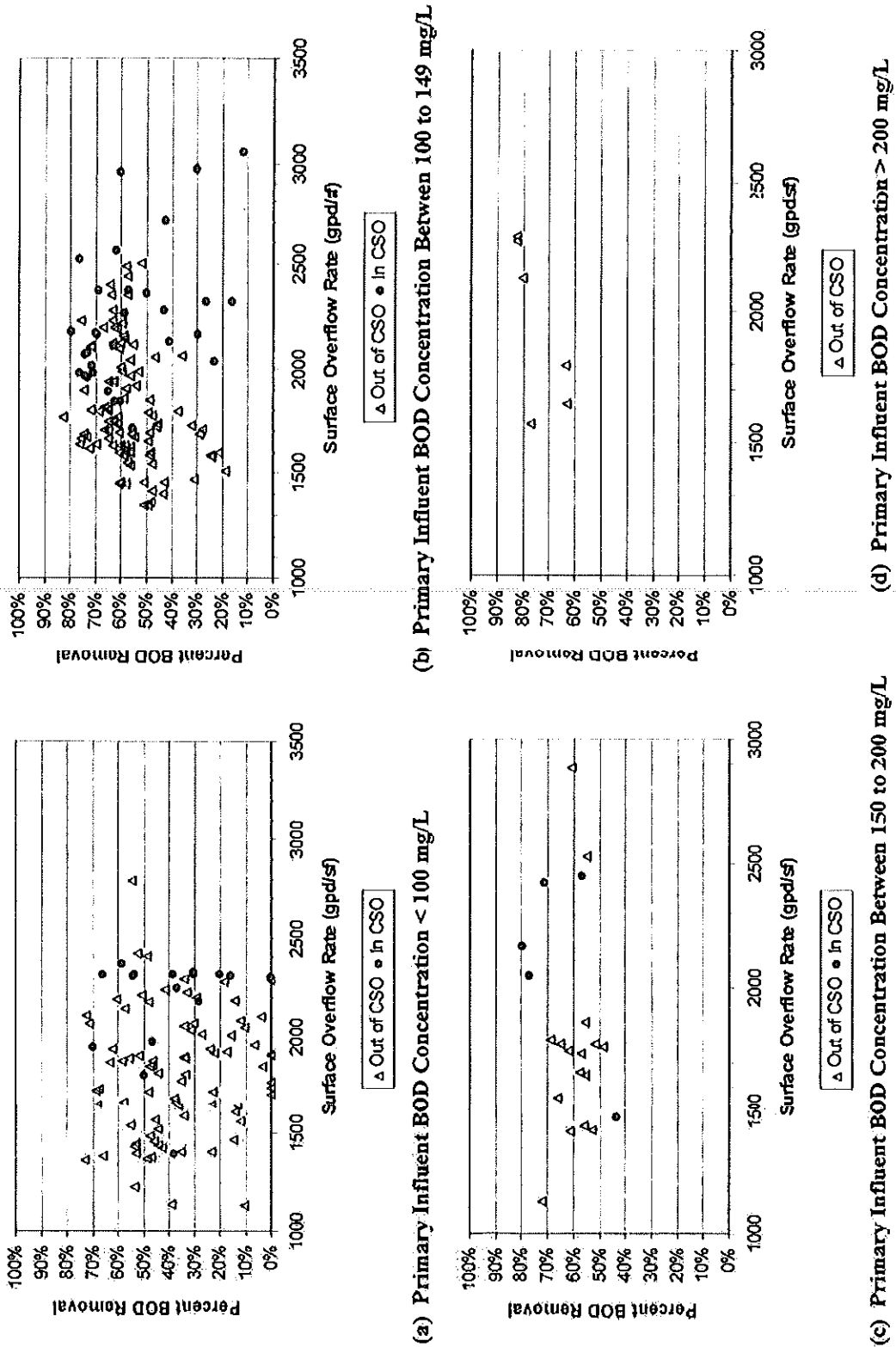


Figure 17. Average Daily Surface Overflow Rates vs. Percent BOD Removals over Four Primary Influent BOD Concentration Ranges

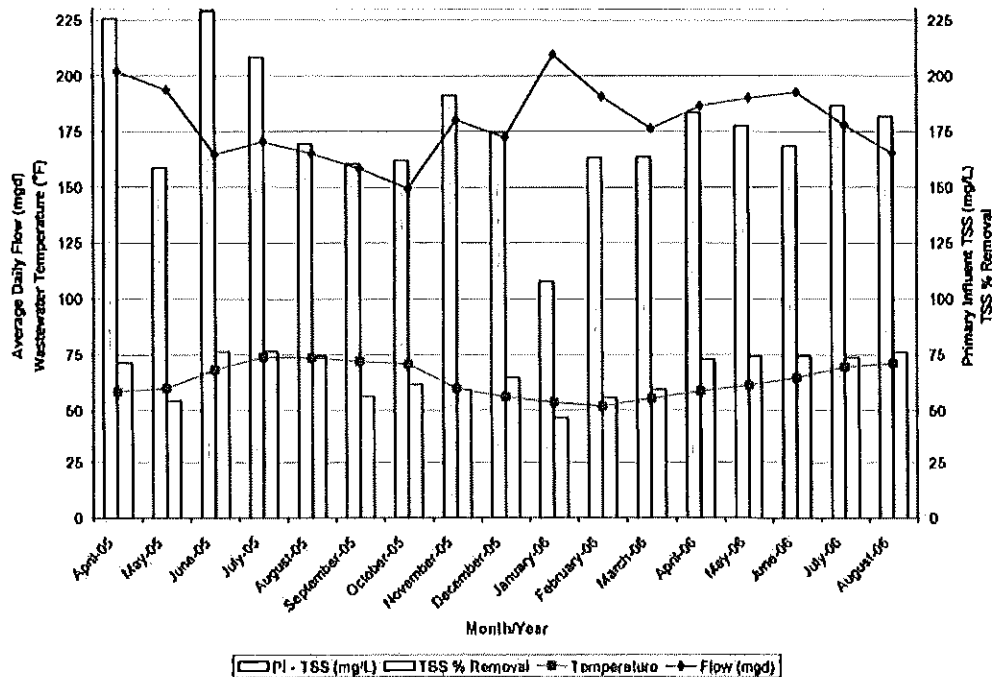


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across the full range of SORs. Below 100 mg/L BOD the percent removals were inconsistent (0% to 73%) throughout the range of SORs as shown in Figure 17 (a). This evaluation further supports a conclusion that the surface overflow rates did not have a discernable influence on TSS and BOD removal in the ALCOSAN primary sedimentation tanks during the primary stress testing program. Similar difficulties finding a strong relationship between SOR and TSS removals have been reported in case studies at other wastewater treatment facilities (WEF MOP FD-8, second edition, 2006).

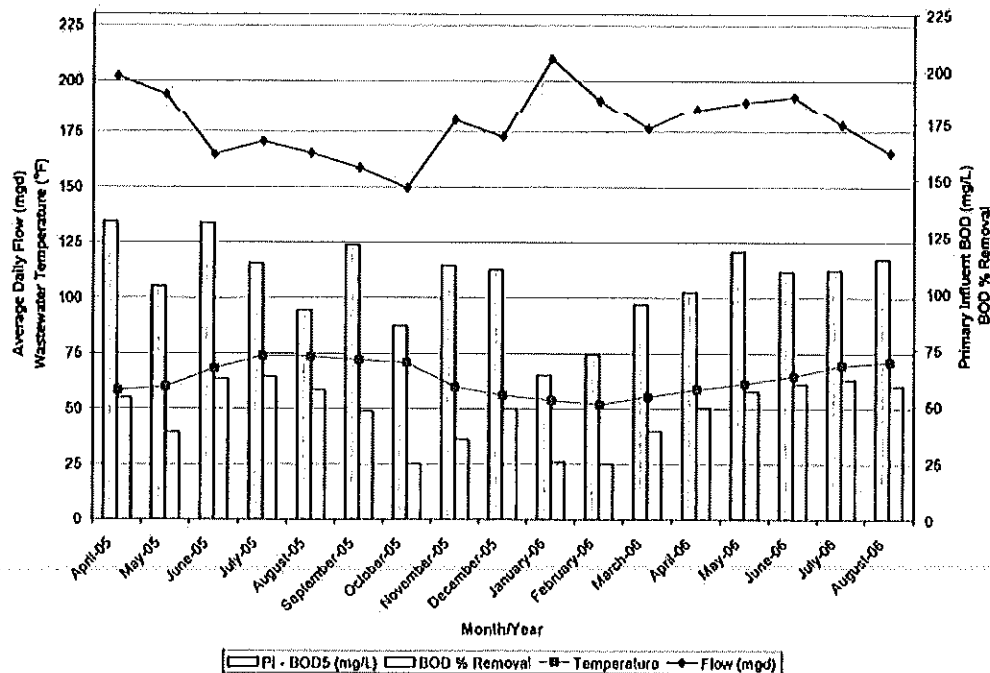
The affects of wastewater temperature and influent concentrations on primary treatment performance are not uniquely separable using the primary stress testing data, since the trends are similar and often occur simultaneously. The colder seasons also exhibit the lowest average primary influent TSS and BOD concentrations when compared to warmer seasons that exhibit higher primary influent TSS and BOD concentrations. For example, the months of January 2006 and February 2006 exhibited the coldest average daily wastewater temperature and also some of the lowest average daily primary influent TSS and BOD concentrations. These concurrent conditions also resulted in some of the lowest average percent removals measured during the primary stress testing program as shown on Figure 18 and Figure 19 for TSS and BOD, respectively.

Figure 18. Comparison of Average Monthly Primary Influent TSS Concentration, Water Temperature and Plant Flow with Percent TSS Removal in Primary Treatment



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Figure 19. Comparison of Average Monthly Primary Influent BOD Concentration, Water Temperature and Plant Flow with Percent BOD Removal in Primary Treatment



PERFORMANCE OF THE PRIMARY SEDIMENTATION TANKS DURING WET WEATHER EVENTS

Although it is not anticipated that hourly performance monitoring of the primary treatment process would be a required as part of a discharge permit; a series of discrete samples of primary influent and primary effluent were collected during 22 CSO events to provide information on the variation of wastewater strength entering the primary sedimentation tanks and the resulting impact on TSS and BOD removals during storm events. The following trends were observed from this sampling effort:

- An early rise, or spike in primary influent TSS concentration is common to most of the storms within the first or second hour of the event.
- A corresponding early rise in the primary influent BOD concentration during the monitored CSO events is typically much smaller in order of magnitude than the TSS spike, or in some cases no significant change was observed in BOD concentration.
- When a storm is preceded by a period of dry weather the TSS concentration of the primary influent is significantly higher and the early spike in concentration is more pronounced than if the storm is preceded by a period of wet weather.

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- After the initial rise in primary influent TSS concentration during a CSO event, it is also typical to experience a subsequent decrease in TSS concentration within one or two hours after the measured peak concentration.

During the 22 monitored CSO events 99 discrete sample sets of primary influent and primary effluent were collected and analyzed in the laboratory for TSS and BOD. These discrete samples allow for determination of hourly TSS and BOD removals during selected periods of the storm events. Table 1 provides a summary of each monitored storm event including the duration of time the plant was operating "In CSO", number of tanks in service, average SOR during the storm, TSS and BOD removals for each discrete sample set and the average TSS and BOD concentrations.

During the 22 monitored CSO events the hourly TSS removals in the primary sedimentation tanks remained within or exceeded the expected process performance range of 50 to 70% during all but four storms and in all but 14 of the total 99 sample sets. Likewise, hourly BOD removals met or exceeded the expected performance range for primary treatment (greater than 30%) for all discrete samples during 15 storms and in all but 18 of the 105 total sample sets.

The storm on May 14 and 15, 2005 provided the opportunity to observe the primary sedimentation tank performance during large storm conditions. Based on the Pittsburgh International Airport weather station data this storm generated a total of 1.27 inches of rain and reached a peak intensity of 0.64 inches-per-hour. Figure 20 shows a time series of plant flow with primary influent and primary effluent TSS concentrations from discrete samples collected during the storm event. Figure 21 presents the same time series of plant flow with primary influent and primary effluent BOD concentrations. These figures also show a simulated plant flow time series if the plant flow was not limited to 235 mgd. The ALCOSAN regional conveyance system computer model used to simulate plant flow during wet weather is further described later in this section of the TM.

An early rise in primary influent TSS concentration was observed during the storm on May 14th from 284 mg/L TSS at 12:00 AM to 376 mg/L TSS by 2:00 AM; which was then followed by a drop in primary influent TSS concentration to 175 mg/L by 6:00 AM. This initial "first flush" was followed by an extended period of dilute primary influent TSS concentration and low percent TSS removal. The TSS removals from the ten sets of discrete samples collected during this storm ranged from 14 to 55% and averaged 32%. These lower than average percent removals reflect the dilution of the primary influent TSS concentration over most of the storm, which averaged 89 mg/L TSS while the primary effluent TSS concentration averaged 60 mg/L in the discrete samples as shown in Table 1.

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Table 1. Summary of Primary Sedimentation Tanks Performance During CSO Events

Date of Storm	Total Rainfall (inches)	Hours Plant In CSO	No. of Primary Tanks in Service	Average SOR (gpd/sf)	Primary Treatment Performance Based on Discrete Sample Sets		Primary Influent: Average Concentration of Discrete Samples		Primary Effluent Average Concentration of Discrete Samples	
					TSS % Removal	BOD % Removal	TSS (mg/L)	BOD (mg/L)	TSS (mg/L)	BOD (mg/L)
4/20-21/05*	0.43	6	4	2,970	88, 71, 59	63, 47, 43	320	194	33	94
4/26-27/05*	0.22	6	4	3,100	52, 57, 52 44, 52, 49	0, 32, 32 48, 54, 51	170	122	80	82
4/30/05*	0.32	4	4	3,100	78, 78, 61	72, 69, 47	184	93	49	33
5/11-12/05*	0.5	4	4	3,100	54, 60, 48, 49	20, 27, 24, 6	300	148	141	118
5/14-15/05*	1.56	50	4	3,100	15, 14, 55, 33, 54 47, 26, 16, 37, 25	16, 6, 18, 23, 31 21, 42, 17, 9, 0	89	53	60	43
5/20/05*	0.4	6	4	3,040	56, 55, 61 72, 52, 62	28, 46, 47 82, 73, 59	130	87	49	33
5/23/05*	0.49	8	4	3,090	79, 84, 72, 75	64, 71, 56, 58	212	86	47	32
6/6/05	0.15	4	5	2,250	34	64	288	131	47	47
6/14/05	0.11	3	5	2,490	69, 75, 75	44, 53, 59	227	110	60	52
6/16-17/05	0.21	2	5	2,460	68, 78, 31, 66, 61	64, 69, 61, 47, 39	164	102	45	45
6/30-7/1/05	0.18	6	5	2,510	74, 86, 84, 81	28, 51, 54, 51	433	119	76	65
7/5-06/05	1.89	7	5	2,430	85, 72, 70 71, 52, 76	70, 68, 60 66, 54, 48	229	109	38	42
7/12-13/05	Trace	3	5	2,490	79, 75, 66, 69	55, 59, 53, 53	244	96	67	43
7/21/05	0.35	3	5	2,410	79, 75, 72	63, 62, 47	284	116	69	49
7/25/05	Trace	3	5	2,400	30	63	188	117	38	43
7/25-26/05	0.62	6	5	2,390	85, 89, 76, 71	68, 68, 69, 49	268	125	50	45
7/26-27/05	0.62	6	5	2,400	74, 78, 70	17, 34, 59	192	92	49	57
8/16/05	0.27	7	6	1,980	78, 91, 85 76, 72, 82	46, 82, 79 58, 70, 77	241	109	42	32
8/29/05	0.47	12	6	1,990	71, 76, 71 80, 71, 66	79, 75, 73 70, 53, 54	181	111	49	35
8/30-31/05	1.18	29	6	1,980	86, 30, 72 71, 73, 74	79, 49, 52 52, 56, 51	176	108	36	39
9/26/05	0.38	11	6	1,730	63, 69, 66 50, 71, 72	57, 56, 45 36, 53, 47	204	137	70	67
9/29/05	0.57	8	6	1,720	79, 77, 72, 46, 44	0, 13, 74, 63, 52	178	110	34	63

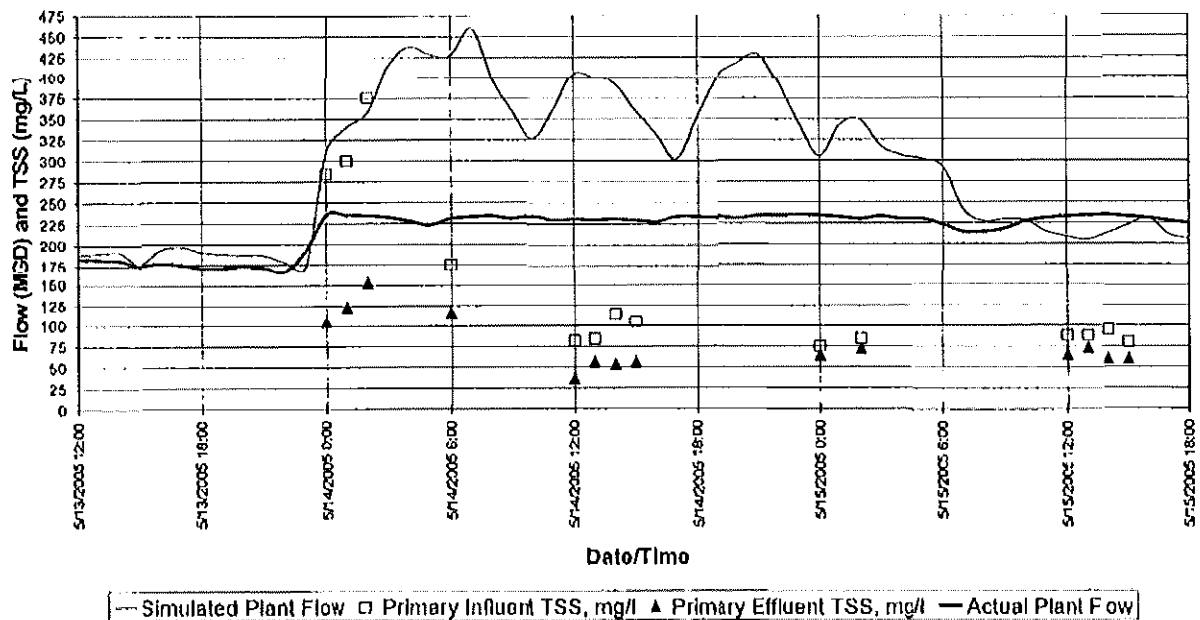
* Storms where plant flows were also simulated using ALCOSAN's Hydraulic/Hydrologic computer model.

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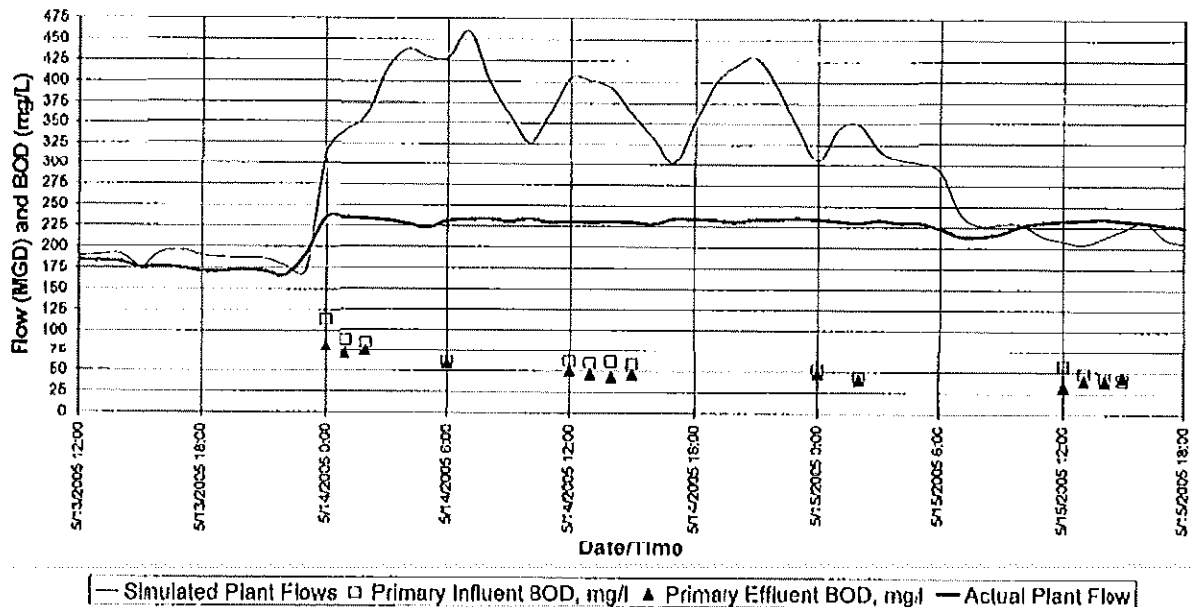
The initial first flush spike in primary influent TSS concentration exhibited in Figure 20 was not observed in the primary influent BOD concentration. As shown in Figure 21 the first sample collected at 12:00 AM on May 14th had a BOD concentration of 114 mg/L, which is close to the overall average daily primary influent BOD concentration. As the storm progressed, dilution of the primary influent BOD concentrations continued to less than 50 mg/L near the end of the storm. The BOD removals from the ten sets of discrete samples during this storm ranged from 0 to 42% and averaged 18%. These lower than average percent removals also reflect the dilution of primary influent BOD concentration during most of the storm, which averaged 53 mg/L BOD while the primary effluent BOD concentration averaged 43 mg/L in the discrete samples as shown in Table 1.

A hydraulic/hydrologic (H/H) computer model of the ALCOSAN regional conveyance system was used to simulate peak wastewater flows to the Woods Run WWTP if there were no limitation of plant capacity. Plant flows were simulated for the months of April and May of 2005 as shown in Figures 1 through 14 included in Appendix E. During this time period of computer model simulation discrete samples of primary influent and primary effluent were collected during seven storm events that occurred between April 20, 2005 and May 5, 2005 as noted in Table 1 above. Five of the seven storms each yielded 0.49 inches of rainfall or less and the computer model simulated peak flows between 350 to 400 mgd and predicted wet weather flow surges lasting 8 to 12 hours. The discrete sampling of primary influent during these storms exhibited average to above average TSS concentrations (116 to 353 mg/L TSS) and BOD concentrations (58 to 211 mg/L BOD). The performance of the primary treatment process, as measured by discrete sampling during the storms, ranged from 44% to 88% TSS removal and 0% to 82% BOD removal.

Figure 20. Primary Stress Testing TSS Time Series during May 14 & 15, 2005 Storm



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Figure 21. Primary Stress Testing BOD Time Series during May 14 & 15, 2005 Storm


The storm beginning on May 11, 2005 was a flash storm (i.e., high-intensity and short-duration) resulting in 0.5 inches of total rainfall; a simulated peak flow of 500 mgd and a wet weather flow surge lasting approximately six hours was predicted by the computer model. During this storm the primary influent TSS and BOD concentrations were above average (268 to 324 mg/L TSS and 131 to 159 mg/L BOD). The performance of the primary treatment process ranged from 48% to 60% TSS removal and 6% to 27% BOD removal.

The large storm beginning on May 14, 2005 yielded 1.27 inches of rainfall. The computer model simulated a peak flow of approximately 460 mgd and predicted a storm surge duration extending over 30 hours with plant flow remaining above 300 mgd for most of the storm as shown on Figures 20 and 21. During this storm the primary influent TSS and BOD concentrations were below average (75 to 115 mg/L TSS and 40 to 62 mg/L BOD). The performance of the primary treatment process ranged from 14% to 55% TSS removal and 6% to 42% BOD removal, though as noted previously, effluent concentrations were also low.

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SUMMARY OF FINDINGS

The primary stress testing program conducted during 2005 and 2006 for evaluating primary sedimentation tank capacity and performance with regard to operation of the plant under wet weather conditions revealed the following findings:

- The hydraulic capacity of each primary sedimentation tank is approximately 60 mgd. Therefore, with all nine primary sedimentation tanks in operation the total hydraulic capacity of the primary treatment process would be 540 mgd which is 10% less than the 600 mgd originally projected for wet weather operation.
- The wastewater sampling performed for the primary stress testing program also provided information on wastewater characteristics during dry and wet weather. For purpose of this study wet weather was defined as when the plant was "In CSO" as a function of the water level in the Main Pumping Station wet well. Dry weather was defined as when the plant was "Out of CSO". Table 2 summarizes the average TSS and BOD concentrations based on daily composite samples of primary influent and primary effluent collected during the primary stress testing program. The average primary effluent TSS and BOD concentrations were similar during both dry and wet weather conditions. It is noteworthy that without the co-settling of WAS in the primary sedimentation tanks the average primary effluent TSS and BOD concentrations observed during the testing program are relatively dilute and close to meeting secondary treatment standards considering that the ALCOSAN NPDES permit limitations for TSS following secondary treatment are 30 mg/L, 45 mg/L and 60 mg/L on a average monthly, average weekly and instantaneous maximum basis, respectively. Similarly, the NPDES permit limitations for BOD are 20 mg/L, 30 mg/L and 40 mg/L (May 1 to October 31) and 25 mg/L, 37.5 mg/L and 50 mg/L (November 1 to April 30) each on an average monthly, average weekly, and instantaneous maximum basis, respectively.

Table 2. Summary of Primary Influent and Primary Effluent Average TSS and BOD Concentrations

Location/Weather Conditions	Average Concentration, mg/L	
	TSS	BOD
Primary Influent		
Dry Weather	181	109
Wet Weather	157	90
Primary Effluent		
Dry Weather	53	51
Wet Weather	54	46

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- The primary influent average BOD concentration during wet weather (90 mg/L) is valuable information for the evaluation of the proposed wet weather split flow operating strategy. Under the split flow strategy a portion of primary influent, equal to the secondary treatment capacity, would bypass primary treatment and flow directly to secondary treatment after initial preliminary treatment (screening and grit removal). Thus, the average BOD concentration to the secondary treatment process while operating under the split flow strategy would be similar to the average primary influent BOD concentration observed during wet weather in the primary stress testing program.
- Within the period and extent of monitoring performed to date, the primary sedimentation tanks performed efficiently in comparison with regulatory standards and design practice, despite high sustained surface overflow rates. Over the entire testing period the SOR averaged nearly 2,000 gpd/sf and the primary treatment process achieved an average 66% TSS removal and 48% BOD removal based on the evaluation of daily composite samples.
- The variation of surface overflow rates 1,000 to 3,100 gpd/sf in the ALCOSAN primary sedimentation tanks did not have a discernable effect on TSS and BOD percent removals during the primary stress testing program. The TSS and BOD percent removals each remained relatively constant throughout the monitored range of SORs except for when the primary influent concentrations were dilute. At primary influent TSS concentrations below 150 mg/L and BOD concentrations less than 100 mg/L, the percent removals were inconsistent across the entire range of observed SORs.
- The primary influent TSS and BOD concentrations appear to have an influence on primary treatment process performance. The TSS and BOD removals exhibited a trend of higher percent removals as influent concentration increases. These trends were similar during both dry and wet weather conditions.
- The wastewater temperature also appears to have an influence on the primary treatment process performance within the wastewater temperature range observed (49 to 78 degrees F). As the wastewater temperature increased so did the percent removals of TSS and BOD. These trends were similar during both dry and wet weather conditions.
- The influence of primary influent TSS and BOD concentrations and wastewater temperature are often concurrent. The months with the lowest percent TSS and BOD removals in the primary treatment process are also the months of lowest wastewater temperature and lowest primary influent TSS and BOD concentrations.

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- Analysis of discrete (hourly composite) samples of primary influent and primary effluent during wet weather events exhibited TSS concentration spikes in the primary influent early in the storm, typical of a "first flush" condition, that were subsequently diluted in a matter of hours. Spikes in the primary influent BOD concentration were experienced, but typically at a lower order of magnitude or not at all compared to the TSS concentrations. TSS and BOD percent removals remained relatively consistent for smaller storm events, but did exhibit some reduction during larger and longer storm events when primary influent TSS and BOD concentrations were diluted below average conditions.

It can be concluded that the findings of the primary stress testing program support the concept of using the primary sedimentation tanks for wet weather treatment at flows up to the hydraulic capacity of each process unit (60 mgd/tank) which equates to a surface overflow rate of approximately 3,100 gpd/sf. This study shows without co-settling of waste activated sludge in the primary sedimentation tanks the primary effluent TSS and BOD concentrations observed during wet weather remains similar to the concentrations observed during dry weather.

Since rerating the primary sedimentation tanks to operate at higher surface overflow rates is a key component of the concept to increase wet weather treatment capacity at the WWTP and the ALCOSAN Consent Decree specifies investigation of enhanced primary treatment as a requisite to the bypass demonstration this TM is concluded with the following comments about enhancements to the ALCOSAN primary treatment process:

- The high efficiency of the existing primary sedimentation tanks periodically raises operating concerns with the activated sludge secondary treatment system, especially during extended dry periods. On those occasions the BOD in the primary effluent is insufficient to maintain an adequate "food" supply to the activated sludge in the aeration basins. When this food to microorganism ratio drops significantly the impacts are loss of biological activity and foam production. Therefore, the installation of permanent enhancements to the primary sedimentation tanks, such as baffles and lamella plates or tube settlers would further aggravate this low BOD loading condition.
- The observation of relatively constant primary effluent TSS and BOD concentrations during both wet and dry weather may be indicative of the nonsettlicable fraction of TSS and BOD in the wastewater. Conventional primary sedimentation can only remove the TSS and BOD associated with the settleable solids in the wastewater (WEF, MOP FD-3, second edition, 2006). The laboratory test method for TSS is actually measuring both settleable and nonsettlicable TSS. Therefore, it is possible that the ALCOSAN primary sedimentation tanks are removing the settleable TSS while maintaining a constant nonsettlicable TSS in the primary effluent during dry and

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wet weather conditions. This theory could be investigated by conducting additional sampling and laboratory tests for nonsettleable TSS in the primary effluent using Method 2540 of Standard Methods (WEF, MOP FD-8, second edition, 2006).

- Chemically enhanced primary treatment (CEPT) uses coagulant and/or flocculant addition to raw wastewater to improve the removal efficiency of settleable solids and also remove a portion of the nonsettleable solids by increasing particle size. While the implementation of CEPT for wet weather treatment at ALCOSAN may be potentially feasible it would need to be explored by bench studies and field testing in order to predict full-scale performance.



**ALCOSAN Phase 2 Facilities Planning
for the Woods Run WWTP**

Draft Bypass Justification Report

April 2010

CDM



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**PHASE II FACILITIES PLANNING
MEMORANDUM**

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Date: May 24, 2006

From: Joe Lagnese, EPM and Chris Yendell, EPM

Subject: Draft Technical Memorandum SDO-1 – CIP Phase II Facility Plan Update - Pilot Plant Testing

Contents: Introduction
Pilot Plant Concept
Scope of Work
Results of Testing Program
Discussion of Findings
Recommendations
Tables
Figures
Testing and Sampling Protocol

INTRODUCTION

PURPOSE

This memorandum summarizes the design modifications, renovation and two phases of operation of ALCOSAN's secondary treatment pilot plant. The first phase of operation was initiated on February 14, 2005 and continued through May 27, 2005. The second phase of operation was initiated on January 16, 2006 and continued through April 2, 2006. The purpose of the pilot studies was to examine the feasibility of the proposed split flow concept of wet weather treatment at ALCOSAN's Woods Run Wastewater Treatment Plant (WWTP), as more fully outlined below.

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PROGRAM HISTORY

In fulfillment of the requirements of the Pennsylvania Sewage Facilities Act of 1965 (Act 537), and in accordance with the 1994 Federal Clean Water Act and in response to directives received from PaDEP, the Board of Directors of ALCOSAN authorized the completion of a Comprehensive Sewage Facilities Plan during 1994. The scope of this planning effort included the following topics:

1. Elimination of odors detectible off-site from the ALCOSAN WWTP.
2. Expansion of secondary treatment capacity to site limits for anticipated growth, redevelopment and increased wet weather capacity.
3. Maximization of flows to the treatment plant during wet weather to reduce the discharge of sewage to the rivers and streams of southwestern Pennsylvania.
4. Assumption of broader technical and institutional roles in managing wet weather flows in the member communities.
5. Institution of a long-range comprehensive plan that uses funds efficiently for capital improvements and operations.
6. Provision of wastewater treatment capacity for communities in watersheds with inadequate collection and treatment facilities, as well as communities serviced by WWTPs with operational problems.

This Act 537 Plan was finalized and submitted to PaDEP during 1996. The document was subsequently approved by PaDEP during 1997.

ACT 537 PLAN TREATMENT PROCESS RECOMMENDATIONS

The current pilot plant effort is associated with ALCOSAN's Act 537 Plan recommended alternative for expansion of secondary treatment capacity for anticipated growth and maximization of treatment plant flows during periods of wet weather. The Act 537 Plan proposes for wet weather treatment the following operational strategies:

- For flows up to 275 mgd: Primary clarification and secondary treatment of all headworks (screened and degritt) flow, followed by disinfection prior to discharge.
- For flows of 275-600 mgd: Primary clarification of all headworks flows and secondary treatment of 275 mgd of the primary clarifier effluent, with remaining

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primary clarifier effluent flow (0 – 325 mgd) bypassing the secondary process and mixing with the secondary effluent prior to disinfection and discharge.

- For flows of 600-875 mgd: Secondary treatment of 275 mgd of headworks flow and primary treatment of the remaining headworks flow (325 – 600 mgd), with the primary effluent and secondary effluent being combined prior to disinfection and discharge.

Given that there are few large treatment plants using this approach to wet weather treatment, piloting was deemed desirable to ensure its feasibility at ALCOSAN. This technical memorandum deals specifically with the feasibility of the proposed treatment scheme as tested by the pilot plant treatment facility.

Beyond the scope of this effort is the manner by which transmission, and the transition between the different flow regimes may be managed. These considerations will be dealt with in subsequent technical memoranda.

STATUS OF CONSENT DECREE NEGOTIATIONS

Subsequent to the approval of ALCOSAN's 537 Plan, ALCOSAN submitted a Regional Long Term Wet Weather Control Concept Plan (LTWWCCP). The purpose of the plan was to outline a general strategy for meeting regulations and policies for control of SSOs and CSOs. The 537 Plan proposed approach to wet weather treatment at the WWTP is an integral component of the LTWWCCP. Following submittal of the LTWWCCP, ALCOSAN entered into a dialogue with PaDEP and USEPA regarding the plan and its proposed wet weather management strategies. After initial discussions, the regulatory agencies determined that ALCOSAN's wet weather management strategies should be the subject of an adjudicated Consent Decree. Negotiations on the terms of the Consent Decree began in 2000 between ALCOSAN, the U.S. Justice Department, USEPA, PaDEP and ACHD. To date, however, the specifics of this agreement are still under negotiation and have not been finalized.

BYPASS DEMONSTRATION AND INTERIM ROUTING PLAN

Indications are that the proposed approach to wet weather treatment will be considered as part of ALCOSAN's Long Term Control Plan submittal for wet weather flow management. Pursuant to this, a Draft Workplan for development of Bypass Demonstration Documentation has been developed and is intended to satisfy the requirements of both the Interim Routing Plan and the Bypass Demonstration Appendix of the Consent Decree currently under negotiation. It is also intended to satisfy the Bypass Demonstration requirements of 40 CFR 122 as outlined in USEPA's CSO Policy.

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PILOT PLANT CONCEPT

GOALS AND OBJECTIVES

General

The present flow regime at the ALCOSAN treatment facility includes secondary (activated sludge) treatment of screened, degritted and primary treated wastewater. The Act 537 Plan's proposed treatment methodology involves bypassing a portion of headworks wastewater directly to secondary treatment using the existing processes.

Phase 1 Pilot Testing Program

The main objective of the Phase 1 pilot testing program was to demonstrate the ability of the secondary treatment process to meet discharge permit conditions when treating 275 mgd of headworks flow without primary treatment during wet weather flow conditions. A second objective was to demonstrate that the secondary treatment process is capable of treating a constant flow rate of 275 mgd of primary clarifier effluent for extended periods of time when the plant flow is in the range of 275 – 600 mgd.

Phase 2 Pilot Testing Program

The main objective of the Phase 2 pilot testing program was to demonstrate the ability of the secondary treatment process to meet discharge permit conditions during wet weather events, particularly during relatively rapid change-overs from treating primary effluent to the treatment of primary influent, and the eventual return to treating primary effluent. A second objective was to evaluate the use of chemical treatment (polymer addition) to enhance secondary clarifier efficiency during wet weather events.

PILOT PLANT FACILITIES

Existing Facilities

The concept of pilot scale treatment is not a new one at ALCOSAN. In the late 1980's, a pilot treatment plant having two process trains was constructed to investigate the effectiveness of secondary treatment using specially developed microorganisms (i.e. bio-augmentation). The majority of the original pilot treatment facility remained in the central pipe gallery at the facility.

Upon initiation of the current effort, each train of the existing pilot treatment plant consisted of four 300 gallon nominal capacity process tanks and a six foot diameter 675 gallon nominal capacity clarifier. Each train was also equipped with an additional 300 gallon nominal

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capacity waste sludge tank. Several non-operational progressing cavity pumps also remained from the previous effort. Additional equipment included an influent flow splitter box and an aeration system fed from the full-scale plant aeration system.

The current pilot testing program is similar to the previous in that it duplicates the full-scale process, and requires the same number and type of tanks. Given the above, and in the interest of time and money, it was desirable to utilize existing equipment as much as possible for this effort. ALCOSAN staff involved with the operation of the first pilot plant reported several shortcomings of the facility as follows:

- The progressing cavity pumps suffered excessive wear, presumably due to the accumulation of grit within the system.
- Excess scum and floatable materials accumulated on the liquid surface of the process tanks.
- Solids tended to accumulate and 'bridge' in the cone section of the clarifiers reducing the efficiency of the return sludge transfer system.

Phase 1 Pilot Testing Program

To address the above issues, the following modifications were made:

- A new 350 gallon scum and grit tank was added upstream of each process train to address the floatables and premature pump wear problems.
- Fillets were added to the cone bottoms of the clarifiers to reduce the clarifier sludge accumulation problems experienced in the previous effort.

In addition to the above, the following modifications were made:

- A primary influent water feed system was constructed consisting of an induced flow centrifugal pump, in-line grinder and 2-inch diameter piping and appurtenances to bring primary influent flow from the east primary influent channel to the scum and grit tanks.
- A primary effluent water feed system was constructed consisting of a submersible pump and 2-inch diameter piping and appurtenances to bring primary effluent flow from one of the east primary effluent launders to the scum and grit tanks.
- Ten portable mixers were purchased and installed in the process and scum and grit tanks to enhance oxygen transfer and/or ensure mixing of waste constituents.

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- Six progressing cavity pumps driven by adjustable frequency drives were purchased and installed to function as feed, return, and waste sludge pumps. Associated 2-inch diameter piping and appurtcnances were also installed to facilitate proper system operation.
- Four samplers were installed to monitor the quality of the primary influent, primary effluent and pilot plant process train effluents.
- A return activated sludge (RAS) recycle loop was added to each clarifier to address sludge accumulation problems which were again experienced in the current effort. Utilizing the waste activated sludge (WAS) pump, this loop draws sludge from the conc section of the clarifier for discharge back to the clarifier bottom through a 2-inch diameter header pipe equipped with an end cap and small side orifices. The pumped recycle loop acted to fluidize the settled solids in the clarifiers thereby reducing the compaction of solids observed to cause operational problems.

Phase 2 Pilot Testing Program

Experience gained in operating the pilot treatment facilities under the Phase 1 testing program identified several opportunities for improvement. Pursuant to the above, the following modifications were made to the system in advance of conducting the Phase 2 Pilot Testing Program:

- The 1.5-inch diameter lines connecting Pass 4 and the clarifier influent were upsized to 3-inch diameter.
- A flushing connection was installed on the spool piece upstream of the Primary Influent Grinder.
- Two 40 gpm submersible Primary Effluent pumps were purchased to replace the existing two 25 gpm Primary Effluent Pumps.
- A spare progressing cavity pump was purchased to serve as a back-up for the Feed, RAS and WAS pumps.
- The suction lines of the Feed Pumps were interconnected and valved such that both pumps can draw flow from either of the Scum and Grit Tanks simultaneously, or from both Scum and Grit Tanks separately.
- A chemical feed system (dilution/feed tank and a polymer feed pump) was installed to facilitate polymer addition to the East Train.

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- Plastic scum baffles were added around the periphery of the clarifier weirs after initiation of the testing to minimize loss of floating solids in the effluent.

The process flow diagram for the renovated pilot plant is presented in attached Figures 1A and 1B.

RELATIONSHIP TO FULL SCALE CONDITIONS

The existing full scale ALCOSAN treatment facility employs the unit operations of pumping, screening and degritting, primary sedimentation, activated sludge secondary treatment (normally operating in the contact stabilization mode), final clarification and disinfection prior to discharge. The capacities of the various unit processes are presented in Table 1.

The following is a tabulation of primary clarifier influent and effluent BOD₅, COD, TSS and VSS average values based on those reported by ALCOSAN for the year 2004. Percent removals of these parameters in the primary treatment step is also given.

Parameter	BOD ₅ (mg/L)	COD (mg/L)	TSS (mg/L)	VSS (mg/L)
Primary Clarifier Influent	92	183	148	110
Primary Clarifier Effluent	51	102	49	37
Removal (%)	40	40	65	64

The contact stabilization mode of the activated sludge process was developed for municipal wastewaters that have an appreciable amount of organic matter in the form of particulate solids that are readily sorbed. In theory, contact stabilization involves two passes or tanks, one for the sorption of organic materials, and the other for bio-oxidation of the sorbed materials. The current full scale aeration process is designed to permit one-pass sludge stabilization, with the feed of primary clarifier effluent being sent as plug flow through the remaining three passes. Alternately, the process can be operated with step feed to all three passes. The pilot plant was designed such that the first of the four passes would be used for sludge stabilization and the remaining three passes would be used for aerating the mixture of primary clarifier effluent/influent and partially stabilized RAS.

Since the pilot study focused on the performance of the secondary treatment process at the facility, it was necessary to establish a relationship between the full-scale and pilot-scale processes. The flow rate to the pilot plant has been calculated on a proportional basis corresponding to full scale aeration volume (30 million gallons) and pilot plant aeration volume (1,200 gallons). On this basis, the pilot plant flow rate corresponding to the full scale plant flow of 275 mgd is 7.64 gpm. As a practical matter, the feed rates were maintained at approximately 8 gpm.

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The RAS rate of the full-scale facility was similarly utilized to proportion the RAS rate of the pilot-scale facility. The full-scale RAS ratio to plant forward flow was calculated as 105/275 or 0.38. This corresponds to a pilot-scale RAS rate of 2.9 gpm based upon a forward flow of 8 gpm. However, because of clogging difficulties in the final clarifiers, the RAS rate of the pilot plant was increased to 4 gpm (or 0.50 RAS ratio) just preceding the start of the target 2,000 mg/L MLSS test series conducted during the Phase 1 Pilot Testing Program.

It is difficult to size a prototype final clarifier that will perform equivalent to a full scale facility. A particularly limiting factor where hindered settling is involved is the depth dimension. The existing plant final clarifiers have a depth of over 14 feet whereas the pilot plant clarifiers have a total depth of only five feet and straight sides of only 19 inches. It should also be noted that the configuration of the pilot plant clarifiers, especially with respect to effluent weir configuration (i.e. four small weir boxes spaced evenly around the perimeter) is substantially different, (and much less ideal) than the full circumference effluent weirs on the plant's full size clarifiers. Accordingly, the clarifiers only function in the study was to provide for the recycling of concentrated mixed liquor solids to the aeration units while maintaining solids loss to a level less than the wasting required to maintain the target MLSS and solids retention time (SRT), which was accomplished throughout the study. The adequacy of the existing final clarifiers has been evaluated on the basis of various test settling characteristics of the mixed liquor monitored during the study, which were then applied to accepted prediction models for full scale performance.

The present operation of the WWTP includes co-settling of primary and waste activated sludge (WAS) within the primary clarifiers. To ensure primary effluent quality at higher hydraulic loading rates, the Act 537 Plan recommended separate thickening of primary sludge and WAS. To simulate this provision, the East primary clarifiers, the source of primary clarifier effluent for pilot plant testing, were operated without WAS co-settling throughout the duration of the Phase 1 pilot testing and the majority of the Phase 2 pilot testing. Co-settling of primary and WAS resumed on March 6, 2006.

LIMITATIONS

In theory, pilot scale testing is designed to represent full scale conditions. In reality, there are limitations to any pilot scale testing program. A summary of the known limitations of the Phase 1 pilot plant operation representing full scale performance are as follows:

- The pilot plant was run continuously regardless of prevailing weather conditions (after initial acclimation, the West train always on primary effluent, the East train always on primary influent). The strength of the primary clarifier influent feed to the pilot plant during the test period varied with prevailing weather conditions. With the exception of wet weather first flush, flow during dry weather is expected to be more concentrated than during wet weather. It is also reasonable to expect that the impact

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of first flush on plant operations will have occurred prior to the time that the flow reaches 600 mgd, the flow rate at which secondary treatment of the headworks flow may be initiated. This should lead to more conservative conclusions with regards to wet weather organic loadings.

- The performance testing of the pilot plant train receiving headworks flow had the benefit of a period of acclimation, whereas the manner and extent that the transfer of process flow will occur under full scale operating conditions had yet to be fully developed.
- Although there are testing methods and modeling procedures applicable to pilot plant operations to assess the capability of the existing clarifiers to provide adequate thickening, there do not exist similar tests and procedures for assessing the adequacy of the existing final clarifiers for achieving clarification, or capture of pinpoint floc, above the sludge blanket. Here, professional judgment based on design overflow rate standards is required.

A summary of the known limitations of the Phase 2 pilot plant operation representing full scale performance are as follows:

- The manner and extent that the transfer of process flow will occur under full scale operating conditions has yet to be fully developed. For the purpose of the testing, wet weather was deemed present at such time that the main plant entered CSO conditions (i.e. when the plant wet well was at a level greater than or equal to 685 feet). Notification that the main plant was in CSO mode came through plant security by radio or phone. Given that the pilot plant was manned two shifts per day, the switchover to CSO mode for the pilot plant could be delayed.
- The number and duration of CSO events experienced during the Phase 2 testing period was limited. Only six relatively minor CSO events were experienced, with the longest event having a duration of approximately four days.
- Bench scale testing of polymers revealed a very significant improvement in the speed and extent of solids settling. However, the results of polymer use in the pilot plant operation have not been satisfactory in that a significant amount of floating material developed on the clarifier during its use. This problem could be the result of one or more of several factors, including inadequate mixing of polymer and mixed liquor, entrainment of air from the high DO and highly mixed contact basins, or the use of recycled sludge to prevent bottom clogging of the clarifier. Additional pilot testing would be required to better assess the significance of the various potential causes.

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SCOPE OF WORK

OPERATIONAL PROTOCOL APPROVED BY PADEP

In preparation for Phase 1 of the pilot testing program, a testing and sampling protocol was developed. A copy of the protocol dated August 12, 2004, as submitted to PaDEP for approval, is attached. Approval of the protocol was received by letter from PaDEP dated September 21, 2004 (copy attached).

In discussions with ALCOSAN following the Phase 1 pilot testing program it was noted that due to unusually dry weather, there was no opportunity to assess the performance of the activated sludge process following a change of feed from primary clarifier effluent to primary clarifier influent during "real-time" wet weather conditions. Further, it was noted that some degradation of secondary clarifier effluent quality occurred during periods of extended primary influent feed to the process. Exploration of the use of polymers was a recommendation for further testing. For these reasons it was deemed advantageous to proceed with a second phase of pilot testing. Pursuant to this, a protocol was developed to be followed for the Phase 2 pilot testing program (copy attached).

DEVIATIONS FROM APPROVED PROTOCOL

Establishing a protocol serves as a framework to follow for any testing endeavor. No protocol, however, can fully anticipate what will actually happen during real time testing conditions. Consequently, peculiarities discovered during the Phase 1 testing program necessitated implementation of the following deviations from the approved protocol:

- Although testing evaluation was maintained at two different target MLSS concentrations of 1,500 and 2,000 mg/L of the originally proposed testing protocol, it was necessary to repeat the initial 1,500 mg/L MLSS test series because of the reliance upon COD measurements for monitoring the reduction of biodegradable organics that proved to be faulty and unreliable.
- Although the original protocol statement anticipated the possibility of significant increases in the RAS rate proportionally above plant capability, it was only necessary to increase the recycle ratio (ratio of RAS rate to influent flow rate) from the plant's present capability of 105 mgd/275 mgd or 0.38 to the pilot plant's ratio of 4 gpm/8 gpm or 0.50.
- It became apparent that the two trains performed nearly equally on the basis of effluent CBOD₅. There was, therefore, no reason to expect that the effluent of the train receiving headworks flow would have a chlorine demand different from the present full scale operations as demonstrated by the pilot plant train receiving primary

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clarifier effluent. On this basis, the originally intended chlorine demand testing was voided from the study.

- A period of excessive wet weather flow conditions did not occur during the six months of Phase 1 pilot plant testing and the intent given in the protocol to monitor pilot plant performance under alternating severe flow conditions could not be achieved.

The Phase 2 pilot testing program deviated from the protocol as follows:

- Sludge collector equipment problems required primary sedimentation tanks E-0 and W-0 to be taken out of service. These tanks were being used to separately gravity thicken WAS to avoid co-settling of WAS in the primary sedimentation tanks. As a result of these equipment problems, cosettling of WAS in the primary sedimentation tanks resumed on March 6, 2006 and continued through the conclusion of the Phase 2 pilot testing program.

ACTUAL MODE OF OPERATION

The pilot plant was set up as two individual, four pass, process trains, each intended as a small scale version of one process train of the actual full-scale treatment facility. The trains were designated West and East, with each train capable of receiving either primary influent or primary effluent feed.

For the Phase 1 pilot testing program, the West Train functioned as the control (primary effluent feed) and the East Train as the test (primary influent feed) train. Proportioned on process volume at a flow of 275 mgd, each pass of the pilot plant was designed to operate at a forward (feed) flow of 7.64 gpm (8.0 gpm). The return activated sludge (RAS) rate was variable, but was set at 50% of the forward flow.

As in the case of the full-scale facility, the pilot plant was operated in the contact stabilization mode of the activated sludge process. Pass 1 served as the stabilization tank and Passes 2 through 4 served as the contact tanks. Mixed liquor flowed from Pass 4 into the clarifier where solids separation occurred. Treated effluent flowed over the weirs and into a continuously overflowing sampling bucket, while settled solids were returned to Pass 1 at a controlled rate. Periodic wasting of solids, in addition to those lost in the effluent, was required to maintain mixed liquor solids at designated test conditions (i.e. 1,500 and 2,000 mg/L). Pilot plant effluent and waste sludge flowed into a sump where it was pumped to the full-scale treatment process.

For the Phase 2 pilot testing program, process parameters (i.e. mode of operation, feed, recycle rates, sludge wasting, etc.) remained identical to those employed in Phase 1. In

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Phase 2, however, both trains functioned as wet weather test units operated at a target mixed liquor solids concentration range of between 1,500 and 2,000 mg/L. Upon initiation of the test, both trains were given primary effluent feed throughout the system acclimation period. Upon notification that the main plant entered CSO conditions, as defined by wet well level reaching elevation 685 feet, the switchover from primary effluent to primary influent feed (i.e. CSO mode) was made to both trains. The CSO mode of treatment was then maintained until the main treatment plant wet well level subsided to elevation 680 feet or lower, at which time both trains were switched back to primary effluent feed. For practical purposes, operation in the CSO mode was maintained for a minimum of 24-hours following the initiation of the switchover from primary effluent to primary influent feed. Concurrent with the wet weather testing, and throughout the operation in CSO mode, the East Train mixed liquor flow to the clarifier was dosed with polymer solution to investigate its effects on settleability.

SAMPLING AND MONITORING

Sampling during the pilot plant operation consisted of composite and grab samples. The composite samples were taken to assess loadings and performance, whereas the grab samples were for operational purposes. Additionally, the process tanks were field monitored for pH and dissolved oxygen content.

Four composite samplers were utilized at the pilot treatment facility. Two of the samplers were set up to sample the primary influent and primary effluent feed. The other two samplers drew samples from the East and West Train clarifier effluents. Isco portable composite samplers were utilized for this purpose. The samplers were programmed to draw samples at 15 minute intervals. The samples were composited over a 24-hour period into a single container.

Settleability tests (i.e. zone settling and sludge volume index) were run in the field on a daily basis on the Pass 1 (return sludge) and Pass 4 (mixed liquor) tanks. Grab samples of the Pass 1 and Pass 4 contents were also collected for analysis.

LABORATORY ANALYSES

Samples collected on a daily basis were taken to the ALCOSAN laboratory for analysis. The sampling and testing protocol was modified during the Phase 1 pilot testing effort. Initially, the theory was to derive a correlation between COD and BOD₅ that would allow monitoring of COD, which is a faster test. This effort failed to establish a suitable correlation, particularly in the clarifier effluent samples. As a result, daily monitoring of BOD₅ was initiated in lieu of COD, prior to the initiation of the testing for which the performance evaluation is reported herein. The modified sampling and testing protocol continued throughout the remainder of the Phase 1 and Phase 2 pilot testing programs.

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During the Phase 1 and Phase 2 pilot testing programs, the influent composite samples were analyzed daily for BOD₅, TSS and VSS. During Phase 1 testing, clarifier effluent samples from both process trains were analyzed daily for ammonia nitrogen, CBOD₅ and TSS and VSS. Under Phase 2, analysis of the clarifier effluent samples for ammonia nitrogen was suspended. The grab samples of Pass 1 (return sludge) and Pass 4 (mixed liquor) were analyzed daily for TSS and VSS.

PHASE 1 TEST CONDITIONS

Under the Phase 1 pilot testing program, the pilot plant process tankage was seeded with return activated sludge from the main facility. Feed of primary effluent from the main facility was initiated to both trains on February 14, 2005. Following the initiation of the operation, both trains were operated for a time to reach steady-state conditions. This acclimation period ran from February 14 through February 25, 2005. During this time the test train (East), and the control train (West), were run in an identical manner, in a mode similar to that employed in the full-scale facility. At the end of this acclimation period, the East and West trains were producing effluents that were qualitatively similar to each other and to the effluent of the full-scale facility.

On February 25, 2005, after both pilot treatment trains reached steady-state, the feed of primary effluent to the East Train was discontinued, and the feed of primary influent was initiated. The MLSS of the East and West contact tanks were adjusted to approximately 1,500 mg/L TSS. This marked the beginning of the first test condition. This segment of the testing continued through March 13, 2005. However, because of the problems encountered with poor COD/BOD correlation, the results of this testing have been disregarded.

On March 14, 2005, the consensus was to hold the feed sources constant to the East and West trains while increasing the MLSS to 2,000 mg/L TSS. Transitioning to this level required only a few days until steady state conditions were re-established. This test condition continued through April 20, 2005.

On April 21, 2005 it was decided to hold the feed sources constant and transition both trains down to a MLSS of 1,500 mg/L TSS. Again, this transition took several days and this repeat test at 1,500 mg/L continued through May 27, 2005.

PHASE 2 TEST CONDITIONS

Under the Phase 2 pilot testing program, the pilot plant process tankage was seeded with return activated sludge from the main facility during the week of January 2, 2006, at which time feed of primary effluent from the main facility to both trains was initiated. The acclimation period ran through January 16, 2006 when the testing period began.

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During the course of the testing, the main plant entered CSO on six occasions. Upon notification that the main plant had entered CSO, the pilot plant feed to both trains was switched from primary effluent to primary influent and the feed of polymer to the East mixed liquor flow to the clarifier was initiated. A listing of the CSO events experienced during the Phase 2 pilot testing period follows:

- January 17 through January 19, 2006.
- January 23 through January 25, 2006.
- February 3 thorough February 6, 2006.
- February 16, 2006.
- March 12 through March 15, 2006.
- March 31, 2006.

The results of the CSO event which occurred between January 17 and January 19, 2006 were disregarded since the sampling data was incomplete and the polymer feed system was inoperable. Consequently, the findings of the Phase 2 pilot testing have been based on five CSO events.

Mixed liquor suspended solids were held at the 1,500 to 2,000 mg/L target range throughout the testing period. The Phase 2 testing program was suspended on April 3, 2006.

RESULTS OF TESTING PROGRAM

TECHNICAL CONSIDERATIONS

In conducting the Phase 1 pilot testing program, two pilot plant activated sludge trains were employed. One train (West) represented prevailing operations whereby primary effluent is treated, whereas the other train (East) simulated the full-scale plant's operation with a primary influent feed. The testing objectives were twofold, including an assessment of biological capability as well as an assessment of clarification limitations.

In the Phase 2 pilot testing program, both pilot plant activated sludge trains were employed. Under dry weather conditions, both trains represented prevailing operations whereby primary effluent is treated. Under wet weather (CSO) conditions, the feed to both trains was switched to primary influent, and the East Train mixed liquor flow to the clarifier was dosed with a polymer solution. The testing objectives were twofold, including an assessment of the performance effects that might result from a relatively rapid change-over from treating primary effluent to treatment of primary influent, and the eventual return to treating primary effluent, as well as the effectiveness of chemical treatment to enhance clarifier efficiency.

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PHASE I ASSESSMENT OF BIOLOGICAL CAPABILITY

The first objective of the Phase 1 pilot testing program was to determine the comparative biological capability of the activated sludge process to treat primary influent, when operated in a mode and under conditions similar to those experienced with the full scale system processing primary clarifier effluent at a flow rate of 275 mgd. A major goal of these tests was maintenance of MLSS concentration in a range similar to the historical levels of plant control (i.e., 1,500 to 2,000 mg/L). The other control parameters of dissolved oxygen and mixing could not exactly duplicate full scale operations, but knowing that these conditions were not limiting to full scale performance, they were controlled in the pilot plant above limiting conditions, as the data for dissolved oxygen levels indicate. The environmental factors of temperature and pH were also monitored. For the testing period at the target MLSS of 2,000 mg/L, which occurred during cold weather conditions, opportunity for testing performance at temperatures as low as 11.2°C was provided.

A secondary objective of this phase of testing was to determine the ability of the prevailing operation treating primary clarifier effluent to sustain required performance at a prolonged period of 275 mgd maximum flow.

Although MLSS concentration was used as the major control parameter, it is SRT, which has a relationship with MLSS, that is the critical measure and determinant of process performance of the activated sludge process. The SRT, or mean cell residence time (MCRT) as more often used in academic or more fundamental research efforts, is usually limited to the contents of the aeration basins without consideration of the solids in the final clarifiers. MCRT is determined by dividing the mass of solids under aeration by the mass of solids removed from the system to maintain a constant MLSS, part in the effluent and part as the directed removal of a portion of the return sludge or the mixed liquor to a waste sludge processing unit. In normal full scale operation, the loss in the effluent is minimal and is often omitted from the SRT determination. However, under pilot testing conditions, the effluent losses usually represented a significant portion of the total solids wasted from the system to maintain the intended target MLSS (and in turn the operating SRT), and were thus included in the SRT calculations reported herein.

BOD was the parameter used for evaluating treatment performance, and more specifically, soluble BOD₅ was the basis for measuring the extent that the aerated reactor could reduce influent BOD₅. In the activated sludge process, the degradable organic content of influent feed to the reactor is comprised of two different physical sources of substrate – the soluble portion dissolved in the wastewater and the non-soluble portion enmeshed in the particulate matter. It is, however, generally accepted that as wastewater is combined with mixed liquor in the aerated reactor, the degradable content of the particulate matter is solubilized or otherwise taken up and synthesized by the active biomass. Accordingly, the BOD₅ of the mixed liquor leaving the aerated reactor is then comprised of the residual soluble and

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solubilized BOD₅ of the influent and the BOD₅ of the synthesized active biomass. It is thus the comparison of the feed BOD₅ with the soluble BOD₅ of the effluent that is the true measure of the capability of the biological reactor to reduce degradable content. The extent that the respiration rate of the escaping active biomass solids adds to the effluent BOD₅ is solely a function of the final clarifier's ability to capture, retain and recycle particulate matter.

For each day's evaluation of the testing program, the respiration rate driven BOD₅ of the effluent solids was determined by comparing the BOD₅ of total effluent sample with the BOD₅ of the filtered effluent sample, the difference of which represented the BOD₅ of the effluent solids. This BOD₅ in turn was compared with the concentration of suspended solids in the effluent to provide a measure of the BOD₅ content of the effluent suspended solids.

As a practical matter, performance of the pilot plant operations was thereby based on a combination of the solid-free effluent BOD₅ test results and the BOD₅ contribution of the corresponding effluent suspended solids at the maximum monthly permit level of 30 mg/L.

Some practical adjustments were made in furthering this performance measuring strategy. First, to eliminate the respiration rate of nitrifying organisms that would not be expected to be present in the primary wastewaters, but could be present after aeration, the effluent BOD₅ analysis was modified to limit respiration to carbonaceous oxidation, which is referred to as CBOD₅. The other adjustment was to use filtered effluent samples to represent soluble CBOD₅ content, when in effect filtered samples are a measure of both colloidal and soluble content. Because of the difficulty involved in performing analysis of true soluble content and the expected modest addition of colloidal BOD₅, this compromise was made.

PHASE 1 ASSESSMENT OF CLARIFICATION LIMITATIONS

The second objective of the Phase 1 pilot testing program was to evaluate the settling characteristics of the mixed liquor solids in a manner that would provide a basis for utilizing available performance projection models, which could be used to assess the capability of the plant's final clarifiers to meet effluent solids limits when operating in the proposed wet weather mode. This indirect approach was required due to the non-correlation of the pilot plant clarifiers with the full scale units.

There are basically two phenomena that control final clarifier performance: one is thickening related to the hindered settling of the solids mass from inlet concentration to the concentration of the withdrawal of the return sludge from the clarifier, and the other is the efficiency of settling the discrete particles that remain above the sludge blanket.

There are two forces at work in the hindered settling conditions of final clarifiers in activated sludge systems – one is the gravity forces or flux providing a downward motion of the

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compacting solids, and the other is the underflow or bulk flux created by the return sludge pumping from the bottom of the clarifier. Clarifier area is critical to the process since the smaller the area the slower will be the rate that the mass concentrates and settles. Clarifier failure occurs when the sludge blanket continues to rise to the point that the top of the blanket can not be retained in the clarifier.

All common to the same basic concepts, there are graphical models that are used to project limiting thickening conditions; or the conditions that assure a constant sludge blanket, by relating sludge volume index (a measure of settled sludge density), some measure of the settled solids being removed from the system and solids loading rate or the components of the solids loading rate (overflow rate and mixed liquor suspended solids concentration). The sludge volume index (SVI) is a measure of the volume in milliliters (ml) occupied by a gram of solids (dry weight) after 30 minutes quiescent settling, with the settled volume measurement made in either a one or two liter cylinder, and with or without gentle stirring. There remains some uncertainty as to which SVI testing procedure is more representative of full scale settling conditions. Most treatment plants use one liter graduated cylinders and no stirring for the SVI determinations. As a general rule, it has been found that mixed liquors (aeration tank contents) with an unstirred SVI exceeding 150-175 ml/gm settle and compact poorly. SVIs less than 70-85 ml/gm generally indicate fast settling but many times leave a supernatant (the level above the sludge blanket) with a turbid appearance due to so-called pinpoint floc. An ideal range is generally considered to be between 80 and 120 ml/gm. There are many causes for high SVI conditions, the major one being an over abundance of filamentous organisms.

With regard to the settling and retaining of the discrete particles that prevail above the sludge blanket, overflow rate, i.e., the rate of effluent flow per unit area, is usually the controlling factor as to the success of clarifier performance in this regard. The overflow rate is generally related to the settling velocity of the suspended particles, in a manner such that as the overflow rate increases, the greater will be the loss of the lighter particles. There is no practical method for relating required surface area of the clarifier with the clarification of pinpoint floc above the sludge blanket. For the most part, reliance is based on maintaining as low an overflow rate as is possible and in conformance with good design practice. Whereas failure of clarifier performance due to thickening limitations can impair the entire process due to the potential massive loss of solids, the failure of the clarification component of clarifier performance will usually not be of a magnitude to affect process performance, but rather the potential is in the modest exceedance of effluent limits for suspended solids.

**PHASE 1 PERFORMANCE RESULTS FOR OPERATION AT THE TARGET MLSS
OF 2,000 mg/L**

Data for this test series evaluation was obtained for the period of March 16 through April 20, 2005, which followed an operating period that was initiated in mid-February, 2005 but as

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discussed previously did not provide a useful basis for evaluation because of reliance upon COD/BOD₅ relationship that proved erratic. This preceding period of operation did provide opportunity to correct some deficiencies of system operation, as well as provide an extended period for acclimation.

A summary of the data relating to the evaluation of BOD₅ removal performance for the complete test series operation at the target MLSS concentration of 2,000 mg/L is given in Table 2 for the East Train (receiving primary clarifier influent) and in Table 3 for the West Train (receiving primary clarifier effluent). A summary of the other operating conditions for both trains is given in Table 4.

The results of this test series are summarized as follows:

- The primary influent and effluent fed to the test units were slightly stronger in BOD₅ than experienced at the full-scale WWTP for the year 2004 and slightly higher in TSS concentration, with the primary influent during the test period averaging 99 mg/L BOD₅ and 188 mg/L TSS versus the year 2004 WWTP average of 92 mg/L BOD₅ and 148 mg/L TSS. The primary effluent during the test period averaged 53 mg/L BOD₅ and 71 mg/L TSS versus the year 2004 WWTP average of 51 mg/L BOD₅ and 49 mg/L TSS.
- The East Train at an average SRT of 3.7 days obtained the same filtered CBOD₅ levels (3-6 mg/L) in the effluent as did the West Train operating at an average SRT of 11.9 days. These low filtered CBOD₅ results indicate a high level of performance during a period of relatively low temperature.
- With the trains operating at the same MLSS, the greater required wasting of solids from the East train due to the greater amount of non-degradable solids and greater amount of BOD₅ (resulting in higher synthesis of biomass) in the primary clarifier influent is the reason for the difference in SRT. A summary of the sludge removed from the respective trains to maintain a relatively constant MLSS concentration is given in Table 5. As noted, the solids lost in the effluent were higher for the East Train than for the West Train, but the proportion of solids lost in the effluent was a much higher proportion of the total solids removed from the system for the West Train than for the East Train. It should be pointed out that the task of maintaining a constant MLSS was difficult since the extent of purposeful wasting from the RAS was required to be made subject to the uncertainty as to the solid loss that would be experienced in the effluent as well the uncertainty as to the strength of the feed to the trains for the ensuing day of control.
- Based on the combination of the daily filtered CBOD₅ and the daily CBOD₅ contribution of TSS at the maximum monthly permitted concentration of 30 mg/L,

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the total effluent CBOD₅ by this procedure of projected performance was 10.1 mg/L for the East Train and 9.8 mg/L for the West Train, well below the monthly permitted effluent CBOD₅ value of 25 mg/L. A graphical representation of the daily BOD₅ performance on this premise is given in Figures 2 and 3 respectively for the East and West Trains.

- With regard to settling characteristics, the mixed liquor from both trains settled extremely well as indicated by the low sludge volume index (SVI) results, which averaged 63 ml/gm for the East train and 85 ml/gm for the West Train. However, as indicated above regarding low SVI conditions, there were indications of turbidity in the supernatant of the test cylinders as well as in the clarifier effluents, and more so for the East Train than the West Train. Although direct correlation of the pilot plant clarifiers with full scale clarification units is not appropriate, it is noteworthy that on a relative basis, the higher effluent TSS of the East Train is some indication that the lack of primary treatment could be responsible for a lower SVI and consequently a higher level of pinpoint floc remaining above the falling sludge blanket.
- In observing the settling that occurs in the Settled Volume (SV) test cylinders for the mixed liquor from the East Train, it is apparent that the zone settling rate (the rate that the top of the sludge mass or blanket collapses) is very rapid, leaving behind slower settling particles, which when enough time is given will eventually settle on the compacted mass at the bottom of the cylinder. This condition can be caused by there being insufficient number of filament type bacteria to provide a meshing condition that serves to drag the finer particles with the descending and compacting mass. The condition for the East Train might also be in part due to a higher level of heavier inert material in the mixed liquor as a result of the absence of primary clarification that works to make the blanket fall at such high rates that it does not consolidate fast enough to provide sufficient straining effect. Zone settling rates (ZSR), based on the use of a 2-liter settleometer, were in the very high rate range of 3.0 – 6.0 m/hr (0.17 – 0.34 feet/min). Graphical representations of a typical 30 minute settling test for both trains is given in Figure 4A. The tests were performed with and without stirring, with there being little difference in the zone settling rate or SVI between the Stirred Settled Volume (SSV) and unstirred Settled Volume (SV). There was a small but discernable difference in the final compacted volumes of the East and West Trains, with the East Train having a slightly faster ZSR. It was also observed that the final compacted volume recorded at the test time of 30 minutes, actually occurred for the most part in less than 15 minutes.
- In testing with the settleometer, it was observed that stirring did not have much effect on the SVI until solids concentrations were increased to levels significantly higher than 1500-2000 mg/L range of the pilot plant operations. It is believed this is due to

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the high zone settling rate of this sludge since it has been reported that stirring has more of a differential effect on sludges of lower zone settling rates.

- To project the capability of the plant's final clarifiers to satisfy the thickening aspects of performance when operating with the primary clarifier influent, graphical models that relate maximum solids loading (or equivalent overflow rates) to SVI and some measures of return sludge, have been used. They are all based on gravity flux curves that relate settling velocity to solids concentration, obtained from surveys of representative activated sludge plants. However, there are differences in the method that the gravity flux relationships were determined, and with regard to whether stirring was or was not used. The SVI values reported herein were based on stirred settling; however, duplicate test settling performed without stirring revealed little difference. For the purpose of this evaluation, both the graphical model developed by Daigger and Roper based on unstirred SVI and the model developed by Keinath based on stirred SVI were used to assess the extent that the clarifiers of the full scale plant would be adequate at the test-revealed SVI of 75 (the high value of the range) for treating primary clarifier influent at a MLSS of 2,000 mg/L, based on the following projected full scale operating conditions:

Maximum Flow	275 mgd
RAS Rate	105 mgd
MLSS	2,000 mg/L
RAS SS	$2,000 \times (275 + 105) / 105 =$ 7,200 mg/L
Clarifier Surface Area (all units operating)	250,000 sf
Solids Loading	$[(275 + 105) \times 2000 \times 8.35] / 250000 =$ 25.4 ppd/sf
Overflow Rate	$275000000 / 250000 =$ 1,100 gpd/sf
Underflow Rate	$105,000,000 / 250,000 =$ 420 gpd/sf
Recycle ratio (R)	$105 / 275 =$ 0.38

With reference to the graph in Figure 5, for the Daigger Roper model, and in Figure 6, for the Keinath model, it is apparent that the 75 SVI line on both graphs does not extend to the intersection with the applicable RAS concentration line. Therefore, the thickening limitation is best determined in terms of the maximum MLSS that can be tolerated without exceeding the thickening limitation of the system. And this can be determined by finding the RAS solids concentration, or underflow concentration that is coincidental with the point of intersection of the underflow rate line and the SVI line. With the underflow concentration, the MLSS can be calculated from the relationship it has with R, the recycle ratio. On this basis, the following maximum allowable MLSS are indicated, with both being significantly greater than the operating MLSS of 2,000 mg/L:

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	<u>RAS SS</u>	<u>Max MLSS</u>
	(From Graph)	(RAS SS/(1+1/R))
Daigger Roper model	15,500 mg/L	4,284 mg/L
Keinath model	11,700 mg/L	3,233 mg/L

The solids loadings corresponding to these limiting concentrations would be 54 pounds per day per square feet (ppd/sf) for the Daigger Roper model and 41 ppd/sf for the Keinath model, all significantly greater than the 25.4 ppd/sf indicated above for projected maximum wet weather loading conditions and available capacities.

- An analysis based on the maximum SVI (100 ml/gm) of the West Train (receiving primary clarifier effluent) revealed a similar under loading at the 2,000 mg/L operation for the Daigger Roper model, which indicated an allowable maximum MLSS of 3,730 mg/L. However, the Keinath model indicated that the operating MLSS of 2,000 mg/L was just at the limiting concentration for satisfactory thickening.

**PHASE 1 PERFORMANCE RESULTS FOR OPERATION AT THE TARGET MLSS
OF 1,500 mg/L**

Data for the evaluation of this test series were obtained for the period of April 26 through May 26. A summary of the data relating to the evaluation of BOD₅ removal performance for the complete test series operation at the target MLSS concentration of 1,500 mg/L is given in Table 6 for the East Train (receiving primary clarifier influent) and in Table 7 for the West Train (receiving primary clarifier effluent). A summary of the other operating conditions for both trains is given in Table 8.

Aside from the difference in the target MLSS concentration, this last testing differs from the previous test series at 2,000 mg/L in the following ways:

- For the period of May 13 - 30, 2005 only four of the primary clarifiers were on line, in a separate program to stress-test the primary clarifiers. This had no effect on the basis of loading to the East Train, the train receiving primary clarifier influent, but did provide the potential to increase the loading to the West train, which was not, however, observed.
- The temperatures were higher as a result of the onset of spring and warmer air and wastewater conditions, with the average for the first series at 13°C and the average for the second series at 16°C.
- The average BOD₅ concentrations were higher (118 mg/L vs. 99 mg/L for the East Train and 61 mg/L vs. 53 mg/L for the West Train), while the average TSS

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concentrations were somewhat lower (175 mg/L vs. 188 mg/L for the East Train and 63 vs. 71 for the West Train)

The results of this test series are summarized as follows:

- The East Train at an average SRT of 2.2 days obtained an average filtered effluent CBOD₅ levels (3.2 mg/L) comparable to the West Train (3.1 mg/L) operating at an average SRT of 5.6 days, as well as comparable to the levels obtained at the target MLSS of 2,000 mg/L, while operating at somewhat higher temperature conditions.
- A summary of the sludge removed from the respective trains to maintain a relatively constant MLSS concentration is given in Table 9. Similar to that observed for the target MLSS of 2,000 mg/L operation, the solids lost in the effluent were higher for the East Train than for the West Train, and the solids lost in the effluent were a higher proportion of the total solids removed from the system for the West Train than for the East Train.
- Based on the combination of the daily filtered CBOD₅ and the daily CBOD₅ contribution of TSS at the maximum monthly permitted concentration of 30 mg/L, the total effluent CBOD₅ by this procedure of projected performance was 11.2 mg/L for the East Train and 11.8 mg/L for the West Train, well below the monthly permitted effluent CBOD₅ value of 25 mg/L. A graphical representation of the daily BOD₅ performance on this premise is given in Figures 7 and 8, respectively for the East and West Trains.
- With regard to settling characteristics, the mixed liquor from both trains continued to settle extremely well and similar to first test series, as indicated by the low settled volume index results, which averaged 70 ml/gm for the East train and 86 ml/gm for the West Train. However, as indicated for the operation at the higher target MLSS, there were indications of turbidity in the supernatant of the test cylinders as well as in the clarifier effluents, and more so for the East Train than the West Train, and greater for the East Train than at the target 2,000 mg/L operation. A graph of a typical ZSR for both trains is given in Figure 4B, and as indicated, the ZSRs are higher than for the 2,000 mg/L series and closer for the two trains than observed for the 2,000 mg/L series.
- The thickening models as discussed previously and as shown graphically in Figures 5 and 6, were used with the following projected operating conditions:

Maximum Flow	275 mgd
RAS Rate	105 mgd
MLSS	1,500 mg/L

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RAS SS	$1,500 \times (275 + 105) / 105 =$	5,428 mg/L
Maximum SVI (East Train basis)		100 ml/gm
Clarifier Surface Area (all units operating)		250,000 sf
Solids Loading	$[(275 + 105) \times 1500 \times 8.35] / 250000 =$	19.0 ppd/sf
Overflow Rate	$275000000 / 250000 =$	1,100 gpd/sf
Underflow Rate	$105,000,000 / 250,000 =$	420 gpd/sf In
Recycle Rate (R)		0.38

On the basis of the analysis described above for the first series test, the following maximum allowable MLSS values are indicated for the two models, with both being significantly greater than the operating MLSS of 1,500 mg/L:

	<u>RAS SS</u> (From Graph)	<u>Max MLSS</u> (RAS SS/(1+1/R))
Daigger Roper model	13,500 mg/L	3,730 mg/L
Keinath model	8,500 mg/L	2,350 mg/L

The solids loadings corresponding to these limiting concentrations would be 47 ppd/sf for the Daigger Roper model and 30 ppd/sf for the Keinath model, both significantly greater than the 19 ppd/sf indicated above for projected maximum wet weather loading conditions and available capacities.

- Since the maximum SVI for the West train was the same as for the East train for this test series, the model results given above for operating with primary clarifier influent feed apply to operation with primary clarifier effluent.
- Although the continuing low SVI conditions appear to safely accommodate thickening requirements of final clarification, there still remains a concern regarding the clarification aspects of final clarification, i.e., the retention of discrete particles above the sludge blanket and subsequent loss in the effluent. Although absolute comparison can not be made between the performance of the pilot plant clarifiers and the full scale clarifiers as previously discussed, the comparison of the performance of the pilot plant clarifiers under the different loading conditions of the experimentation can provide some comparison and insight as to this aspect of clarifier performance with the full scale units. In this regard, it is noted that at the target 2,000 mg/L test series, the West train consistently performed at an effluent TSS concentration less than the monthly permit limit of 30 mg/L, whereas the East train performed at higher TSS levels, exceeding 30 mg/L about 30 per cent of the time. In the 1,500 mg/L target test series, the West train again never exceeded the 30 mg/L, whereas the East train exceeded this limit 70 per cent of the time. It is apparent from this comparison that the absence of primary clarification as was the case for the East Train imposed some greater level of difficulty in reducing the light particles that tended to suspend

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above the sludge blanket than did the West Train that received a primary clarified feed.

PHASE 2 ASSESSMENT OF WET WEATHER OPERATION

The first objective of the Phase 2 pilot plant testing was to demonstrate the capability of the secondary treatment process to maintain adequate performance during the proposed wet weather mode of operation. Differing from the Phase 1 pilot testing program which focused on treatment performance under equilibrium conditions, the Phase 2 pilot testing focused on evaluating the relatively rapid transition from the normal primary effluent feed to a primary influent feed during wet weather, and subsequently the change back to primary effluent feed at the conclusion of the storm event.

Both pilot plant process trains were placed in operation and acclimated under the same primary effluent feed source. Since Phase 1 pilot testing exhibited similar treatment performance at both target MLSS concentrations of 1,500 mg/l and 2,000 mg/l, the target for Phase 2 pilot plant operation was to keep the MLSS concentrations between 1,500 to 2,000 mg/l. The test variation between the two pilot plant process trains included polymer addition to the East Train in an attempt to chemically enhance the clarifier performance during wet weather events (i.e., when operating with a primary influent feed).

An important pilot testing protocol decision was to identify the appropriate criteria for making the change from primary effluent feed to primary influent feed to simulate the intended "real-time" wet weather transitioning of the operation. Given the current cap for wastewater flow pumping into the ALCOSAN treatment plant of 225 mgd, it is not feasible to monitor the peak flow that each particular storm event would generate in the ALCOSAN conveyance system. However, when wastewater flows exceed 225 mgd a rising water level occurs in the wet well of the Main Pumping Station. Through experience and conveyance system modeling ALCOSAN has determined that combined sewer overflows will occur when the water level in the wet well reaches or exceeds an elevation of 685 feet. ALCOSAN currently monitors and reports the time and duration that the wet well elevation exceeds 685 feet in their monthly Discharge Monitoring Reports (DMRs). With this understanding of current operations it was decided to use the same criteria to change the pilot plant mode of operation from primary effluent to primary influent feed when the wet well elevation reaches 685 feet.

Once operating under the wet weather mode, the decision to return to dry weather operation by switching the pilot plant back to primary effluent feed was based on the wet weather event ending and confirming the water level in the wet well dropped below an elevation of 685 feet for several hours. The timing of the transition out of wet weather operation was considered less critical than entering wet weather operation since it is likely such an operation would occur at the most suitable time for the plant operators. For the pilot plant operation this

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transition normally occurred in the early morning when the composite samples were collected and reset for the next day. This also helped to keep the composite samples consistent under one mode of operation.

PHASE 2 ASSESSMENT OF POLYMER ENHANCED CLARIFICATION

The second objective of the Phase 2 pilot testing program was to assess the potential for enhancement of clarifier performance during wet weather by the addition of a polymer coagulant between the last reaction tank and the clarifier. The East process train was used to perform the polymer testing. The West process train did not receive polymer and was considered a control for comparison of clarifier performance without polymer addition.

The limitations of comparisons between the pilot plant clarifiers and full-scale final settling tanks have been previously described in this memorandum. However, the pilot testing of chemical enhancement was considered beneficial in regards to the comparison of results between the test and control pilot clarifiers. Unfortunately, the limitations of polymer addition and mixing facilities in the pilot plant made it difficult to optimize the process with the limited number of storm events encountered during the Phase 2 testing program.

Initial bench scale testing was performed with the assistance of representatives of ALCOSAN's current polymer supplier for sludge dewatering (Polydyne). As a result of this testing, emulsion type polymers (Clarifloc® NE-489 and Clarifloc® C-6215) were selected for pilot plant testing purposes. Clarifloc® NE-489 polymer was used at a dosage range of 1.0 to 1.5 mg/L during wet weather events between January 16 and February 15, 2006. Clarifloc® C-6215 polymer was used at a dosage range of 0.5 to 1.5 mg/L during wet weather events between February 16 and April 2, 2006. The polymer bench testing exhibited a visible improvement in the rate of settling and the clarity of the supernatant in the samples treated with polymer compared to the samples that received no polymer treatment. However, this improvement in clarifier performance was not experienced in the Phase 2 pilot testing.

PHASE 2 PERFORMANCE RESULTS

Data for the evaluation of the Phase 2 test series were obtained for the period of January 16 through April 2, 2006. A summary of the data relating to the evaluation of BOD₅ removal performance for the complete test series operation is given in Table 10 for the West Train and in Table 11 for the East Train. A summary of other operating conditions for both trains is given in Table 12. A summary of the solids removed from the East and West Trains to maintain the target MLSS range of 1,500 to 2,000 mg/L is presented in Table 13.

General observations of the Phase 2 pilot test series are summarized below:

- The average solids removed from the system to maintain the target MLSS concentration of 1,500 to 2,000 mg/L was similar for both trains (8.8 pounds per day for the East Train

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and 7.6 pounds per day for the West Train) and the proportion of average solids lost in the effluent to the average total solids removed from the system was almost identical for both trains (0.36 for the East Train and 0.32 for the West Train). The East Train had an average SRT of 4.0 days, and the West Train had an SRT of 4.4 days throughout the duration of the monitoring period. It can be concluded that both pilot test trains maintained similar activated sludge conditions during the Phase 2 testing program.

- Based on the combination of the average daily soluble (filtered) CBOD₅ and the calculated average CBOD₅ contribution of TSS at the maximum monthly permitted concentration of 30 mg/L, the combined average effluent CBOD₅ was 12.5 mg/L for the East Train and 13.3 mg/L for the West Train for the Phase 2 pilot testing period. A graphical representation of the daily projected CBOD₅ performance for the Phase 2 pilot testing period is given in Figures 9 and 10 for West and East Trains, respectively.
- The Phase 2 pilot plant projected performance is well below the monthly permitted effluent CBOD₅ value of 25 mg/L. However, it is noted that the Phase 2 pilot testing achieved slightly lower performance than the Phase 1 pilot testing projected average CBOD₅ performance of 10.1 mg/L for the East Train and 9.8 mg/L for the West Train.
- The improved clarification performance observed in the polymer bench tests was not demonstrated in the pilot plant testing, which for the most part actually revealed a level of decreased solids reduction performance. It is likely that the ineffectiveness of polymer in enhancing the performance of the pilot plant clarifiers was due to the limiting conditions of polymer application to the pilot plant and not to the inherent properties of the polymer. The limitations of time and a small number of wet weather events prevented further optimization of the polymer selection, addition and mixing mechanisms during the Phase 2 testing.

The pilot plant results during each of the six wet weather events are summarized below. The reference to rainfall amounts are taken from precipitation records at the Pittsburgh International Airport weather station.

Wet Weather Event No. 1 (January 17-20, 2006): This storm event included 0.38 inches of rain on January 17 and 0.05 inches of rain on January 18, 2006. The ALCOSAN WWTP entered CSO conditions during the evening of January 17 and remained in CSO for over 50 hours, ending on January 19. During this time the plant came out of CSO for two brief periods of time. The pilot plant was switched to wet weather mode in the evening of January 17 close to the time the main plant entered CSO conditions and remained in this mode until the morning of January 20. The addition of polymer to the East Train clarifier began on the morning of January 18. However, sampling and operational problems experienced with the pilot plant led to the conclusion to disregard performance data from this event.

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Wet Weather Event No. 2 (January 23-26, 2006): This storm event included 0.21 inches of rain on January 23; 0.13 inches of rain on January 24; and 0.03 inches of rain on January 25. The ALCOSAN WWTP entered CSO conditions at approximately 1:00AM on January 23 and remained there until the afternoon of January 26. The WWTP came out of CSO for two brief time periods, including approximately three hours on January 24 and six hours on January 26. The pilot plant was switched into wet weather mode in the morning of January 23 at 8:00AM when the pilot plant operator arrived to work, which is approximately 7 hours after the main plant entered CSO conditions. Polymer addition to the East Train commenced immediately after the switch-over. The pilot plant remained in wet weather operation through the early morning of January 26. The pilot plant was taken out of the wet weather mode of operation for a period of four hours on January 24 when the main plant came out of CSO and it was believed the event was over. The pilot plant performance results during this event are summarized below:

- The laboratory analyses of daily composite samples of the primary influent feed source to the pilot plant during the three days of wet weather operation exhibited consecutive daily TSS concentrations of 86, 78 and 130-mg/L and consecutive daily CBOD₅ concentrations of 60.4, 59.1 and 91.7-mg/L.
- When compared to 26 daily composite samples of primary influent collected in January 2006 under the concurrent primary stress testing program, the primary influent TSS and CBOD₅ concentrations during this storm were close to the monthly averages of 108 mg/L TSS and 63.8 mg/L CBOD₅, with a slight dilution of strength during the middle of the event.
- The soluble (filtered) CBOD₅ concentrations in pilot plant effluent daily composite samples collected during the storm event remained low and stable throughout the storm (ranging from 3.7 to 7.4 mg/L in the East Train and 7.4 to 8.0 mg/L in the West Train), but were slightly higher than the overall average performance for the Phase 2 pilot plant testing (4.0 mg/L in the East Train and 4.2 mg/L in the West Train).
- Pilot plant effluent TSS analyses indicated that polymer addition to the East Train clarifier did not improve TSS removal performance when compared to the West Train, since higher TSS concentrations were measured in the East Train effluent.

Wet Weather Event No. 3 (February 3-7, 2006): A 0.03 inch storm event during the late evening of February 2 followed by a 0.55 inch storm on February 3 caused the ALCOSAN WWTP to enter CSO conditions at approximately 3:00AM on February 3 and remain there for approximately 24 hours. The pilot plant was switched to the wet weather mode by 8:00AM on February 3, which is approximately five hours after the main plant entered CSO conditions. Polymer addition to the East Train commenced immediately after the switchover. The pilot plant remained in wet weather operation through the early morning of February 7. The pilot plant performance results during this event are summarized below:

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- The composite samples for the first day of the storm were disregarded based on sampling discrepancies.
- The laboratory analyses of daily composite samples of the primary influent feed source to the pilot plant during the final three days of wet weather operation exhibited consecutive daily TSS concentrations of 176, 100, and 76-mg/L and consecutive daily CBOD₅ concentrations of 97.6, 53.4, and 58.0-mg/L.
- When compared to 28 daily composite samples of primary influent collected in February 2006 under the concurrent primary stress testing program, the primary influent TSS and CBOD₅ concentrations at the beginning of this storm were close to the monthly averages of 163 mg/L TSS and 73 mg/L CBOD₅, then became progressively more dilute in strength as the event continued.
- The soluble (filtered) CBOD₅ concentrations in pilot plant effluent daily composite samples collected during the storm event remained low and stable throughout the storm (ranging from 2.1 to 3.6 mg/L in the East Train and 2.5 to 4.7 mg/L in the West Train), which are close to the overall average performance for the Phase 2 pilot plant testing (4.0 mg/L in the East Train and 4.2 mg/L in the West Train).
- Pilot plant effluent TSS analyses indicated that polymer addition to the East Train clarifier did not improve TSS removal performance when compared to the West Train, since higher TSS concentrations were measured in the East Train effluent on all but one day of the event.

Wet Weather Event No. 4 (February 16-17, 2006): A 0.26 inch storm event in the morning of February 16 caused the ALCOSAN WWTP to enter CSO conditions around 10:00AM on February 16 and remain there for approximately nine hours. The pilot plant was switched into wet weather mode by 10:30AM and remained there until the morning of February 17. Polymer addition to the East Train commenced within 4 hours after the switchover. The pilot plant performance results during this event are summarized below:

- The composite primary influent sample for February 16 exhibited TSS and CBOD₅ concentrations of 180 mg/L and 179.5 mg/L, respectively.
- When compared to 28 daily composite samples of primary influent collected in February 2006 under the concurrent primary stress testing program, the primary influent TSS and CBOD₅ concentrations at the beginning of this storm were higher than the monthly averages of 163 mg/L TSS and 73 mg/L CBOD₅.

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- Low soluble CBOD₅ concentrations of 6.3 mg/L and 4.3 mg/L were measured in the effluent of the East and West trains, respectively. These results are near the overall average performance for the Phase 2 pilot plant testing (4.0 mg/L in the East Train and 4.2 mg/L in the West Train). However, it is notable that the 6.3 mg/L soluble CBOD₅ concentration is 50% above the overall average for the East Train during Phase 2 pilot plant testing.
- Pilot plant effluent TSS analyses indicated that polymer addition to the East Train clarifier did not improve TSS removal performance when compared to the West Train, since higher TSS concentrations were measured in the East Train effluent.

Wet Weather Event No. 5 (March 12-16, 2006): This storm event included 1.01 inches of rain starting in the morning of March 12, followed by 0.45 inches of rain on March 13. The ALCOSAN WWTP entered CSO conditions around 7:00AM on March 12 and remained there for approximately 89 hours until early morning of March 16. The pilot plant was placed into the wet weather mode within minutes of the plant entering CSO. Polymer addition to the East Train commenced within 90 minutes of the switchover. The pilot plant remained in wet weather operation until 9:30AM on March 16. This storm was the largest and longest wet weather event that occurred concurrently with the Phase 2 pilot plant operations. The pilot plant performance results during this event are summarized below:

- The laboratory analyses of daily composite samples of the primary influent feed source to the pilot plant during the four days of wet weather operation exhibited consecutive TSS concentrations of 144, 204, 92 and 108-mg/L and consecutive CBOD₅ concentrations of 60.0, 57.7, 60.6, and 69.5-mg/L.
- When compared to 30 daily composite samples of primary influent collected in March 2006 under the concurrent primary stress testing program, the primary influent TSS concentration on the first day of this storm was close to the monthly average of 164 mg/L, then spiked to over 200 mg/L on the second day, followed by significant dilution on the third and fourth days of the event. In contrast the primary influent CBOD₅ remained steady at well below the monthly average of 95 mg/L CBOD₅ throughout the event. These results suggest storm water dilution of organic content in the wastewater flow entering the plant while at the same time creating a spike in the total suspended solids presumably from inorganic sources during the first half of the storm.
- The soluble (filtered) CBOD₅ concentrations in pilot plant effluent daily composite samples collected during the storm event remained low and stable throughout the storm (ranging from 3.0 to 4.9 mg/L in the East Train and 2.7 to 3.5 mg/L in the West Train), which are close to the overall average performance for the Phase 2 pilot plant testing (4.0 mg/L in the East Train and 4.2 mg/L in the West Train).

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- The pilot plant effluent CBOD₅ concentrations remained low and stable throughout the storm at, or below, the overall average performance for the Phase 2 testing.
- Pilot plant effluent TSS analyses indicated that polymer addition to the East Train clarifier did begin to show slightly improved TSS removal when compared to the West Train.

Wet Weather Event No. 6 (March 31- April 1, 2006): A small storm event of 0.04 inches during the evening of March 31 caused the ALCOSAN WWTP to enter CSO conditions around 5:00PM on March 31 and remain there for approximately three hours. The pilot plant was switched into wet weather mode by 5:10PM and remained there until 8:00AM on April 1. Polymer addition to the East Train was commenced around 1:30PM on March 31, prior to the CSO event, in a separate effort to optimize the polymer addition process. The pilot plant results during this event are summarized below:

- The pilot plant influent composite samples exhibited low CBOD₅ and TSS concentrations of 55 mg/L and 34 mg/L, respectively. These values most likely represent the influence of a more dilute primary effluent in the composite sample collected for around nine hours before the pilot plant switchover to primary influent.
- Low soluble CBOD₅ concentrations of 3.7 mg/L and 4.3 mg/L were measured in the effluent of the East and West trains, respectively.
- The polymer addition that began prior to the wet weather event resulted in a TSS concentration in the East Train effluent composite sample of 6 mg/L, which is better than the 14 mg/L TSS measured in the West Train effluent composite sample. The improved performance is possibly attributed to the change in polymer, and the attempts to improve addition and mixing mechanisms.

DISCUSSION OF FINDINGS

As mentioned previously, the activated sludge treatment of non-clarified wastewater is not unique as it has been used successfully for a long period of time at many treatment plants in this country, although usually for lesser capacity than 275 mgd. As the treatment capacity increases, there are economic benefits to the reduction of aeration capacity and the power requirements related thereto that favors primary clarification. The operation of activated sludge systems at SRTs of 2-4 days, as required for the contemplated wet weather operation, is also not unique. There are many large municipal plants not having stringent ammonia nitrogen requirements that consistently perform successfully at SRTs in this range. And further, the use of polymers to improve the settling of activated sludge has a long and successful history, particularly in the standby capability as envisioned for potential and interim use in ALCOSAN's contemplated wet weather strategy.

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The information herein is given preliminary to the discussion of findings to provide some perspective of the goal of this pilot plant effort, which is more to substantiate the base conditions of the contemplated wet weather treatment strategy, rather than to explore an uncertain or unknown treatment process. This substantiation is also for the purpose of reassuring both EPA and DEP by pilot plant demonstration and on a site specific basis, that the contemplated wet weather strategy will be successful in meeting regulatory requirements.

The substantiation of the wet weather strategy can be considered in three broad categories. First, there is the need to demonstrate that the plant's activated sludge process when operating under steady state conditions and within prevailing operating criteria is capable of reducing biodegradable content to within permit limits. By steady state conditions, it is meant to represent the condition whereby the process has had opportunity to adjust to the changed loading condition. Second, there is the need to demonstrate that the plant's activated sludge process would respond without loss of required treatment capability to a relatively rapid change from primary clarifier effluent loading to primary influent loading (non-steady state conditions). This transition occurs in response to a wet weather event with resulting wastewater flows greater than the plant's primary treatment capacity. And thirdly, there is the need to demonstrate that the activated sludge solids produced during the biological reaction will properly separate from the treated effluent, and that with the limitations of pilot testing the clarification process, further demonstrate that the use of flocculating chemicals will enhance the solid separation process. This demonstration was proposed in the event full scale operations would reveal any limitations in achieving regulated effluent solids limits.

Regarding the first effort, we believe the first phase pilot plant testing program fully demonstrated that the plant's existing activated sludge process, operating under steady state conditions and at normal mixed liquor concentration of 1,500-2,000 mg/L range and SRTs of 2 - 4 days will be adequate from two perspectives. First, to reduce biodegradable content of the plant's clarified wastewater during the extended period of time when the activated sludge process is receiving a constant primary clarifier effluent flow of 275 mgd (nominal secondary treatment capacity). Then second, to provide adequate treatment when the activated sludge process is receiving a constant primary clarifier influent flow of 275 mgd. These capabilities have actually been demonstrated by the Phase I pilot testing effort with wastewater of higher strength than would be expected during wet weather and high flow conditions.

The first phase pilot plant testing also demonstrated that the activated sludge process operation had very good bulk settling characteristics, which is well within criteria of the models used to determine the acceptability of such characteristics. As well as there are procedures to evaluate and project bulk settling capabilities of activated sludge, there are no acceptable procedures to demonstrate by pilot plant testing the capability of the full scale clarifiers to capture and retain the pin point floc that sometimes floats above the sludge

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blanket, which if extensive could result in effluent suspended solids levels above permit limits.

The second phase testing program was intended to determine performance of the process when the loading to the activated sludge process was rapidly changed from primary clarifier effluent to primary clarifier influent at the initiation of a wet weather event, as well as to demonstrate the use of polymers to enhance clarification.

Although the testing did demonstrate adequate reduction of biodegradable content for the wet weather events occurring during the test period, the limited number and low intensity of the wet weather events are considered insufficient to provide conclusive and convincing demonstration of the system's capability in this regard. It was anticipated that the late winter/spring period of testing would provide the more dramatic wet weather events usually resulting from winter snow melt and spring rains, but this was not the case in 2006. With the expectation that spring and summer rains would not provide the type of wet weather conditions that would prove useful to the type of demonstration desired, the second phase testing program was terminated with the potential that it would be taken up again later in the year or in 2007. This testing effort was also limited by the need of plant operations part way through the program to have waste activated sludge re-introduced into the primary clarifiers, thereby changing the nature of the primary clarifier effluent from that upon which the testing program was based.

The effort to demonstrate polymer effectiveness in improving solids settling was also limited during this second phase test program. Whereas the effectiveness of polymer addition was demonstrated on a bench scale basis, it could not be demonstrated in the pilot plant. The major reason for this is believed to be in regard to unacceptable application and mixing conditions. As originally devised, the polymer application point was in the piping between the last aeration unit and the clarifier. It is suspected that this did not provide for adequate mixing with the possibility that the polymer, viscous in nature, stratified in the short distance between the application point and the final clarifier, and did not have opportunity to properly mix and come in contact with all of the mixed liquor solid particles prior to dispersal in the clarifier. To the extent that such a condition existed it not only prevented the solids from being flocculated, but could have been responsible for the floating particles observed in the upper levels of the tank contents. There is reason to believe that with more time and experimentation, the proper application of the polymer to the mixed liquor could be achieved, and results obtained in the bench scale testing could be duplicated in the pilot clarifiers.

RECOMMENDATIONS

It is recommended that the second phase pilot plant testing program be repeated when more frequent and extensive wet weather conditions are expected to occur, which may be late

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winter 2007 as originally anticipated for late winter 2006. A repeat of the second phase testing protocol during a sustained wet weather period should provide the basis to demonstrate that the activated sludge process as proposed to be operated under the contemplated wet weather strategy will perform within permit requirements. It will also provide opportunity to demonstrate the extent that polymers will enhance the clarification process. However, prior to the initiation of the pilot test program, special effort and testing should be made of the polymer feed and mixing system to assure that adequate and proper mixing can be achieved in the pilot plant.

TABLES

Table 1
Process Capacities

Process	Estimated Capacity (mgd)		Criteria/Remarks
	All units	Largest Unit Out of Service	
Influent Pumping	505	404	Based on a wet-well water surface elevation of 680 ft (current operating level).
Bar Screens	300	225	Original Design Capacity.
Grit Chambers	285-114	213-85.5	Range corresponds to WEF/ASCE ^a recommended range of detention times: 2 minutes - 5 minutes.
	190	143	Based on typical 3-minute detention time.
Primary-Sedimentation Tanks	415	367	Based on 2,500 gpd/ft ² surface-overflow rate. Criteria for tanks not receiving WAS.
	250	220	Based on 1,500 gpd/ft ² surface-overflow rate. Criterion for tanks receiving WAS.
Aeration Basins	290	253	Based on RUST Environment and Infrastructure Intermediate Design Submittal dated June 28, 1996.
Final Clarifiers	300	281	Based on PaDEP criteria of 1,200 gpd/ft ² overflow rate.
Chlorine Contact Tanks	280	140	Based on PaDEP criteria of 15-minute detention time at peak hourly flow ¹ .
^a Water Environment Federation/American Society of Civil Engineers			

TABLE 2
PHASE 1 PILOT PLANT TESTING
EAST TRAIN (*)
PERFORMANCE AT TARGET MLSS OF 2,000 MG/L

	<u>MLSS</u> (mg/L)	<u>SRT</u> (days)	<u>Influent</u> <u>BOD5</u> (mg/L)	<u>Total</u> <u>Effluent</u> <u>CBOD5</u> (mg/L)	<u>Filtered</u> <u>Effluent</u> <u>CBOD5</u> (mg/L)	<u>CBOD5 of</u> <u>Effluent</u> <u>TSS</u> (mg/L)	<u>Effluent</u> <u>TSS</u> (mg/L)	<u>CBOD5</u> <u>per Effl.</u> <u>TSS</u> (mg/mg)	<u>CBOD5</u> <u>of TSS @</u> <u>30 mg/L</u> (mg/L)	<u>Total</u> <u>CBOD5</u> <u>with TSS</u> <u>of 30 mg/L</u> (mg/L)
3/16/2005	2,300	5.8	103	7.1	2.9	4.2	15	0.28	8.4	11.3
3/17/2005	2,525	2.7	85	6.6	2.2	4.4	17	0.26	7.8	10.0
3/18/2005	2,380	1.9	111	12.7	5.3	7.4	25	0.30	8.9	14.2
3/19/2005	2,380	2.0					28			
3/20/2005	1,720	3.0	105	10.5	4.4	6.1	20	0.31	9.2	13.6
3/21/2005	1,750	6.9	110	7.8	4.5	3.3	21	0.16	4.8	9.3
3/22/2005	2,280	3.6	113	9.4	5.1	4.3	28	0.15	4.6	9.7
3/23/2005	2,250	3.3	69	9.8	3.1	6.7	21	0.32	9.6	12.7
3/24/2005	2,400	2.2	88	8.7	3.0	5.7	23	0.25	7.4	10.4
3/25/2005	2,180	4.0	87	9.2	3.2	6.0	19	0.31	9.3	12.5
3/26/2005	1,817	2.2	88	13.1	4.5	8.6	33	0.26	7.9	12.4
3/27/2005	1,967	2.5	109	11.1	2.5	8.6	43	0.20	6.0	8.5
3/28/2005	2,150	3.1	64	6.6		6.6	32	0.21	6.2	6.2
3/29/2005	1,800	9.7	54	6.6	3.3	3.3	27	0.12	3.7	7.0
3/30/2005	2,125	4.7	85	9.1	2.0	7.1	27	0.26	7.9	9.9
3/31/2005	2,000	6.4	77	5.3	2.6	2.7	17	0.16	4.8	7.4
4/1/2005	2,160	5.0	109	11.0	4.0	7.0	19	0.37	11.2	15.2
4/2/2005	2,640	3.3	38	10.2	2.0	8.2	19	0.42	12.7	14.7
4/3/2005	2,840	3.6	41	10.2	3.4	6.8	23	0.30	8.9	12.3
4/4/2005	1,360	8.2	54	8.9	2.7	6.2	26	0.24	7.2	9.9
4/5/2005	1,700	11.9	61	5.3	2.0	3.3	23	0.14	4.3	6.3
4/6/2005	2,575	3.1	65	7.2	2.7	4.5	30	0.15	4.5	7.2
4/7/2005	1,317	3.6	104	8.5	3.0	5.5	14	0.39	11.8	14.8
4/8/2005	2,080	2.9	122	12.9	4.5	8.4	46	0.18	5.5	10.0
4/9/2005	220	2.0	187	10.8	4.1	6.7	44	0.15	4.6	8.7
4/10/2005	2,340	3.8	94	7.8	2.5	5.3	23	0.23	6.9	9.4
4/11/2005	2,100	1.9	133	6.8	2.7	4.1	33	0.12	3.7	6.4
4/12/2005	2,067	1.7	172	8.3	2.9	5.4	22	0.25	7.4	10.3
4/13/2005	2,667	2.3	162	7.9	2.5	5.4	23	0.23	7.0	9.5
4/14/2005	2,233	2.1	84	7.2	2.8	4.4	25	0.18	5.3	8.1
4/15/2005	2,700	2.2	106	8.0	2.2	5.8	25	0.23	7.0	9.2
4/16/2005	2,260	2.0	99	12.7	4.4	8.3	34	0.24	7.2	11.6
4/17/2005	1,770	3.6	84	11.5	4.4	7.1	39	0.18	5.5	9.9
4/18/2005	2,275	2.2	128	8.7	3.0	5.7	43	0.13	4.0	7.0
4/19/2005	2,650	1.8	129	8.6	2.9	5.7	55	0.10	3.1	6.0
4/20/2005	2,900	1.0	158	12.0	3.6	8.4	26	0.32	9.7	13.3
Average	2,136	3.7	99	9.1	3.2	5.9	27.0	0.23	7	10.1

(*) Receives headworks Influent

TABLE 3
PHASE 1 PILOT PLANT TESTING
WEST TRAIN (*)
PERFORMANCE AT TARGET MLSS OF 2,000 MG/L

	MLSS (mg/L)	SRT (days)	Influent BOD5 (mg/L)	Total Effluent CBOD5 (mg/L)	Filtered Effluent CBOD5 (mg/L)	CBOD5 of Effluent TSS (mg/L)	Effluent TSS (mg/L)	CBOD5 per Effl. TSS (mg/mg)	CBOD5 of TSS @ 30 mg/L (mg/L)	Total CBOD5 with TSS of 30 mg/L (mg/L)
3/16/2005	1,475	19.5	58	6.2	2.6	3.6	11.4	0.32	9.5	12.1
3/17/2005	1,525	20.3	58	6.7	2	4.7	11.3	0.42	12.5	14.5
3/18/2005	1,780	14.1	77	10.1	4.9	5.2	18.0	0.29	8.7	13.6
3/19/2005	1,980	13.6		7.8	3.4	4.4	21.3	0.21	6.2	9.6
3/20/2005	2,000	19.9	70	8.6	3.8	4.8	14.7	0.33	9.8	13.6
3/21/2005	2,000	14.8	66	8.5	2.9	5.6	20.7	0.27	8.1	11.0
3/22/2005	2,070	15.8	62	9.8	3.6	6.2	20.0	0.31	9.3	12.9
3/23/2005	1,700	13.7	54	8.1	2	6.1	21.6	0.28	8.5	10.5
3/24/2005	2,220	21.7	61	10.6	3	7.6	18.4	0.41	12.4	15.4
3/25/2005	2,020	12.5	56	9.9	2.2	7.7	24.7	0.31	9.4	11.6
3/26/2005	2,060	14.4	54	10.8	3.1	7.7	23.3	0.33	9.9	13.0
3/27/2005	2,260	4.9	55	7.9	1.8	6.1	25.0	0.24	7.3	9.1
3/28/2005	1,850	6.5	33	5.2	2	3.2	25.0	0.13	3.8	5.8
3/29/2005	1,700	32.3	35	3.5	1.9	1.6	8.0	0.20	6.0	7.9
3/30/2005	1,775	16.3	50	5	2	3	16.7	0.18	5.4	7.4
3/31/2005	2,040	11.4	47	5.4	2	3.4	16.7	0.20	6.1	8.1
4/1/2005	2,071	10.1	69	8.7	3.5	5.2	20.7	0.25	7.5	11.0
4/2/2005	2,080	7.5	31	4.6	2	2.6	31.3	0.08	2.5	4.5
4/3/2005	2,380	12.7	36	5.6	2	3.6	16.0	0.23	6.8	8.8
4/4/2005	1,840	15.1	36	5.9	2	3.9	18.0	0.22	6.5	8.5
4/5/2005	1,740	10	36	6.4	2	4.4	28.0	0.16	4.7	6.7
4/6/2005	1,900	18	33	3.5	2	1.5	16.7	0.09	2.7	4.7
4/7/2005	1,900	15	57	6.6	2.7	3.9	14.7	0.27	8.0	10.7
4/8/2005	2,140	13.4	65	5.4	2	3.4	13.3	0.26	7.7	9.7
4/9/2005	2,220	21.8	80	5.8	2	3.8	15.3	0.25	7.5	9.5
4/10/2005	2,260	16.2		6			21.0			
4/11/2005	2,425	5.5		5.9			18.4			
4/12/2005	2,467	4.7	72	6.7	2	4.7	19.0	0.25	7.4	9.4
4/13/2005	2,067	8.3	89	7	2.1	4.9	16.0	0.31	9.2	11.3
4/14/2005	2,233	6.3	24	5.2	2	3.2	20.0	0.16	4.8	6.8
4/15/2005	2,286	8.2	53	7.1	2.1	5	18.7	0.27	8.0	10.1
4/16/2005	2,171	3.9	59	9.9	4.2	5.7	20.8	0.27	8.2	12.4
4/17/2005	2,575	7.7	53	6.8	2	4.8	20.8	0.23	6.9	8.9
4/18/2005	2,400	10.9	45	6	2.2	3.8	22.4	0.17	5.1	7.3
4/19/2005	2,350	5	55	5.3	1.8	3.5	25.3	0.14	4.2	6.0
4/20/2005	1,940	3.6	68	7	2.9	4.1	18.4	0.22	6.7	9.6
Average	2,061	11.9	53	6.9	2.5	4.5	19.2	0.23	7.2	9.8

(*) Receives primary treated influent.

TABLE 4
PHASE 1 PILOT PLANT TESTING
SUMMARY OF OTHER OPERATING CONDITIONS
AT TARGET MLSS OF 2,000 MG/L

	EAST TRAIN (*) Average (Range)	WEST TRAIN (+) Average (Range)
Feed TSS, mg/L	188 (100-355)	71 (50-102)
Feed TSS, % Volatile	73 (63-85)	76 (61-86)
Feed Temperature, °C	13.2 (11.2-15.1)	13 (10.7-16.1)
Operating Temperature, °C (4th Aeration Unit)	13.8 (11.8-16.4)	13.5 (11.4-16.1)
Feed pH	(6.8-7.2)	(6.9-7.3)
Effluent pH	(6.8-7.2)	(6.5-6.9)
Dissolved Oxygen, mg/L	6 (4.2-7.4)	5.9 (3.9-8.2)
SVI, ml/gm	63 (50-71)	85 (63-103)
Influent NH ₃ -N, mg/L	6.7 (2-13.3)	6.5 (2.1-10.8)
Effluent NH ₃ -N, mg/L	2.6 (2-3.9)	1.9 (1-3.1)

(*) Receives headworks influent.

(+) Receives primary treated influent.

TABLE 5
PHASE 1 PILOT PLANT TESTING
SOLIDS REMOVED FROM TRAINS
TO MAINTAIN TARGET MLSS OF 2,000 MG/L

	East Train (*)			West Train (+)		
	Effluent TSS Loss (lbs/d)	Wasted From RAS (lbs/d)	Total TSS Removed (lbs/d)	Effluent TSS Loss (lbs/d)	Wasted From RAS (lbs/d)	Total TSS Removed (lbs/d)
3/16/2005	1.5	4.1	5.6	1.1	0.0	1.1
3/17/2005	1.7	12.1	13.8	1.1	0.0	1.1
3/18/2005	2.5	16.6	19.1	1.8	0.0	1.8
3/19/2005	2.8	12.6	15.3	2.1	0.0	2.1
3/20/2005	2.0	6.0	8.0	1.4	0.0	1.4
3/21/2005	2.0	1.8	3.8	2.0	0.0	2.0
3/22/2005	2.8	6.6	9.3	2.0	1.0	3.0
3/23/2005	2.1	7.3	9.3	2.1	0.0	2.1
3/24/2005	2.2	13.6	15.8	1.5	2.1	3.7
3/25/2005	1.9	5.6	7.5	2.4	0.0	2.4
3/26/2005	3.2	9.1	12.3	2.3	2.3	4.6
3/27/2005	4.2	7.4	11.6	2.5	4.2	6.6
3/28/2005	3.1	6.9	10.0	2.5	1.9	4.4
3/29/2005	2.7	0.0	2.7	0.8	0.0	0.8
3/30/2005	2.7	3.8	6.4	1.6	0.0	1.6
3/31/2005	1.7	3.1	4.8	1.6	1.0	2.6
4/1/2005	1.8	5.0	6.8	2.0	1.0	3.1
4/2/2005	1.9	9.4	11.3	3.1	1.0	4.1
4/3/2005	2.3	7.5	9.7	1.6	1.0	2.6
4/4/2005	2.6	0.0	2.6	1.8	0.0	1.8
4/5/2005	2.3	0.0	2.3	2.8	0.0	2.8
4/6/2005	2.9	8.5	11.4	1.6	0.0	1.6
4/7/2005	1.4	4.0	5.4	1.4	0.5	1.9
4/8/2005	4.5	6.3	10.8	1.3	1.0	2.3
4/9/2005	4.3	3.8	8.1	1.5	0.0	1.5
4/10/2005	2.3	7.0	9.2	2.1	0.0	2.1
4/11/2005	3.3	13.5	16.7	1.8	4.7	6.6
4/12/2005	2.2	14.6	16.8	1.9	5.7	7.6
4/13/2005	2.3	14.4	16.7	1.6	2.1	3.6
4/14/2005	2.5	12.8	15.3	2.0	3.5	5.5
4/15/2005	2.4	16.1	18.6	1.8	2.4	4.3
4/16/2005	3.4	14.5	17.8	2.0	6.5	8.6
4/17/2005	3.8	4.0	7.8	2.0	2.0	4.1
4/18/2005	4.2	10.8	15.0	2.2	1.1	3.3
4/19/2005	5.4	15.1	20.4	2.5	4.5	7.0
4/20/2005	2.6	36.6	39.2	1.8	7.9	9.7
Average	2.7	8.9	11.6	1.9	1.6	3.5

(*) Receives headworks influent.

(+) Receives primary treated influent.

TABLE 6
PHASE 1 PILOT PLANT TESTING
EAST TRAIN (*)
PERFORMANCE AT TARGET MLSS OF 1,500 MG/L

	<u>MLSS</u>	<u>SRT</u>	<u>Influent</u>	<u>Total</u>	<u>Filtered</u>	<u>CBOD5 of</u>	<u>CBOD5</u>	<u>CBOD5</u>	<u>CBOD5</u>	<u>Total</u>
	(mg/L)	(days)	<u>BOD5</u>	<u>Effluent</u>	<u>Effluent</u>	<u>Effluent</u>	<u>Effluent</u>	<u>per Effl.</u>	<u>of TSS @</u>	<u>CBOD5</u>
			(mg/L)	(mg/L)	(mg/L)	<u>TSS</u>	<u>TSS</u>	<u>TSS</u>	<u>30 mg/L</u>	<u>with TSS</u>
						(mg/L)	(mg/L)	(mg/mg)	(mg/L)	<u>of 30 mg/L</u>
										(mg/L)
4/26/2005	1,280	2.3	136.2	13.6	4.1	9.5	32.0	0.30	8.9	13.0
4/27/2005	2,175	1.9	184.9	11.4	3.2	8.2	25.3	0.32	9.7	12.9
4/28/2005	1,575	2.6	150.8	13.1	4.1	9.0	42.7	0.21	6.3	10.4
4/29/2005	2,067	1.6	133.0	12.2	3.6	8.6	26.0	0.33	9.9	13.5
4/30/2005	1,700	1.2	121.9	13.0	2.6	10.4	34.0	0.31	9.2	11.8
5/1/2005	1,280	1.9	116.7	12.6	4.1	8.5	26.7	0.32	9.6	13.7
5/2/2005	1,317	3.4	96.5	16.3	3.2	13.1	19.0	0.69	20.7	23.9
5/3/2005	1,683	3.3	118.0	10.8	3.6	7.2	28.0	0.26	7.7	11.3
5/4/2005	1,580	3.9	102.5	11.3	2.2	9.1	30.0	0.30	9.1	11.3
5/5/2005	1,400	3.6	179.8	15.4	4.0	11.4	31.0	0.37	11.0	15.0
5/6/2005	1,360	1.7	124.2	8.5	3.6	4.9	18.0	0.27	8.2	11.8
5/7/2005	2,060	1.5	109.2	7.2	2.4	4.8	24.0	0.20	6.0	8.4
5/8/2005	1,800	2.8	88.2	7.6	3.0	4.6	34.7	0.13	4.0	7.0
5/9/2005	1,933	2.4	110.9	10.7	2.6	8.1	66.0	0.12	3.7	6.3
5/10/2005	2,075	1.1	138.5	12.5	3.2	9.3	41.3	0.23	6.8	10.0
5/11/2005	1,600	1.2	126.0	10.9	3.5	7.4	36.0	0.21	6.2	9.7
5/12/2005	1,750	1.7	93.6	8.6	3.0	5.6	38.7	0.14	4.3	7.3
5/13/2005	1,275	1.8	112.5	10.8	2.8	8.0	34.0	0.24	7.1	9.9
5/14/2005	1,983	1.8	55.9	8.9	2.1	6.8	38.0	0.18	5.4	7.5
5/15/2005	1,733	3.6	75.5	11.4	3.5	7.9	43.5	0.18	5.4	8.9
5/16/2005	1,600	2.4	97.0	12.5	2.6	9.9	38.7	0.26	7.7	10.3
5/17/2005	1,500	2.1	100.2	10.3	3.7	6.6	41.3	0.16	4.8	8.5
5/18/2005	1,300	1.7	124.5	11.2	4.2	7.0	34.7	0.20	6.1	10.3
5/19/2005	1,825	2.4	157.4	22.8	4.3	18.5	33.0	0.56	16.8	21.1
5/20/2005	1,680	1.6	126.0	8.9	3.5	5.4	17.3	0.31	9.4	12.9
5/21/2005	1,517	2.0	114.1	9.6	2.6	7.0	21.3	0.33	9.9	12.5
5/22/2005	1,167	1.7	153.4	13.7	3.4	10.3	46.7	0.22	6.6	10.0
5/23/2005	1,533	1.7	99.8	12.9	2.9	10.0	41.0	0.24	7.3	10.2
5/24/2005	1,047	1.6	82.0	10.5	2.9	7.6	38.0	0.20	6.0	8.9
5/25/2005	1,283	2.9	107.4	10.2	2.4	7.8	34.0	0.23	6.9	9.3
5/26/2005	1,790	3.3	105.0	10.6	2.7	7.9	39.0	0.20	6.1	8.8
Average	1,609	2.2	118.0	11.6	3.2	8.4	34.0	0.27	8.0	11.2

(*) Receives headworks influent.

TABLE 7
PHASE 1 PILOT PLANT TESTING
WEST TRAIN (*)
PERFORMANCE AT TARGET MLSS OF 1,500 MG/L

	<u>MLSS</u>	<u>SRT</u>	<u>Influent</u>	<u>Total</u>	<u>Filtered</u>	<u>CBOD5 of</u>	<u>CBOD5</u>	<u>CBOD5</u>	<u>CBOD5</u>	<u>Total</u>
	(mg/L)	(days)	<u>BOD5</u>	<u>Effluent</u>	<u>Effluent</u>	<u>Effluent</u>	<u>Effluent</u>	<u>per Effl.</u>	<u>of TSS @</u>	<u>CBOD5</u>
			(mg/L)	(mg/L)	(mg/L)	<u>TSS</u>	<u>TSS</u>	(mg/mg)	30 mg/L	with TSS
						(mg/L)	(mg/L)		(mg/L)	of 30 mg/L
4/26/2005	1,920	7.5	65.4	9.2	7.7	1.5	17.6	0.09	2.6	10.3
4/27/2005	1,875	3.0	72.6	7.1	3.1	4.0	12.0	0.33	10.0	13.1
4/28/2005	1,675	5.2	68.1	7.4	2.8	4.6	15.3	0.30	9.0	11.8
4/29/2005	1,933	4.4	55.5	7.4	2.3	5.1	10.0	0.51	15.3	17.6
4/30/2005	1,657	3.7	58.9	6.4			17.3			
5/1/2005	1,540	6.1	55.6	6.7	2.2	4.5	14.7	0.31	9.2	11.4
5/2/2005	1,550	3.9	49.3	5.0			13.1			
5/3/2005	1,480	21.0	43.1	6.6	2.3	4.3	10.5	0.41	12.3	14.6
5/4/2005	1,500	12.3	45.4	7.2			11.0			
5/5/2005	900	11.2	60.5	8.0	3.8	4.2	17.3	0.24	7.3	11.1
5/6/2005	2,040	4.6	76.9	8.4	3.2	5.2	18.0	0.29	8.7	11.9
5/7/2005	1,940	3.0	67.9	6.7	1.8	4.9	20.7	0.24	7.1	8.9
5/8/2005	1,820	5.3	66.1	6.7	2.2	4.5	24.8	0.18	5.4	7.6
5/9/2005	2,267	6.7	78.8	8.8	2.5	6.3	28.0	0.23	6.8	9.3
5/10/2005	2,325	2.3	82.0	9.3	3.3	6.0	17.6	0.34	10.2	13.5
5/11/2005	1,675	2.0	88.0	6.8	2.8	4.0	19.2	0.21	6.3	9.1
5/12/2005	1,750	2.2	58.4	6.5	2.5	4.0	17.6	0.23	6.8	9.3
5/13/2005	1,425	6.9	75.8	8.8	3.0	5.8	17.1	0.34	10.2	13.2
5/14/2005	1,983	3.1	55.1	5.9	3.0	2.9	14.8	0.20	5.9	8.9
5/15/2005	2,167	7.0	55.4	8.3	3.5	4.8	17.0	0.28	8.5	12.0
5/16/2005	1,833	4.6	51.5	2.5	3.5		14.7			
5/17/2005	1,900	6.2	61.7	7.8	4.2	3.6	15.3	0.24	7.1	11.3
5/18/2005	1,667	3.1	68.1	6.8	3.4	3.4	14.0	0.24	7.3	10.7
5/19/2005	1,540	4.3	65.2	9.3	4.2	5.1	13.5	0.38	11.3	15.5
5/20/2005	1,500	4.1	79.3	7.9	3.6	4.3	10.7	0.40	12.1	15.7
5/21/2005	1,760	2.9	63.5	8.6	2.8	5.8	11.3	0.51	15.4	18.2
5/22/2005	1,467	5.0	61.3	7.0	3.5	3.5	15.4	0.23	6.8	10.3
5/23/2005	1,700	3.0	46.6	5.9	2.8	3.1	11.7	0.26	7.9	10.7
5/24/2005	1,300	3.9	36.8	5.1	2	3.1	10.0	0.31	9.3	11.3
5/25/2005	1,283	5.6	39.9	4.8	1.9	2.9	9.0	0.32	9.7	11.6
5/26/2005	1,320	7.9	45.2	5.6	2.1	3.5	12.0	0.29	8.8	10.9
Average	1,700	5.6	61.0	7.0	3.1	4.3	15.2	0.3	8.8	11.8

(*) Receives primary treated influent.

TABLE 8
PHASE 1 PILOT PLANT TESTING
SUMMARY OF OTHER OPERATING CONDITIONS
AT TARGET MLSS OF 1,500 MG/L

	EAST <u>TRAIN (*)</u> Average (Range)	WEST <u>TRAIN (+)</u> Average (Range)
Feed TSS, mg/L	175 (100-236)	63 (31-94)
Feed TSS, % Volatile	77 (67-91)	77 (63-84)
Feed Temperature, °C	16.1 (14.6-17.6)	16.1 (14.8-17.5)
Operating Temperature, °C (4th Aeration Unit)	16.7 (15.2-17.9)	16.6 (15.2-18.0)
Feed pH	(6.6-7.0)	(6.6-7.0)
Effluent pH	(6.5-6.9)	(6.5-6.8)
Dissolved Oxygen, mg/L (4th Aeration Unit)	5.3 (4.0-6.8)	4.5 (3.5-5.4)
SVI, ml/gm	70 (46-96)	86 (65-100)
Influent NH ₃ -N, mg/L	8.8 (5.9-11.3)	9.2 (5.5-12.0)
Effluent NH ₃ -N, mg/L	2.7 (1.8-3.9)	1.5 (1.0-2.1)

(*) Receives headworks influent.

(+) Receives primary treated influent.

TABLE 9
PHASE 2 PILOT PLANT TESTING
SOLIDS REMOVED FROM TRAINS
TO MAINTAIN TARGET MLSS OF 1,500 mg/L

	East Train (*)			West Train (+)		
	Effluent TSS Loss (lbs/d)	Wasted From RAS (lbs/d)	Total TSS Removed (lbs/d)	Effluent TSS Loss (lbs/d)	Wasted From RAS (lbs/d)	Total TSS Removed (lbs/d)
4/26/2005	3.1	3.8	7.0	1.7	1.9	3.7
4/27/2005	2.5	15.0	17.4	1.2	8.0	9.2
4/28/2005	4.2	5.2	9.4	1.5	3.4	4.9
4/29/2005	2.6	17.0	19.6	1.0	5.4	6.4
4/30/2005	3.3	18.2	21.6	1.7	4.9	6.7
5/1/2005	2.6	7.3	10.0	1.4	2.3	3.8
5/2/2005	1.9	3.6	5.5	1.3	4.6	5.9
5/3/2005	2.8	4.5	7.3	1.0	0.0	1.0
5/4/2005	2.9	3.2	6.1	1.1	0.8	1.9
5/5/2005	3.0	3.3	6.4	1.7	0.0	1.7
5/6/2005	1.8	9.4	11.1	1.8	4.5	6.3
5/7/2005	2.4	17.6	20.0	2.0	7.3	9.4
5/8/2005	3.4	6.0	9.4	2.4	2.5	4.9
5/9/2005	6.5	5.4	11.9	2.8	2.0	4.7
5/10/2005	4.1	22.5	26.6	1.7	12.5	14.3
5/11/2005	3.5	17.2	20.7	1.9	10.2	12.1
5/12/2005	3.8	11.1	14.9	1.7	10.6	12.3
5/13/2005	3.3	6.1	9.5	1.7	1.6	3.2
5/14/2005	3.7	9.4	13.2	1.5	7.2	8.6
5/15/2005	4.3	1.8	6.1	1.7	2.3	4.0
5/16/2005	3.8	5.7	9.5	1.4	4.6	6.1
5/17/2005	4.1	6.1	10.1	1.5	2.8	4.3
5/18/2005	3.4	7.8	11.2	1.4	6.7	8.1
5/19/2005	3.2	7.5	10.8	1.3	4.3	5.6
5/20/2005	1.7	13.7	15.4	1.1	4.3	5.4
5/21/2005	2.1	9.1	11.2	1.1	7.9	9.0
5/22/2005	4.6	5.3	9.9	1.5	2.9	4.4
5/23/2005	4.0	8.9	12.9	1.2	7.1	8.2
5/24/2005	3.7	8.1	11.8	1.0	4.2	5.1
5/25/2005	3.3	2.8	6.2	0.9	2.6	3.4
5/26/2005	3.8	3.0	6.8	1.2	1.3	2.5
Average	3.3	8.6	11.9	1.5	4.5	6.0

(*) Receives headworks influent.

(+) Receives primary treated influent.

TABLE 10
PHASE 2 PILOT PLANT TESTING
WEST TRAIN
PERFORMANCE IN/OUT WET WEATHER TRANSITION

	<u>MLSS</u>	<u>SRT</u>	<u>Influent</u>	<u>Total</u>	<u>Filtered</u>	<u>CBOD5 of</u>	<u>Effluent</u>	<u>CBOD5</u>	<u>CBOD5</u>	<u>Total</u>
	(mg/L)	(days)	<u>BOD5</u>	<u>Effluent</u>	<u>Effluent</u>	<u>Effluent</u>	<u>TSS</u>	<u>per Effl.</u>	<u>of TSS @</u>	<u>CBOD5</u>
			(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/mg)	30 mg/L	with TSS
										of 30 mg/L
1/16/2006	2,067	3.6	61	25.1		25.1	36	0.70	20.9	20.9
1/17/2006	1,500	1.9	69	21.6	7.6	14.0	14	1.00	30.0	37.6
1/18/2006	2,200	7.7	50	10.1		10.1	8	1.26	37.9	37.9
1/19/2006	1,080	2.8	35	46.9	7.8	39.1	41	0.95	28.6	36.4
1/20/2006	1,400	3.8	62	6.7	5.7	1.0	1	1.43	42.9	48.6
1/21/2006	1,580	2.5	58	17.9	5.6	12.3	41	0.30	8.9	14.5
1/22/2006	1,180	4.5	44	13.1	7.6	5.5	25	0.22	6.5	14.1
1/23/2006	1,200	3.5	60	14.4	7.4	7.0	29	0.24	7.2	14.6
1/24/2006	1,340	3.7	59	21.5	7.7	13.8	22	0.63	18.8	26.5
1/25/2006	1,520	2.3	92	15.4	8.0	7.4	36	0.21	6.2	14.2
1/26/2006	1,820	1.7	38	16.5	6.0	10.5	40	0.26	7.9	13.9
1/27/2006	690	5.4	47	9.2	3.7	5.5	29	0.19	5.7	9.4
1/28/2006	960	4.4	50	16.4	2.9	13.5	44	0.31	9.2	12.1
1/29/2006	1,200	9.1	39	8.4	3.9	4.5	25	0.18	5.4	9.3
1/30/2006	2,360	19.6	63	15.5	7.3	8.2	20	0.41	12.3	19.6
1/31/2006	1,180	5.3	35	10.4	5.4	5.0	18	0.28	8.3	13.7
2/1/2006	1,173	4.9	46	9.6	4.5	5.1	25	0.20	6.0	10.5
2/2/2006	1,600	4.9	35	8.8	3.0	5.8	28	0.21	6.2	9.2
2/3/2006	1,107	4.3					9			
2/4/2006	1,540	2.3	98	20.7	4.7	16.0	56	0.29	8.6	13.3
2/5/2006	1,060	2.7	53	8.3	2.5	5.8	23	0.26	7.7	10.2
2/6/2006	1,353	2.6	58	5.8	3.3	2.5	12	0.21	6.3	9.6
2/7/2006	1,373	4.0	18	4.3	2.5	1.8	17	0.11	3.2	5.7
2/8/2006	1,160	2.6	46	7.5	3.9	3.6	24	0.15	4.5	8.4
2/9/2006	1,440	11.2	47	4.1	3.3	0.8	23	0.03	1.0	4.3
2/10/2006	1,300	3.3	37	6.6	3.1	3.5	5	0.70	21.0	24.1
2/11/2006	1,040	3.5	69	12.3	3.3	9.0	28	0.33	9.8	13.1
2/12/2006	1,367	3.3	49	10.4	2.6	7.8	44	0.18	5.3	7.9
2/13/2006	1,500	3.5	51	12.1	2.0	10.1	39	0.26	7.8	9.8
2/14/2006	1,127	4.2	39	10.2	4.8	5.4	21	0.25	7.6	12.4
2/15/2006	1,099	4.9	55	12.3	4.5	7.8	17	0.46	13.8	18.3
2/16/2006	1,073	3.6	180	11.3	4.3	7.0	16	0.44	13.1	17.4
2/17/2006	1,333	1.5	75	9.7	2.7	7.0	16	0.44	13.1	15.8
2/18/2006		4.9	68	11.0	3.1	7.9	22	0.36	10.8	13.9
2/19/2006	1,627	4.4	52	11.5	3.7	7.8	31	0.25	7.5	11.2
2/20/2006	1,007	3.7	47	8.1	4.8	3.3	17	0.20	5.9	10.7
2/21/2006	1,130	4.8	53	14.4	3.9	10.5	31	0.34	10.3	14.2
2/22/2006	1,227	4.9	68	12.1	6.8	5.3	22	0.24	7.2	14.0
2/23/2006	1,127	9.1	22	4.0	3.1	0.9	13	0.07	2.1	5.2
2/24/2006	1,293	3.2	43	3.6	3.5	0.1	8	0.01	0.4	3.9
2/25/2006	1,140	3.7	140	11.8	2.7	9.1	39	0.23	7.0	9.7
2/26/2006	1,153	3.2	36	4.4	3.2	1.2	19	0.06	1.9	5.1
2/27/2006	1,240	2.7	77	10.6	4.1	6.5	29	0.22	6.7	10.8
2/28/2006	8,487	14.1	38	5.3	2.1	3.2	18	0.18	5.3	7.4
3/1/2006	1,354	3.2	48	7.0	2.2	4.8	18	0.27	8.0	10.2
3/2/2006	1,299	3.8	44	18.5	4.4	14.1	29	0.49	14.6	19.0
3/3/2006	1,340	2.6	80	10.6	6.0	4.6	26	0.18	5.3	11.3

TABLE 10
PHASE 2 PILOT PLANT TESTING
WEST TRAIN
PERFORMANCE IN/OUT WET WEATHER TRANSITION

	<u>MLSS</u>	<u>SRT</u>	Influent	Total	Filtered	CBOD5 of	Effluent	CBOD5	CBOD5	Total
	(mg/L)	(days)	<u>BOD5</u>	<u>Effluent</u>	<u>Effluent</u>	<u>Effluent</u>	<u>TSS</u>	per Effl.	of TSS @	CBOD5
			(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	<u>TSS</u>	30 mg/L	with TSS
								(mg/mg)	(mg/L)	of 30 mg/L
3/4/2006	1,307	2.1	77	13.2	4.0	9.2	68	0.14	4.1	8.1
3/5/2006	1,340	4.9	74	13.4	5.3	8.1	27	0.30	9.1	14.4
3/6/2006	1,347	2.4	50	9.4	6.2	3.2	16	0.20	6.0	12.2
3/7/2006	1,247	3.6	77	6.9	4.8	2.1	13	0.16	4.7	9.5
3/8/2006	1,480	2.4	81	9.9	4.7	5.2	32	0.16	4.9	9.6
3/9/2006	1,313	2.6	75	12.6	4.0	8.6	35	0.25	7.4	11.4
3/10/2006	1,507	2.9	48	5.3	4.6	0.7	4	0.18	5.3	9.9
3/11/2006	1,187	4.2	93	9.9	4.3	5.6	10	0.56	16.8	21.1
3/12/2006	1,320	2.3	60	11.1	2.9	8.2	44	0.19	5.6	8.5
3/13/2006	1,340	1.6	58	11.0	2.7	8.3	43	0.19	5.8	8.5
3/14/2006	1,327	3.1	61	9.7	3.4	6.3	27	0.23	7.0	10.4
3/15/2006	8,013	4.6	70	6.1	3.5	2.6	11	0.24	7.1	10.6
3/16/2006	1,173	3.4	43	8.3	3.6	4.7	26	0.18	5.4	9.0
3/17/2006	1,160	2.9	55	14.2	4.7	9.5	51	0.19	5.6	10.3
3/18/2006	787	3.1	50	13.2	2.5	10.7	56	0.19	5.7	8.2
3/19/2006	527	6.5	58	7.7	3.6	4.1	23	0.18	5.3	8.9
3/20/2006	1,033	7.3	48	8.2	3.8	4.4	21	0.21	6.3	10.1
3/21/2006	1,273	9.7	54	8.6	3.6	5.0	17	0.29	8.8	12.4
3/22/2006	1,447	3.7	38	7.5	3.3	4.2	16	0.26	7.9	11.2
3/23/2006	1,187	6.6	49	7.4	2.3	5.1	20	0.26	7.7	10.0
3/24/2006	1,213	6.5	37	4.6	3.0	1.6	7	0.25	7.4	10.4
3/25/2006	1,280	7.4	85	14.4	3.3	11.1	35	0.32	9.5	12.8
3/26/2006	1,347	3.1	67	10.6	4.4	6.2	23	0.27	8.2	12.6
3/27/2006	1,347	3.8	75	11.1	3.5	7.6	31	0.25	7.4	10.9
3/28/2006	1,433	2.9	58	9.2	3.8	5.4	24	0.23	6.8	10.6
3/29/2006	1,387	4.5	61	6.0	3.7	2.3	9	0.27	8.1	11.8
3/30/2006	1,433	4.0	33	5.7	2.5	3.2	20	0.16	4.8	7.3
3/31/2006	1,687	2.4	55	9.8	4.3	5.5	14	0.41	12.2	16.5
4/1/2006	1,460	1.9	56	12.4	4.3	8.1	31	0.26	7.8	12.1
4/2/2006	980	3.3	68	10.6	5.1	5.5	26	0.21	6.3	11.4
Average	1,490	4.4	59	11.1	4.2	7.0	25.1	0.31	9	13.3

Bold type = wet weather mode

TABLE 11
PHASE 2 PILOT PLANT TESTING
EAST TRAIN
PERFORMANCE IN/OUT WET WEATHER TRANSITION
WITH POLYMER ADDITION

	<u>MLSS</u>	<u>SRT</u>	<u>Influent</u>	<u>Total</u>	<u>Filtered</u>	<u>CBOD5 of</u>	<u>Effluent</u>	<u>CBOD5</u>	<u>CBOD5</u>	<u>Total</u>
	(mg/L)	(days)	<u>BOD5</u>	<u>Effluent</u>	<u>Effluent</u>	<u>Effluent</u>	<u>Effluent</u>	<u>per Effl.</u>	<u>of TSS @</u>	<u>CBOD5</u>
			(mg/L)	(mg/L)	(mg/L)	<u>TSS</u>	<u>TSS</u>	<u>TSS</u>	<u>30 mg/L</u>	<u>with TSS</u>
						(mg/L)	(mg/L)	(mg/mg)	(mg/L)	<u>of 30 mg/L</u>
										(mg/L)
1/16/2006	1,933	3.8	61	37.6		37.6	42	0.90	26.9	26.9
1/17/2006	1,550	1.9	69	19.5	7.3	12.2	27	0.45	13.6	20.9
1/18/2006	1,500	2.6	50	9.1		9.1	20	0.46	13.7	13.7
1/19/2006	1,580	4.6	35	23.7	4.0	19.7	24	0.82	24.6	28.6
1/20/2006	830	2.7	62	8.8	5.6	3.2	2	2.00	60.0	65.6
1/21/2006	1,980	3.2	58	19.7	6.4	13.3	50	0.27	8.0	14.4
1/22/2006	1,800	4.2	44	13.1	3.5	9.6	32	0.30	9.0	12.5
1/23/2006	1,500	2.2	60		5.9		76			
1/24/2006	350	1.2	59	10.5	7.4	3.1	33	0.09	2.8	10.2
1/25/2006	1,280	2.6	92	7.7	3.7	4.0	24	0.17	5.0	8.7
1/26/2006	3,180	3.6	38	12.3	6.5	5.8	39	0.15	4.5	11.0
1/27/2006	2,980	6.9	47	8.2	2.0	6.2	26	0.24	7.2	9.2
1/28/2006	1,760	7.3	50	12.6	2.6	10.0	36	0.28	8.3	10.9
1/29/2006	3,200	5.0	39	7.7	4.0	3.7	40	0.09	2.8	6.8
1/30/2006	2,060	8.9	63	16.1	6.0	10.1	32	0.32	9.5	15.5
1/31/2006	2,340	7.9	35	12.2	5.3	6.9	22	0.31	9.4	14.7
2/1/2006	1,760	8.5	46	10.1	5.3	4.8	31	0.16	4.7	10.0
2/2/2006	787	2.2	35	6.6	2.2	4.4	40	0.11	3.3	5.5
2/3/2006	1,900	2.1					17			
2/4/2006	2,420	1.0	98	12.2	3.2	9.0	34	0.27	8.0	11.2
2/5/2006	1,840	6.8	53	9.9	3.6	6.3	39	0.16	4.9	8.5
2/6/2006	607	1.7	58	9.4	2.1	7.3	20	0.37	11.0	13.1
2/7/2006	2,067	2.4	18	4.3			27			
2/8/2006	1,847	4.1	46	8.3	3.4	4.9	27	0.18	5.4	8.8
2/9/2006	1,327	3.5	47	7.8	4.8	3.0	36	0.08	2.5	7.3
2/10/2006	1,920	3.7	37	6.6	2.0	4.6	7	0.69	20.6	22.6
2/11/2006	1,353	3.2	69	18.3	3.7	14.6	49	0.30	8.9	12.6
2/12/2006	2,033	3.3	49	15.2	3.1	12.1	48	0.25	7.6	10.7
2/13/2006	1,460	4.0	51	11.7	5.6	6.1	37	0.16	4.9	10.5
2/14/2006	1,540	4.8	39	13	3.4	9.6	36	0.27	8.0	11.4
2/15/2006	1,493	4.1	55	11	6.5	4.0	41	0.10	2.9	9.4
2/16/2006	1,580	5.2	180	17	6.3	10.4	32	0.33	9.8	16.1
2/17/2006	1,953	1.3	75	13	3.9	9.5	29	0.33	9.8	13.7
2/18/2006	1,440	6.7	68	14	4.7	9.7	33	0.30	8.9	13.6
2/19/2006	4,340	3.7	52	14	4.1	10.2	34	0.30	9.0	13.1
2/20/2006	1,420	3.5	47	12.9	4.9	8.0	39	0.21	6.2	11.1
2/21/2006	1,980	4.2	53	12.4	4.0	8.4	45	0.19	5.6	9.6
2/22/2006	1,567	4.6	68	13.0	7.1	5.9	47	0.13	3.8	10.9
2/23/2006	1,440	2.5	22	5.4	2.5	2.9	69	0.04	1.3	3.8
2/24/2006	1,067	3.4	43	7.1	4.4	2.7	11	0.24	7.2	11.6
2/25/2006	1,313	2.4	140	26.6	3.2	23.4	86	0.27	8.2	11.4
2/26/2006	1,160	2.5	36	5.1	3.6	1.5	67	0.02	0.7	4.3
2/27/2006	1,847	24.1	77	5.7	4.1	1.6	10	0.17	5.1	9.2
2/28/2006	1,607	4.7	38	6.7	1.9	4.8	48	0.10	3.0	4.9
3/1/2006	2,087	2.7	48	10.7	3.0	7.7	68	0.11	3.4	6.4
3/2/2006	1,987	4.5	44	11.1	5.1	6.0	24	0.25	7.5	12.6
3/3/2006	1,773	1.9	80	10.6	5.0	5.6	75	0.07	2.2	7.2

TABLE 11
PHASE 2 PILOT PLANT TESTING
EAST TRAIN
PERFORMANCE IN/OUT WET WEATHER TRANSITION
WITH POLYMER ADDITION

	<u>MLSS</u> (mg/L)	<u>SRT</u> (days)	<u>Influent</u> <u>BOD5</u> (mg/L)	<u>Total</u> <u>Effluent</u> <u>CBOD5</u> (mg/L)	<u>Filtered</u> <u>Effluent</u> <u>CBOD5</u> (mg/L)	<u>CBOD5 of</u> <u>Effluent</u> <u>TSS</u> (mg/L)	<u>Effluent</u> <u>TSS</u> (mg/L)	<u>CBOD5</u> <u>per Effl.</u> <u>TSS</u> (mg/mg)	<u>CBOD5</u> <u>of TSS @</u> <u>30 mg/L</u> (mg/L)	<u>Total</u> <u>CBOD5</u> <u>with TSS</u> <u>of 30 mg/L</u> (mg/L)
							40	0.32	9.5	12.7
3/4/2006	1,753	2.9	77	15.9	3.2	12.7				
3/5/2006	1,580		74							
3/6/2006	1,693	3.1	50	10.5	2.9	7.6	20	0.38	11.4	14.3
3/7/2006	1,633	3.3	77	10.7	4.3	6.4	22	0.29	8.7	13.0
3/8/2006	1,793	2.6	81	8.2	3.2	5.0	26	0.19	5.8	9.0
3/9/2006	1,700	2.4	75	11.3	3.9	7.4	28	0.26	7.9	11.8
3/10/2006	1,973	3.7	48	5.7	4.0	1.7	7	0.25	7.6	11.6
3/11/2006	1,520	3.1	93	19.1	5.0	14.1	30	0.47	14.1	19.1
3/12/2006	1,727	2.4	60	8.2	3.1	5.1	36	0.14	4.3	7.4
3/13/2006	1,920	1.8	58	6.5	3.0	3.5	13	0.28	8.3	11.3
3/14/2006	2,033	1.9	61	8.4	4.9	3.5	16	0.23	6.8	11.7
3/15/2006	2,167	1.2	70	8.1	3.6	4.5	17	0.26	7.8	11.4
3/16/2006	1,793	3.7	43	7.2	3.4	3.8	26	0.15	4.4	7.8
3/17/2006	1,973	2.1	55	9.0	3.4	5.6	25	0.23	6.8	10.2
3/18/2006	1,500	8.3	50	8.9	2.5	6.4	29	0.22	6.6	9.1
3/19/2006	1,553	4.0	58	11.9	4.5	7.4	40	0.19	5.6	10.1
3/20/2006	1,707	4.5	48	8.4	3.7	4.7	25	0.19	5.6	9.3
3/21/2006	1,840	3.8	54	9.1	4.2	4.9	15	0.33	10.0	14.2
3/22/2006	1,873	12.0	38	8.5	3.6	4.9	23	0.21	6.4	10.0
3/23/2006	2,473	5.2	49	8.7	2.2	6.5	19	0.35	10.4	12.6
3/24/2006	1,933	4.0	37	6.2	3.3	2.9	8	0.36	10.9	14.2
3/25/2006	1,553	4.8	85	15.4	4.7	10.7	42	0.25	7.6	12.3
3/26/2006	1,720	2.7	67	17.5	4.0	13.5	45	0.30	8.9	12.9
3/27/2006	1,620	3.3	75	12.7	3.8	8.9	33	0.27	8.0	11.8
3/28/2006	1,907	3.0	58	10.9	3.9	7.0	31	0.23	6.8	10.7
3/29/2006	1,773	3.4	61	9.1	3.1	6.0	33	0.18	5.4	8.5
3/30/2006	1,953	3.2	33	7.9	1.5	6.4	37	0.17	5.1	6.6
3/31/2006	1,900	4.0	55	7.0	3.7	3.3	6	0.55	16.5	20.2
4/1/2006	1,940	1.8	56	17.1	3.3	13.8	27	0.52	15.5	18.8
4/2/2006	1,540	3.2	68	10.5	4.0	6.5	32	0.20	6.1	10.1
Average	1,776	4.0	59	11.5	4.0	7.6	32.6	0.29	9	12.5

Bold type = wet weather mode

TABLE 12
PHASE 2 PILOT PLANT TESTING
SUMMARY OF OTHER OPERATING CONDITIONS
IN/OUT WET WEATHER TRANSITION

	EAST TRAIN (*) Average (Range)	WEST TRAIN Average (Range)
Feed TSS, mg/L	71 (20-204)	71 (20-204)
Feed TSS, % Volatile	77 (47-97)	77 (47-97)
Feed Temperature, °C	11.9 (10.8-13.9)	11.9 (10.8-13.9)
Operating Temperature, °C (4th Aeration Unit)	12.0 (10.1-14.8)	11.9 (10.1-14.9)
Feed pH	(6.2-7.7)	(6.6-7.2)
Effluent pH	(6.4-7.1)	(6.2-7.0)
Dissolved Oxygen, mg/L	7.7 (1.6-10.7)	8.4 (3.2-10.8)
SVI, ml/gm	64 (30-157)	66 (12-102)

(*) Receives polymer addition.

TABLE 13
PHASE 2 PILOT PLANT TESTING
SOLIDS REMOVED FROM TRAINS
TO MAINTAIN TARGET MLSS OF 1,500 - 2,000 mg/L

	East Train (*)			West Train		
	Effluent TSS Loss (lbs/d)	Wasted From RAS (lbs/d)	Total TSS Removed (lbs/d)	Effluent TSS Loss (lbs/d)	Wasted From RAS (lbs/d)	Total TSS Removed (lbs/d)
1/16/2006	4.1	3.0	7.1	3.5	7.0	10.5
1/17/2006	2.6	13.5	16.2	1.4	10.4	11.7
1/18/2006	2.0	11.3	13.3	0.8	2.8	3.6
1/19/2006	2.3	2.4	4.7	4.0	3.7	7.7
1/20/2006	0.2	16.3	16.5	0.1	7.3	7.3
1/21/2006	4.9	3.3	8.2	4.0	6.3	10.3
1/22/2006	3.1	3.0	6.2	2.5	2.7	5.2
1/23/2006	7.4	2.8	10.2	2.9	3.8	6.7
1/24/2006	3.2	0.9	4.2	2.1	4.7	6.9
1/25/2006	2.3	3.9	6.2	3.5	10.2	13.7
1/26/2006	3.8	7.3	11.1	3.9	15.8	19.7
1/27/2006	2.5	2.6	5.2	2.8	0.0	2.8
1/28/2006	3.5	0.0	3.5	4.3	0.0	4.3
1/29/2006	3.9	3.6	7.5	2.4	0.0	2.4
1/30/2006	3.1	0.0	3.1	2.0	0.0	2.0
1/31/2006	2.1	1.8	3.9	1.8	2.9	4.7
2/1/2006	3.0	0.0	3.0	2.5	2.4	4.9
2/2/2006	3.9	2.2	6.1	2.7	3.5	6.2
2/3/2006	1.6	13.4	15.0	0.8	4.3	5.2
2/4/2006	3.3	27.1	30.3	5.5	7.2	12.6
2/5/2006	3.8	0.0	3.8	2.2	6.8	9.0
2/6/2006	2.0	2.6	4.6	1.2	9.3	10.5
2/7/2006	2.6	10.6	13.2	1.7	5.5	7.1
2/8/2006	2.6	3.7	6.3	2.3	6.6	8.9
2/9/2006	3.5	0.9	4.4	2.2	0.0	2.2
2/10/2006	0.7	8.3	9.0	0.5	7.2	7.7
2/11/2006	4.8	1.5	6.3	2.7	3.4	6.1
2/12/2006	4.7	3.2	7.9	4.3	3.1	7.4
2/13/2006	3.6	1.4	5.1	3.8	3.9	7.7
2/14/2006	3.5	1.0	4.5	2.1	3.0	5.1
2/15/2006	4.0	0.9	4.9	1.7	2.4	4.1
2/16/2006	3.1	0.9	4.0	1.6	3.8	5.3
2/17/2006	2.8	18.7	21.5	1.6	15.8	17.4
2/18/2006	3.2	0.0	3.2	2.1	2.2	4.3
2/19/2006	3.3	9.7	13.1	3.0	5.1	8.1
2/20/2006	3.8	1.9	5.7	1.6	4.0	5.7
2/21/2006	4.4	1.5	5.9	3.0	1.6	4.6
2/22/2006	4.6	0.0	4.6	2.1	2.4	4.5
2/23/2006	6.8	1.4	8.2	1.3	0.9	2.1
2/24/2006	1.1	3.7	4.8	0.7	6.9	7.6
2/25/2006	8.4	0.0	8.4	3.8	2.1	5.9
2/26/2006	6.5	0.0	6.5	1.9	5.0	6.9

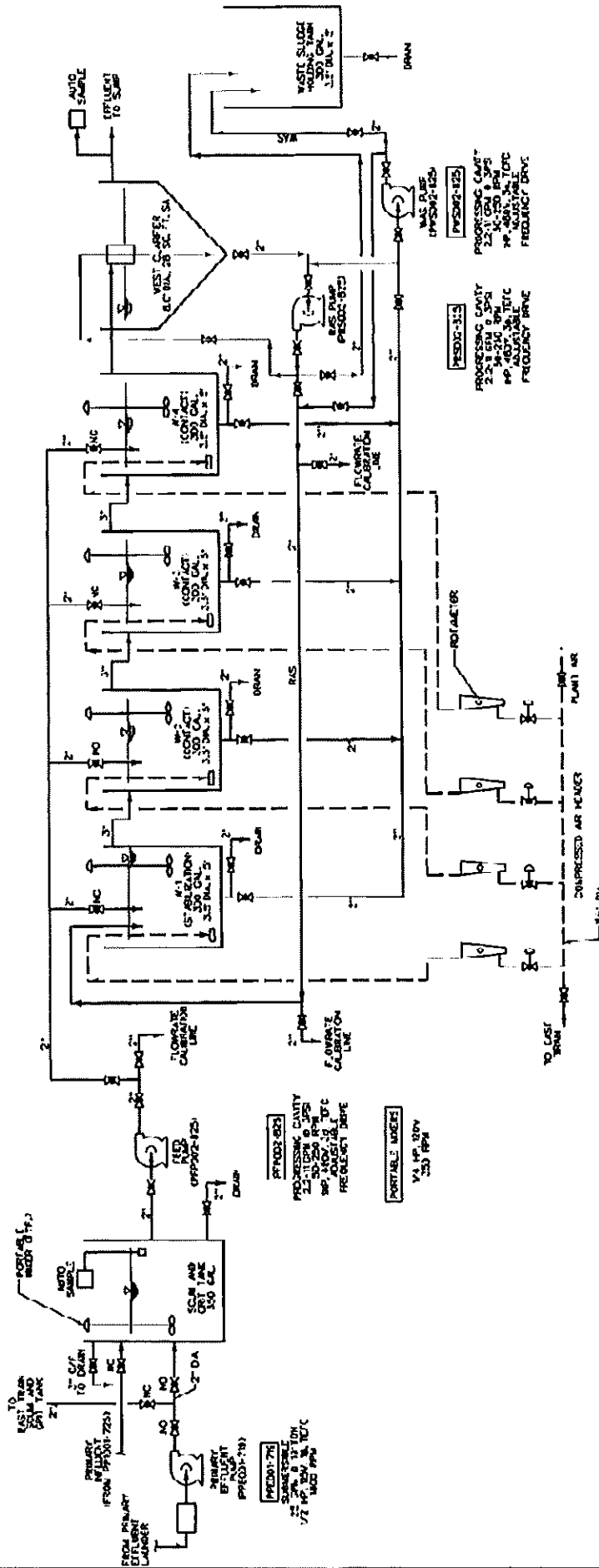
TABLE 13
PHASE 2 PILOT PLANT TESTING
SOLIDS REMOVED FROM TRAINS
TO MAINTAIN TARGET MLSS OF 1,500 - 2,000 mg/L

	East Train (*)			West Train		
	Effluent TSS Loss (lbs/d)	Wasted From RAS (lbs/d)	Total TSS Removed (lbs/d)	Effluent TSS Loss (lbs/d)	Wasted From RAS (lbs/d)	Total TSS Removed (lbs/d)
2/27/2006	0.9	0.0	0.9	2.8	5.6	8.4
2/28/2006	4.7	1.9	6.6	1.8	5.6	7.3
3/1/2006	6.6	3.2	9.8	1.8	6.3	8.1
3/2/2006	2.3	4.0	6.3	2.8	3.9	6.8
3/3/2006	7.3	7.9	15.2	2.5	6.7	9.2
3/4/2006	3.9	5.2	9.1	6.6	5.2	11.9
3/5/2006		2.3		2.6	2.3	4.9
3/6/2006	2.0	6.0	8.0	1.6	10.7	12.2
3/7/2006	2.1	4.8	6.9	1.3	5.2	6.5
3/8/2006	2.5	8.3	10.8	3.1	7.4	10.5
3/9/2006	2.7	8.3	11.1	3.4	6.1	9.5
3/10/2006	0.7	7.1	7.7	0.4	8.6	9.0
3/11/2006	2.9	4.4	7.3	1.0	4.3	5.3
3/12/2006	3.5	7.3	10.8	4.3	6.4	10.7
3/13/2006	1.2	14.8	16.1	4.2	13.2	17.4
3/14/2006	1.5	14.5	16.0	2.6	6.4	9.1
3/15/2006	1.7	55.8	57.4	1.1	17.5	18.6
3/16/2006	2.5	5.1	7.7	2.5	5.2	7.8
3/17/2006	2.4	11.0	13.4	5.0	3.6	8.5
3/18/2006	2.8	0.0	2.8	5.5	0.0	5.5
3/19/2006	3.9	2.0	5.9	2.2	0.0	2.2
3/20/2006	2.4	3.3	5.8	2.0	1.0	3.0
3/21/2006	1.4	5.8	7.3	1.7	1.0	2.7
3/22/2006	2.2	0.0	2.2	1.6	11.5	13.1
3/23/2006	1.8	4.0	5.8	2.0	1.3	3.3
3/24/2006	0.8	5.6	6.4	0.6	2.9	3.5
3/25/2006	4.1	1.1	5.2	3.4	0.0	3.4
3/26/2006	4.4	5.0	9.5	2.2	6.4	8.6
3/27/2006	3.2	4.5	7.8	3.0	3.5	6.5
3/28/2006	3.0	6.3	9.3	2.3	7.3	9.6
3/29/2006	3.2	4.3	7.5	0.8	5.2	6.0
3/30/2006	3.6	5.3	9.0	2.0	4.4	6.4
3/31/2006	0.6	6.4	6.9	1.3	11.5	12.8
4/1/2006	2.6	13.7	16.3	3.1	12.6	15.7
4/2/2006	3.1	4.2	7.3	2.5	3.5	6.0
Average	3.2	5.6	8.8	2.4	5.2	7.6

(*) Receives polymer addition.

Bold type = wet weather mode

FIGURES



ALLEGANY COUNTY SANITARY AUTHORITY
WASTEWATER TREATMENT PLANT
PITTSBURGH, PENNSYLVANIA
CP PAGE 2

FIGURE 1A

EXTRACT 2C-

NOV 21 1973

212	SP-12	42.200.5000-12	Q
213	SP-13	42.200.5000-13	Q



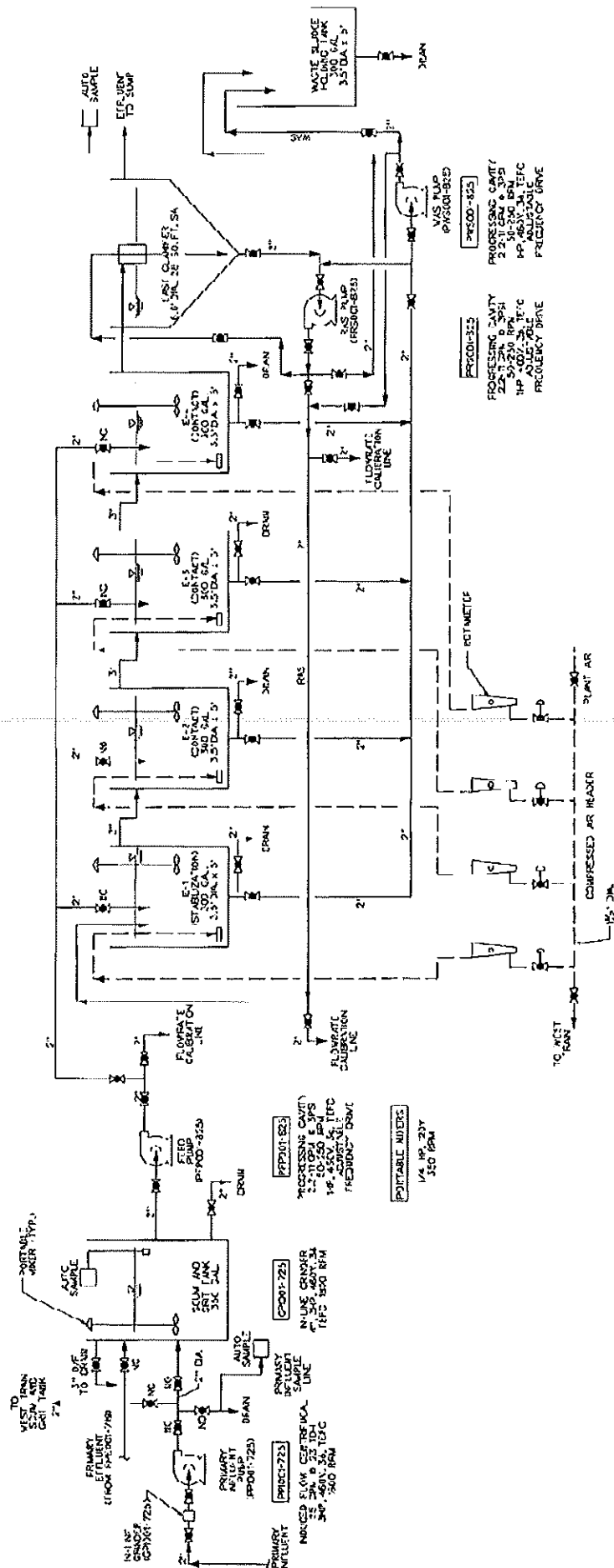


FIGURE 13

ALLIERRY COUNTY SANITARY AUTHORITY
WASTEWATER TREATMENT PLANT
PITTSBURGH, PENNSYLVANIA

CP PHASE : 1

SEAC NONE
FLIGHT EAST
DAY: NETTER

			4
			5
			2
			1
A-3	50001	Q2778500-104	Q
REV	1.00	POURCHAS	CM

ALPACAS
MYL TEAM
5/20/11

AS FRODO BAGGINS
THE RING OF POWER
THE LAST OF HIS KIND

FIGURE 2
PHASE 1 PILOT PLANT TESTING
EAST TRAIN BOD5 PERFORMANCE
2,000 mg/L Target MLSS

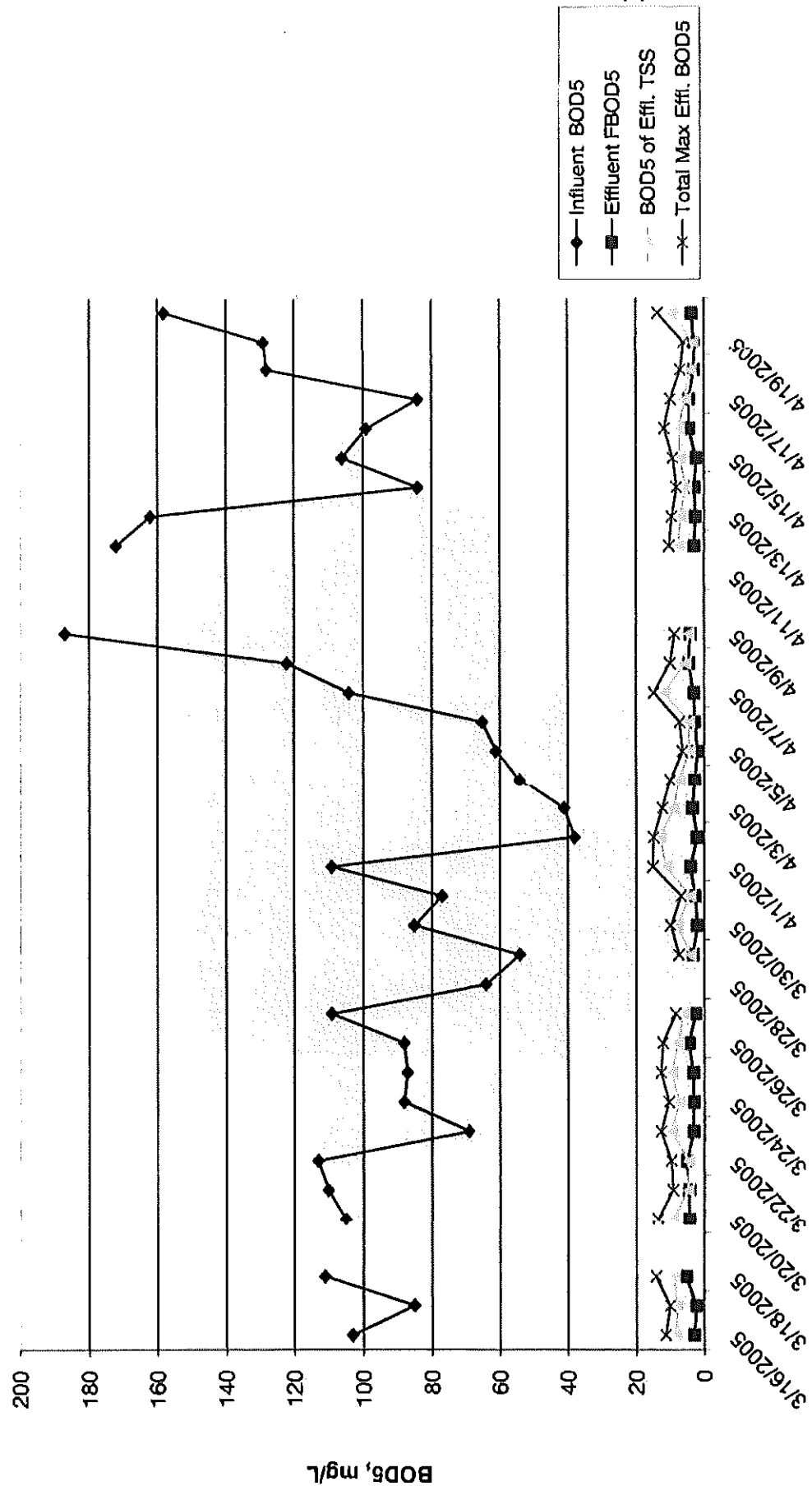


FIGURE 3
PHASE 1 PILOT PLANT TESTING
WESTRAIN BOD5 PERFORMANCE
2,000 mg/L Target MLSS

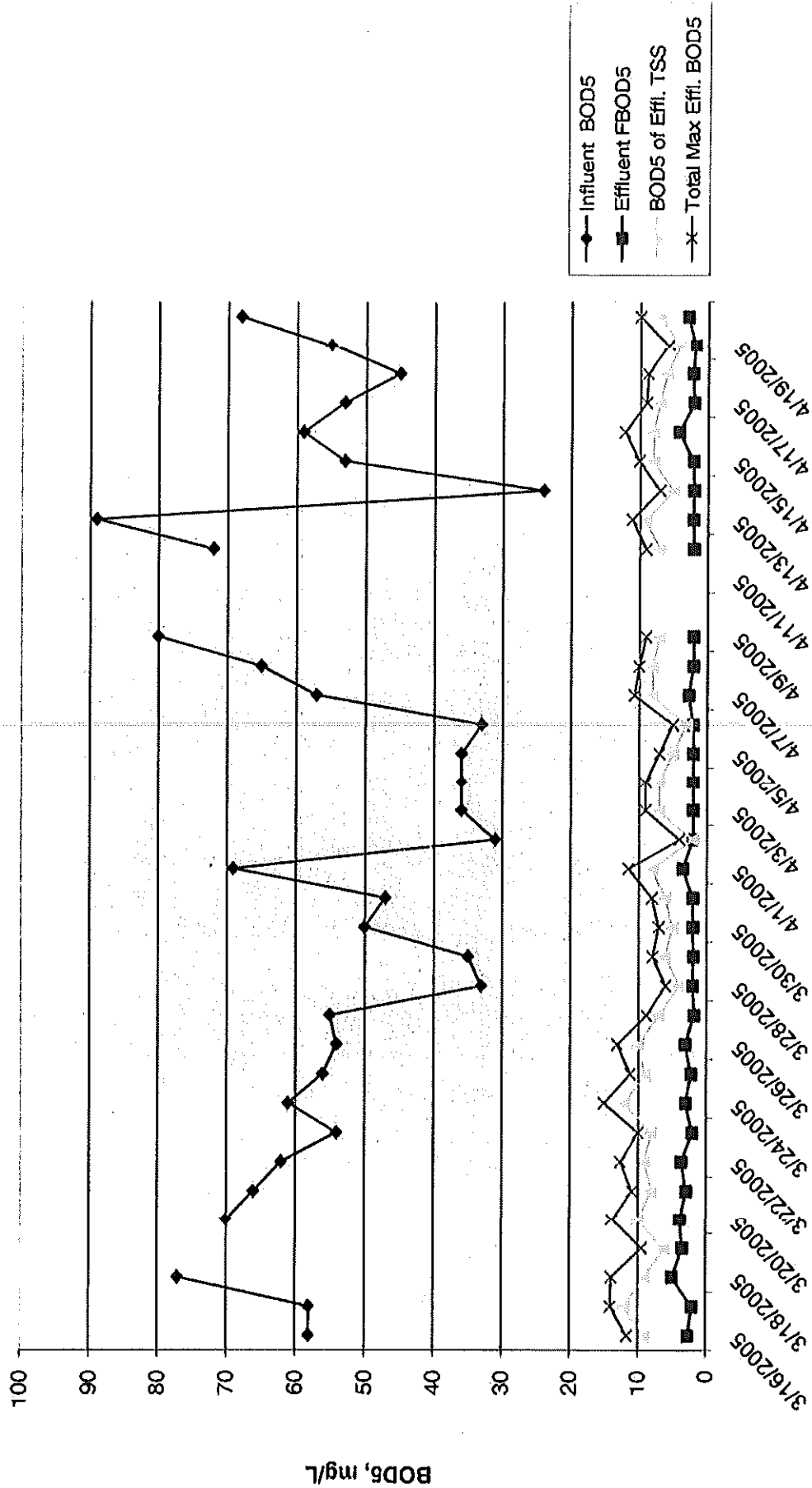


FIGURE 4A
PHASE 1 PILOT PLANT TESTING
4/16/05 ZSR GRAPH FOR
2,000 MG/L TEST SERIES

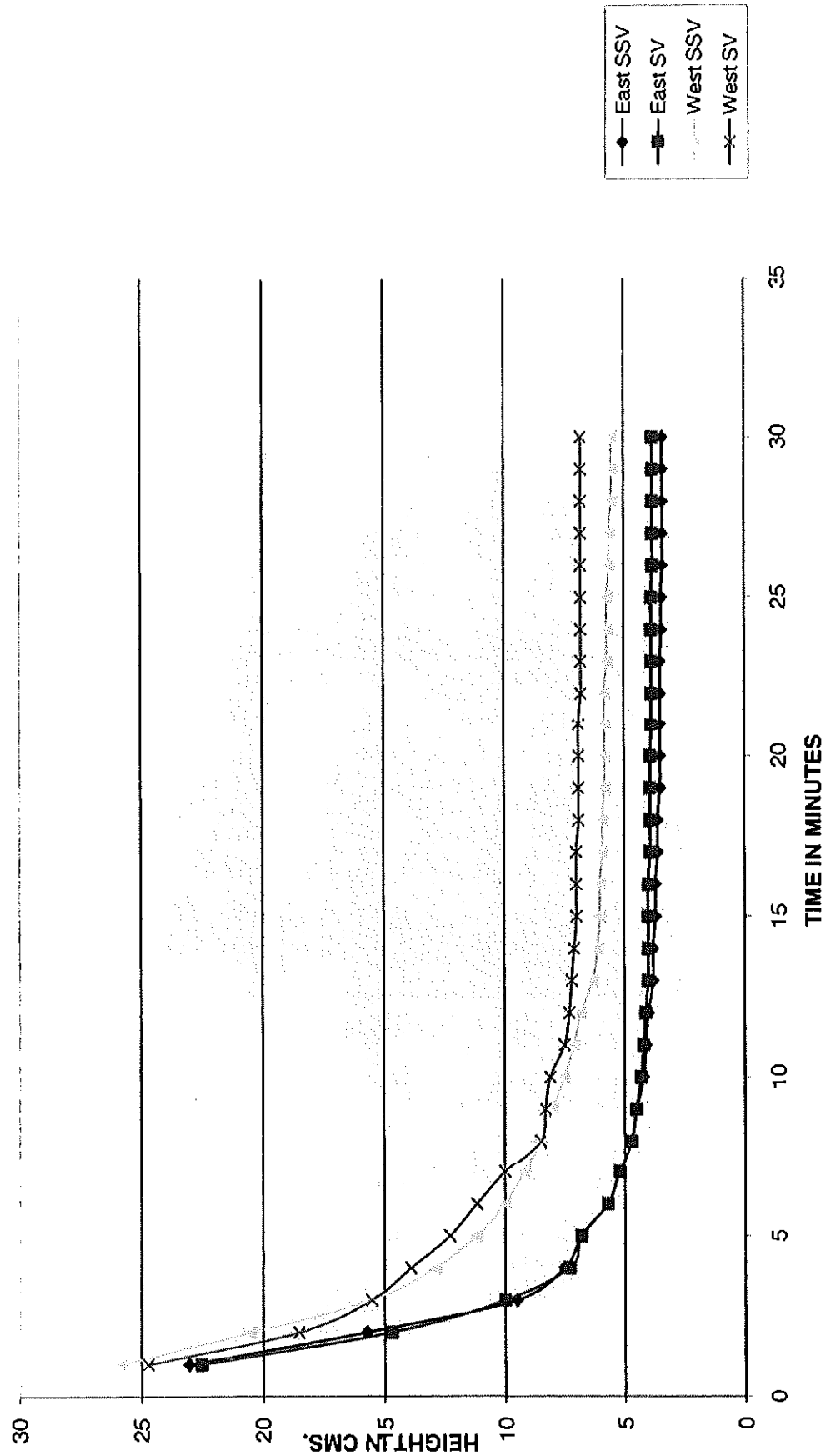


FIGURE 4B
PHASE 1 PILOT PLANT TESTING
5/21/05 ZSR GRAPH FOR
1,500 MG/L TEST SERIES

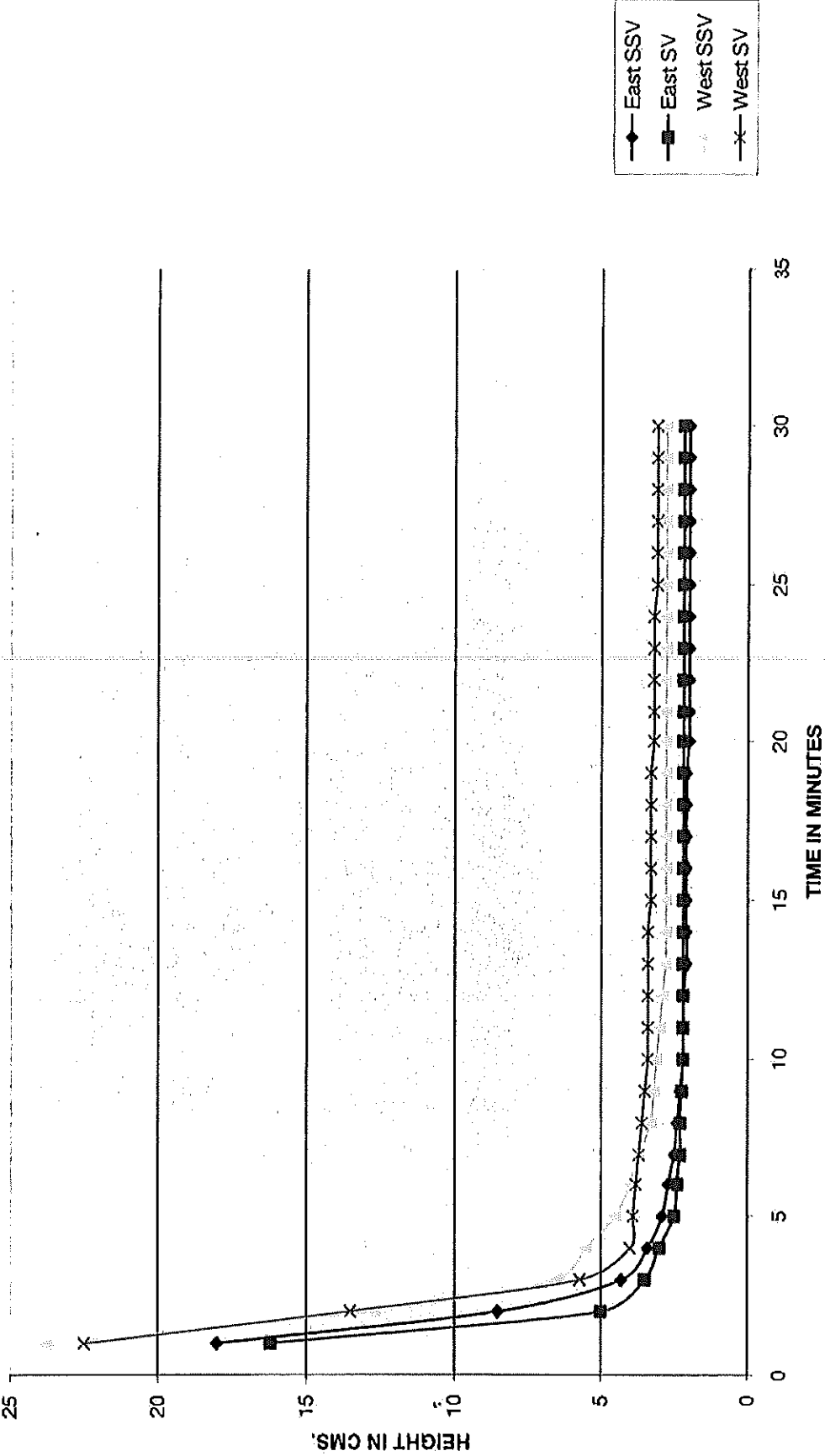
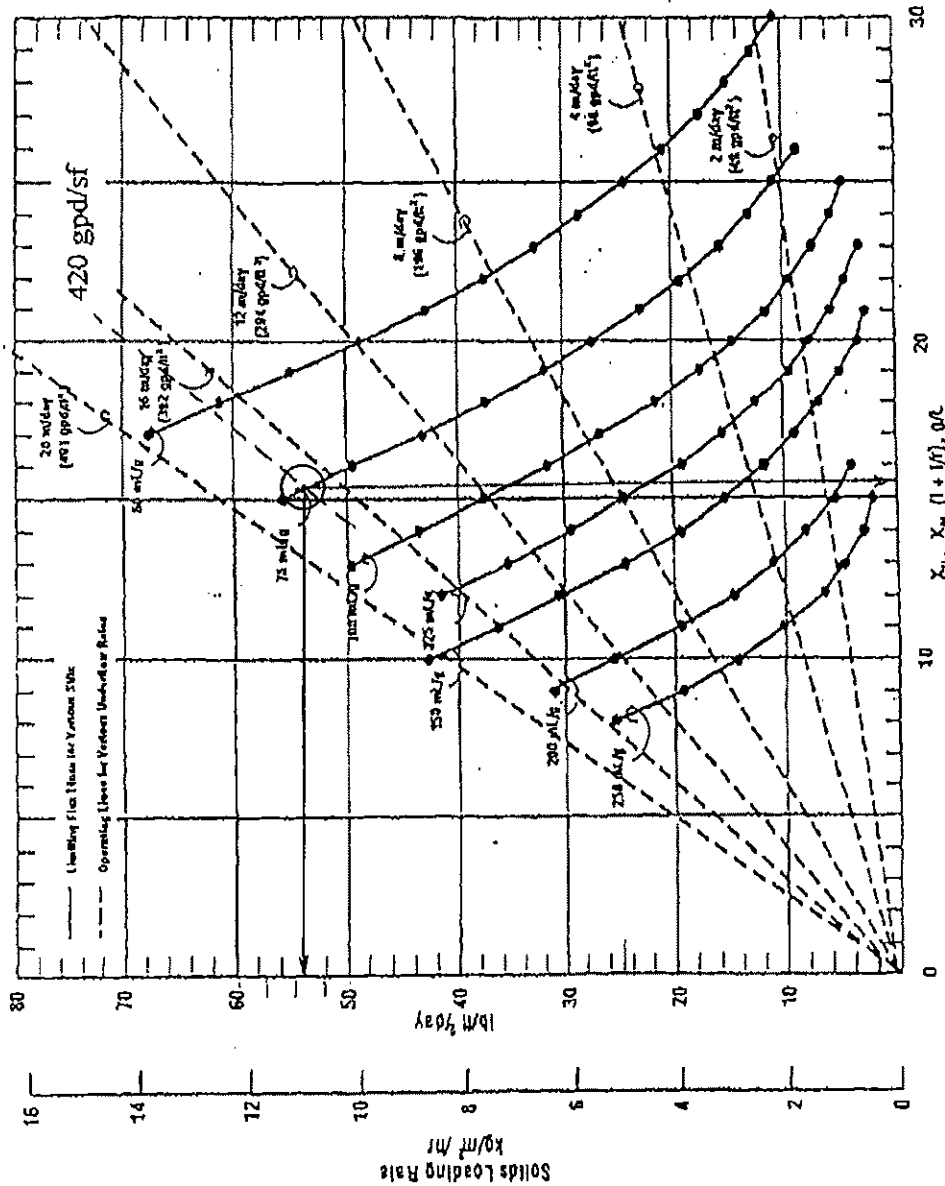
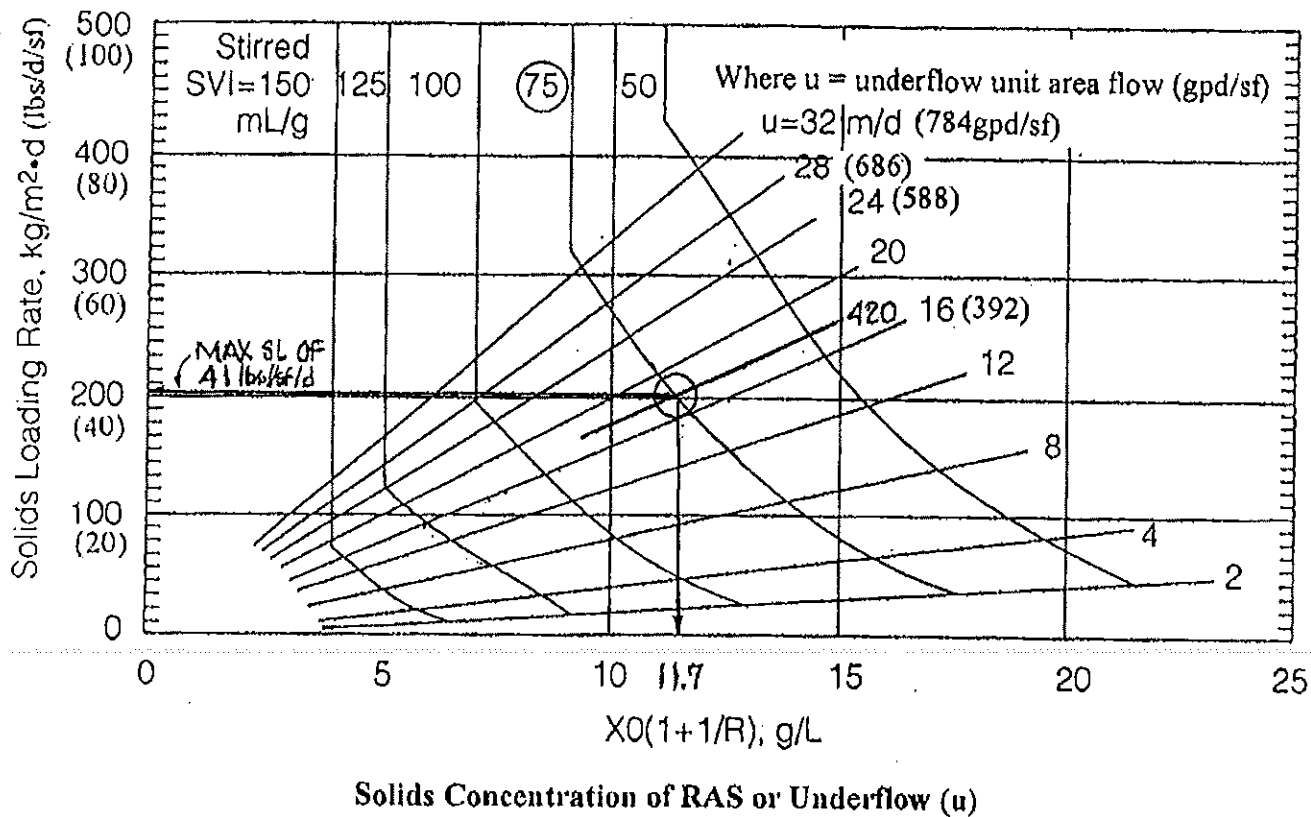


FIGURE 5

DAIGER ROPER MODEL





Example for East Train, 2,000 mg/L Test Series

At intersection of 75 SVI line and the 420 gpd/sf underflow line at full-scale clarifier area and max RAS (105 mgd), the underflow concentration is indicated to be 11.7 gms/L. With Recycle ratio of 0.382, XO (MLSS) equates to 3.23 gm/L.

FIGURE 6
KEINATH MODEL

FIGURE 7
PHASE 1 PILOT PLANT TESTING
EAST TRAIN BOD5 PERFORMANCE
1,500 mg/L Target MLSS

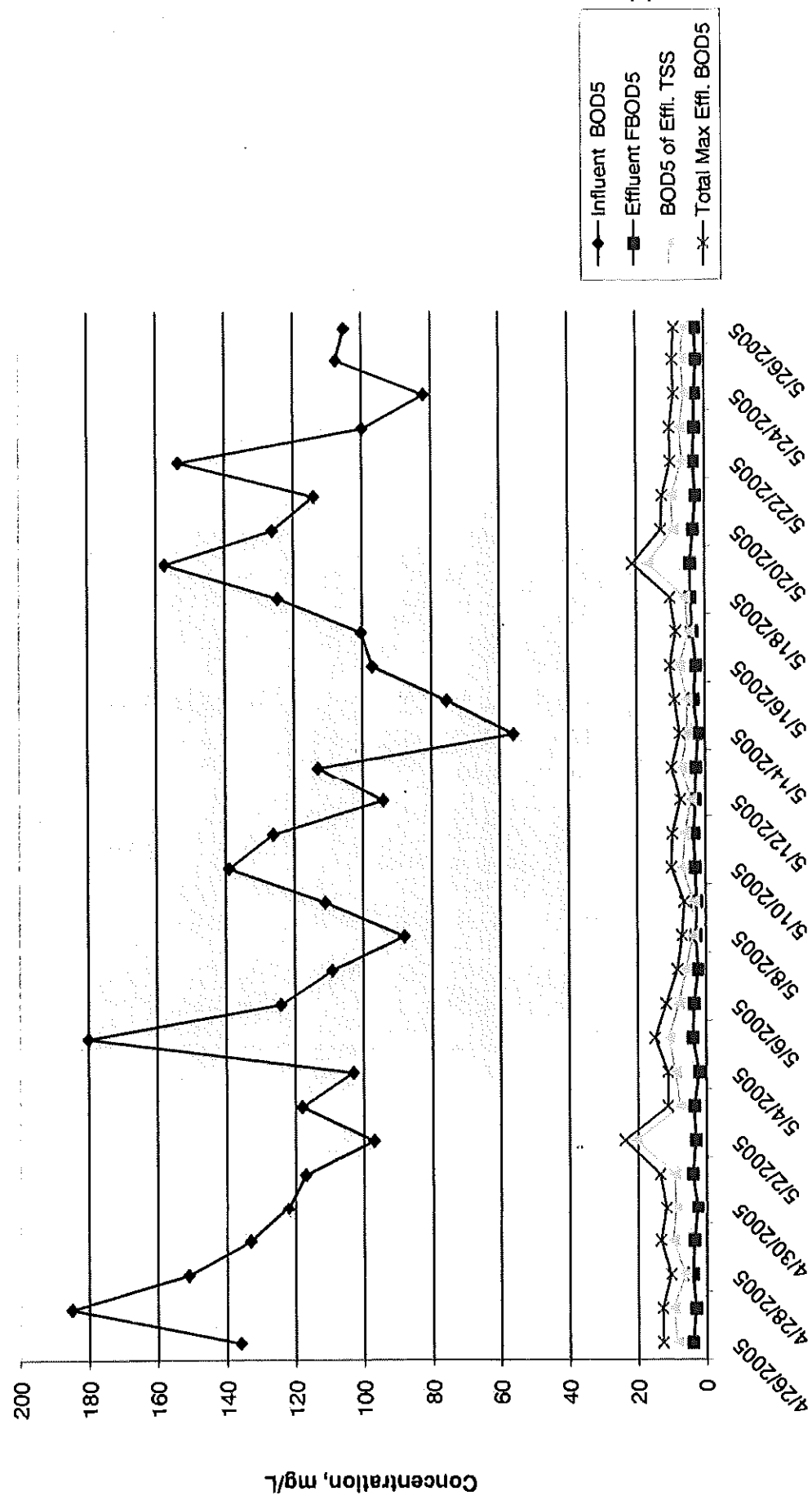


FIGURE 8
PHASE 1 PILOT PLANT TESTING
WEST TRAIN BOD5 PERFORMANCE
1,500 mg/L Target MLSS

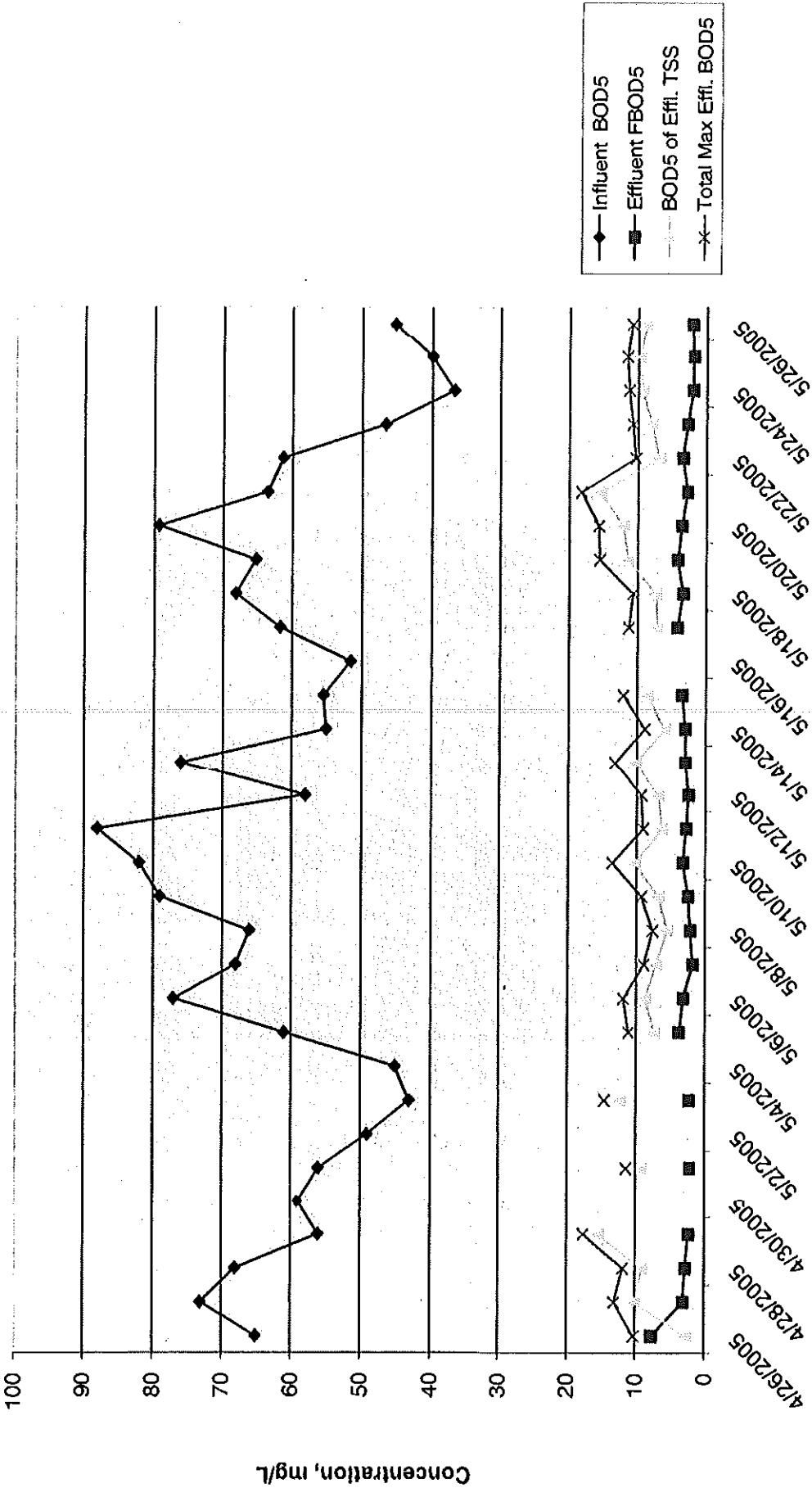


FIGURE 9
PHASE 2 PILOT PLANT TESTING
WEST TRAIN BOD5 PERFORMANCE

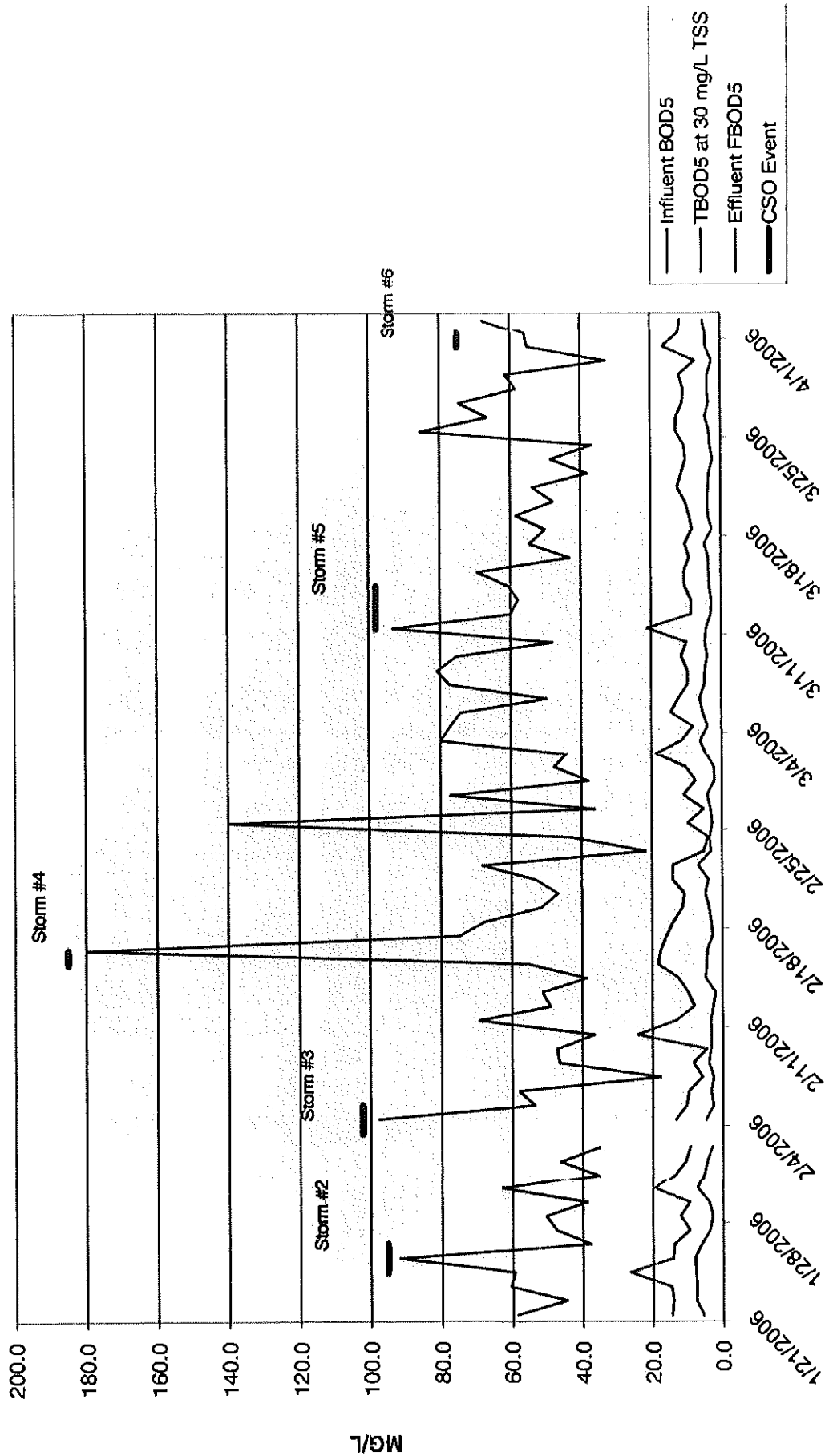
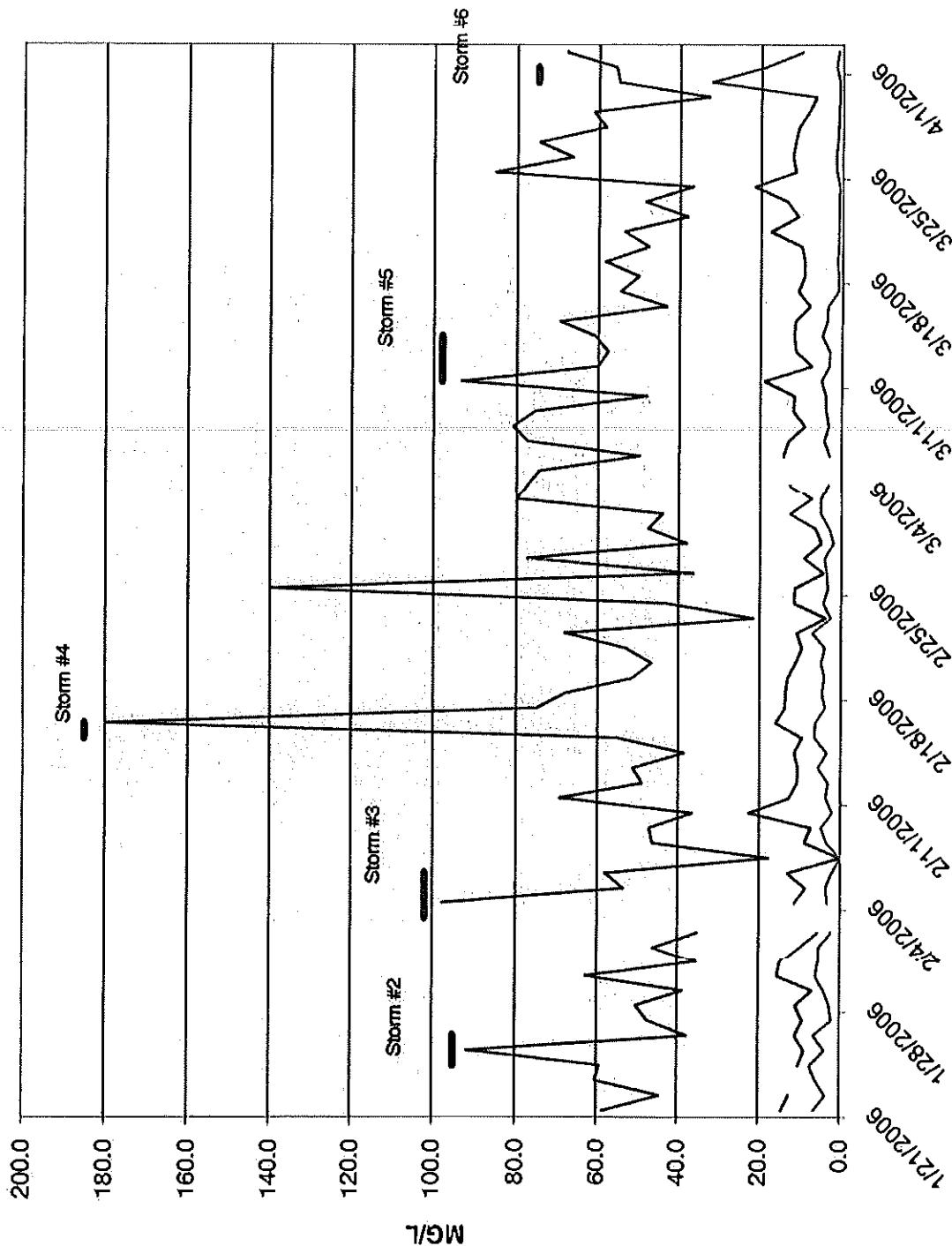
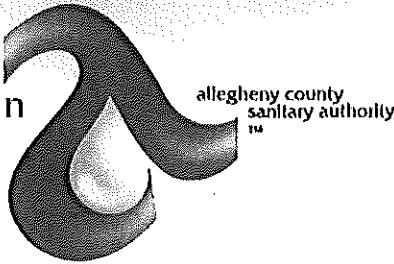


FIGURE 10
PHASE 2 PILOT PLANT TESTING
EAST TRAIN BOD5 PERFORMANCE



alcosan



November 10, 2010

Members of the Board

Rep. Harry Roadshaw
Chairman

Sylvia C. Wilson

Jack Shea

Evelyn R. O'Brien

Jacques L. Moya

Daniel G. Keller

Theresa Keil-Smith

Arlette Scott Williams
Executive Director

David W. Borneman, P.E.
*Director
Engineering & Construction*

Arthur M. Tomilla, Esq.
*Director
Environmental Compliance*

William H. Inks, CPA
*Director
Finance & Administration*

Jan M. Oliver
*Director
Regional Conveyance*

Douglas A. Jackson, P.E.
*Director
Operations & Maintenance*

Ms. Allison Graham
Environmental Engineer
U. S. Environmental Protection Agency
Region III
1650 Arch Street
Philadelphia, PA 19103-2029

Mr. Paul Eiswerth
Water Management
Southwest Regional Office PaDEP
400 Waterfront Drive
Pittsburgh, PA 15222

Ms. Michelle Buys
Public Drinking Water and Waste Management Program
Allegheny County Health Department
3901 Penn Avenue, Building #5
Pittsburgh, PA 15224-1318

RE: ALCOSAN Initial Regional Affordability Analysis

Dear Ms. Graham, Mr. Eiswerth and Ms. Buys:

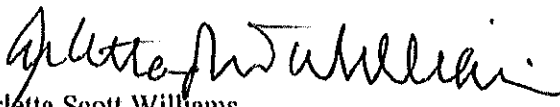
This letter follows up on our meeting of April 29th, 2010 concerning potential wet weather treatment strategies involving bypassing at the Woods Run Wastewater Treatment Plant. As you may recall, the agencies requested that ALCOSAN provide an initial Affordability Analysis for the ALCOSAN service area.

Attached please find an initial Affordability Analysis which includes an estimate of the level of regional wastewater investments resulting in a Residential Indicator exceeding 2% of median household income. The relationship of this amount to wet weather treatment alternatives is also addressed. This analysis furthers the discussion of April 29th as to the technical and financial feasibility of treatment alternatives that do not include process bypassing.

We look forward to continuing our dialogue on this topic. If we may provide any additional information to you, please do not hesitate to contact Mr. David Borneman P.E., Director of Engineering and Construction at (412) 734-8369.

Sincerely,

ALLEGHENY COUNTY SANITARY AUTHORITY


Arletta Scott Williams
Executive Director

Attachment

**Attachment 1 to
Letter to Regulatory Agencies Concerning
ALCOSAN Initial Affordability Analysis**

1.0 INTRODUCTION

ALCOSAN and the regulatory agencies (USEPA Region III, PaDEP and ACHD) met on April 29th 2010 to discuss potential wet weather treatment strategies involving bypassing at the Woods Run Wastewater Treatment Plant. In this context, the agencies requested that ALCOSAN provide the initial results of the Affordability Analysis for the ALCOSAN service area. The Affordability Analysis is quantified through the use of the Residential Indicator (RI) which is defined as annual wastewater costs for a typical household divided by the median household income (MHI) of the service area. Under the EPA guidelines¹, Residential Indicators wherein annual wastewater costs exceed 2% of the MHI are considered to impose high burdens.

2.0 CURRENT REGIONAL RESIDENTIAL INDICATOR

2.1 Costs of Wastewater Service

The 2010 ALCOSAN residential charges consist of an \$8.48 quarterly service charge and a commodity charge of \$4.04 per 1000 gallons of water discharged to the sewerage system. Based on an analysis of historical ALCOSAN billing data, the average residential account within the ALCOSAN service area, the typical household uses approximately 14.5 thousand-gallon units (T-gallons) of water per quarter. This results in the average ALCOSAN annual bill for 2010 of \$268. There is considerable variation in the municipal user charges for the local collection sewer systems, ranging in 2010 from \$51 to \$450 for a typical household. Four municipalities have no direct collection system user charge and recover the costs of their local systems through property taxes and their general funds. A representative sample of current typical household wastewater costs by municipality, arranged by deciles is provided in Table 1.

**Table 1
Typical Household Wastewater Costs By Select Municipalities**

Municipality	Percentile	Annual Typical Household Cost		
		ALCOSAN	Municipal	Total
East Pittsburgh Borough	10%	\$268	\$73	\$341
Pitcairn Borough	20%	\$268	\$93	\$361
Whitaker Borough	30%	\$268	\$138	\$406
Wilkins Township	40%	\$268	\$151	\$419
Trafford Borough	49%	\$268	\$173	\$441
East McKeesport Borough	60%	\$268	\$198	\$466
Roslyn Farms Borough	70%	\$268	\$232	\$500
Baldwin Township	80%	\$268	\$261	\$529
Neville Borough	91%	\$268	\$370	\$639

¹ Combined Sewer Overflows – Guidance for Financial Capability Assessment and Schedule Development
EPA 832-B-97-004

Municipality	Percentile	Annual Typical Household Cost		
		ALCOSAN	Municipal	Total
Indiana Twp.- Ottawa District*	100%	\$268	\$704	\$972
Other Representative Municipalities				
Braddock	17%	\$268	\$87	\$355
Fox Chapel	24%	\$268	\$96	\$364
City of Pittsburgh	42%	\$268	\$152	\$420
Penn Hills	97%	\$268	\$449	\$717
* Includes local collection system expansion costs.				

For this analysis, a population weighted typical annual household cost may be used. The current weighted average municipal cost per typical household is \$184 annually. The total weighted average sewer charges for households in the service area is \$450, including ALCOSAN and municipal charges.

2.2 Regional Median Household Income

There is wide diversity in incomes between the 83 municipalities served by ALCOSAN. At the municipal level, median household incomes range from \$16,500 to \$174,000 annually (2009 estimate). There are also wide intra-municipal income variations. For example, the median household incomes of Census block groups within the City of Pittsburgh range from approximately \$8,000 per year to over \$170,000 annually. To account for this diversity, median household incomes were evaluated at the Census block group level. The Census block and block group delineations were integrated with the ALCOSAN sewershed polygons to isolate portions of municipalities that are partially within the ALCOSAN service area. Pending the availability of 2010 Census data, interim estimates of median household income are available for eleven municipalities with populations over 20,000² as shown on Table 2.

Table 2
Estimated Median Household Incomes for Largest Service Municipalities

Municipality	Population	1999 MHI	2007 MHI	2009 Estimate	Change 1999 - 2009	Annualized Growth
Bethel Park Municipality	33,556	\$53,791	\$59,125	\$61,952	9.9%	1.2%
McCandless Township	29,022	\$62,159	\$69,273	\$66,404	11.4%	1.4%
Monroeville Municipality	29,349	\$44,653	\$55,825	\$57,859	25.0%	2.8%
Mount Lebanon Municipality	33,017	\$60,783	\$73,765	\$76,453	21.4%	2.4%
Penn Hills Municipality	46,809	\$39,960	\$43,291	\$44,134	8.3%	1.0%
Pittsburgh City	334,563	\$28,588	\$32,344	\$33,523	13.1%	1.6%
Plum Borough	26,940	\$48,386	\$61,644	\$67,830	27.4%	3.1%
Ross Township	32,551	\$46,542	\$57,001	\$59,078	22.5%	2.6%
Shaler Township	29,757	\$49,118	\$60,421	\$62,623	23.0%	2.6%
Upper St. Clair Township	20,053	\$87,581	\$102,307	\$110,033	16.8%	2.0%
West Mifflin Borough	22,464	\$36,130	\$43,212	\$46,568	19.6%	2.3%

²

American Community Survey Three-Year Estimates, Place-Selected Economic Characteristics: 2005-2007.

These municipalities collectively represent about 60% of the service area population. Income growths of the eleven municipalities from 1999 - 2007 were weighted by population to get a regional, annual single growth factor for of 1.8%. The service area MHI calculated using this method is \$43,200.

2.3 Regional Residential Indicator

To calculate the Residential Indicator, the current regional typical cost per household (\$450) was divided by the median household income of the service area (\$43,200), resulting in a current conditions Residential Indicator of 1.04%.

3.0 CURRENT YEAR AFFORDABILITY ANALYSIS

The difference between the wastewater system revenues currently generated and those that would need to be generated if the Residential Indicator were to equal 2% can be thought of as a measure of incremental affordability capacity.

3.1 Estimating Incremental Affordability Capacity

The estimated 2010 MHI for the ALCOSAN service area is \$43,200. For this MHI, the EPA High Burden threshold of 2% of income would be triggered at an annual wastewater cost of \$864. Therefore, the typical ALCOSAN service area household would have a hypothetical capacity of \$414 (current dollars) annually for incremental wastewater costs. Assuming that annual costs would increase proportionately for the non-residential connections, the ALCOSAN service area could potentially generate an additional \$174.5 million annually for wastewater system capital improvements. This amount is calculated using the financial assumptions listed in table 3 as follows, with Z = the amount of wastewater capital improvement expenditures that could be incurred regionally by ALCOSAN and the municipalities to reach the 2% Residential Indicator.

Table 3
Financial Assumptions

Bond Interest Rate	6%	$\$414 \times 302,000 \text{ residential connections} = \$125,600,000$
Debt Amortization Term (Years)	30	$\$125,600,000 / 0.72 = \$174,500,000$
Capital Recovery Factor	7.26%	$(Z \times 0.02) + (Z \times 0.0726) = \$174,500,000$
Residential Share of Future Costs	72%	$Z \times 0.0926 = \$174,500,000$
Annual O&M as % of Capital Costs	2% ³	$Z = \$1.9 \text{ billion}$

Based on this calculation and set of assumptions, the ALCOSAN service area could hypothetically incur approximately \$1.9 billion (current dollar) in incremental wastewater infrastructure investments before triggering the 2% high burden regional residential indicator.

³ The annual operations and maintenance of 2% of capital costs is taken from the mid-range of percentages being utilized by ALCOSAN for control alternatives analysis.

3.2 Available Wet Weather Plan Funding

The \$1.9 billion (current dollars) calculated above represents the combined total available capital investments by ALCOSAN and the municipalities possible within the ALCOSAN service area without exceeding the 2% Residential Indicator criterion. Capital improvements to the existing ALCOSAN wastewater treatment plant, ALCOSAN's regional conveyance system, and the municipal collection system that will be necessary to maintain regulatory compliance and environmental protection must be considered before the portion of the hypothetical \$1.9 billion available for the implementation of the Wet Weather Plan can be defined. Pending a detailed evaluation of non-Wet Weather Plan capital investment needs, an affordable Wet Weather Plan could range from less than \$1.5 billion to less than \$1.8 billion (current dollars).

3.4 Simplifying Assumption

The current year affordability analysis includes several simplifying assumptions. First, all costs are expressed in current dollars. The use of current year costs obviates the need to inflate future costs to an unknown construction schedule. The use of current year costs also eliminates the need to project the rates of inflation for the current regional wastewater system cost and for median household income growth.

3.5 Sensitivity Analysis

The set of assumptions (shown previously on Table 3) applied to current year dollars result in the Regional Residential Indicator reaching 2% of MHI when the aggregate (ALCOSAN and municipal) wastewater investments reach approximately \$1.9 billion in current dollars. As may be seen in Table 4, plausible variations in the key assumptions would result in Affordability Capacities ranging from approximately \$1.3 billion to \$2.3 billion (current dollars). The alternative values shown on the table represent one set of potential conditions. The ranges between the upper and lower values for each variable reflect an implicit probability distribution based upon regional history and national and regional trends.

Table 4
2% Regional Residential Indicator Sensitivity Analysis

Variable	Scenario			Amount Triggering 2% RI (billions)	
	Base Case	Plausible Higher	Plausible Lower	Plausible Higher	Plausible Lower
Bond Interest Rate	6%	7%	5%	\$1.7	\$2.0
Bond Period (Years)	30	20	30	\$1.9	\$1.6
Residential Share of Costs	72%	75%	70%	\$1.8	\$1.9
Annual O&M Costs as % Total Capital Costs	2%	3%	1%	\$1.7	\$2.1
All Most Favorable / Least Favorable				\$2.3	\$1.3

4.0 FUTURE CONDITIONS AND CONTRIBUTING FACTORS

The current year affordability analysis presented above indicated an affordability capability of approximately \$1.9 billion for new regional wastewater investments by ALCOSAN and the municipalities. Future economic and demographic trends beyond ALCOSAN's control such as construction inflation, income growth and population will materially affect the affordability of future wastewater investments, including the Wet Weather Plan. The affordability analysis in the approved WWP will be based on the best professional judgments as to future economic, demographic and institutional conditions on the part of ALCOSAN and of the agencies. Key variable trends that will impact the future are described below.

4.1 Capital Project Inflation

ALCOSAN utilizes an annual inflation rate of 3.67% in its control alternatives analyses. This inflation rate is based on five year average annual change in the *Engineering News Record* Construction Cost Index (ENRCCI) for Pittsburgh between 2004 and 2008. For this memorandum, a mid-point of construction of 2024 was utilized to ascertain the potential impacts of inflation on the current year amount of new wastewater capital investments triggering the 2% Residential Indicator (\$1.9 billion). Using the ACT rate of inflation, the \$1.9 billion in current (2010) dollars would be projected to inflate to approximately \$3.1 billion assuming for illustration a 2024 mid-point of construction:

$$\text{Inflated Cost} = \$1.9 \text{ billion} \times 1.0367^{(2024 - 2010)} = \$3.1 \text{ billion}$$

This would translate into a cost per household of approximately \$686 annually in 2026 dollars (The year of full WWP implementation, when the full impact of debt service and O&M costs impacts the user charges), compared to the \$414 currently available below the high burden threshold. Using a single midpoint for all future wastewater capital investments is simplistic. As the Wet Weather Plan elements are developed and further information about the magnitude and timing of municipal wastewater capital investments are understood, a more refined analysis will be possible.

4.2 Current Wastewater System(s) Cost Trends

Inflationary pressures and future capital financings for non-Wet Weather Plan related system improvements must be considered in forecasting future base line household wastewater costs. During the ten year period of 2001 through 2010, ALCOSAN's costs for the typical household increased by an annual average of approximately 6%, from \$148 annually to \$268 annually. The concomitant municipal rate increases have not been determined. If the ALCOSAN rate of increase were to hold through 2026, the typical household wastewater cost of \$450 per year would be \$1,156 in 2026. However, the 6% annualized rate increases experienced during the previous decade were heavily influenced by the upgrades and expansion at ALCOSAN's wastewater treatment plant, large increases in health care and other employee benefit costs and the loss of approximately \$5 million in annual operating grants from the Commonwealth of Pennsylvania. Using a reasonable alternative annual rate inflator of 3% based on the CPI, the current regional typical household wastewater cost of \$450 per year would be \$722 in 2026.

4.3 Household Income Growth

ALCOSAN has estimated that household incomes grew at a population weighted average rate of approximately 1.8% annually during the previous decade. If this income growth rate were to continue through 2026, the estimated regional (service area) median household income would be approximately \$57,600. At this income, a Regional Residential Indicator of 2% would be about \$1,150 annually. The \$1.9 billion (current dollars) of wastewater investment that would increase the Residential Indicator to 2% of MHI would, accounting for inflation and income growth, result in a Regional Residential Indicator of 2.45% in 2026:

$$\begin{aligned} \text{Regional Residential Indicator}^{2026} &= \\ (\text{Current Wastewater System}^{2026} + \text{Incremental Costs}^{2026}) / \text{Regional MHI}^{2026} &= \\ (\$722 + \$686) / \$57,600 &= \\ \$1,408 / \$57,600 &= 2.45\% \end{aligned}$$

However, income growth in the past decade may have been anomalous. The population weighted annualized income growth rate for the twenty-year period of 1989 through 2009 is estimated to be 2.4%. Applying this rate through 2026, the current estimated Regional MHI would be projected to grow to \$63,200. At this income, a Residential Indicator of 2% would be triggered by about \$1,260 of annual wastewater costs.

4.4 Service Population

ALCOSAN experienced a decrease in the service area population during the 1990s, from approximately 880,000 in 1990 to 842,000 in 2000. This is a 0.44% annual rate of decline. If this rate of change were to continue through 2026, the estimated service population would be approximately 751,000. Conversely, the Southwestern Pennsylvania Commission's Cycle 8 population projections applied to the ALCOSAN service area forecast a service population of about 856,000.

4.5 Number of Residential Connections and Households

The number of ALCOSAN residential customers has remained relatively steady over the past ten years at approximately 302,000 to 304,000. This consistency is also true for total connections, which have remained near 316,000. The number of households, on the other hand, decreased from 1990 to 2000 at an estimated average annual rate of -0.23%. This decline, applied to the 360,000 households identified in the 2000 census, would lead to an estimated 340,000 households by 2026.

4.6 Billed Water Consumption

Billed wastewater flow (billed water consumption) has declined at an annualized rate of 2% over the past ten years, from approximately 29.6 billion gallons in 2001 to a projected 23.6 billion gallons for 2010. Most of the decline in billed flow has been attributable to the commercial and industrial user classes. It is not known if this trend will continue, but given the fixed nature of much of the wastewater system, its continuation would lead to an increase in the relative costs per household.

5.0 Implications for Wet Weather Bypassing Strategies

The estimated \$1.9 billion in available affordability capacity can be viewed in the context of analyzing the benefits, costs and financial feasibility of wet weather treatment strategies at ALCOSAN's treatment plant. Estimated capital costs for the plant wet weather expansion strategies involving bypassing ranged from approximately \$530 million to \$740 million. Estimated capital costs for the storage and pump back and for the satellite treatment alternatives were significantly higher and, in many cases, exceeded the financial capacity. It should also be noted that from a financial basis, the alternatives to the proposed bypass plant expansion strategy would utilize much if not all of the remaining financial capability for other wet weather controls and system improvements upstream of the plant.

PNDI # _____ USFWS Project # 2017-0718

U.S. FISH AND WILDLIFE SERVICE

110 Radnor Road, Suite 101, State College, PA 16801

This responds to your inquiry about a PNDI Internet Database search that resulted in a potential conflict with a federally listed, proposed or candidate species.

PROJECT LOCATION INFORMATION

County: Allegheny
 Township: City of Pittsburgh and Borough of Bellevue

MISC INFORMATION

Date received by FWS: 11/16/2018
☐ ACTIVE ☐ ARCHIVE

USFWS COMMENTS ☒ EMAILED ☐ MAILED Email: bradley.olson@arcadis.com
 To: Bradley Olson Affiliation: Arcadis

SPECIFIC PROJECT: Allegheny County Sanitary Authority (ALCOSAN) Woods Run WWTP Expansion

FISH AND WILDLIFE SERVICE COMMENT(s):

X **NOT LIKELY TO ADVERSELY AFFECT**

The federally listed northern riffleshell, clubshell, rayedbean, rabbitsfoot, sheepsnose, snuffbox occurs or may occur in or near the project area. However, based on our review of the information provided, including the project description and location (the Service concurs with the probable absence of the above-listed mussels based on a freshwater mussel survey conducted August 23-29, 2018. Furthermore the survey indicated that habitat was not conducive for the above-listed mussels within the project area),

no adverse effects to this species are likely to occur. If there is any change in the location, scale, scope, layout or design of the project, further consultation or coordination with the Service will be necessary.

The above determination is valid for two years from the date of this letter. In addition, this response relates only to federally listed, proposed, and candidate species under our jurisdiction, based on an office review of the proposed project's location and anticipated impacts. No field inspection of the project area has been conducted by this office. Consequently, comments on this form are not to be construed as addressing other Service concerns under the Fish and Wildlife Coordination Act or other authorities. *Please reference the above PNDI # and USFWS Project # in any future correspondence regarding this project.*

This review was conducted by the biologist listed below. He/she can be contacted at 814-234-4090.

☐ Bonnie Dershem (x7453)
☐ Melinda Turner (x7449)

☐ Brian Scofield (x7471)
☒ Nicole Ranalli (x7455)

☐ Jennifer Kagel (x7451)
☐ Pamela Shellenberger (x7459)

ROBERT ANDERSON
 Digitally signed by
 ROBERT ANDERSON
 Date: 2018.12.13
 14:22:14 -05'00'

SIGNATURE: _____

Supervisor, Pennsylvania Field Office



Pennsylvania Natural Diversity Inventory

Pennsylvania Natural Diversity Inventory MANUAL PROJECT SUBMISSION FORM

This form provides site information necessary to perform an Environmental Review for special concern species and resources listed under the Endangered Species Act of 1973, the Wild Resource Conservation Act, the Pennsylvania Fish and Boat Code or the Pennsylvania Game and Wildlife Code.

Applicant Information

Name: Allegheny County Sanitary Authority (ALCOSAN)

Address: 3300 Preble Ave. Pittsburgh Pa 15233

Phone Number:

Email:

Contact Person Information - if different from applicant

Name: Tom Schevtchuk

Address: ALCOSAN Wet Weather Program Office - Same Street Address As Above

Phone Number: 412-734-6226

Email: schevtchukta@cdmsmith.com

Project Information

Project Name: Woods Run Wwtp Capacity Expansion

Project Reference Point (center point of project): Latitude: 40.47553 Longitude: -80.043568 Datum: NAD83

Municipality: Pittsburgh

County: Allegheny

☒ Attach a portion of a U.S.G.S. 7 1/2 Minute Quadrangle Map with Project Boundaries clearly marked.

U.S.G.S. Quad Name: Pittsburgh West, Pa (In Proj. Description)

Provide GIS shapefiles showing the project boundary (strongly recommended) To be provided with submission

Project Description

Proposed Project Activity (including ALL earth disturbance areas and current conditions)

Phased expansion of wet weather treatment capacity within campus of existing Woods Run WWTP.

Additional tankage and appurtenances will be constructed. See attached project description.

Total Acres of Property: 56

Acreage to be Impacted: 11 approx

- Will the entire project occur in or on an existing building, parking lot, driveway, road, maintained road shoulder, street, runway, paved area, railroad bed, or maintained lawn? Yes ☒ No ☒ All work in existing plant footprint.
- Are there any waterways or waterbodies (intermittent or perennial rivers, streams, creeks, tributaries, lakes or ponds) in or near the project area, or on the land parcel? If so, how many feet away is the project? Yes ☒ Feet No ☐ Plant located on Ohio River, new disinfection and outfall adjacent to riverbank.
- Are wetlands located in or within 300 feet of the project area? Yes ☒ No ☐ If No, is this the result of a wetland delineation? Plant is on the Ohio River (Riverine classification) no other wetlands identified.
- How many acres of tree removal, tree cutting or forest clearing will be necessary to implement all aspects of this project? 0

Dept. of Conservation and Natural Resources
Bureau of Forestry, Ecological Services Section
400 Market St., PO Box 8552
Harrisburg, PA 17105

Email: RA-HERITAGEREVIEW@state.pa.us
fax: 717-772-0271

PA Game Commission
Bureau of Wildlife Habitat Management
Division of Environmental Planning & Habitat Protection
2001 Elmerton Avenue
Harrisburg, PA 17110-9797
RA-PGC_PNDI@pa.gov

PA Fish and Boat Commission
Natural Diversity Section
450 Robinson Lane
Bellefonte, PA 16823

Email: RA-FBPACENOTIFY@pa.gov

US Fish and Wildlife Service
Pennsylvania Field Office
110 Radnor Rd; Suite 101
State College, PA 16801
no faxes please

Allegheny County Sanitary Authority (ALCOSAN)
Act 537 Special Study
Pennsylvania Natural Diversity Inventory Project Description
March, 2017

1.0 Site Description

The ALCOSAN Wastewater Treatment Plant is located at 3300 Preble Avenue in Pittsburgh. The plant site is approximately 56 acres in size, and is situated between the Norfolk-Southern railroad tracks and the Ohio River. The plant site is beneath, and approximately bisected by the McKees Rocks Bridge. The plant location is shown on Figure 1 (7.5" USGS Quad Sheet).

2.0 Site Environmental Impacts

County Stormwater Management Plan

Stormwater management activities at the ALCOSAN treatment plant site are regulated under the Pennsylvania Clean Streams Law and the Allegheny County Subdivision and Land Development Ordinance. Publicly owned wastewater treatment plants are categorically included under the statewide general stormwater permitting program. Pending detailed facilities planning and preliminary design work, ALCOSAN anticipates that there will be no net increase to stormwater runoff because of the treatment plant improvements.

Construction activities during the implementation of the treatment plant CIP will be conducted according to Allegheny County stormwater management regulations pursuant to the Storm Water Management Act. During the project design, ALCOSAN will coordinate with the Allegheny County Conservation District as to the need for an Earth Disturbance Permit. An approved Soil Erosion and Sediment Control Plan will be followed during construction.

Wetlands

Wetlands possess three essential characteristics: 1) hydric soils; 2) wetland hydrology; and 3) hydrophytic vegetation. All characteristics must be fulfilled for an area to be classified as a wetland.¹ The U. S. Fish and Wildlife Service (FWS) has identified wetlands throughout the United States primarily by stereoscopic analysis of high altitude aerial photographs. Wetlands were identified on the photographs based on vegetation, visible hydrology and geography by Classification of Wetlands and Deep Water Habitats of the United States.²

Hydric soils information for both Allegheny and Washington Counties was provided by the U. S. Department of Agriculture's Soil Conservation Service (SCS). The SCS has identified those soils, within each county, with the potential of containing hydric components. These soils are subdivided into soils with major components hydric and soils with inclusions of hydric components. Soils with major hydric components have a high probability of being classified as hydric soils and supporting hydrophytic vegetation. Those soils with inclusions of hydric

¹ USEPA/USCOE Field Guide for Determining Wetlands, 1989.

² FWB/OBS 79/31

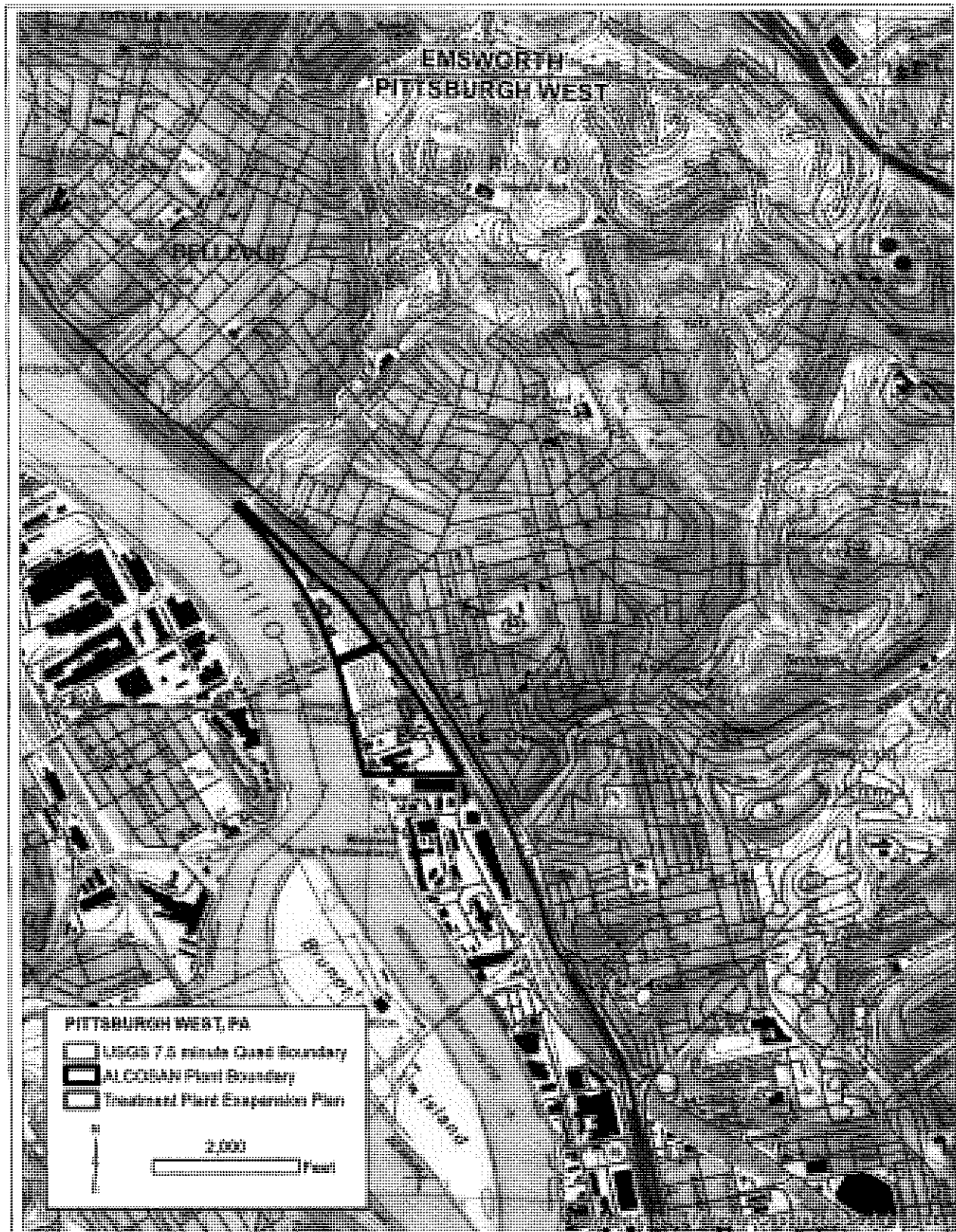


Figure 1 – ALCOSAN Woods Run Wastewater Treatment Plant Location

components have the potential for being classified as hydric soils and must be field checked for an actual determination.

The National Wetlands Inventory wetlands map (Figure 2) prepared by the US Fish and Wildlife Service does not show any wetlands on the ALCOSAN Woods Run Wastewater Treatment Plant site. However, the map does identify a Riverine Wetland, the Ohio River, next to the site. Based on soils information provided by the SCS it does not appear that any of the soil types with major hydric components, located within Allegheny County (i.e., Atkins Silt Loam, Brinkerton Silt Loam), appear on the site. The primary soil type on the site is classified as Urban Land, which the SCS has determined has the potential for the inclusion of hydric components. Note that the locations and footprint of the new treatment units shown on Figure 2 are approximate.

Waterway Disturbances and Floodplain Impacts

Most of the treatment plant site is located upland of the 100-year flood elevation (725 feet).³ Based upon this elevation, the existing Energy Recovery Building, Dewatering Building and related appurtenances are within the 100-year floodplain. As a part of the Part II permit application package for the Phase II treatment plant expansion, ALCOSAN will request a jurisdictional determination as to the applicability of permitting requirements under Section 105 (floodway) or Section 106 (floodway fringe) of the Pennsylvania Administrative Code. Based upon ALCOSAN's current understanding, the plant wet weather capacity expansion activities will not require permitting under Section 105. The applicability of Section 106 is to be determined during the design phase. PaDEP determined that permits were not required for the Phase 1 plant expansion which occurred in the late 1990s under Sections 105 and 106.

Based upon the FEMA flood profile for the Ohio River, the 100-year flood elevation at the McKees Rocks Bridge is 724 feet. Figure 3 shows the irregularly shaped contour of the 724-foot elevation line on the current plant site. Please note that the elevation at the top of the existing flood wall which runs along most of the length of the current plant site is approximately 727.07 feet. The flood wall ends upstream of the process treatment areas, perpendicular to Tracy Street; hence river elevations that exceed 726 feet upstream of the flood wall could result in localized flooding in the areas shown on the site plan.

Rare, Endangered or Threatened Plant and Animal Species

In preparing the 1996 Act 537 Plan, ALCOSAN requested a *Pennsylvania National Diversity Inventory (PNDI)* from the PaDEP Bureau of Forestry. In response, the Bureau affirmed that no rare or endangered species are found at the ALCOSAN treatment plant.

Historical and Archaeological Resources Protection

Construction of the ALCOSAN treatment plant began in 1956 and was completed in 1959. Between 1970 and 1972, the plant was expanded and modified to provide secondary wastewater treatment.

³ Source: FEMA Flood Boundary and Floodway Map - City of Pittsburgh (Panel No. 420063-0030) 1981.

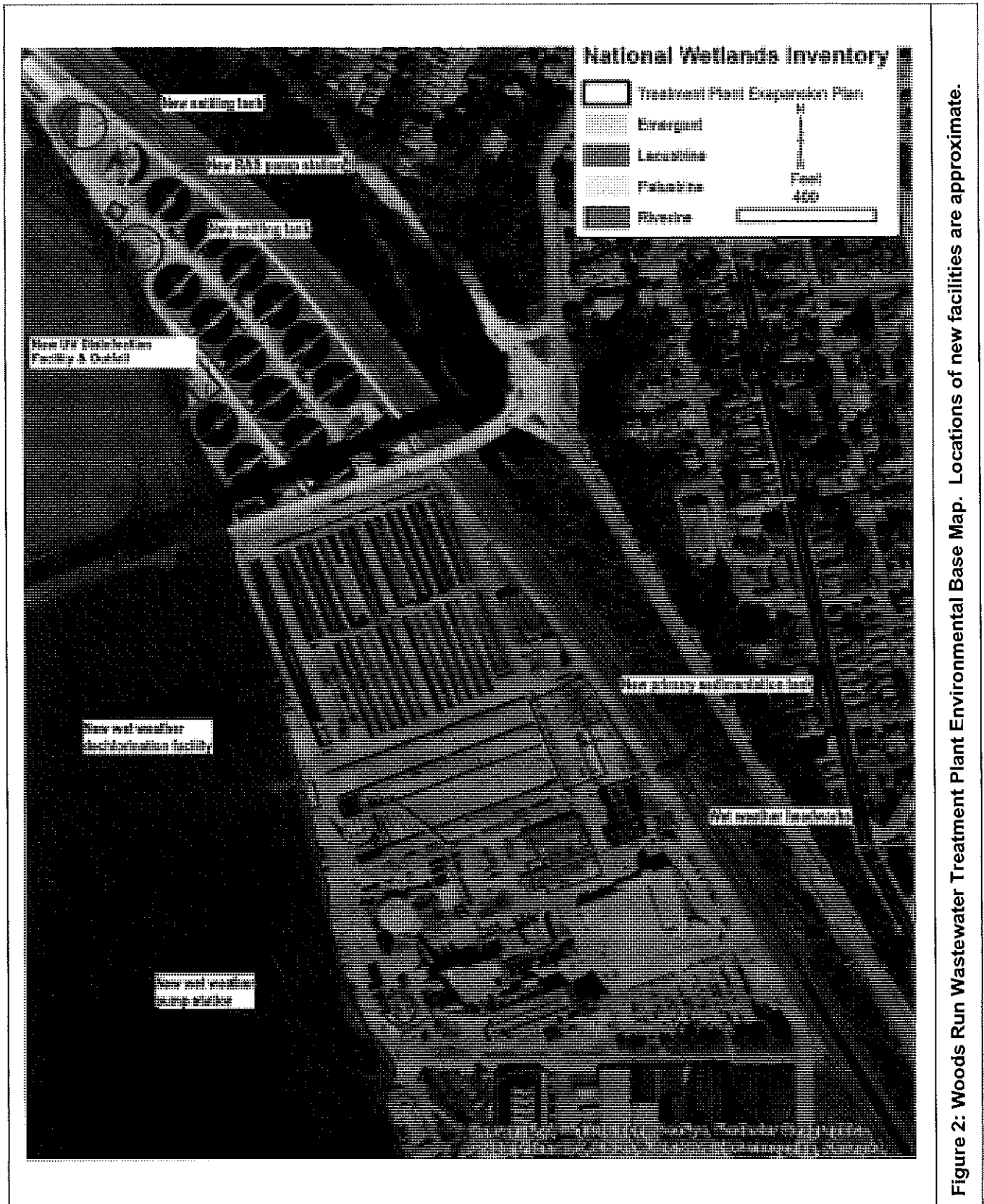
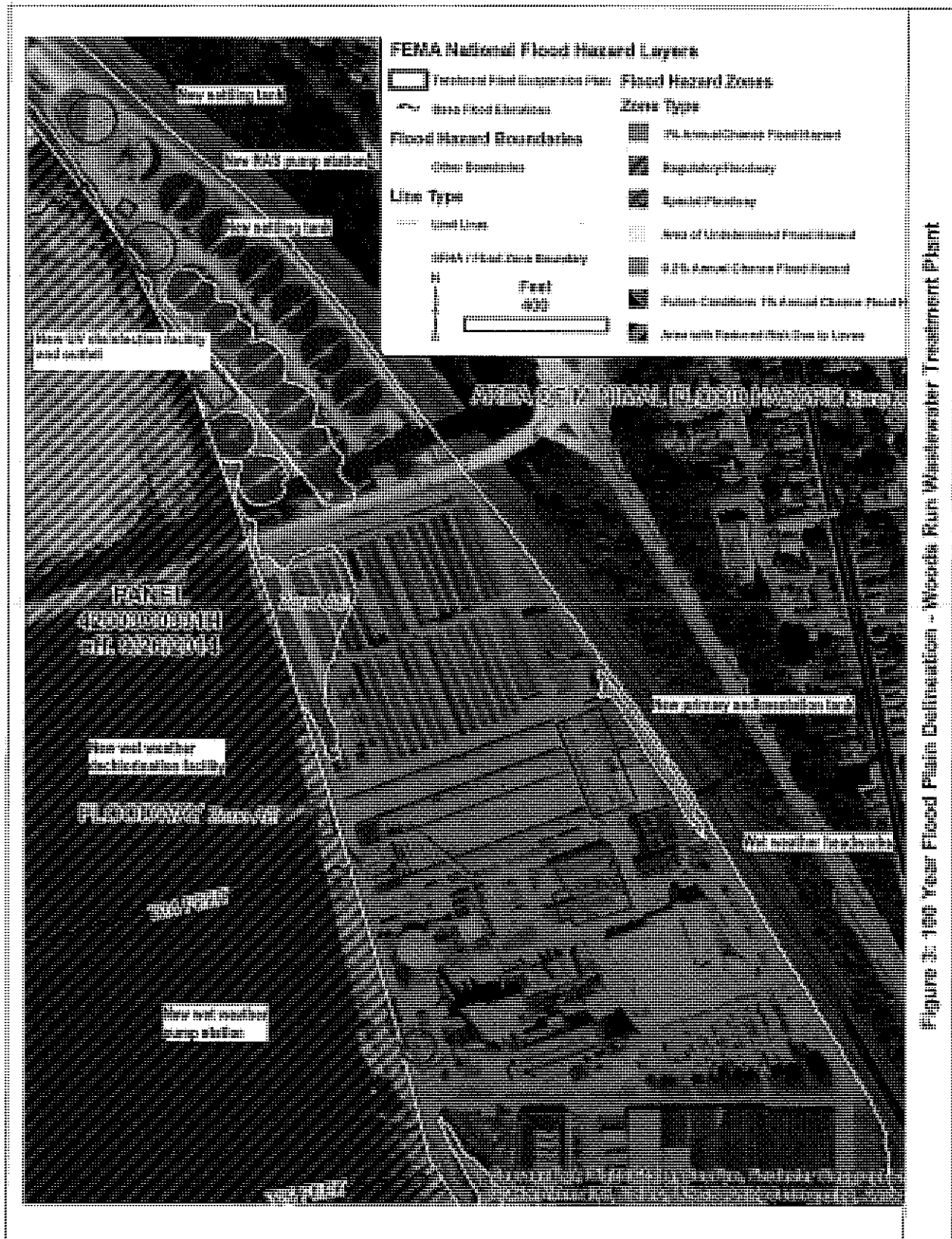


Figure 2: Woods Run Wastewater Treatment Plant Environmental Base Map. Locations of new facilities are approximate.



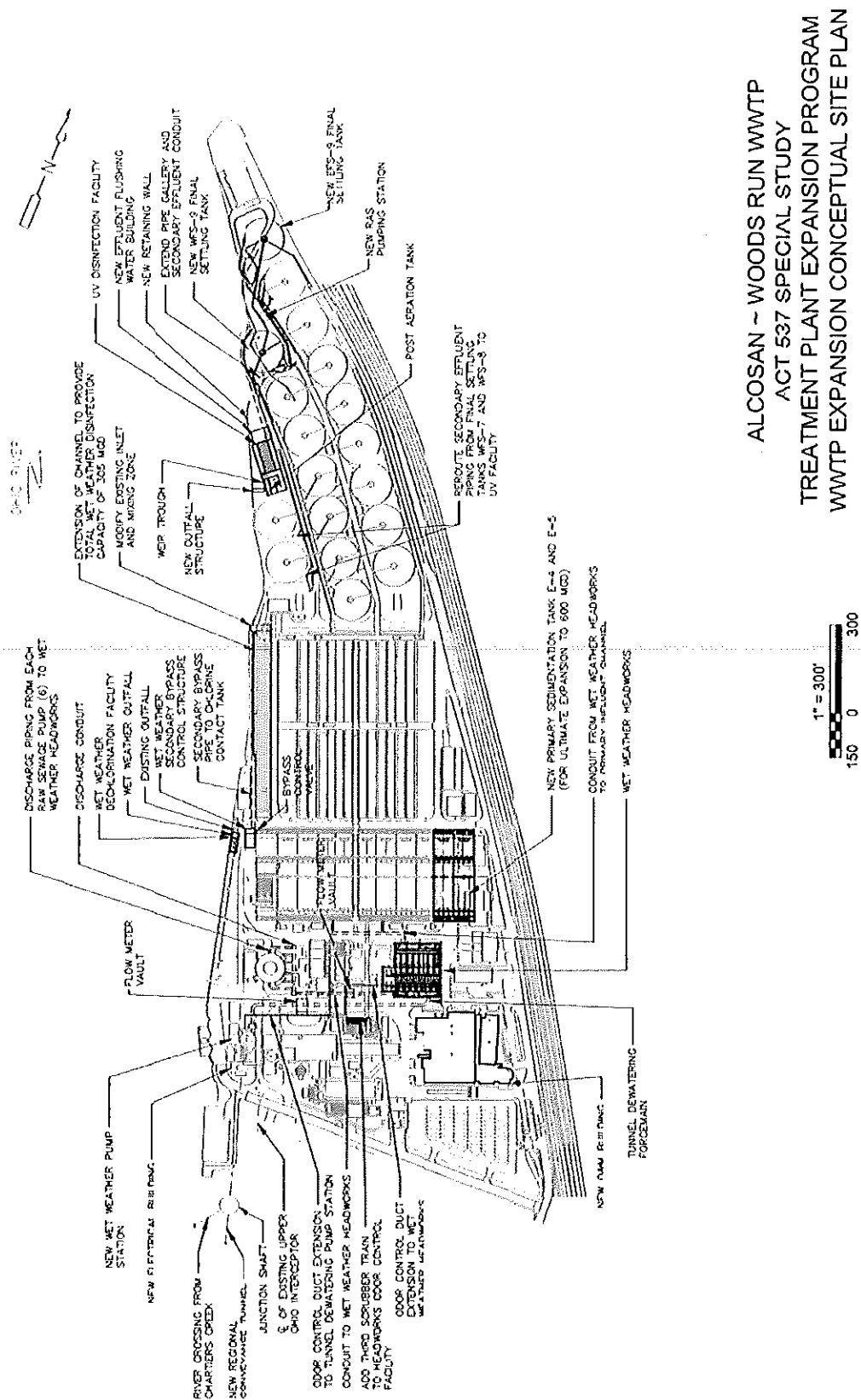
In preparing the 1996 Act 537 Plan, ALCOSAN requested a site review from the Bureau of Historic Preservation within the Pennsylvania Historical and Museum Commission. Subsequently, the Bureau confirmed that there are no known historic sites and no potential impacts on known archaeological and historical sites relevant to the proposed treatment plant improvements. ALCOSAN requested an updated determination from the Bureau in January of 2017.

3.0 Project Description

Under its Interim Measures Wet Weather (IWWP), ALCOSAN proposes to expand the wet weather treatment capacity at its Woods Run Wastewater Treatment Plant. Primary treatment capacity will be expanded to 480 mgd initially and 600 mgd ultimately. Secondary treatment capacity will be expanded to 295 mgd. The expansion of wet weather treatment capacity to 480 mgd and related adjustments to regulator structures is expected to result in a 3 billion gallons per year reduction in ALCOSAN overflow volume. This represents a 33% reduction relative to projected future (2046) flow conditions.

The long term plan includes a 120 mgd expansion of the total raw wastewater pumping capacity to facilitate the ultimate expansion to 600 mgd of wet weather treatment capacity. While different options to achieve this pumping capacity will be evaluated, this review request assumes that a 120 mgd Wet Weather Pump Station will be constructed.

Construction of the treatment plant expansion will be phased, with construction currently scheduled to occur between 2019 and 2025. A treatment plant site plan showing the anticipated construction for the various projects is provided as Figure 4. Note that the locations and footprint of the new treatment units shown on Figure 4 are approximate.



ALCOSAN ~ WOODS RUN WWTP
ACT 537 SPECIAL STUDY
TREATMENT PLANT EXPANSION PROGRAM
WWTP EXPANSION CONCEPTUAL SITE PLAN

ALCOSAN Act 537 Special Study
Pennsylvania Natural Diversity Inventory Project Review
February, 2017

Figure 4
Site Plan - ALCOSAN Woods Run WWTP Wet Weather Capacity Expansion

1. PROJECT INFORMATION

Project Name: **manual_Woods Run WWTP Capacity Expansion**

Date of Review: **10/2/2017 10:35:09 AM**

Project Category: **Waste Transfer, Treatment, and Disposal, Liquid waste/Effluent, Wastewater treatment plant (construction, expansion or modification)**

Project Area: **2.89 acres**

County(s): **Allegheny**

Township/Municipality(s): **PITTSBURGH**

ZIP Code: **15212; 15233**

Quadrangle Name(s): **PITTSBURGH WEST**

Watersheds HUC 8: **Upper Ohio**

Watersheds HUC 12: **Kilbuck Run-Ohio River**

Decimal Degrees: **40.476155, -80.042763**

Degrees Minutes Seconds: **40° 28' 34.1590" N, 80° 2' 33.9453" W**

This is a draft receipt for information only. It has not been submitted to jurisdictional agencies for review.

2. SEARCH RESULTS

Agency	Results	Response
PA Game Commission	Potential Impact	FURTHER REVIEW IS REQUIRED, See Agency Response
PA Department of Conservation and Natural Resources	No Known Impact	No Further Review Required
PA Fish and Boat Commission	No Known Impact	No Further Review Required
U.S. Fish and Wildlife Service	No Known Impact	No Further Review Required

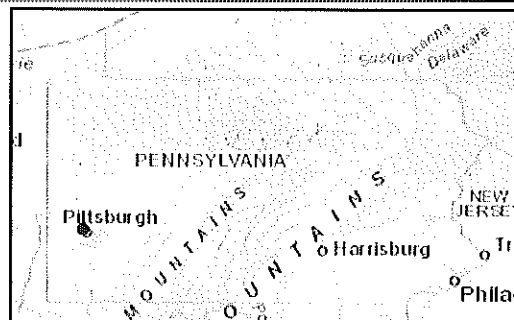
As summarized above, Pennsylvania Natural Diversity Inventory (PNDI) records indicate there may be potential impacts to threatened and endangered and/or special concern species and resources within the project area. If the response above indicates "No Further Review Required" no additional communication with the respective agency is required. If the response is "Further Review Required" or "See Agency Response," refer to the appropriate agency comments below. Please see the DEP Information Section of this receipt if a PA Department of Environmental Protection Permit is required.

manual_Woods Run WWTP Capacity Expansion

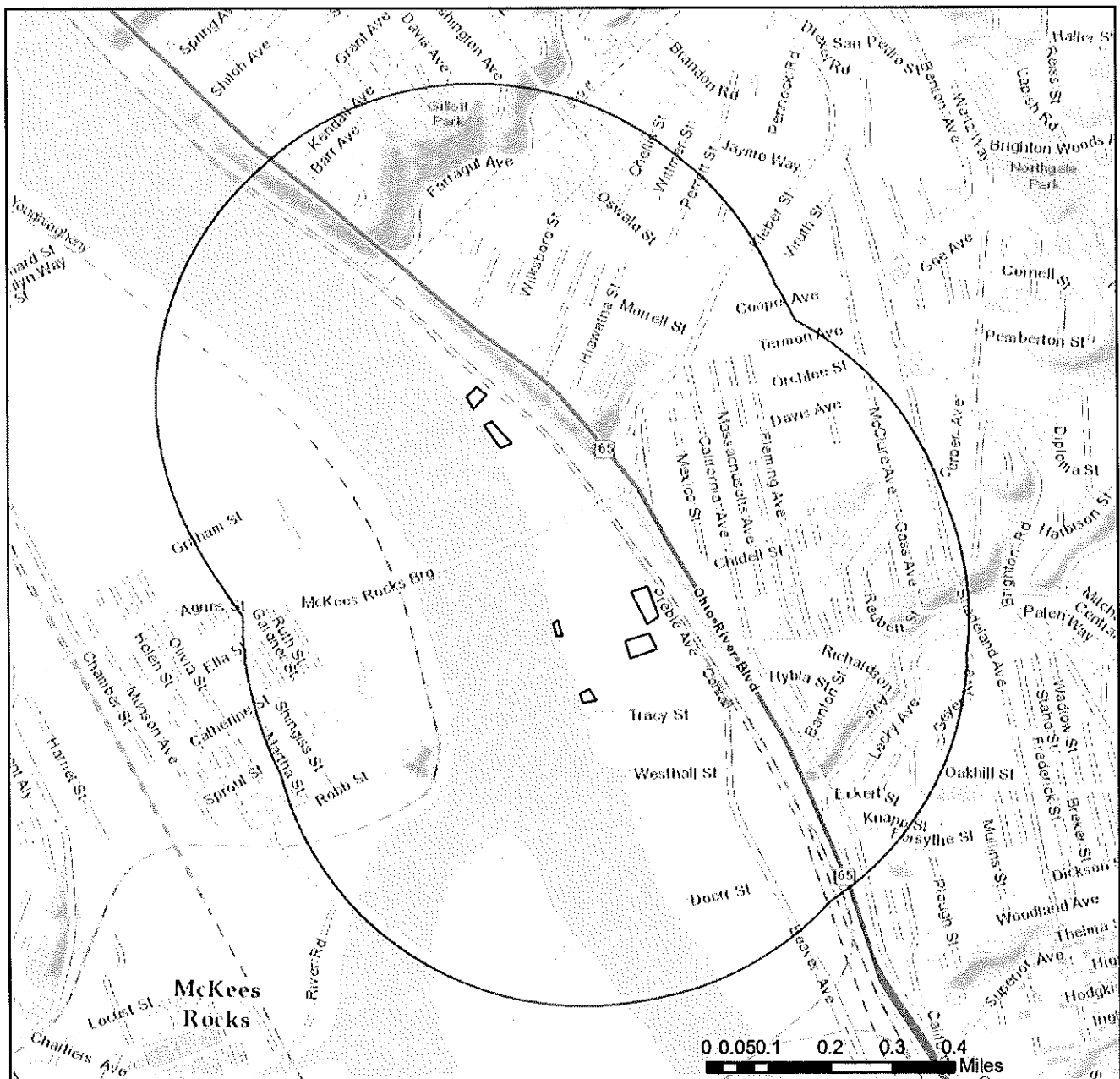


- ☐ Project Boundary
- ☐ Buffered Project Boundary

Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community
Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user

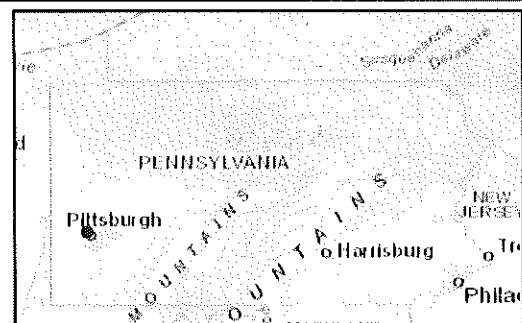


manual_Woods Run WWTP Capacity Expansion



- ☐ Project Boundary
- ☐ Buffered Project Boundary

Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community



3. AGENCY COMMENTS

Regardless of whether a DEP permit is necessary for this proposed project, any potential impacts to threatened and endangered species and/or special concern species and resources must be resolved with the appropriate jurisdictional agency. In some cases, a permit or authorization from the jurisdictional agency may be needed if adverse impacts to these species and habitats cannot be avoided.

These agency determinations and responses are **valid for two years** (from the date of the review), and are based on the project information that was provided, including the exact project location; the project type, description, and features; and any responses to questions that were generated during this search. If any of the following change: 1) project location, 2) project size or configuration, 3) project type, or 4) responses to the questions that were asked during the online review, the results of this review are not valid, and the review must be searched again via the PNDI Environmental Review Tool and resubmitted to the jurisdictional agencies. The PNDI tool is a primary screening tool, and a desktop review may reveal more or fewer impacts than what is listed on this PNDI receipt. The jurisdictional agencies **strongly advise against** conducting surveys for the species listed on the receipt prior to consultation with the agencies.

PA Game Commission

RESPONSE:

Further review of this project is necessary to resolve the potential impact(s). Please send project information to this agency for review (see WHAT TO SEND).

PGC Species: (Note: The Pennsylvania Conservation Explorer tool is a primary screening tool, and a desktop review may reveal more or fewer species than what is listed below.)

Scientific Name	Common Name	Current Status
Falco peregrinus	Peregrine Falcon	Endangered

PA Department of Conservation and Natural Resources

RESPONSE:

No Impact is anticipated to threatened and endangered species and/or special concern species and resources.

PA Fish and Boat Commission

RESPONSE:

No Impact is anticipated to threatened and endangered species and/or special concern species and resources.

U.S. Fish and Wildlife Service

RESPONSE:

No impacts to **federally** listed or proposed species are anticipated. Therefore, no further consultation/coordination under the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq. is required. Because no take of federally listed species is anticipated, none is authorized. This response does not reflect potential Fish and Wildlife Service concerns under the Fish and Wildlife Coordination Act or other authorities.

* Special Concern Species or Resource - Plant or animal species classified as rare, tentatively undetermined or candidate as well as other taxa of conservation concern, significant natural communities, special concern populations (plants or animals) and unique geologic features.

** Sensitive Species - Species identified by the jurisdictional agency as collectible, having economic value, or being susceptible to decline as a result of visitation.

WHAT TO SEND TO JURISDICTIONAL AGENCIES

If project information was requested by one or more of the agencies above, upload* or email* the following information to the agency(s). Instructions for uploading project materials can be found [here](#). This option provides the applicant with the convenience of sending project materials to a single location accessible to all three state agencies. Alternatively, applicants may email or mail their project materials (see AGENCY CONTACT INFORMATION).

***Note:** U.S. Fish and Wildlife Service requires applicants to mail project materials to the USFWS PA field office (see AGENCY CONTACT INFORMATION). USFWS will not accept project materials submitted electronically (by upload or email).

Check-list of Minimum Materials to be submitted:

____ Project narrative with a description of the overall project, the work to be performed, current physical characteristics of the site and acreage to be impacted.

____ A map with the project boundary and/or a basic site plan (particularly showing the relationship of the project to the physical features such as wetlands, streams, ponds, rock outcrops, etc.)

In addition to the materials listed above, USFWS REQUIRES the following

____ **SIGNED** copy of a Final Project Environmental Review Receipt

The inclusion of the following information may expedite the review process.

____ Color photos keyed to the basic site plan (i.e. showing on the site plan where and in what direction each photo was taken and the date of the photos)

____ Information about the presence and location of wetlands in the project area, and how this was determined (e.g., by a qualified wetlands biologist), if wetlands are present in the project area, provide project plans showing the location of all project features, as well as wetlands and streams.

4. DEP INFORMATION

The Pa Department of Environmental Protection (DEP) requires that a signed copy of this receipt, along with any required documentation from jurisdictional agencies concerning resolution of potential impacts, be submitted with applications for permits requiring PNDI review. Two review options are available to permit applicants for handling PNDI coordination in conjunction with DEP's permit review process involving either T&E Species or species of special concern. Under sequential review, the permit applicant performs a PNDI screening and completes all coordination with the appropriate jurisdictional agencies prior to submitting the permit application. The applicant will include with its application, both a PNDI receipt and/or a clearance letter from the jurisdictional agency if the PNDI Receipt shows a Potential Impact to a species or the applicant chooses to obtain letters directly from the jurisdictional agencies. Under concurrent review, DEP, where feasible, will allow technical review of the permit to occur concurrently with the T&E species consultation with the jurisdictional agency. The applicant must still supply a copy of the PNDI Receipt with its permit application. The PNDI Receipt should also be submitted to the appropriate agency according to directions on the PNDI Receipt. The applicant and the jurisdictional agency will work together to resolve the potential impact(s). See the DEP PNDI policy at <https://conservationexplorer.dcnr.pa.gov/content/resources>.

5. ADDITIONAL INFORMATION

The PNDI environmental review website is a preliminary screening tool. There are often delays in updating species status classifications. Because the proposed status represents the best available information regarding the conservation status of the species, state jurisdictional agency staff give the proposed statuses at least the same consideration as the current legal status. If surveys or further information reveal that a threatened and endangered and/or special concern species and resources exist in your project area, contact the appropriate jurisdictional agency/agencies immediately to identify and resolve any impacts.

For a list of species known to occur in the county where your project is located, please see the species lists by county found on the PA Natural Heritage Program (PNHP) home page (www.naturalheritage.state.pa.us). Also note that the PNDI Environmental Review Tool only contains information about species occurrences that have actually been reported to the PNHP.



United States Department of the Interior

FISH AND WILDLIFE SERVICE

Pennsylvania Field Office
110 Radnor Road, Suite 101
State College, Pennsylvania 16801-4850



December 4, 2017

Tom Schevtchuk
Allegheny County Sanitary Authority (ALCOSAN)
3300 Preble Avenue
Pittsburgh, PA 15233

RE: USFWS Project #2017-0718

Dear Mr. Schevtchuk:

This correspondence supersedes the Service letter of April 6, 2017. The purpose of this letter is to correct the project location from the Allegheny River to the Ohio River. The proposed Woods Run WWTP Capacity Expansion project is in the City of Pittsburgh, Allegheny County, Pennsylvania. The April 6, 2017, Service correspondence was in response to the project submittal of March 9, 2017. The Ohio River navigation pool is inhabited by three federally listed, endangered mussel species, the northern riffleshell (*Epioblasma torulosa rangiana*), the clubshell (*Pleurobema clava*), and the rayed bean (*Villosa fabalis*). The following comments are provided pursuant to the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*) to ensure the protection of endangered and threatened species.

This project involves phased improvements and expansion of an existing sewage facility adjacent to the Ohio River. At this time, you are requesting comments on the study, due to the fact that the plan is not yet finalized. Under the section *Rare, Endangered, or Threatened Plant and Animal Species*, it states that no rare, threatened, or endangered species are found at the ALCOSAN treatment plant. We respectfully request that the above listed mussel species be considered throughout the planning process. Freshwater mussels, including the above listed species, are sedentary filter-feeders, and as such, they are vulnerable to substrate disturbance, silt deposition, scouring, water quality degradation, changes in channel morphology, and alterations of river hydrology.

Please coordinate with this office during your phased expansion in order to ensure that your project is designed to avoid potential adverse effects to mussels and their habitat. Once finalized, please provide detailed project plans, including the location of outfalls into the Ohio River and an erosion and sedimentation control plan. Additionally, in order to help guide your plans in terms of waste water discharge, the Service would like to bring the following mussel-specific water quality information to your attention.

NPDES Criteria to Protect Federally Listed Mussels

NPDES modeling typically allows for a mixing zone. The resulting discharge criteria, even if protective beyond the mixing zone, may result in aquatic toxicity within the mixing zone. The NPDES regulations at 40 CFR 122.44(d)(1)(i) require the establishment of an effluent limit for any pollutant that is, or may be, discharged at a level that “... will cause, have a reasonable potential to cause, or contribute to an excursion above any State water quality standard, including State narrative criteria for water quality.” The Endangered Species Act prohibits take of individual mussels anywhere, including within mixing zones. Furthermore, it is not clear if the model accounts for incomplete mixing that occurs in rivers due to the presence of islands and wide shallow runs or low flow conditions. Thus, to prevent unauthorized take, criteria in permits authorizing discharges into federally listed mussel habitat must be met at the end of the discharge pipe.

Chloride Criterion

The EPA criterion of 230 mg/L chloride and daily maximum concentrations of 860 mg/L chloride are the standards derived for general application in surface waters without consideration of recent mussel toxicity data. Furthermore, no supporting information is provided to demonstrate that these discharge limits will achieve concentrations in the river of less than 78 mg/L that are protective of individual federally listed mussels as derived in the Service’s study conducted in Warren PA. Given the presence of federally listed, endangered mussels in the discharge area, the Service contends that, to prevent take of federally listed mussels, surface water concentrations less than 78 mg/L are warranted at the end of the discharge pipe. The Service requests that the monitoring requirements for this NPDES permit include either a 78 mg/L instream monitoring criterion for chloride at the outfall, or a maximum daily effluent limit calculated to ensure that chloride concentrations do not exceed 78 mg/L in the river.

Ammonia Criterion

Mussels are highly sensitive to ammonia. Given the presence of federally listed, endangered mussels in the discharge area, the Service contends that, to prevent take of listed species, the USEPA chronic criterion for ammonia to protect freshwater mussels (1.9 mg/L) must be met at the end of the discharge pipe. The Service requests that the monitoring requirements for this NPDES permit include either a 1.9 mg/L instream monitoring criterion for ammonia at the outfall, or a maximum daily effluent limit calculated to ensure that ammonia concentrations in the river do not exceed 1.9 mg/L.

Nickel Criterion

The current EPA criteria are 522 µg/L for acute exposures and 29 µg/L for chronic exposures in waters with hardness at 50 mg/L. A recent study with four species of freshwater mussels demonstrated that the EPA acute criterion is not protective of these species (Wang et al., in press). Based on acute toxicity values generated in this study, an acute exposure value of 131 µg/L at 50 mg/L hardness is justified for protection of federally listed mussel species. Using the EPA acute to chronic ratio for nickel, the estimated chronic value for the protection of federally

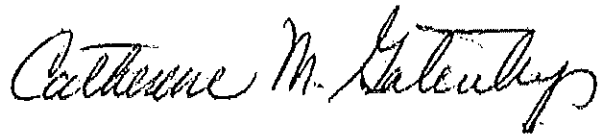
listed mussels would be 7.3 µg/L at 50 mg/L hardness. Given the presence of federally listed, endangered mussels in the discharge area, the Service contends that, to prevent take of listed species, a chronic criterion for nickel to protect freshwater mussels (7.3 µg/L) must be met at the end of the discharge pipe. The Service requests that the monitoring requirements for this NPDES permit include either a 7.3 µg/L instream monitoring criterion for nickel at the outfall, or a maximum daily effluent limit calculated to ensure that nickel concentrations do not exceed 7.3 µg/L in the river.

This response relates only to endangered or threatened species under our jurisdiction, based on an office review of the proposed project's location. No field inspection of the project area has been conducted by this office. Consequently, this letter is not to be construed as addressing potential Service concerns under the Fish and Wildlife Coordination Act or other authorities.

To avoid potential delays in reviewing your project, please use the above-referenced USFWS project tracking number in any future correspondence regarding this project.

If you have any questions regarding this matter, please contact Nicole Ranalli of this office at 814-234-4090.

Sincerely,

A handwritten signature in cursive script, reading "Catherine M. Gatenby".

Catherine M. Gatenby, Ph.D.
Acting Field Office Supervisor



Pennsylvania Fish & Boat Commission

Division of Environmental Services

Natural Diversity Section

450 Robinson Lane

Bellefonte, PA 16823

814-359-5237

April 27, 2017

IN REPLY REFER TO

SIR# 47429

Allegheny County Sanitary Authority
Tom Schevtchuk
3300 Preble Avenue
Pittsburgh, Pennsylvania 15233

**RE: Species Impact Review (SIR) – Rare, Candidate, Threatened and Endangered Species
PNDI Search No.
Woods Run WWTP Capacity Expansion
ALLEGHENY County: Pittsburgh City**

Dear Tom Schevtchuk:

This responds to your inquiry about a Pennsylvania Natural Diversity Inventory (PNDI) Internet Database search “potential conflict” or a threatened and endangered species impact review. These projects are screened for potential conflicts with rare, candidate, threatened or endangered species under Pennsylvania Fish & Boat Commission jurisdiction (fish, reptiles, amphibians, aquatic invertebrates only) using the Pennsylvania Natural Diversity Inventory (PNDI) database and our own files. These species of special concern are listed under the Endangered Species Act of 1973, the Wild Resource Conservation Act, and the Pennsylvania Fish & Boat Code (Chapter 75), or the Wildlife Code.

An element occurrence of a rare, candidate, threatened, or endangered species under our jurisdiction is known from the vicinity of the proposed project. However, given the nature of the proposed project, the immediate location, or the current status of the nearby element occurrence(s), no adverse impacts are expected to the species of special concern.

This response represents the most up-to-date summary of the PNDI data and our files and is valid for two (2) years from the date of this letter. An absence of recorded species information does not necessarily imply species absence. Our data files and the PNDI system are continuously being updated with species occurrence information. Should project plans change or additional information on listed or proposed species become available, this determination may be reconsidered, and consultation shall be re-initiated.

Our Mission:

www.fish.state.pa.us

To protect, conserve and enhance the Commonwealth's aquatic resources and provide fishing and boating opportunities.

April 27, 2017

If you have any questions regarding this review, please contact Doug Fischer at 814-359-5195 and refer to the SIR # 47429. Thank you for your cooperation and attention to this important matter of species conservation and habitat protection.

Sincerely,

A handwritten signature in black ink, reading "Christopher A. Urban". The signature is written in a cursive, flowing style.

Christopher A. Urban, Chief
Natural Diversity Section

CAU/DF/dn

Schevtchuk, Thomas

From: Braun, Olivia <olbraun@pa.gov>
Sent: Thursday, April 06, 2017 10:21 AM
To: Schevtchuk, Thomas
Subject: Woods Run Wwtp Capacity Expansion
Attachments: Project Map.pdf

Good Morning,

The PGC is in the process of reviewing the above referenced project. In an effort to get a better understanding of the proposed upgrades to the existing treatment plant, the PGC is requesting the additional information about the New UV Disinfection Facility and Outfall identified on the attached map. At your earliest convenience, please provide the following information so that we may continue the review of your project.

1. Site plans for the New UV Disinfection Facility and Outfall that illustrate the location and building height of the proposed infrastructure.
2. What type of equipment or heavy machinery is required to install/construct the New UV Disinfection Facility and Outfall? Will cranes be required? If so, please provide details such as crane heights, where they will be located, etc.
3. An anticipated construction timeline for the New UV Disinfection Facility and Outfall.

Thanks,

Olivia A. Braun
Pennsylvania Game Commission
Bureau of Wildlife Habitat Management
Division of Environmental Planning & Habitat Protection
2001 Elmerton Avenue
Harrisburg, PA 17110
Phone: 717-787-4250, Extension 3128

Schevtchuk, Thomas

From: David Borneman <David.Borneman@alcosan.org>
Sent: Tuesday, June 06, 2017 10:38 AM
To: 'olbraun@pa.gov'
Cc: Schevtchuk, Thomas; Kluitenberg, Edward; Daniel Lockard; Douglas Jackson; Michelle Buys; Arthur Tamilla; Dupuis, Timothy J.; Hughes, Colleen; Cowburn, Scott
Subject: Woods Run Wwtp Capacity Expansion
Attachments: Project Map.pdf

Olivia,

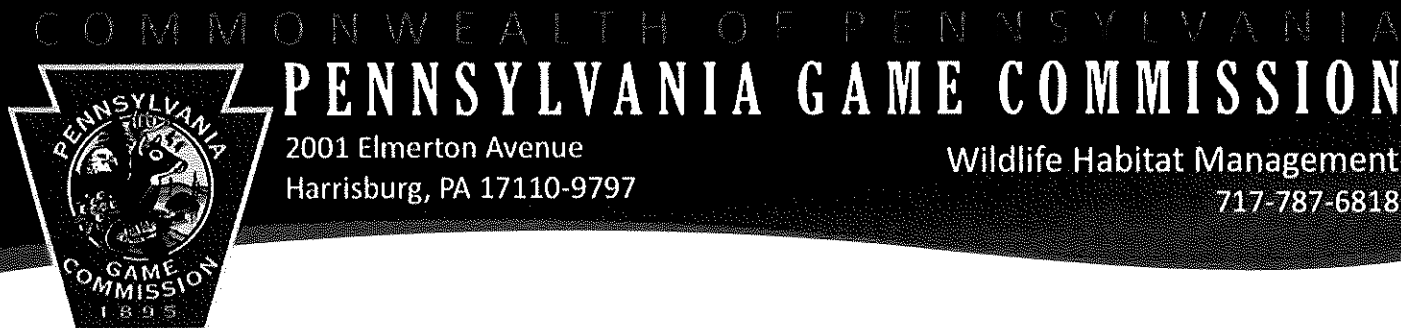
I am responding to your April 6, 2017 request for additional information. I apologize for the delay in this response. The types of questions and additional information you are requesting is not available at this time. The project is in the planning and preliminary design phase. The means and methods of construction and the preliminary layout, elevation and height of the proposed infrastructure have not been completed to date. We anticipate final design of the proposed facilities to begin in 2018 thru 2019. At that time, we can provide additional information that you are requesting. Construction through conventional bidding is tentatively scheduled to begin at the earliest in the year 2020.

If you need to discuss this further, please call me or e-mail me.

Thanks,
Dave

David W Borneman PE
Director, Engineering & Construction
ALCOSAN
3300 Preble Avenue
Pittsburgh, PA 15233

P: 412-734-8369
F: 412-734-8716
E: david.borneman@alcosan.org



June 15, 2017

Mr. Tom Schevtchuk
ALCOSAN Wet Weather Program Office
3300 Preble Avenue
Pittsburgh, Pennsylvania 15233
schevtchukta@cdmsmith.com

PNDI Manual Project Submission
Re: Woods Run Wwtp Capacity Expansion
City of Pittsburgh, Allegheny County, Pennsylvania

Dear Mr. Schevtchuk,

Thank you for submitting the Pennsylvania Natural Diversity Inventory (PNDI) Manual Project Submission Form for review. The Pennsylvania Game Commission (PGC) screened this project for potential impacts to species and resources of concern under PGC responsibility, which includes birds and mammals only.

Potential Impact Anticipated

PNDI records indicate species or resources of concern are located in the vicinity of the project. The PGC has received and thoroughly reviewed the information that you provided to this office as well as PNDI data, and has determined that potential impacts to threatened, endangered, and species of special concern birds and mammals may be associated with your project. Therefore, additional measures are necessary to avoid potential impacts to the species listed below.

Scientific Name	Common Name	PA Status
<i>Falco peregrines</i>	Peregrine falcon	ENDANGERED

Next Steps

The following seasonal restriction should be performed to avoid impacts to nesting peregrine falcons located within the vicinity of project area:

- All activities related to this project should be completed outside of peregrine falcon nesting season (between August 1 and February 14). No activities related to this project should occur during nesting season, February 15 to July 31.

This response represents the most up-to-date summary of the PNDI data files and is valid for two (2) years from the date of this letter. An absence of recorded information does not necessarily

imply actual conditions on site. Should project plans change or additional information on listed or proposed species become available, this determination may be reconsidered.

Should the proposed work continue beyond the period covered by this letter, please resubmit the project to this agency as an "Update" (including an updated PNDI receipt, project narrative and accurate map). If the proposed work has not changed and no additional information concerning listed species is found, the project will be cleared for PNDI requirements under this agency for two additional years.

This finding applies to impacts to birds and mammals only. To complete your review of state and federally-listed threatened and endangered species and species of special concern, please be sure that the U.S. Fish and Wildlife Service, the PA Department of Conservation and Natural Resources, and/or the PA Fish and Boat Commission have been contacted regarding this project as directed by the online PNDI ER Tool found at www.naturalheritage.state.pa.us.

Sincerely,



Olivia A. Braun
Environmental Planner
Division of Environmental Planning & Habitat Protection
Bureau of Wildlife Habitat Management
Phone: 717-787-4250, Extension 3128
Fax: 717-787-6957
E-mail: Olbraun@pa.gov

A PNHP Partner



Pennsylvania Natural Heritage Program

OAB/oab

cc: Laroche
Brauning
Gross
Barber
Librandi Mumma
Anderson
Trusso
File

BUREAU OF FORESTRY

October 2, 2017

PNDI Number: 641209

Tom Schevtchuk
CDM Smith
3300 Preble Avenue
Pittsburgh, PA 15233
Email: schevtchukta@cdmsmith.com (hard copy will not follow)

Re: ALCOSAN - Woods Run WWTP Capacity Expansion
Pittsburgh, Allegheny County, PA

Dear Mr. Schevtchuk,

Thank you for the submission of the Pennsylvania Natural Diversity Inventory (PNDI) Environmental Review Receipt Number 641209 for review. PA Department of Conservation and Natural Resources screened this project for potential impacts to species and resources under DCNR's responsibility, which includes plants, terrestrial invertebrates, natural communities, and geologic features only.

No Impact Anticipated

PNDI records indicate that no known occurrences of species or resources under DCNR's jurisdiction occur in the vicinity of the project. Therefore, the project referenced above is not expected to impact plants, terrestrial invertebrates, natural communities, and geologic features of concern. No further coordination with DCNR is needed for this project.

This response represents the most up-to-date review of the PNDI data files and is valid for two (2) years only. If project plans change or more information on listed or proposed species becomes available, our determination may be reconsidered. Should the proposed work continue beyond the period covered by this letter, please resubmit the project to this agency as an "Update" (including an updated PNDI receipt, project narrative and accurate map). As a reminder, this finding applies to potential impacts under DCNR's jurisdiction only. Visit the PNHP website for directions on contacting the Commonwealth's other resource agencies for environmental review.

Should you have any questions or concerns, please contact Jason Ryndock, Ecological Information Specialist, by phone (717-705-2822) or via email (c-jryndock@pa.gov).

Sincerely



Greg Podnieszinski, Section Chief
Natural Heritage Section



PROJECT REVIEW FORM
Request to Initiate SHPO Consultation on
State and Federal Undertakings

SHPO USE ONLY

Second Amended Appendix A-22-b
DATE RECEIVED:

ER NUMBER:

REV: 10/2014

SECTION A: PROJECT NAME & LOCATION

Is this a new submittal? ☒ YES ☐ NO OR ☐ This is additional information for ER Number:

Project Name Woods Run WWTP Capacity Expansion County Allegheny Municipality ALCOSAN (authority)
Project Address 3300 Preble Avenue City/State/ Zip Pittsburgh PA 15233

SECTION B: CONTACT INFORMATION & MAILING ADDRESS

Name Tom Schevtchuk Phone (412) 208-2525
Company CDM Smith Fax
Street/PO Box ALCOSAN Wet Weather Program Office, 3300 Preble Avenue Email
City/State/Zip Pittsburgh PA 15233 schevtchukta@cdmsmith.com

SECTION C: PROJECT DESCRIPTION

This project is located on: ☐ Federal property ☐ State property ☒ Municipal authority ☐ Private property
(check all that apply)

List all federal and state agencies and programs providing funds, permits, licenses.	Agency Type	Agency/Program/Permit Name	Project/Permit/Tracking Number (if applicable)
	State	Pa Dept. Environmental Protection	NPDES PA0025984

Proposed Work – Attach project description, scope of work, site plans, and/or drawings

Project includes (check all that apply): ☒ Construction ☒ Demolition ☐ Rehabilitation ☐ Disposition

Total acres of project area: Plant 56 Total acres of earth disturbance: approx. 11

Are there any buildings or structures within the project area? ☒ Yes ☐ No Approximate age of buildings: 25 to 50 years

Does this project involve properties listed in or eligible for the National Register of Historic Places, or designated as historic by a local government?	Yes ☐	No ☒	Unsure ☐	Name of historic property or historic districts

Please print and mail completed form and all attachments to:

PHMC
State Historic Preservation Office
400 North St.
Commonwealth Keystone Building, 2nd Floor
Harrisburg, PA 17120-0093

Attachments – Please include the following information with this form

- ☒ **Map** – 7.5' USGS quad showing project boundary and Area of Potential Effect
- ☒ **Description/Scope** – Describe the project, including any ground disturbance and previous land use
- ☒ **Site Plans/Drawings** – Indicate the location and age, if known, of all buildings in the project area
- ☒ **Photographs** – Attach prints or digital photographs showing the project site, including images of all buildings and structures keyed to a site plan

SHPO DETERMINATION (SHPO USE ONLY)

☐ There are NO HISTORIC PROPERTIES in the Area of Potential Effect	☐ The project will have NO ADVERSE EFFECTS WITH CONDITIONS (see attached)
☐ The project will have NO EFFECT on historic properties	☐ SHPO REQUESTS ADDITIONAL INFORMATION (see attached)
☐ The project will have NO ADVERSE EFFECTS on historic properties:	

SHPO REVIEWER: _____ DATE: _____

**Allegheny County Sanitary Authority (ALCOSAN)
Act 537 Special Study
Historical Resources Determination Notice
February, 2017**

1.0 Site Description and History

The ALCOSAN Wastewater Treatment Plant is located at 3300 Preble Avenue in Pittsburgh. The plant site is approximately acres in size, and is situated between the Norfolk-Southern railroad tracks and the Ohio River. The plant site is beneath, and approximately bisected by the McKees Rocks Bridge. The plant location is shown on Figure 1 (1.5" USGS Quad Sheet). Construction of the ALCOSAN treatment plant began in 1956 and was completed in 1959. Between 1970 and 1972, the plant was expanded and modified to provide secondary wastewater treatment. Between 1997 and 2003 ALCOSAN expanded the treatment capacity of the plant and made other capital improvements pursuant to its 1996 Act 537 Plan. A history of the plant site was compiled through the use of historical USGS maps from 1906, 1956, 1960, 1979 and 1993; Sanborne Fire Insurance Maps from 1926 and 1950; and information provided by the Authority.

By 1926 the majority of the site was owned by three industries: Pressed Steel Car Company, Pittsburgh Forge and Iron Company, and the Pennsylvania Railroad. One small commercial and residential section was also located within the confines of the current property where the primary clarifier tanks are currently located. Most of the industrial buildings were demolished by 1951. Remaining industrial, residential and commercial buildings were demolished between 1956 and 1958. No structures presently on site predate 1956. A layout of the treatment plant as currently configured is provided as Figure 2.

In preparing the 1996 Act 537 Plan, ALCOSAN requested a site review from the Bureau of Historic Preservation within the Pennsylvania Historical and Museum Commission. Subsequently, the Bureau confirmed that there were no known historic sites and potential impacts on known archaeological and historic sites relevant to the plant site.

2.0 Project Description

Under its Interim Measures Wet Weather (IWWP), ALCOSAN proposes to expand the wet weather treatment capacity at its Woods Run Wastewater Treatment Plant. Primary treatment capacity will be expanded to 480 mgd initially and 600 mgd ultimately. Secondary treatment capacity will be expanded to 295 mgd.

The long-term plan includes a 120 mgd expansion of the total raw wastewater pumping capacity to facilitate the ultimate expansion to 600 mgd of wet weather treatment capacity. While different options to achieve this pumping capacity will be evaluated, this review request assumes that a 120 mgd Wet Weather Pump Station will be constructed.

Construction of the treatment plant expansion will be phased, with construction currently scheduled to occur between 2021 and 2025. A treatment plant site plan showing the anticipated construction for the various projects is provided as Figure 3. ALCOSAN anticipates that three buildings will be demolished during the course of the plant expansion program:

1. Old Operations and Maintenance Building - Circa 1956 through 1959
2. Laboratory Building - Circa early 1990s
3. Engineering Building - Circa early 1990s.

A site plan showing the locations of these structures is provided as Figure 4. Photographs of the buildings are provided as Figures 5A through 5C.

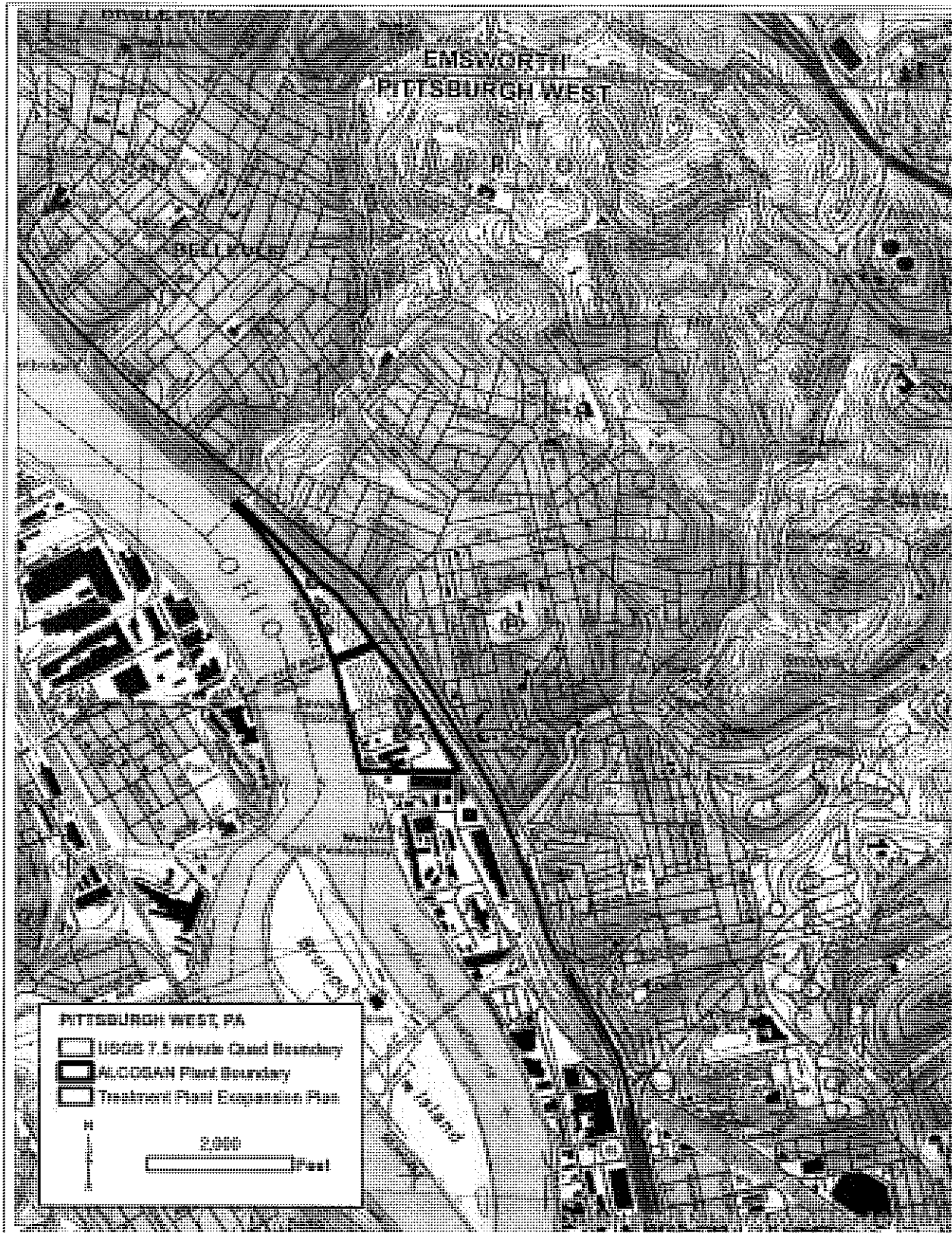


Figure 1 – ALCOSAN Woods Run Wastewater Treatment Plant Location

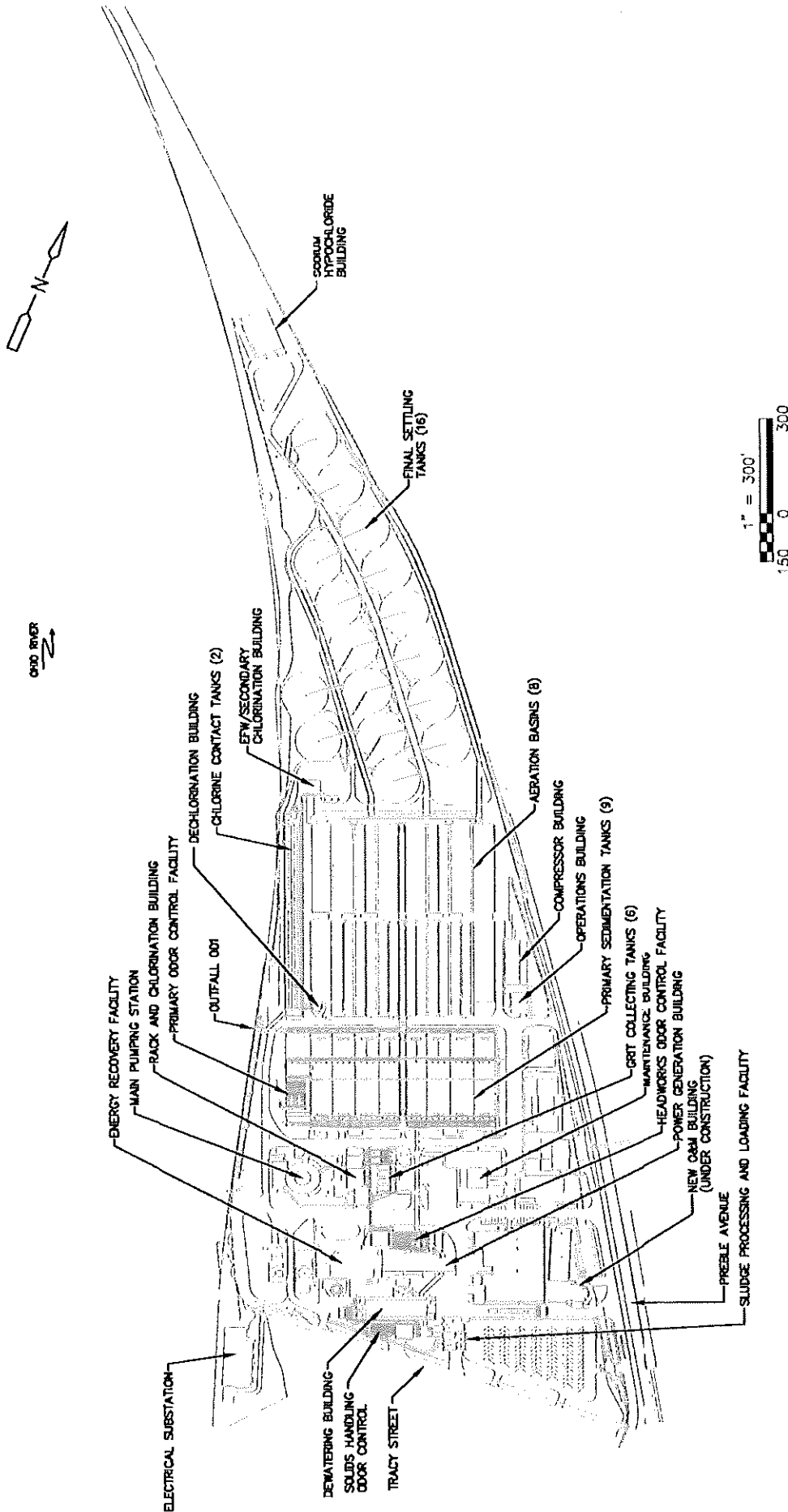


Figure 2
Site Plan – ALCOSAN Woods Run WWTP Current Configuration

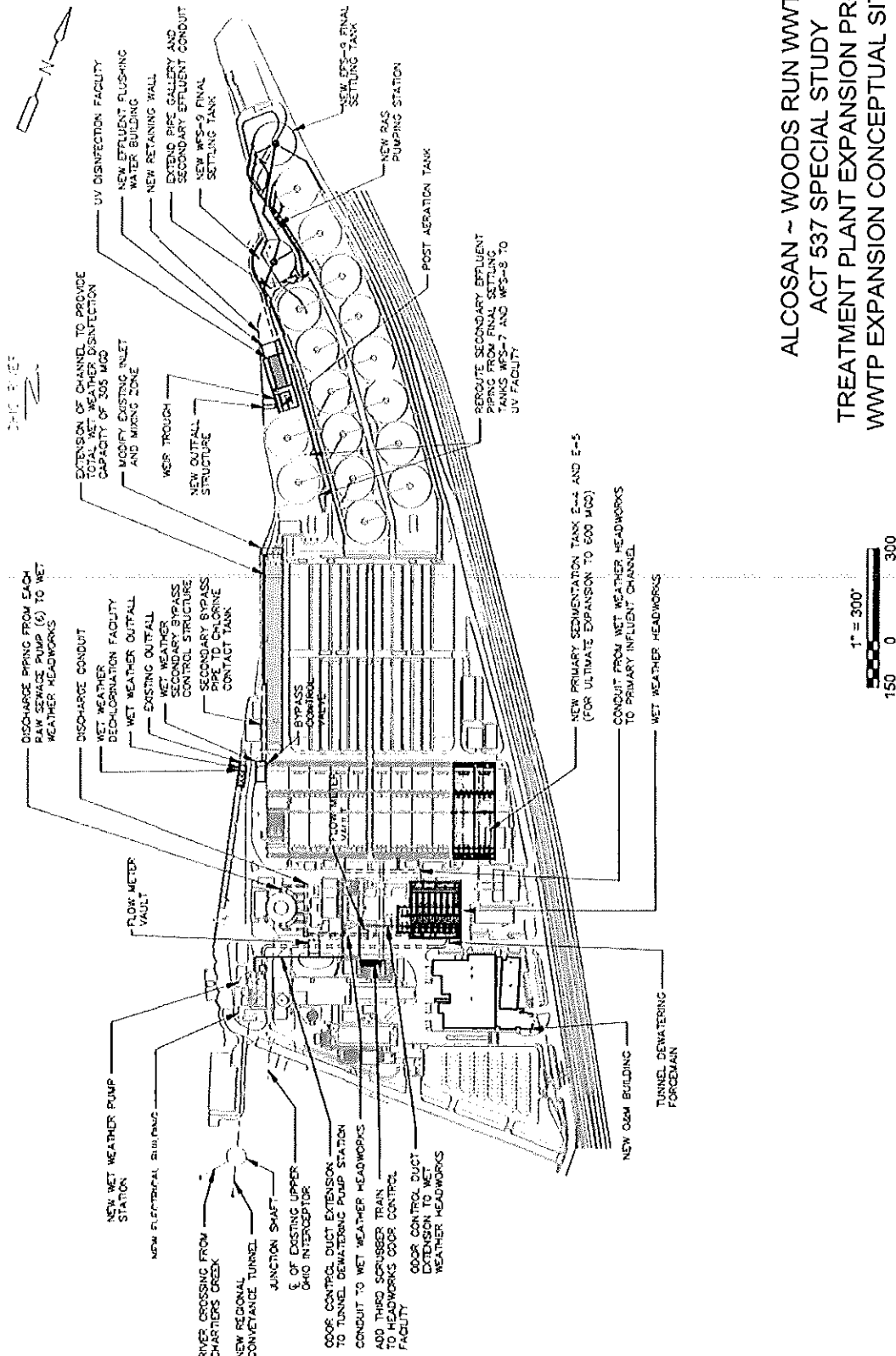


Figure 3
Site Plan – ALCOSAN Woods Run WWTP Wet Weather Capacity Expansion

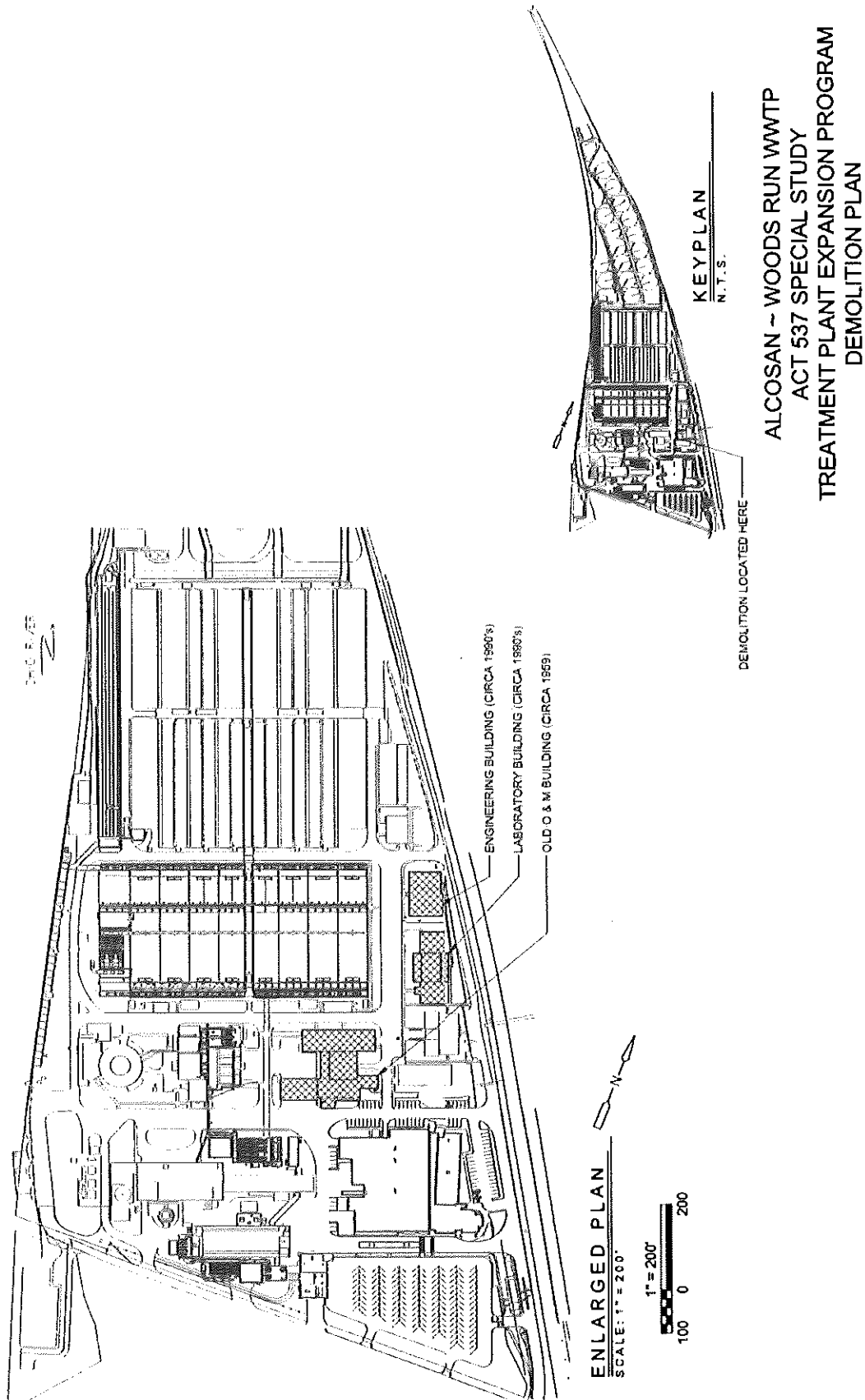


Figure 4
Demolition Plan – ALCOSAN Woods Run WWTP Wet Weather Capacity Expansion

ALCOSAN Act 537 Special Study

February, 2017



Figure 5-A
ALCOSAN Old Operations & Maintenance Building

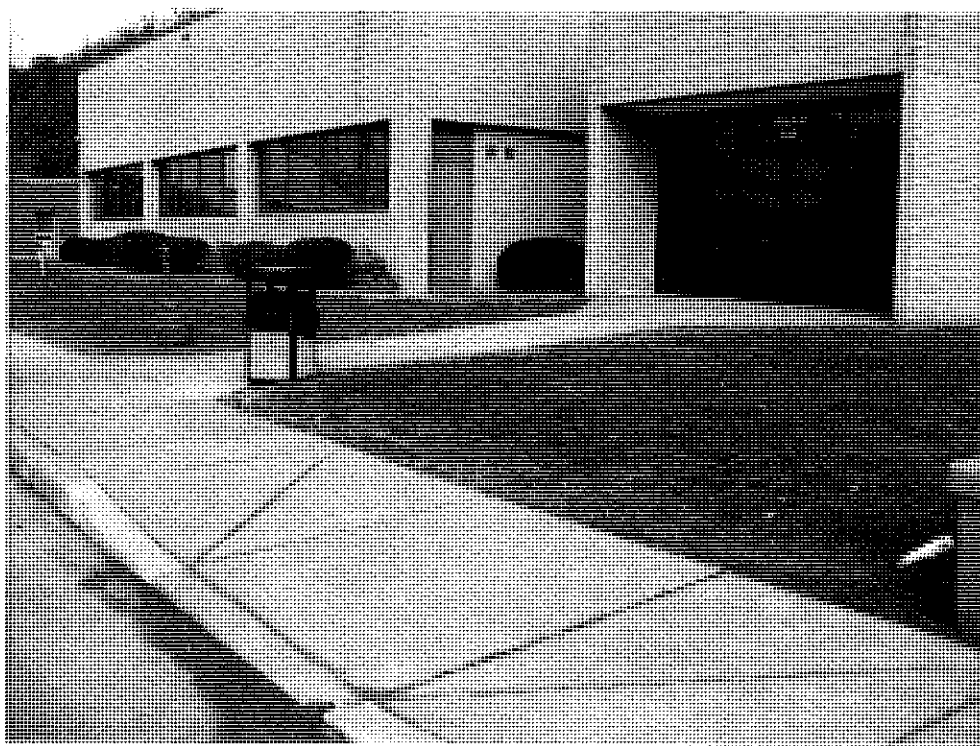


Figure 5-B
ALCOSAN Laboratory Building

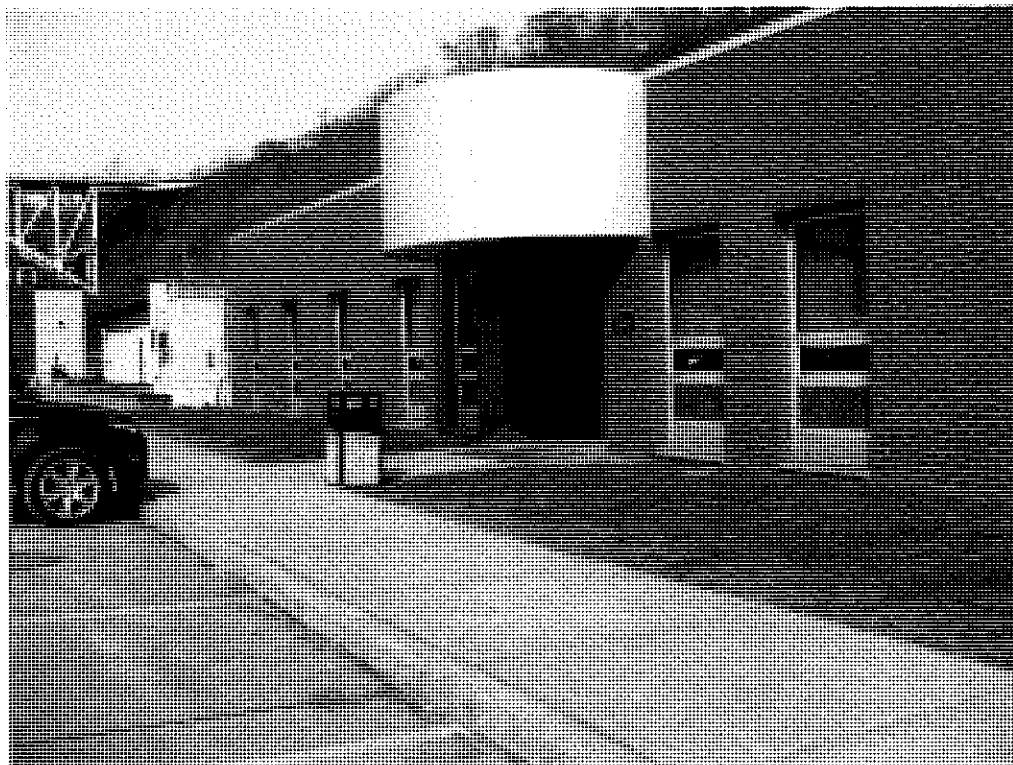
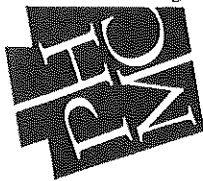
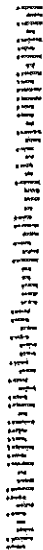


Figure 5-C
ALCOSAN Engineering Building (currently used by Industrial Waste)

 Pennsylvania Historical & Museum Commission
Bureau for Historic Preservation
State Historic Preservation Office
400 North Street, 2nd Floor
Harrisburg, PA 17120-0093

Hasler
09/27/2017
USPS
\$00.46
ZIP 1720
0440460879



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PROJECT REVIEW FORM

Request to Initiate SHPO Consultation on
State and Federal Undertakings

Second Amended Appendix A-22-b
Emailed 3/30/17

SHPO USE ONLY	
DATE RECEIVED:	03/13/17
ER NUMBER:	0017-108-003-A

REV: 10/2014

SECTION A: PROJECT NAME & LOCATION

Is this a new submittal? ☒ YES ☐ NO OR ☐ This is additional information for ER Number:

Project Name Woods Run WWTP Capacity Expansion County Allegheny Municipality ALCOSAN (authority)

Project Address 3300 Preble Avenue City/State/ Zip Pittsburgh PA 15233

SECTION B: CONTACT INFORMATION & MAILING ADDRESS

Name	Tom Schevtchuk	Phone	(412) 208-2525
Company	CDM Smith	Fax	
Street/PO Box	ALCOSAN Wet Weather Program Office, 3300 Preble Avenue		Email
City/State/Zip	Pittsburgh PA 15233	schevtchukta@cdmsmith.com	

SECTION C: PROJECT DESCRIPTION

This project is located on: ☐ Federal property ☐ State property ☒ Municipal authority ☐ Private property
(check all that apply)

List all federal and state agencies and programs providing funds, permits, licenses.	Agency Type	Agency/Program/Permit Name	Project/Permit/Tracking Number (if applicable)
	State	Pa Dept. Environmental Protection	NPDES PA0025984

Proposed Work – Attach project description, scope of work, site plans, and/or drawings

Project includes (check all that apply): ☒ Construction ☒ Demolition ☐ Rehabilitation ☐ Disposition

Total acres of project area: Plant 56 Total acres of earth disturbance: approx. 11

Are there any buildings or structures within the project area? ☒ Yes ☐ No Approximate age of buildings: 25 to 50 years

Does this project involve properties listed in or eligible for the National Register of Historic Places, or designated as historic by a local government?	Yes ☐	No ☒	Unsure ☐	Name of historic property or historic districts

Please print and mail completed form and all attachments to:

PHMC
State Historic Preservation Office
400 North St.
Commonwealth Keystone Building, 2nd Floor
Harrisburg, PA 17120-0093

Attachments – Please include the following information with this form

- ☒ Map – 7.5' USGS quad showing project boundary and Area of Potential Effect
- ☒ Description/Scope – Describe the project, including any ground disturbance and previous land use
- ☒ Site Plans/Drawings – Indicate the location and age, if known, of all buildings in the project area
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- ☐ The project will have NO EFFECT on historic properties ☐ SHPO REQUESTS ADDITIONAL INFORMATION (see attached)
- ☐ The project will have NO ADVERSE EFFECTS on historic properties:

SHPO REVIEWER:

DATE:

03/21/17

03/08/17

Preliminary Planning Project No. S432

Task 2.4 – Value Engineering Technical Memorandum

Final

Prepared For

ALCOSAN

December 8, 2017



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Preliminary Planning Project No. S432 Task 2.4 - Value Engineering Technical Memorandum (Final)

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Appendix B. Program Cost Summaries and Breakdowns

Appendix C. Operations and Maintenance Costs and Net Present Worth Summaries/Calculations

Appendix D. Alternative Evaluation Details

LIST OF ACRONYMS AND ABBREVIATIONS

AACEI	Association for the Advancement of Cost Engineering
ACH	Air Changes per Hour
ACT537	Pennsylvania Sewage Facilities Act 537
ALCOSAN	Allegheny County Sanitary Authority
avg	average
CAD	Computer Aided Drafting
CEPT	Chemically Enhanced Primary Treatment
CSI	Construction Specifications Institute
CSO	Combined Sewer Overflow
CT	Concentration times Time
<i>E. Coli</i>	Escherichia coli
Eff.	Efficiency
EHRT	Enhanced High Rate Treatment
ENR	Engineering News Record
F. Coli	Fecal coliform
FEMA	Federal Emergency Management Agency
FM	Force main
FPS	Feet Per Second
GLB	Green Leave Behinds
GI	Green Infrastructure
GIS	Geographic Information System
gpd/sf	Gallons per day per square foot
HGL	Hydraulic Grade Line
hp	Horsepower
HVAC	Heating, Ventilation and Air Conditioning
KW	Kilowatt
KW-Hr	Kilowatt-hour
lb, or lbs	Pound, or pounds
lf	Linear Feet
LOC	Level of Control
LTCP	Long-Term Control Plan
MG	Million Gallons
MGD	Million Gallons per Day
mg/L	Milligrams per liter
NMC	Nine Minimum Controls

No.	Number
NPDES	National Pollutant Discharge Elimination System
NPW	Net Present Worth
O&M	Operations and Maintenance
PADEP	Pennsylvania Department of Environmental Protection
PCCP	Prestressed Concrete Cylinder Pipe
PFD	Process Flow Diagram
PM	Program Manager
PS	Pump Station
PVC	Polyvinyl Chloride
PWSA	The Pittsburgh Water and Sewer Authority
RAS	Return Activated Sludge
RTB	Retention Treatment Basin
SD	Screening and Disinfection
SF	Square Foot
SOR	Surface Overflow Rate
SHPO	State Historic Preservation Office
SWD	Side Water Depth
TBD	To Be Determined
TDPS	Tunnel Dewatering Pump Station
TSS	Total Suspended Solids
typ	typical
USEPA	United States Environmental Protection Agency
VFD	Variable Frequency Drive
WAS	Waste Activated Sludge
WWP	Wet Weather Plan
WWPS	Wet Weather Pump Station
WWTP	Wastewater Treatment Plant
yr, or yrs	Year, or years

EXECUTIVE SUMMARY

The purpose of this Value Engineering task is to evaluate whether the Allegheny County Sanitary Authority's (ALCOSAN) treatment of up to 600 million gallons per day (MGD) of wet weather flows should be handled at the Woods Run Wastewater Treatment Plant (WWTP) or by using a combination of the WWTP and a satellite treatment facility. The Regional Wet Weather Plan includes conceptual planning for expanding the existing Woods Run WWTP from a peak flow rate of approximately 250 million gallons per day (MGD) to 600 MGD. This includes expanding the secondary treatment capacity from 250 MGD to 295 MGD and providing for an additional 305 MGD of primary treatment and disinfection through a conventional CSO-related bypass.

The Pittsburgh Water and Sewer Authority's (PWSA) Green Infrastructure (GI) Study report considered system configuration scenarios, including expansion of the Woods Run WWTP, to use in determining minimum and maximum levels of green infrastructure needed to achieve the 85% combined sewage captured goal. The report identified system configurations, including operational changes at the influent pump station to maximize the existing conveyance capacity, and construction of high rate treatment infrastructure at the WWTP to process flows above 600 MGD. As part of this study, there was a recommendation that providing wet weather treatment using a satellite treatment facility near the plant property would be more cost effective than expanding the WWTP wet weather treatment capacity to 600 MGD. As part of the subsequent Preliminary Planning project, a task was included to perform a value engineering effort to review the merits of this recommendation.

Considering the above, it is important to note that plant improvements required to achieve additional wet weather treatment capacity of up to 480 MGD will be completed regardless of any alternatives at or near the plant considered for expanding the total wet weather treatment capacity to 600 MGD. This is logical since the existing Main Pump Station and the primary clarifiers already have treatment capacities of 480 MGD and can be more cost effectively improved to provide wet weather treatment up to that capacity. In addition, the secondary treatment facility expansion to 295 MGD is part of the wet weather plan commitments and is a given for this analysis. Lastly, a wet weather pump station with 120 MGD capacity would also be required to achieve the total wet weather pumping capacity of 600 MGD. The result is that the value engineering alternatives discussed in this memorandum differentiated in only how to provide wet weather treatment for flows between 480 MGD and 600 MGD using WWTP improvements, a satellite treatment facility or a combination of both. The improvements required to expand the plant's wet weather treatment capacity to 480 MGD and the proposed new 120 MGD wet weather pump station required to increase flows to 600 MGD, are common to all alternatives and account for approximately 76.2 to 84.7 percent of the total life cycle costs over the range of alternatives needed to achieve the wet weather treatment capacity of 600 MGD. This technical memorandum documents the value engineering performed under this task for the alternatives that would achieve the required equivalent treatment capacity of 600 MGD at or near the Woods Run WWTP.

Technical Assumptions

Key technical assumptions were made to guide the development of the alternatives to be evaluated. These included flow capacity, which was determined to be in increments of 60 MGD to match the capacities of the primary settling tanks proposed in the Regional Wet Weather Plan. There are two additional primary clarifiers proposed to increase the primary treatment capacity by 120 MGD. This logically led to an assumption to set the capacity of the satellite treatment facility alternatives at 60 MGD and 120 MGD, corresponding to WWTP wet weather capacities of 540 MGD and 480 MGD, respectively.

The treatment parameters for the satellite treatment facilities were assumed to be equivalent to that expected for wet weather treatment proposed for the WWTP. Based on stress testing of the primary sedimentation tanks in 2005 and 2006 at 3,100 gpd/sf, the percent removal of total suspended solids (TSS) was determined to be approximately 68%, with no effluent TSS exceeding 50 mg/L when the influent TSS is less than 150 mg/L. The disinfection parameter is based on NPDES Permit No. PA0025984 Outfall 001 (the current WWTP outfall) and the proposed NPDES permit for the wet weather bypass, both of which are 200/100 ml for F. Coliform.

Four satellite treatment technology options were considered and screened based on their typical performance. **Table ES-1** summarizes the four technologies and how they compare with planned wet weather improvements at the WWTP.

Table ES-1: Treatment Performance Comparison			
Satellite Treatment Technology Option	Surface Overflow Rate (gpd/sf)	Total Suspended Solids Removal Target	Disinfection Target & Contact Time
Current WWTP Planned Improvements – Primary Settling plus disinfection / dechlorination	3,100	68%	200#/100 ml F. Coli average (Apr-Oct) 15-minute contact time at peak hour flow (PADEP)
Ballasted Flocculation	>12,000	85%	200#/100 ml F. Coli average (Apr-Oct) 10-minute contact time
Enhanced High Rate Treatment (EHRT)	7,000	70% for average TSS _i >150 mg/L 45 mg/L TSS _e maximum for average TSS _i <150 mg/L	200#/100 ml F. Coli average (Apr-Oct) 10-minute contact time

Table ES-1: Treatment Performance Comparison

Satellite Treatment Technology Option	Surface Overflow Rate (gpd/sf)	Total Suspended Solids Removal Target	Disinfection Target & Contact Time
Retention Treatment Basin (RTB)	6,000	50% to 60% based on annual average	200#/100 ml F. Coli average (Apr-Oct) 10-minute contact time
Screening & Disinfection (SD)	N/A	Minimal	200#/100 ml F. Coli average (Apr-Oct) 5-minute contact time

Based on this comparison, the EHRT process was selected as the treatment technology to be developed for the alternatives. The EHRT process provides screening of the incoming wet weather flow, followed by chemically enhanced settling of solids in a below-grade basin, followed by disinfection and dechlorination, before flow is discharged to the Ohio River.

The site for the proposed satellite EHRT facility would need to be large enough for the facility and for staging, laydown, and stock piling during construction. Land requirements of 2.5 acres and 4 acres were determined for the 60 MGD and 120 MGD EHRTs, respectively. The sites would also need to be located relatively close to the WWTP, which is where the wet weather pump station (WWPS) will be located to deliver the flows to the satellite treatment facility. The potential sites also needed to have reasonable proximity to the existing interceptor for dewatering and the Ohio River for a proposed new outfall for the facility effluent. Based on these criteria, three candidate sites were identified:

- The former Western Penitentiary site, bounded by Westhall Street, the Ohio River, Doerr Street and Beaver /Preble Avenue.
- The trucking site, located at the southeast corner of the intersection of Beaver/Preble Avenues and Eckert Street
- The site immediately south of the WWTP, bounded by Westhall Street, the Ohio River, Tracey Street and Preble Avenue (Valspar Site).

Figures ES-1 through ES-3 illustrate the sites and the proposed parcels (in blue) to accommodate the EHRT facility.

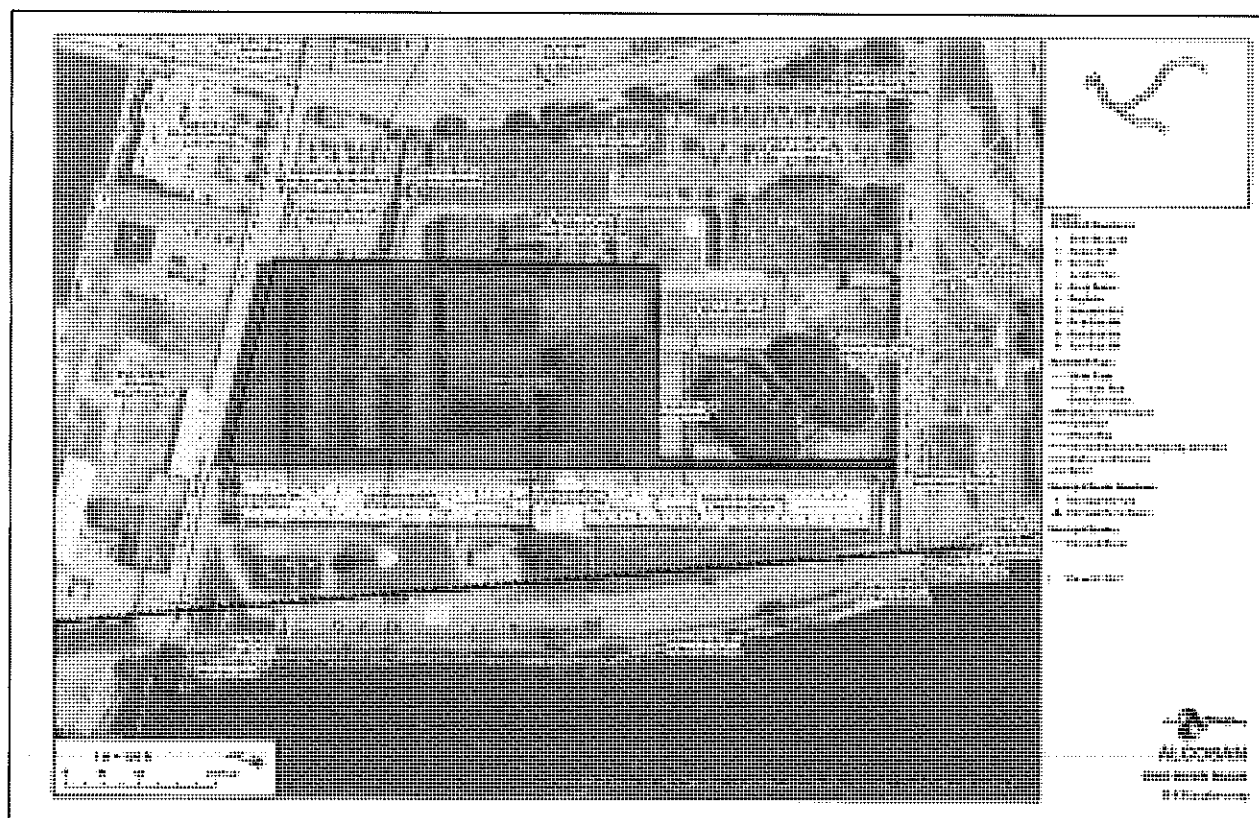


Figure ES-1: Western Penitentiary Site Required Area

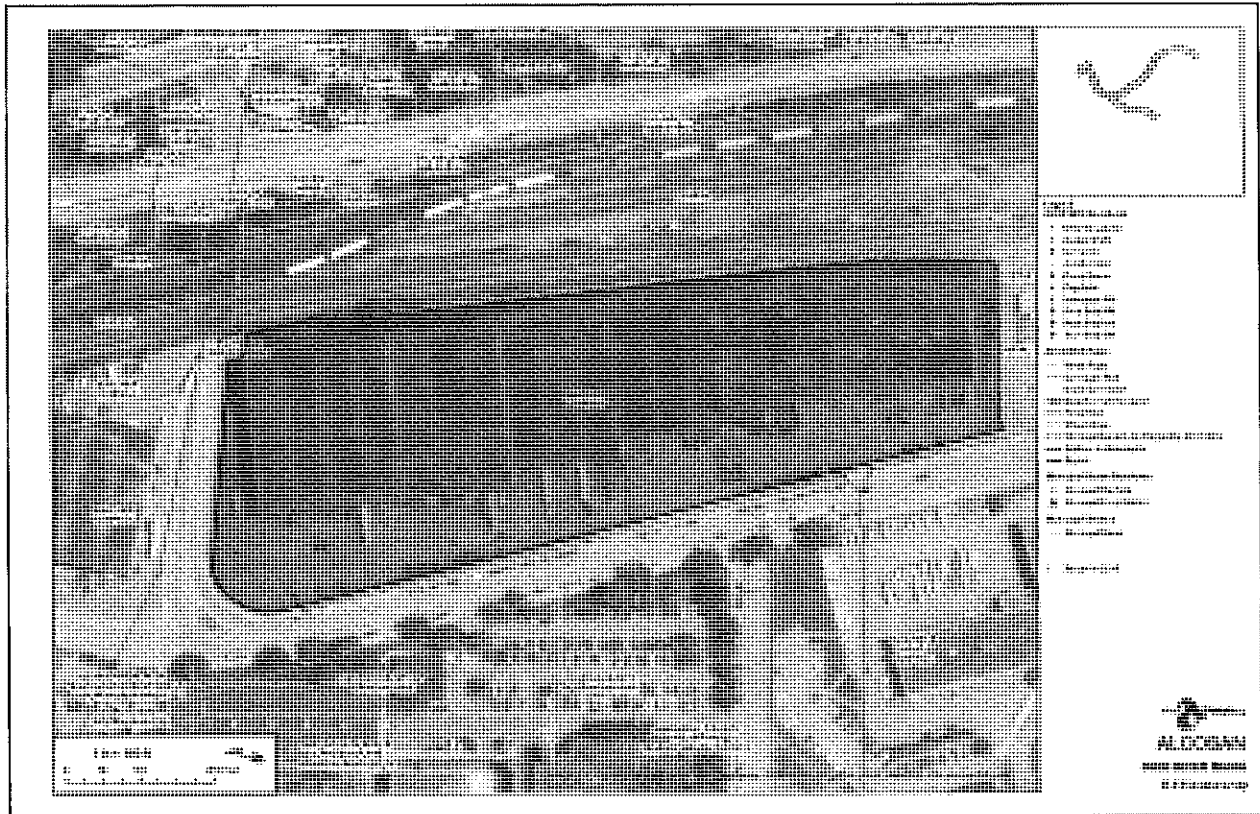


Figure ES-2: Trucking Site Required Area

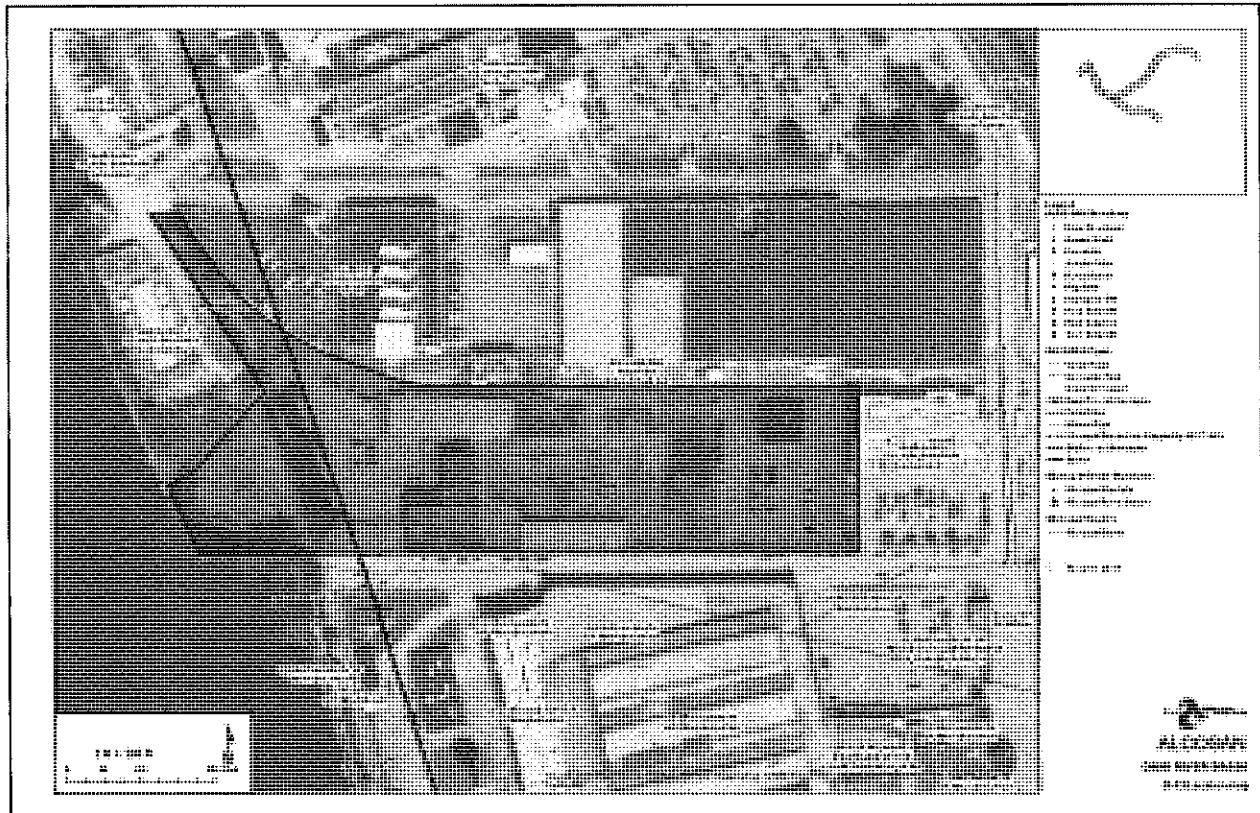


Figure ES-3: Valspar Site Required Area

Alternatives Development

Alternatives were developed based on the two EHRT facility capacities being considered and the three candidate properties considered. The EHRT facilities were customized to fit onto the available sites and routings for force main and sewer pipes between the WWTP, the new WWPS, the candidate sites, and the outfall at the Ohio River were developed. The alternatives developed are summarized in Table ES-2.

Table ES-2: VE Evaluation Alternatives

Alternative	WWTP Total Peak Wet Weather Flow (MGD)	Wet Weather Pump Station		EHRT Facility Flow (MGD)	EHRT Facility Site
		Wet Weather Flow to WWTP (MGD)	Wet Weather Flow to EHRT Facility (MGD)		
Baseline	600	120	-	-	-
1A	540	60	60	60	Western Penitentiary
1B	540	60	60	60	Trucking
1C	540	60	60	60	Valspar
2A	480	0	120	120	Western Penitentiary
2B	480	0	120	120	Trucking
2C	480	0	120	120	Valspar

Evaluation Process

A methodology that considered both economic and non-economic criteria was used to evaluate each alternative developed for this analysis. The cost methodology consisted of:

- Construction costs were developed from quantity takeoffs from conceptual designs for both EHRT facilities and for site work for all three candidate sites. Unit costs were taken from costs developed for the wet weather improvements at the WWTP, from similar studies of EHRTs in other locations such as Cincinnati and Cleveland, and for recent construction work in the Pittsburgh area. Costs were adjusted by the appropriate ENR index to account for escalation and location.
- Construction cost markups for mobilization/demobilization, bonds and insurance, overhead and profit, and estimating contingencies were applied. The markups were consistent with a Class 4 estimate as defined by the AACEI.
- Property acquisition costs were determined using the Allegheny County Real Estate Assessment website data, in combination with engineering judgement on the required acreage and building square footage required to be purchased.
- Total program capital costs were determined for each alternative from the sum of the burdened construction costs, the property acquisition costs, and the non-construction costs (engineering, construction management, ALCOSAN's costs, and legal and administrative costs).

- Operations and maintenance costs were developed based on estimated usage of the facilities, including proposed wet weather improvements at the WWTP, the EHRT facility, the existing influent pump station, and the new WWPS. O&M costs include labor, electrical, chemical, maintenance parts, and non-annual equipment re-builds. The calculated annual costs were then converted to a net present worth.
- A life cycle cost for each alternative was calculated from the total program capital costs and annual operations and maintenance costs to determine the net present worth for each alternative.

To ensure that economic factors were not the only criteria used to evaluate the alternatives, non-cost evaluation criteria consistent with previous ALCOSAN Basin Planning criteria were used to compare alternatives in concert with the economic factors. Each alternative was evaluated based on the following non-economic criteria:

- **Community impacts**, consisting of attributes for aesthetics, odors, and disruptions and for green leave-behind potential
- **Public health and environmental impacts**, consisting of attributes for the alternative's ability to meet the level of control (LOC) objectives and future regulatory requirements
- **Operations and maintenance impacts**, consisting of attributes for reliability and for operating complexity
- **Implementation and construction**, consisting of attributes for the constructability, or construction risk, of each alternative, and for the ease of property and/or easement acquisition

The evaluation approach assigned raw scores to the economic and non-economic factors for each alternative, which were then weighted by an importance factor assigned to each attribute. The weighted scores were then summed to determine a total weighted score. A higher weighted score indicates that an alternative is preferred over an alternative with a lower weighted score.

Alternatives Evaluation

The alternatives were evaluated in economic (life cycle cost) and non-economic terms. The results of the life cycle cost evaluations are shown in **Table ES-3**.

The results of the economic analysis indicate that the life cycle cost of the base alternative was lower than the six alternatives to provide satellite treatment in addition to WWTP upgrades to 480 MGD and 540 MGD, respectively. For the six alternatives, costs tended to be higher for alternatives that required property acquisition and for those that are further from the WWTP site and Ohio River, because of the higher conveyance costs. The non-economic evaluation was also conducted and focused on four overriding criteria with multiple attributes scored for each criterion. The results of the evaluation are shown in **Table ES-4** and are described in more detail in the technical memorandum.

Table ES-3: Life Cycle Cost Summary (2017 \$)							
	Baseline - WWTP Improvements for 600 MGD	Alternative 1A – WWTP Expansion for 540 MGD, WWPS at WWTP, 60 MGD EHRT at Western Penitentiary	Alternative 1B – WWTP Expansion for 540 MGD, WWPS at WWTP, 60 MGD EHRT at Trucking Site	Alternative 1C – WWTP Expansion for 540 MGD, WWPS at WWTP, 60 MGD EHRT at Valspar Site	Alternative 2A – WWTP Expansion for 480 MGD, WWPS at WWTP, 120 MGD EHRT at Western Penitentiary	Alternative 2B – WWTP Expansion for 480 MGD, WWPS at WWTP, 120 MGD EHRT at Trucking Site	Alternative 2C – WWTP Expansion for 480 MGD, WWPS at WWTP, 120 MGD EHRT at Valspar Site
WWTP Wet Weather Expansion Program Capital Costs (\$M) ¹	\$393.6	\$343.2	\$343.2	\$343.2	\$306.4	\$306.4	\$306.4
Wet Weather Pump Station Program Capital Costs (\$M) ²	\$171.0	\$171.0	\$171.0	\$171.0	\$171.0	\$171.0	\$171.0
VE Satellite EHRT Facility Program Capital Costs (\$M)	\$0.0	\$114.7	\$105.5	\$78.0	\$146.3	\$137.2	\$115.7
Present Worth of WWTP Wet Weather Expansion O&M Costs (\$M) ¹	\$21.6	\$20.1	\$20.1	\$20.1	\$18.3	\$18.3	\$18.3
Present Worth of Wet Weather Pump Station O&M Costs (\$M)	\$7.2	\$7.2	\$7.2	\$7.2	\$7.2	\$7.2	\$7.2
Present Worth of VE Satellite EHRT O&M Costs (\$M)	\$0.0	\$3.8	\$3.8	\$3.8	\$7.5	\$7.5	\$7.5
Total Life Cycle Cost (\$M)	\$593.4	\$660.0	\$650.8	\$623.3	\$656.7	\$647.6	\$626.1

Notes:

- 1. WWTP Wet Weather Expansion cost estimates prepared by the WWTP PM.
- 2. WWPS program costs determined from the Interim Measures Wet Weather Plan. Refer to Section 3.2.

Alternative Evaluation Scoring Summary

Table ES-4: Alternative Evaluation Scoring Summary										
Criteria and Total Weight	Attribute	Attribute Weight	Definition of Rating	Rating						
				Baseline - WWTP Upgrade to 600 MGD	Alternative 1A – WWTP Upgrade to 540 MGD, EHRT @ 60 MGD at Western Penitentiary Site	Alternative 1B – WWTP Upgrade to 540 MGD, EHRT @ 60 MGD at Trucking Site	Alternative 1C – WWTP Upgrade to 540 MGD, EHRT @ 60 MGD at Valspar Site	Alternative 2A – WWTP Upgrade to 480 MGD, EHRT @ 120 MGD at Western Penitentiary Site	Alternative 2B – WWTP Upgrade to 480 MGD, EHRT @ 120 MGD at Trucking Site	Alternative 2C – WWTP Upgrade to 480 MGD, EHRT @ 120 MGD at Valspar Site
Economic (20%)	Life-cycle cost (\$M)	20%	5 = Lowest life-cycle cost alternative. 1 = Highest life-cycle cost alternative.	\$593.4	\$660.0	\$650.8	\$623.3	\$656.7	\$647.6	\$626.1
				5.0	1.0	1.6	3.2	1.2	1.7	3.2
Community (20%)	Aesthetics, Odors, Disruption	10%	5 = No long-term disruption or odors anticipated. Improved aesthetics for surrounding areas. 3 = Some long-term disruptions or potential for odors. No improved aesthetics to surrounding area. 1 = Long term disruptions; active sustained odor control required; negative aesthetic impact to surrounding area.	5	3	2	2	3	2	2
	Green leave-behinds	10%	5 = Excellent candidate for green leave behind. 3 = Limited green-leave-behind potential. 1 = No green leave-behind potential.	2	3	3	3	3	3	3
Public Health and Environmental (20%)	Meet LOC objectives	10%	5 = Exceeds LOC objectives. 3 = Meets LOC objectives. 1 = Does not meet LOC objectives.	3	3	3	3	3	3	3
	Meet future regulatory requirements	10%	5 = Easily expandable, and operations flexible enough to be adjusted for more stringent regulations. 3 = Difficult expansion, and operations can be adjusted for more stringent regulations. 1 = No expandability or operational flexibility to adjust for more stringent regulations.	3	3	3	3	3	3	3
Operation and Maintenance (20%)	Reliability (e.g., redundancy)	10%	5 = Firm capacity supported by redundant tankage and equipment. 3 = Firm capacity supported by redundant equipment but not redundant tankage. 1 = No redundant equipment or tankage.	5	3	3	3	3	3	3
	Operating complexity (e.g., facility location, additional training)	10%	5 = Uses same plant treatment schemes with minimal additional training and located at WWTP. 3 = Uses same plant treatment schemes. Off-site satellite treatment relatively close to WWTP. Requires additional training. 1 = Uses same plant treatment schemes. Off-site satellite treatment far from WWTP. Requires additional training.	5	2	2	2	2	2	2
Implementation and Construction (20%)	Constructability (Risk)	10%	5 = Low probability of construction issue and low consequence. 3 = Medium probability of construction issue and medium consequence. 1 = High probability of construction issue and high consequence.	3	2	3	3	2	3	3
	Ease of property/easement acquisition	10%	5 = No additional site required. 3 = Requires additional site at fair market value. 1 = Requires additional site and no apparent property available.	5	3	3	3	3	3	3
Weighted Score				4.1	2.4	2.5	2.8	2.4	2.5	2.8

Conclusions and Recommended Alternative

The Baseline Alternative emerged from the evaluation as the preferred alternative. The economic analysis showed it to be the lowest cost alternative from both a capital cost and life cycle cost perspective. Furthermore, the base alternative also had the most favorable scoring from the non-cost criteria standpoint considering community, public health and environmental, operations and maintenance, implementation and construction related issues. This is because the Baseline Alternative had much greater benefit than the other alternatives in terms of aesthetics, odors, and disruptions, reliability and operating complexity, and property and easement acquisition. For these reasons, the Baseline Alternative (upgrading the wet weather treatment capacity of the WWTP to 600 MGD) is clearly the recommended alternative for achieving wet weather treatment up to 600 MGD at or near the Woods Run WWTP.

1.0 BACKGROUND AND PURPOSE

1.1 VALUE ENGINEERING EVALUATION FOR 600 MGD WET WEATHER TREATMENT

The purpose of this Value Engineering task is to evaluate whether ALCOSAN's treatment of up to 600 million gallons per day (MGD) of wet weather flows should be handled at the Woods Run WWTP or by using a combination of the WWTP and a satellite treatment facility. The concept of using separate treatment infrastructure was suggested in the Pittsburgh Water and Sewer Authority's (PWSA) Green Infrastructure Assessment Study, which is described in a following section. The study advocates the treatment of additional wet weather flows using the following assumptions:

- Flows exceeding the wet weather capacity of the WWTP will be treated at an alternate high rate treatment facility.
- Wet weather flows that exceed the existing influent pumping station capacity to the high rate wet weather treatment facility will be managed by an additional pumping station.

This evaluation develops and compares alternatives for treating these additional wet weather flows using life-cycle costs and non-cost criteria. It is important to note that plant improvements required to achieve additional wet weather treatment capacity of up to 480 MGD will be completed regardless of any alternatives at or near the plant considered for expanding the total wet weather treatment capacity to 600 MGD. This is logical because:

- The existing Main Pump Station and the primary clarifiers already have treatment capacities of 480 MGD and can be more cost effectively improved to provide wet weather treatment up to that capacity.
- The secondary treatment facility expansion to 295 MGD is part of the wet weather plan commitments.
- A wet weather pump station with 120 MGD capacity would also be required to achieve the total wet weather pumping capacity of 600 MGD.

The result is that the value engineering alternatives discussed in this memorandum differentiated in only how to provide wet weather treatment for flows between 480 MGD and 600 MGD using WWTP improvements, a satellite treatment facility or a combination of both. The improvements required to expand the plant's wet weather treatment capacity to 480 MGD and the proposed new 120 MGD wet weather pump station required to increase flows to 600 MGD, are common to all alternatives.

This Value Engineering evaluation capped the wet weather flows requiring treatment at 600 MGD. This is consistent with the wet weather treatment concept proposed in the Act 537 Special Study. Consistent

with the PWSA GI study, the new wet weather pumping station (WWPS) is assumed to be constructed at the WWTP; however, the high rate treatment facility is assumed to be a satellite treatment plant located off-site from the WWTP because of space constraints.

1.2 PITTSBURGH WATER AND SEWER AUTHORITY ALTERNATIVES FOR WET WEATHER TREATMENT

The PWSA published *The Green First Plan: A City-Wide Green Infrastructure Assessment* in 2016. The purpose of the study was to evaluate “the benefits of incorporating extensive hydraulically-connected and cost-effective green infrastructure (GI) implementation through the City of Pittsburgh (City) that could be incorporated into a ‘Green First’ Plan of green and gray infrastructure to address regulatory requirements as well as provide triple bottom line (TBL) benefits.” The study considered system configuration scenarios, including expansion of the Woods Run WWTP, to use in determining the minimum and maximum levels of GI that would need to be implemented to achieve the 85% combined sewage capture goal. PWSA acknowledged that the Recommended Plan includes expansion of the WWTP to 480 MGD and that alternatives, including expanding the WWTP to 600 MGD, were considered but not recommended. The study identified four system configuration scenarios, none of which include the regional tunnel, as follows:

Existing Conditions: This is the baseline scenario and represents the current state of the conveyance system and the WWTP treatment capacity. The existing influent pump station at the WWTP is assumed to operate at a hydraulic grade line (HGL) in the wet well of 670 feet.

480 MGD (WWTP Expansion): This scenario represents the current state of the conveyance system, except the WWTP capacity is expanded to 480 MGD and the influent pump station wet well HGL is reduced to 660 feet.

600 MGD (WWTP Expansion and System Improvements): This scenario expands the WWTP capacity to 600 MGD and reduces the influent pump station wet well HGL to 660 feet. Accumulated sediment is removed from the existing interceptors to maximize their hydraulic capacity and regulator structures are modified for 19 of the 30 high-priority sewersheds to allow more flow into the interceptors.

Lowered HGL Operation During Wet Weather Conditions: This scenario lowers the influent pump station wet well HGL to below the crown of the interceptor to maximize the existing conveyance capacity. The scenario assumes that high rate treatment infrastructure is constructed at the WWTP to process flows greater than 600 MGD. Accumulated sediment is removed from the existing interceptors to maximize their hydraulic capacity and regulator structures are modified for 19 of the 30 high-priority sewersheds to allow more flow into the interceptors. A new influent pump station is included to supplement the existing pump station.

As part of this study, it was recommended that for the alternative to achieve the highest level of wet weather treatment at the plant (600 MGD), use of a satellite treatment facility near the plant could be

more cost-effective than what was proposed for the Woods Run WWTP to achieve this capacity. This recommendation has been reviewed and evaluated as part the ALCOSAN Preliminary Planning project and is summarized and documented in this technical memorandum.

1.3 WET WEATHER PLAN FOR WOODS RUN WWTP

ALCOSAN is expanding the capacity of the Woods Run WWTP to meet the requirements of its Consent Decree. The original conceptual plan for the plant expansion was developed for, and is summarized in, the Regional Wet Weather Plan (WWP), which was developed by the Wet Weather Program Manager (WW PM).

The Wet Weather Plant Expansion, as conceptualized in the WWP, increases plant capacity from its current peak flow rate of 250 MGD to 480 MGD. Ultimately, with the addition of the Regional Tunnel system and the Tunnel Dewatering Pump Station (TDPS), or by incorporation of an Auxiliary Pump Station, the Woods Run WWTP will accommodate a peak wet weather treatment capacity of 600 MGD.

The WWP provides for the expansion of the plant's secondary treatment capacity from 250 MGD to 295 MGD and for the expansion of primary treatment and addition of disinfection facilities by 185 MGD to provide a wet weather plant capacity of 480 MGD, or by 305 MGD to provide a wet weather plant capacity of 600 MGD, through a conventional CSO-related bypass prior to discharge to the Ohio River.

The Wastewater Treatment Plan Program builds upon the Wet Weather Plant Expansion as conceptualized in the WWP. The WWP was accepted as the basis for the work going forward with options and subtle variations to the planned expansion concepts. The Wastewater Treatment Plan Program Manager's (WWTP PM) alternatives analysis took the form of "proof of concept" and mainly focused on flow routing, hydraulic capacity, location of new facilities on the site, connecting conduit requirements and supporting system needs. **Figure 1-1** is a site plan of the proposed improvements. The following is a summary of the proposed improvements recommended as part of the Alternatives Analysis included in the plan:

Preliminary Treatment: Construct a new 360 MGD East Headworks Facility. The East Headworks will include chain and rake type bar screens, aerated grit removal tanks, and support facilities.

Primary Treatment: Construct two (2) new Primary Sedimentation Tanks and appurtenances to increase primary treatment capacity from 480 MGD to 600 MGD. The new Primary Sedimentation Tanks will match the existing tanks in size and capacity.

Thickening: Install six (6) new waste activated sludge (WAS) thickening centrifuges, pumps, piping and appurtenances in the existing Dewatering Building.

Odor Control: Install a third two-stage wet scrubber system at the existing Headworks Odor Control System as required to treat the additional volume of foul air from the new East Headworks Facility. The new Primary Sedimentation Tanks would be tied into the existing Primary Odor Control System.

Secondary Treatment: Construct two (2) new 140-ft diameter final settling tanks as required to increase secondary treatment capacity to 295 MGD. A new Return Activated Sludge (RAS) Pumping Station will be constructed in support of the new settling tanks. The existing RAS pumps and select portions of the existing RAS piping will be replaced as necessary to increase RAS Pumping capacity.

Final Disinfection: Construct a new final disinfection facility at the north end of the treatment plant site to disinfect up to 295 MGD of treated secondary effluent prior to discharge to the Ohio River. Disinfection will be achieved through the addition of sodium hypochlorite, with dechlorination through the addition of sodium bisulfite. Post aeration will be provided as required to meet the final effluent limit for dissolved oxygen.

Wet Weather (CSO Related) Bypass: The existing Chlorine Contact Tank will be converted to a 305 MGD Wet Weather Bypass Disinfection Tank. Disinfection will be achieved through the addition of sodium hypochlorite. Dechlorination will be achieved with the existing sodium bisulfite facilities.

Wet Weather (CSO Related) Bypass Control: Construct new wet weather bypass control structure as required to divert up to 305 MGD of primary effluent to the Wet Weather Disinfection Tank.

Medium Voltage Electrical Distribution System: The existing 5KV electrical distribution system will be upgraded to 13.8KV distribution as required to replace aging infrastructure and to provide flood protection for medium voltage distribution throughout the treatment plant.

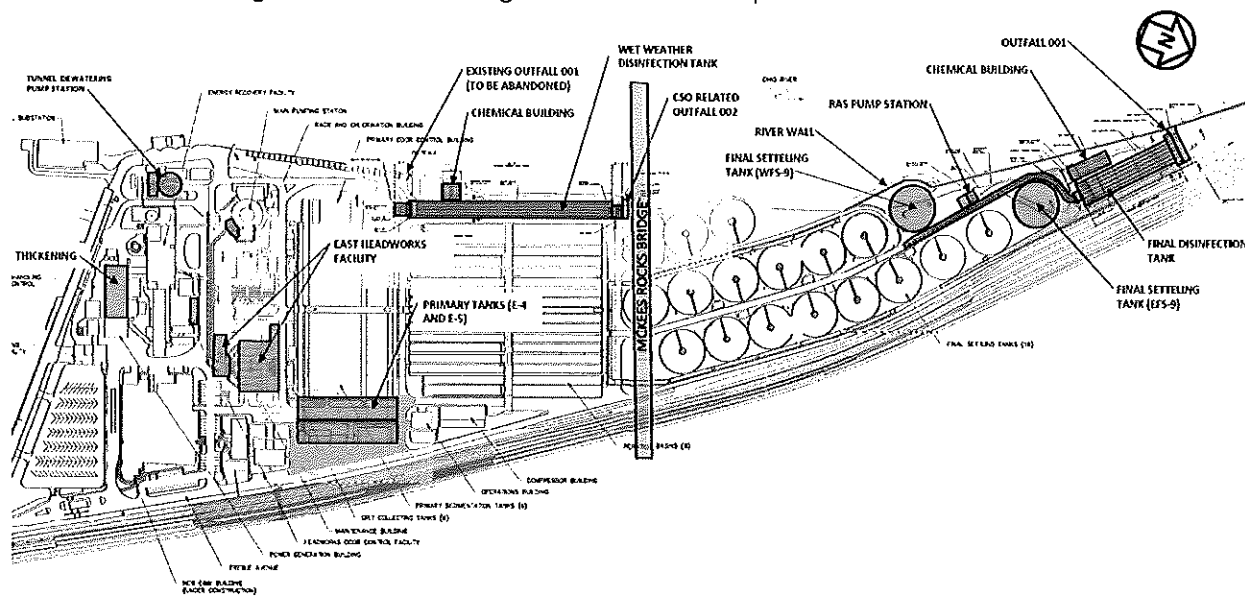


Figure 1-1: WWTP Expansion Site Plan

2.0 TECHNICAL ASSUMPTIONS AND EVALUATION PROCESS

2.1 SATELLITE TREATMENT FACILITIES CAPACITIES (60 MGD, 120 MGD)

The satellite treatment facility will treat wet weather flows that exceed the treatment capacity of the WWTP. Treatment capacities of 60 MGD and 120 MGD were assumed for the satellite treatment facility based on the flow capacities of the WWTP in each alternative.

Per the Act 537 Special Study, the wet weather treatment capacity of the WWTP will be increased to 600 MGD. The Act 537 Special Study requires 600 MGD of wet weather flow to receive at least primary treatment and disinfection. The wet weather treatment concept proposed in the Act 537 Special Study included high rate operation of the existing 9 total primary sedimentation tanks, at a peak surface overflow rate (SOR) of 4,000 gallons per day per square ft (gpd/sf) to achieve a firm capacity (one tank out of service) of 600 MGD, which is equivalent to eight of the nine tanks operating at 75 MGD. During 2005 and 2006, full-scale stress testing was conducted to monitor performance of the primary treatment process under the proposed high rate operation. Field testing results showed that the approximate hydraulic capacity of each existing primary sedimentation tank is 60 MGD, not 75 MGD, which results in a total primary treatment capacity of 540 MGD and a firm capacity of 480 MGD, which is analogous to an SOR of 3,100 gpd/sf based on the configuration of the existing tanks. Accordingly, achieving a firm primary treatment capacity of 600 MGD requires construction of 2 additional 60 MGD primary sedimentation tanks.

Because the satellite treatment facility is intended to provide additional wet weather treatment (both primary and disinfection) equivalent to that proposed at the WWTP, the proposed satellite treatment facility in each alternative is sized to replace one proposed primary sedimentation tank having a 60 MGD capacity or both primary sedimentation tanks having a combined 120 MGD capacity. Using this approach avoids alternatives that would have a proposed primary sedimentation tank with a different capacity than the existing primary sedimentation tanks at the WWTP.

2.2 WET WEATHER PUMP STATION AND EXISTING INTERCEPTOR PARAMETERS

Per the Act 537 Special Study, the wet weather treatment capacity of the WWTP will be 600 MGD. The existing Main Pump Station (MPS) has been upgraded to 480 MGD. Pumping the remaining 120 MGD will require construction of a new wet weather pump station (WWPS), which will also serve as the deep tunnel dewatering pump station for the proposed regional tunnel system. The new pump station will be able to pump to both the satellite treatment facility and the WWTP, regardless of the capacity of the satellite treatment facility. For example, if the satellite treatment facility capacity is 120 MGD, the new pump station will pump up to 120 MGD to the satellite treatment plant once the plant's capacity has been exceeded (480 MGD for this example). For the 60 MGD satellite treatment facility, the new pump station would pump first to the WWTP until its capacity (540 MGD) is exceeded and then pump up to 60

MGD to the new satellite treatment facility. The new pump station would also have to dewater the regional tunnel system to the plant whenever there is available secondary capacity at the WWTP regardless of the potential flow scenarios.

Wet weather flow will be conveyed to the existing influent pump station through the existing interceptor and to the new WWPS through the proposed regional tunnel system. Because the required wet weather capacity at the WWTP is 600 MGD, this evaluation did not consider the condition of the existing interceptor or the size of the proposed regional tunnel system. Instead, a total influent peak wet weather flow of 600 MGD was assumed to be conveyed to the two pumping stations.

The proposed WWPS configuration is based on the Tunnel Dewatering Pump Station (TDPS) concept described in Section 11 of the Interim Measures Wet Weather Plan. The TDPS in that document is noted as located at the lower end of the regional tunnel conveyance system, which is at the WWTP and approximately 150 feet below grade. Section 11 states that pump stations of that depth are typically circular and constructed in a vertical shaft. The VE analysis agreed with and adopted those criteria. In addition, the VE analysis assumed that the WWPS will be configured similarly to the existing MPS, which has a large dry-pit air plenum. This air plenum is assumed to be ventilated at a minimum of 6 air changes per hour (ACH) to not be an electrical classified area per NFPA 820.

2.3 EQUIVALENT TREATMENT PARAMETERS

The proposed satellite treatment facility will provide additional wet weather treatment equivalent to that proposed for the WWTP. This was assumed for relative comparison purposes when looking at alternatives from a value engineering and comparable cost benefit perspective. To perform the VE comparisons, the treatment performances of the alternatives need to be equivalent because the analysis considers the benefit of the treatment process. Application of non-equivalent treatment parameters to any alternatives would unnecessarily skew the analysis for or against those alternatives, depending on the level of treatment provided by those alternatives. The planned improvements at the plant provide a relatively high level of wet weather treatment compared to several technologies commonly considered for satellite treatment of CSOs.

At the WWTP, wet weather flows will be routed through the headworks facilities and primary treatment. After primary treatment, at least 295 MGD of flow will continue to secondary treatment, with the balance of the flow (the wet weather portion) being routed to a bypass where it will receive disinfection and dechlorination before being discharged to the Ohio River.

During 2005 and 2006, full-scale stress testing was conducted to monitor performance of the primary treatment process under proposed high rate operation. The test demonstrated acceptable total suspended solids (TSS) removals at flow rates of 60 MGD per tank, which is equivalent to an SOR of 3,100 gpd/sf. The average daily TSS removal performance during stress testing is shown in **Table 2-1**. Based on these results, the proposed satellite treatment facility must be capable of at least 68% TSS removal when the influent TSS concentration is 150 mg/L or greater. At influent TSS concentrations less

than 150 mg/L, 68% TSS removal performance becomes more difficult to achieve because of the diluted influent TSS concentration. For this reason, a target effluent TSS concentration of 50 mg/L is used for influent TSS concentrations less than 150 mg/L.

Table 2-1: Average Daily TSS Removal Performance during Stress Testing ("In CSO (wet weather) Conditions")

Influent TSS	Effluent TSS	% Removal
153 mg/L	50 mg/L	68%

Source: Table 9-7, ALCOSAN Wet Weather Plan

The disinfection parameters for NPDES Permit No. PA0025984 Outfall 001 (the current WWTP outfall) and the proposed NPDES permit for the wet weather bypass are indicated in **Table 2-2**. The table indicates that both outfalls will likely have the same disinfection and slightly different total residual chlorine limits. The proposed satellite treatment facility will need to meet the same permit requirements as the wet weather bypass.

Table 2-2: Permitted Disinfection Parameters for Current WWTP Outfall and Proposed Disinfection Parameters for Wet Weather Bypass

Parameter	Outfall 001		Wet Weather Bypass Outfall	
Average Monthly	Instant. Maximum	Instant. Maximum	Average Monthly	Instant. Maximum
F. Coli (Apr 1 – Oct 31)	200/100 ml	400/100 ml	200/100 ml	TBD
F. Coli (Nov 1 – Mar 31)	2,000/100 ml	10,000/100 ml	2,000/100 ml	TBD
Total Residual Chlorine	0.5 mg/L	1.6 mg/L	1.0 mg/L	2.0 mg/L

Note:

1. Anticipated instantaneous *E. Coli* maximum = 240/100 ml (Apr 1 – Oct. 31). Anticipated *E. Coli* geometric mean = 130/100ml (Apr. 1 – Oct. 31).

Four different satellite treatment technology options were considered for this application, which are described briefly below.

1. **Ballasted Flocculation.** Ballasted flocculation is a manufactured process that uses a ballast (e.g., microsand) and polymer to create floc particles and achieve high SORs and TSS removals. The process typically consists of coagulation and flocculation zones where the microsand and polymer are added and mechanically mixed, a sedimentation basin for solids settling, and solids handling to recover and reuse the microsand and dispose of the sludge. Manufacturers include

Veolia (ACTIFLO ®) and Degremont (DensaDeg ®). The entire process is preceded by 4 to 6 mm screens.

2. **Enhanced High Rate Treatment (EHRT).** Enhanced high rate treatment uses coagulant and polymer dosing to create floc particles and improve the settling of TSS in a sedimentation basin. Mechanical means of solids removal are not typically provided because of the infrequent flows through CSO facilities. Instead, a series of flushing gates is often used to clean the basin and channels of accumulated solids. The solids are then disposed of into the sewer when sewer and WWTP capacity are available after a storm event. Disinfection is performed in a separate contact basin. The entire process is preceded by ½-inch (typ.) screens.
3. **Retention Treatment Basin (RTB).** A retention treatment basin performs the sedimentation and disinfection processes in the same basin. No coagulant or polymer is typically added to improve TSS removal; instead, the process relies on discrete particle settling. Mechanical means of settled solids removal are not typically provided because of the infrequent flows through CSO facilities. Instead, a series of flushing gates is often used to clean the basin and channels of accumulated solids. The solids are then disposed of into the sewer when sewer and WWTP capacity are available after a storm event. The entire process is preceded by ½- to ¾-inch screens.
4. **Screening & Disinfection (SD).** A screening and disinfection facility provides 4 mm to ½-inch screens for solids removal and a short contact time for disinfection. No facilities (coagulant, polymer, mixing, or settling basins) are provided for TSS removal.

Table 2-3 compares the SOR, TSS removal, and disinfection parameters of the satellite treatment technology options against those of the proposed WWTP wet weather improvements. The RTB and SD processes do not provide equivalent TSS treatment as compared to the currently proposed WWTP improvements. The ballasted flocculation process exceeds the TSS removal and disinfection requirements; however, experience has shown that the process is complex and requires a significant amount of capital and maintenance costs. The EHRT process would provide equivalent wet weather treatment and it does not require as much process-mechanical equipment as the ballasted flocculation process. For this reason, the EHRT technology option was selected as the best method for providing equivalent treatment to the planned improvements in the base alternative for the Woods Run WWTP.

Table 2-3: Treatment Performance Comparison

Satellite Treatment Technology Option	Surface Overflow Rate (gpd/sf)	Total Suspended Solids Removal Target	Disinfection Target & Contact Time
Current WWTP Planned Improvements – Primary Settling plus disinfection/dechlorination	3,100	68%	200#/100 ml F. Coli average (Apr-Oct) 15-minute contact time at peak hour flow (PADEP)
Ballasted Flocculation	>12,000	85%	200#/100 ml F. Coli average (Apr-Oct) 10-minute contact time
Enhanced High Rate Treatment (EHRT)	7,000	70% for average TSS _i >150 mg/L 45 mg/L TSS _e maximum for average TSS _i <150 mg/L	200#/100 ml F. Coli average (Apr-Oct) 10-minute contact time
Retention Treatment Basin (RTB)	6,000	50% to 60% based on annual average	200#/100 ml F. Coli average (Apr-Oct) 10-minute contact time
Screening & Disinfection (SD)	N/A	Minimal	200#/100 ml F. Coli average (Apr-Oct) 5-minute contact time

2.3.1 EHRT Performance Requirements

Section 3 illustrates the typical layouts of an EHRT facility for the alternatives developed in this value engineering analysis. The following sections describe the EHRT's primary components and their performance requirements.

2.3.1.1 Facility Considerations

The EHRT facility was assumed to be a below-grade structure with approximately 3 feet of cover considering the properties proposed for the location of each alternative. This is consistent with similar satellite treatment facilities located within the community outside of plant property throughout CSO communities applying similar technologies. The headworks (screening), chemical storage and feed facilities, electrical room, sampler room, supply and storage rooms, bathroom, and general maintenance area will be in a control building that is above the influent end of the EHRT and will be accessible from grade. Personnel and equipment access points into the EHRT tanks will be provided at grade. The invert of the EHRT facility is expected to be approximately 20 feet below grade.

2.3.1.2 Wet Weather Pump Station Influent Force Main

The wet weather pump station will convey flow to the EHRT from the regional tunnel system. The individual pumps will discharge to a near-surface header inside a valve vault. Two force mains will be routed from the valve vault, one to the WWTP and one to the EHRT facility. The force main to the EHRT facility will convey maximum flow rates of 60 MGD or 120 MGD, depending on the capacity of the EHRT. The force mains will be sized for a maximum flow velocity of 8 fps and constructed of prestressed concrete cylinder pipe.

2.3.1.3 Screening

The influent screens will protect downstream process equipment in the EHRT. Emergency screens will meet the regulatory requirements for Nine Minimum Controls (NMC) for any flows that bypass or shunt around the EHRT should the influent screens become blinded or the EHRT is not able to achieve full flow capacity for whatever reason. Design information for the screens is shown in **Table 2-4**.

The influent screens will be vertical, mechanically-cleaned bar screens. These are recommended so that screenings can be removed at the facility, rather than being reintroduced into the flow channel and conveyed to the WWTP after a storm event. The screenings will be transferred to a dumpster via a 26- to 30-inch wide conveyor belt.

The emergency screens will be used at the upstream end of the shunt or bypass channel to address NMC requirements. These screens will also be vertical, mechanically-cleaned screens, with the screenings transferred to a dumpster via a conveyor belt. Baffles will also be installed to address fats, oil and grease.

Table 2-4: Screening Equipment Criteria		
Parameter	60 MGD EHRT	120 MGD EHRT
Screen Type	Vertical Bar	Vertical Bar
Bar Spacing	½ inch influent screens 1 ½ inch emergency screens	½ inch influent screens 1 ½ inch emergency screens
Number of Screens	3 - Influent 2 - Emergency	3 - Influent 2 - Emergency
Screen Width	5 feet	8 feet
Screen Depth (max)	15 feet (max)	15 feet (max)
Approach Velocity	1 fps	1 fps
Motor hp	10 hp – Influent Screens 5 hp – Emergency Screens	20 hp – Influent Screens 10 hp – Emergency Screens

Screening Control

Once flow in the influent channel reaches a predetermined depth, feedback signals from level sensors will automatically start all screens. Each unit will operate on a timed cycle to clean the bars of debris and transport the debris to the conveyor. The conveyor will start at the same time the screens start. The screens will have the automatic reversing function to remove obstructions. If the water level continues to rise in the influent channel, up to a level where flows are greater than flow capacity of the influent screens or the EHRT, additional flows will be diverted over a weir into the emergency screen channel. The same conveyor belt system will serve the emergency screens.

Screening Reliability/Redundancy

Multiple screens are used to allow for one screen to be out of service. The analysis of the screens also assumed 50% blinding factor to calculate potential head losses through the headworks. As a backup, a float switch will be installed to ensure that the screens start in case of level sensor malfunction. Additionally, high level alarms will be installed and relayed back to the control system. Another potential failure point for a screen is blinding that completely blocks the flow through the screens. If this happens, influent water levels would rise high enough to flow over the bypass weir and through the emergency screens. Stop logs channels will be provided upstream and downstream of each screen to isolate individual screens from flow during maintenance or repair.

2.3.1.4 Solids Removal

The solids removal process will reduce the concentration of TSS in the wet weather flow stream after it has passed through the headworks. The chemical mixing and settling processes must work together to achieve the desired TSS removal requirements.

Chemical Mixing

Chemical mixing is the first critical element in the solids removal process. Mixing requires determination of the correct chemicals and corresponding doses, as well as the method of achieving sufficient mixing with the influent flow to promote solids removals. The chemical addition also depends on the influent flow rate as lower flow rates result in lower overflow rates and higher detention times, requiring less chemical usage.

For enhanced sedimentation, two chemicals are typically used. The first is a coagulant, which counteracts the natural electrostatic charges that keep the fine particles in suspension and which allows the particles to coalesce into an aggregation of particles. The second is a flocculant, which enmeshes the aggregate particles into a larger floc that will settle out of suspension. The EHRT will use ferric chloride as the coagulant and an anionic polymer as the flocculant. The optimum dose of chemicals is typically determined through bench scale jar testing. For this evaluation, dose concentrations were assumed based on experience with similar applications. The proper dissolution of the chemicals into the influent flow is critical to enhancing the solids removal process. Mixing can be accomplished by mechanical means (mixers) or by creating turbulence in the flow channels to achieve hydraulic mixing. Hydraulic mixing is generally preferable, if possible, and is the assumed mixing method for this evaluation because of the higher operations and maintenance costs of mechanical mixing equipment. The addition and mixing of the coagulant should be rapid so considerable turbulence is beneficial. For the polymer addition and mixing, less turbulent conditions are desired to promote formation of larger floc particles.

The size of the chemical mixing zone will depend on the influent flow rate, which impacts the hydraulic retention time and the flow velocity. Both will affect the effectiveness of the chemical addition. To ensure that adequate mixing occurs, the mixing zones are based on an average influent flow rate, instead of the peak flow rate.

The design information used for the chemical mixing is provided in **Table 2-5**.

Table 2-5: Coagulant and Polymer Design Criteria		
Chemical	Channel Velocity (fps)	Contact Time (min.)
Coagulant	1.5 to 2.0	0.8 to 1.1
Polymer	0.5 to 1.0	2.0 to 2.5

Settling Tank

Once the floc particles are formed, the settling tank provides the quiescent conditions for the floc particles to settle to the tank floors, allowing clarified water to flow over the effluent weirs to disinfection. The design information for the settling tank is provided in **Table 2-6**. The settling tank will consist of a concrete tank divided into multiple compartments. The individual compartments will operate in parallel, so they can be isolated and provide operational flexibility, such as capturing early flows that may contain more solids in one tank and passing more dilute flows through the remaining tanks. The peak SOR of 7,000 gpd/sf allows for a smaller footprint than a conventional primary sedimentation tank and is facilitated by the addition of chemical to enhance the settling characteristics of the particles.

Flushing

The settled solids must be removed in a timely manner at the end of a storm event to prepare the EHRT for the next storm event. A floor slope of 1.5% to 2% will help promote flushing and cleaning of the tanks. Once the tank is dewatered, a series of flushing gates will be used to remove the accumulated solids and clean the tank. The solids will be flushed to the influent end of the tank and directed to the dewatering pump station for return to the interceptor. Although the flushing and cleaning process may be automated, operator inspection of the tank will be required because multiple flushes may be needed to fully clean the facility. Design criteria for the flushing bays is shown in **Table 2-6**.

Table 2-6: Settling Tank and Flushing Bay Design Criteria		
Parameter	60 MGD EHRT	120 MGD EHRT
Compartments		
Number	2	2
Length, ft	105	136
Width, ft	27	39
Side Water Depth, ft	15	15
Flushing Bays		
Number	3	3
Length-to-Width Ratio	4:1	4:1
Surface Area, sf/compartment	5,670	10,608
Total Surface Area, sf	11,340	21,216
Volume, MG/compartment	0.64	1.19
Total Volume, MG	1.27	2.38
Surface Overflow Rate, gpd/sf	7,000	7,000
Detention Time, min	30.5	28.6

2.3.1.5 Disinfection/Dechlorination

The design goals for the disinfection and dechlorination systems are to achieve a mean of 3- to 4-log reduction of F. Coliform and to comply with disinfection residuals requirements, at the EHRT design flow and all lower flow rates. The disinfectant will be sodium hypochlorite, and sodium bisulfite will be used for dechlorination. **Table 2-7** summarizes the design parameters for the disinfection and dechlorination system. The usage and storage volumes were based on the use of *E. Coli* as the target organism for permitting at the EHRT design flow.

Table 2-7: Disinfection/Dechlorination Design Criteria

Parameter	60 MGD EHRT	120 MGD EHRT
Minimum Detention Time, minutes	10	
Chlorine Contact Tank		
Volume, MG	0.45	0.93
Layout		
Side Water Depth, ft	15	15
No. of passes	4	4
Pass Width, ft	10	16
Pass Length, ft	100	130
Total Length, ft	400	520
Sodium Hypochlorite Feed		
Design CT value	200 mg/L*min	
Design Sodium Hypochlorite Dose	20 mg/L max.	
Average Sodium Hypochlorite Dose	10 mg/L	
Sodium Hypochlorite Storage		
Delivered Concentration	15%	
Average Stored Concentration	12.5%	
Number of tanks	2	
Volume per tank	5,000 gallons	
Sodium Bisulfite Feed		
Average Total Chlorine Residual	1 mg/L	
Sodium Bisulfite Dose	1.679 mg/L	
Sodium Bisulfite Storage		
Delivered Concentration	38%	
Stored Concentration	25%	
Number of tanks	1	
Volume per tank	5,000 gallons	

Discharge from the settling tanks will be routed in an effluent channel to a chlorine contact tank. High-rate mixers will be positioned in the channel to rapidly disperse sodium hypochlorite into the flow. Two mixers will be provided (one duty/one standby). The high-rate mixer will rapidly disperse the sodium hypochlorite across the entire flow field to initiate the disinfection process. Once the level in the sedimentation tank effluent channel reaches a level above the mixers and flow is entering the facility, the feed pump and mixers will start. The feed pumps and mixers will stop when flow drops to zero.

Sodium hypochlorite will be stored in two 5,000-gallon storage tanks and fed to the rapid mixers using variable speed pumps. The storage tank size is based on the typical tanker truck delivery volume of 4,000 gallons, and 2 tanks are provided to minimize the degradation of sodium hypochlorite. The chlorine contact tanks will provide at least 10 minutes of contact time at the design flow rate of the

EHRT facility. The contact tank is arranged as a serpentine channel to provide plug flow conditions and mitigate against short-circuiting.

Dechlorination will be accomplished using sodium bisulfite. Two high-rate mixers (one duty, one stand-by) will be provided. The high-rate mixers will be positioned at the end of the chlorine contact tank to ensure that the mixer remains completely submerged.

Sodium bisulfite will be stored in one 5,000-gallon storage tank and fed to the high-rate mixers using variable speed pumps. The storage tank size is based on the typical delivery volume of 4,000 gallons.

Disinfection/Dechlorination Control

The sodium hypochlorite feed rate will be based on one of two operator selected modes: "Dose Mode" or "CT Mode". In Dose Mode, a constant dose concentration will be fed throughout the entire event based on the measured influent flow rate. In CT mode, sodium hypochlorite will be dosed to achieve an operator-selected CT value (mg/L*min), where time in minutes is determined by the influent flow rate and the volume of the contact tank. The CT Mode allows for lower doses of sodium hypochlorite during low flow conditions, reducing the chemical usage.

The sodium bisulfite feed rate will target achieving a constant dose concentration throughout the entire event based on the measured influent flow rate. The sodium bisulfite dosing will be initiated once the chlorine tank is full.

Disinfection/Dechlorination Reliability/Redundancy

The disinfection and dechlorination systems' reliability and redundancy are equipment-based. **Table 2-8** summarizes the equipment required for each system. Two mixers will be provided for both the sodium hypochlorite and the sodium bisulfite feeds, with one serving as duty and the other as stand-by. The four units will be similarly sized so they are all interchangeable.

The sodium hypochlorite and sodium bisulfite feed pumps will each have a duty unit and a stand-by unit. A dedicated recirculation pump for the sodium hypochlorite storage tanks will prevent stratification of the chemical within the storage tanks. This pump will be operated intermittently based on a timer to ensure a consistent chemical concentration throughout the tank.

Flushing water will be provided for the chemical feed lines. This will allow the feed lines to be flushed clean of chemicals at the end of each event.

Table 2-8: Disinfection/Dechlorination Equipment

Equipment	Number of Units	Size	Description
Sodium Hypochlorite High Rate Mixers	2 (one duty, one stand-by)	20 hp each	Chemical induction unit
Sodium Hypochlorite Storage Tank Recirculation Pump	1	2 hp	Centrifugal pump
Sodium Bisulfite High Rate Mixers	2 (one duty, one stand-by)	20 hp each	Chemical induction unit
Sodium Hypochlorite Feed Pumps	2 (one duty, one stand-by)	2 hp	Positive displacement metering pump
Sodium Bisulfite Feed Pumps	2 (one duty, one stand-by)	2 hp	Positive displacement metering pump

2.3.1.6 Outfall/Effluent Pump Station

Disinfected effluent from the EHRT will be discharged to the Ohio River through a new outfall structure. A gravity sewer pipe will route effluent from the EHRT to the new outfall. This sewer will be constructed of prestressed concrete cylinder pipe (PCCP) because of its depth and diameter. The invert of the outfall pipe will match the invert of the EHRT facility to ensure gravity flow out of the facility and free discharge over the EHRT effluent weir. To ensure that the EHRT facility can discharge to its design capacity when the Ohio River is at the 25-year flood elevation (matching the ability of the proposed wet weather bypass at the WWTP), an effluent pump station will be constructed at the EHRT. The pump station will consist of several screw pumps operating in parallel to lift the effluent flow above the 25-year flood elevation. This pump station would only be employed when the facility cannot flow through by gravity because of high river elevations. The design criteria for the outfall and effluent pump station are shown in Table 2-9.

Table 2-9: Outfall Pipe and Effluent Pump Station Design Criteria

Parameter	60 MGD EHRT	120 MGD EHRT
Outfall Sewer		
Pipe Material	PCCP	PCCP
Pipe Diameter, inches	72	96
Pipe Length, ft	Depends on EHRT	Depends on EHRT
Pipe Slope	site ~0.5%	site ~0.5%
Effluent Pump Station		
Pump Type	Screw (Archimedean)	Screw (Archimedean)
Number of Pumps	3	5
Pump Diameter, inches	96	96
Pump Capacity, MGD	30	30
Firm Capacity, MGD	60	120
Total Capacity, MGD	90	150
Pump HP, each	200	200

2.3.1.7 Dewatering

Dewatering of the facility and removal of solids that accumulate on the floor will occur after a wet weather event. Gravity dewatering is not feasible because of the depth of the facility, and dewatering pumps will be used to drain the entire facility. The dewatering pumps will be sized to drain the entire facility within 24 hours, which is common for CSO facilities, to ensure the facility is ready for a subsequent CSO event and to mitigate odors. Dewatered flow will be pumped through a force main to a new manhole, from which flow will be conveyed by a new gravity sewer to existing Regulator 027, which is at the west end of Westhall Street. Dewatering will not commence until there is sufficient capacity available in the regulator and the interceptor. One dewatering sump with 3 submersible solids handling pumps will be provided (2 duty, 1 stand-by). **Table 2-10** shows the design criteria for the dewatering system.

Table 2-10: Dewatering System Design Criteria

Parameter	60 MGD EHRT	120 MGD EHRT
Dewatering Pumps		
Time to Dewater Entire Facility	24 hrs	24 hrs
Volume of Entire Facility	1.5 MG	2.9 MG
Number of Pumps	3 (2 duty, 1 stand-by)	3 (2 duty, 1 stand-by)
Pump Capacity	1,100 gpm	2,020 gpm

Once all water has been pumped from the facility, solids that have settled out will remain on the floor. Solids accumulation is expected in the influent channel prior to sedimentation, the settling tanks, and

the chlorine contact tank. Removal of these accumulated solids will require a flushing system. The flushing system will consist of flushing gates that retain a volume of captured CSO and release this water (based on operator input) to create a high velocity wave to scour and transport the solids to the sump for the dewatering pumps. The proposed EHRT facility and flushing system is arranged so that the solids are directed to the dewatering pump sump pit, and sluice gates will be provided in dividing walls that otherwise would prevent flow from reaching the sump pit. This arrangement minimizes the number of dewatering pumps. Water lines will be provided to the flushing wells in case additional flushing of the floor is required after the first flush. Table 2-11 summarizes the equipment for the dewatering and flushing systems.

Table 2-11: Dewatering and Flushing System Design Summary

Equipment	60 MGD EHRT	120 MGD EHRT
Dewatering Pumps		
Pump Type	Solids handling, submersible	Solids handling, submersible
Number of Pumps	centrifugal	centrifugal
Pump Capacity, gpm	3 (2 duty, 1 stand-by)	3 (2 duty, 1 stand-by)
Firm Capacity, gpm	570	1,100
Total Capacity, gpm	1,140	2,200
Pump HP, each	1,710	3,300
	Varies by EHRT site	Varies by EHRT site
Flushing Gates		
Number of Gates	16	16
Gate Size	Varies	Varies
Flushing Sluice Gates		
Number of Sluice Gates	5	12
Sluice Gate Size	Varies	Varies

2.3.1.8 Odor Control and HVAC

Although many wet weather facilities do not normally operate their odor control systems, odor control facilities are typically required for regulatory approval and public acceptance for satellite facilities located in the community. Odorous air is typically produced when flows enter the facility, as the facility is filling, and before and during dewatering. Another source of odors is the screenings room during and after wet weather events if the screenings dumpster has not been emptied. To control potential odor problems, the air from the facility may be treated as it is exhausted. Consequently, the air from the screening and headworks area, the settling tanks, and the contact tanks may need to be treated.

Carbon systems have been shown to be effective in treating odorous air from wet weather events. These systems require little maintenance and work well with the intermittent use that is typically experienced at these types of facilities. The odor control system will maintain the basin and screen area

at a negative air pressure during peak flow into the facility, to prevent odors from escaping. The design criteria for the odor control system is shown in Table 2-12.

Table 2-12: Odor Control System Design Criteria		
Parameter	60 MGD EHRT	120 MGD EHRT
Airflow		
Basin, cfm	6,000	12,000
Screenings/Headworks, cfm	20,000	20,000
Total, cfm	26,000	32,000
Target H ₂ S Removal	>99%	
Odor Control System Type	Activated Carbon	
Number of Towers	1	
Blowers	Centrifugal Fan	
Number of Units	Two (one duty, one stand-by)	

An HVAC system will be provided for the control building. HVAC is not required for the basins since this part of the facility is not normally occupied. The access points to the below-grade basins can be used for temporary ventilation. For the screenings room, heating for a minimum temperature of 65 degrees F will be provided for maintenance, and ventilation fans will be provided to limit summer temperatures to 104 degrees F to protect electronic equipment. The screenings room ventilation rate will normally be 6 ACH. For the following conditions, the screenings room ventilation rate will be increased to 12 ACH: the lower flammable limit exceeds 10%, the room is occupied, or the outdoor air temperature exceeds 50 degrees F. The office, electrical room, and storage side of the control building will be provided with a zoned heating system for a minimum temperature of 72 degrees F, more suitable for personnel. The office will be designed as a conditioned space.

2.3.1.9 Stand-by Power

Stand-by power will be provided in accordance with the Pennsylvania Department of Environmental Protection (PADEP) Document 362-0300-001 (Domestic Wastewater Facilities Manual), to allow continuity of operation during a primary power feed failure. Diesel generator units will be provided for this purpose. For the 60 MGD EHRT, the generator will be rated for 500 kW, and for the 120 MGD EHRT, the generator will be rated for 900 kW. The generator will be located above the local 100-year flood elevation to protect the electrical equipment and housed in a sound attenuating enclosure to reduce noise impacts to the surrounding community. The backup power needs are shown in Table 2-13.

Table 2-13: EHRT Facility Power Needs

Equipment	60 MGD EHRT				120 MGD EHRT			
	No. of Installed Units	kW/Unit	No. of Operating Units	Operating Load (kW)	No. of Installed Units	kW/Unit	No. of Operating Units	Operating Load (kW)
Lighting/Misc. Power								
Exterior	12	0.25	12	3	12	0.25	12	3
Misc. Power During Events	1	4.5	1	4.5	1	4.5	1	4.5
Misc. Power for Routine Inspection	1	23.5	-	-	1	23.5	-	-
Misc. Power for Routine Maintenance	1	23.5	-	-	1	23.5	-	-
Fire, security, communications, etc.	1	11.3	1	11.3	1	11.3	1	11.3
Odor Control	1	40	1	40	1	80	1	80
Influent Gates	6	3.7	6	22.4	6	3.7	6	22.4
Coagulant								
Feed Pumps	2	0.75	1	0.75	2	0.75	1	0.75
Mixers	2	11.2	1	11.2	2	14.9	1	14.9
Flocculant Pump and Mixer	2	3	1	3	2	3	1	3
Disinfectant								
Feed Pumps	2	1.5	1	1.5	2	1.5	1	1.5
Mixers	2	11.2	1	11.2	2	14.9	1	14.9
Recirculation Pump	1	1.5	1	1.5	1	1.5	1	1.5
Dechlorination								
Feed Pump	2	1.5	1	1.5	2	1.5	1	1.5
Mixers	2	11.2	1	11.2	2	14.9	1	14.9
Emergency Screens	3	2.2	2	4.5	3	3.7	2	7.5
Influent Screens	3	2.2	2	4.5	3	3.7	2	7.5

Table 2-13: EHRT Facility Power Needs

Equipment	60 MGD EHRT				120 MGD EHRT			
	No. of Installed Units	kW/Unit	No. of Operating Units	Operating Load (kW)	No. of Installed Units	kW/Unit	No. of Operating Units	Operating Load (kW)
Screenings Conveyor	1	5.6	1	5.6	1	7.5	1	7.5
Dewatering Pumps	3	11.2	-	-	3	18.6	-	-
Effluent Pumps	3	149.1	2	298.3	6	149.1	4	596.6
Effluent Sluice Gates	2	3.8	2	7.5	2	3.8	2	7.5
Flushing Gates	16	0.19	-	-	16	0.19	-	-
Flushing Sluice Gates	6	2.2	-	-	12	3.7	-	-
TOTAL				443.2				800.5

2.3.1.10 Control Building Parameters

A Control Building will house the screenings/headworks area and the occupied areas, which include an electrical room, an office, general storage, a sampler room, a supply room, a restroom, and a work area. The building will be unit masonry construction with a brick face. Rolling overhead doors will be provided for access into the screenings room for removal of the screenings dumpster, and into the work area. The chemical areas, the odor control area, and the generator will be located outdoors in screened courtyards. Chemical equipment, such as storage tanks, that could be subject to freezing will be heat traced and insulated. The architectural elements, including the brick pattern and color, roof style, door style and color, style and color of courtyard screening, etc., will be chosen to fit with the architectural theme of the surrounding buildings. The occupied areas of the building will be located above the 100-year floodplain. The Control Building for the 60 MGD EHRT will be approximately 70 ft by 110 ft, with a 15-ft ceiling height. For the 120 MGD EHRT, the building will be 80 ft by 140 ft with a 15-ft ceiling height.

Architectural

For the purposes of this evaluation the opinion of probable cost includes unit masonry materials as well as incorporates glass block windows and detail bands to provide some interest to the building look. Additionally, a precast plank roof system is assumed.

2.3.1.11 Site Parameters

Access

Access to the site is necessary to allow O&M staff, chemical delivery trucks, and screenings removal equipment to reach the facility. Access roads will consist of asphalt pavement and allow room for chemical delivery trucks to turn around to exit. Several parking spots will be available for O&M staff to park while visiting the site. Concrete sidewalks to the control building and specific access points will be constructed to allow ease of access to the facility. Spill containment will be provided at the chemical delivery area.

For the purposes of this evaluation, three parking spaces will be provided close to the control building. The spaces are also located on site to avoid driving lanes, which would minimize the need to move parked vehicles when delivery trucks arrive.

Access to the EHRT sites during construction was assumed to be along Preble Avenue/Beaver Avenue with easy access to State Route 0065 / Ohio River Boulevard.

Drive aisles will be 24 feet wide, with turning radii sufficient to allow a tanker truck to maneuver within the site without the need for multi-point turns. The paved drive aisles will provide 2 access points to the local roadways to facilitate drive through traffic. A 20-foot sliding security gate will be provided at each access point. Additional facility access is provided at each proposed alternative by a 15-foot driveway around the perimeter of the tanks and building.

Restoration

Restoration of the site was assumed to be grass in any areas not paved, except for the green infrastructure/rain gardens. Green infrastructure area was calculated to be 1/10th of the impermeable surfaces. The EHRT process tanks (settling, disinfection, etc.) have been conceptually designed completely below grade and will not be visible to the public. This further minimizes the need for landscaping. The top of the EHRT facility tanks is conceptually designed to be able to withstand equipment loading.

Site Lighting and Security

The final site consideration is security. While the exterior doors to the EHRT facility will have keyed locks, additional security measures will be needed. It is anticipated that a perimeter fence would be provided at each location (except the Western Penitentiary Site where the Guard Wall is remaining) with site-specific signage warning off potential trespassers. Access through the fence could be either through automated keycard activated gate or manual gate with a padlock. Doors should include intrusion detection hardware that would notify a central location to initiate police response.

Site lighting would be in accordance with ALCOSAN requirements and local ordinances, which may limit the height of poles, type of allowable fixtures, and how much light spill there is onto adjacent properties.

2.4 SITE CONSIDERATIONS**2.4.1 Site Requirements**

Land requirements of the 60 MGD EHRT and the 120 MGD EHRT are approximately 2.5 acres and 4 acres, respectively. This will ensure sufficient room for the facility as well as staging, laydown and stock piles during construction. For the purposes of this alternative evaluation, a minimum 50-foot buffer was targeted from existing structures and rights-of-way for construction equipment and access; however, deviations from this target may be required, and variances may need to be applied for as necessary.

The prospective sites will be located relatively close to the Woods Run WWTP (within approximately 1,000 feet), to reduce the length of force main from the WWPS, and decrease the friction head losses through the pipes. Additionally, the sites should be located near a connection to the existing interceptor, as the dewatering flow is to be conveyed to the WWTP. This can be accomplished either by force main or gravity sewer connection to the interceptor conveyance line/compartments of an existing regulator structure.

The prospective sites will also need to be near major road arteries, or to the Ohio River for ease of access of construction equipment and the transport of materials.

Most of the proposed conveyance pipes were routed such that they are located either within the proposed site or in public rights-of-ways to reduce the number of necessary easements. For each

alternative below, it was assumed that a parcel owned by the City of Pittsburgh, between Tracey Street and Westhall Street, will be used for the force main from the WWPS to the proposed EHRT.

Each alternative is anticipated to have a new outfall to the Ohio River. Any existing outfall would continue to function in its current capacity.

2.4.2 Potential Sites

Based on these requirements, discussions with ALCOSAN, desktop analysis, and limited “windshield” evaluations, three potential sites were identified, namely the Western Penitentiary site, the trucking site, and the Valspar site. A summary of each site follows.

2.4.2.1 Western Penitentiary Site

The Western Penitentiary site is located approximately 1,000 feet upstream and along the Ohio River (to the southeast) from the Woods Run WWTP. Until recently, the site was operated by the State Correctional Institution – Pittsburgh since the 1820s. The site is historically known as the Western Penitentiary or “West Penn”. As of early 2017 the Western Penitentiary is no longer used to house inmates and is currently in the process of inventory clean out. It is anticipated that the property will be vacated by the end of 2017. The entire site is made up of 16 parcels, the majority of which are owned by the Commonwealth of Pennsylvania and operated by the Pennsylvania Department of Corrections. The parcels are bounded by Westhall Street, the Ohio River, Doerr Street and Beaver /Preble Avenue. According to the FEMA flood maps, most of the site is located within the 100-year floodplain. A small portion of the facility containing two larger buildings (estimated at 6 stories each) appears to be out of the floodplain. Several buildings, parking facilities, and what is possibly the powerplant for the Western Penitentiary are included on the properties. A large portion of the site is encompassed by an approximate 25-foot-tall guard wall, making visual observations of the site difficult.

Constructed in 1826, the original Western Penitentiary / warden house is listed as being eligible by SHPO for the National Registry. In 1985 a Phase I Archeological survey was conducted for a proposed expansion of the Western Penitentiary facility. The results of the survey may be available to prospective developers. No features in the area are displayed as protected lands on the Allegheny County Greenways GIS search. The Ohio River is shown as an “Unprotected Land”, additionally several areas adjacent to nearby railroads are shown as “Sensitive Steep Slopes”. None are directly adjacent to the properties evaluated.

According to the Allegheny County Assessment website, the total land of all 16 parcels is 11.66 acres, and the 2017 assessed value is \$58,636,400, of which the majority is building value.

The proposed EHRT site is just south of the Western Penitentiary’s power plant, and may have several large electrical conduits on the property. This site is also located north of the original Western Penitentiary structures, which are not anticipated to be acquired or disturbed during construction activities. This portion of the property was selected for the EHRT site for several reasons, including:

- The proximity to the existing WWTP, the Ohio River, and Regulator 027 minimizes the lengths of pipe required to convey flow to and from the EHRT.
- The location optimizes demolition requirements by avoiding the two larger buildings (each estimated at six stories in height).
- The location limits the number of parcels that may be required for acquisition to four.

Figure 2-1 displays the extent of the 5.7-acre proposed area, shaded in blue, required for construction and permanent acquisition at the Western Penitentiary Site.

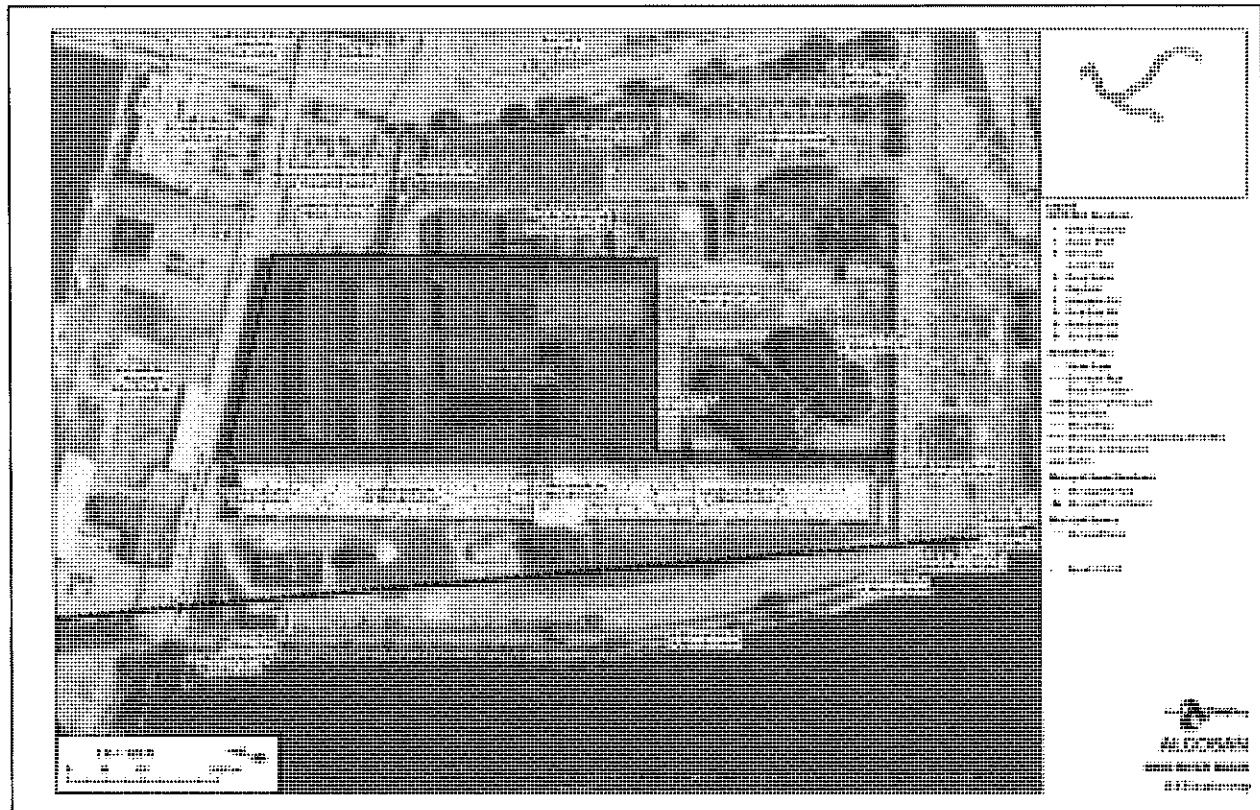


Figure 2-1: Western Penitentiary Site Required Area

Figure 2-2 provides a bird's eye, 3-dimensional view of the site buildings.

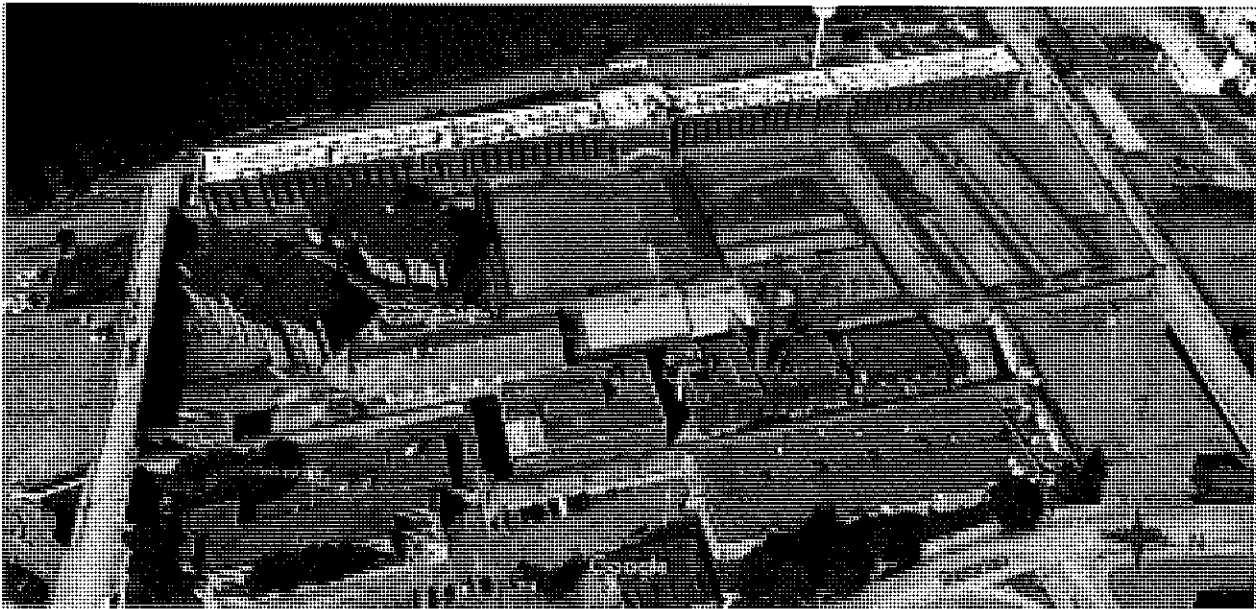


Figure 2-2: Western Penitentiary Site Bird's Eye View

2.4.2.2 Trucking Site

The Trucking Site is located at the intersection of Beaver/ Preble Avenue and Eckert Street. It is diagonally across the intersection from the recently constructed ALCOSAN training facility. The site is bounded on the east by Beaver Avenue, to the north by Eckert Street, to the west by the railroad, and to the south by a private property. According to the FEMA flood maps, a small portion of the property along Eckert Street is in the 100-year floodplain. Most of the parcel contains a one-story block building divided into several rental units. Currently the northern sections of the building appear vacant and may be available for ALCOSAN use. Public records indicate the property is owned by the Buncher Company.

Visual observation of the property noted that no overhead powerlines exist in the area, so electrical service is assumed to be underground. Additionally, the property is adjacent to elevated railroad to the east.

None of the structures have been listed on the National Registry. No features in the area are displayed as protected lands on the Allegheny County Greenways GIS search. Several areas adjacent to the nearby railroads are shown as "Sensitive Steep Slopes", though none are directly adjacent to the property.

According to the Allegheny County Assessment website, the total land of all the parcels is 7.87 acres, and the 2017 assessed value is \$4.383 M.

Figure 2-3 displays the extent of the proposed area for permanent acquisition at the Trucking Site. The area is shaded in blue and contains the entire 7.87 acres of the parcel. The entire parcel is proposed for acquisition because the existing building spans nearly the whole length of the parcel. Acquisition of a portion of the parcel would result in only part of the building being demolished. The remaining structure

[illegible]

Figure 2-4 provides a bird's eye, 3-dimensional view of the site building.

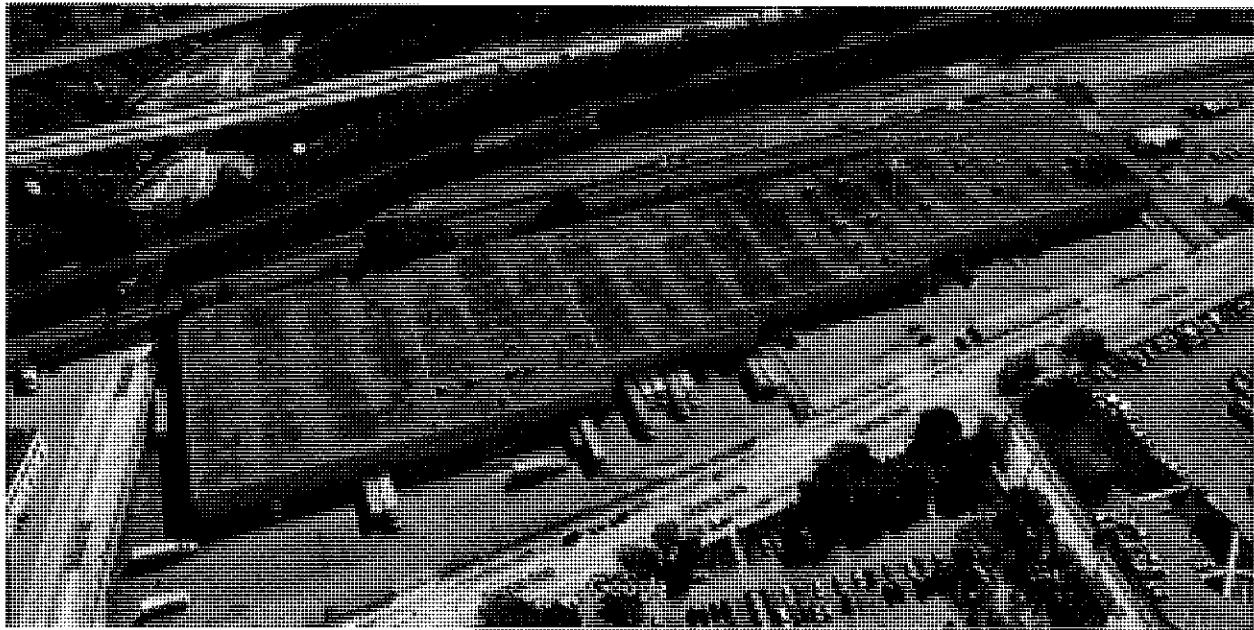


Figure 2-4: Trucking Site Bird's Eye View

2.4.2.3 Valspar Site

The Valspar site is located just south of the Woods Run WWTP, across Tracey Street, and is bounded by Westhall Street, the Ohio River, Tracey Street and Preble Avenue. The property is owned by Engineered Polymer Solutions Inc. According to the FEMA flood maps, portions of the property are in the 100-year floodplain. The northern half of the property contains several active warehouse buildings and offices, which are not anticipated to be acquired or disturbed during construction activities. The southern half of the property contains a 3-story brick building, 2 metal pole type buildings and a small concrete building, but is mostly comprised of pavement and parking areas.

None of the structures have been listed on the National Registry. No features in the area are displayed as protected lands on the Allegheny County Greenways GIS search. The Ohio River is shown as an "Unprotected Land", additionally several areas adjacent to the nearby railroads are shown as "Sensitive Steep Slopes". None are directly adjacent to the properties evaluated.

According to the Allegheny County Assessment website, the total land of all the parcels is 8.86 acres, with the 2017 assessed value being \$3.85M.

Figure 2-5 shows the extent of the 4.9-acre proposed area required for construction with permanent acquisition of the Valspar Site shaded in blue.

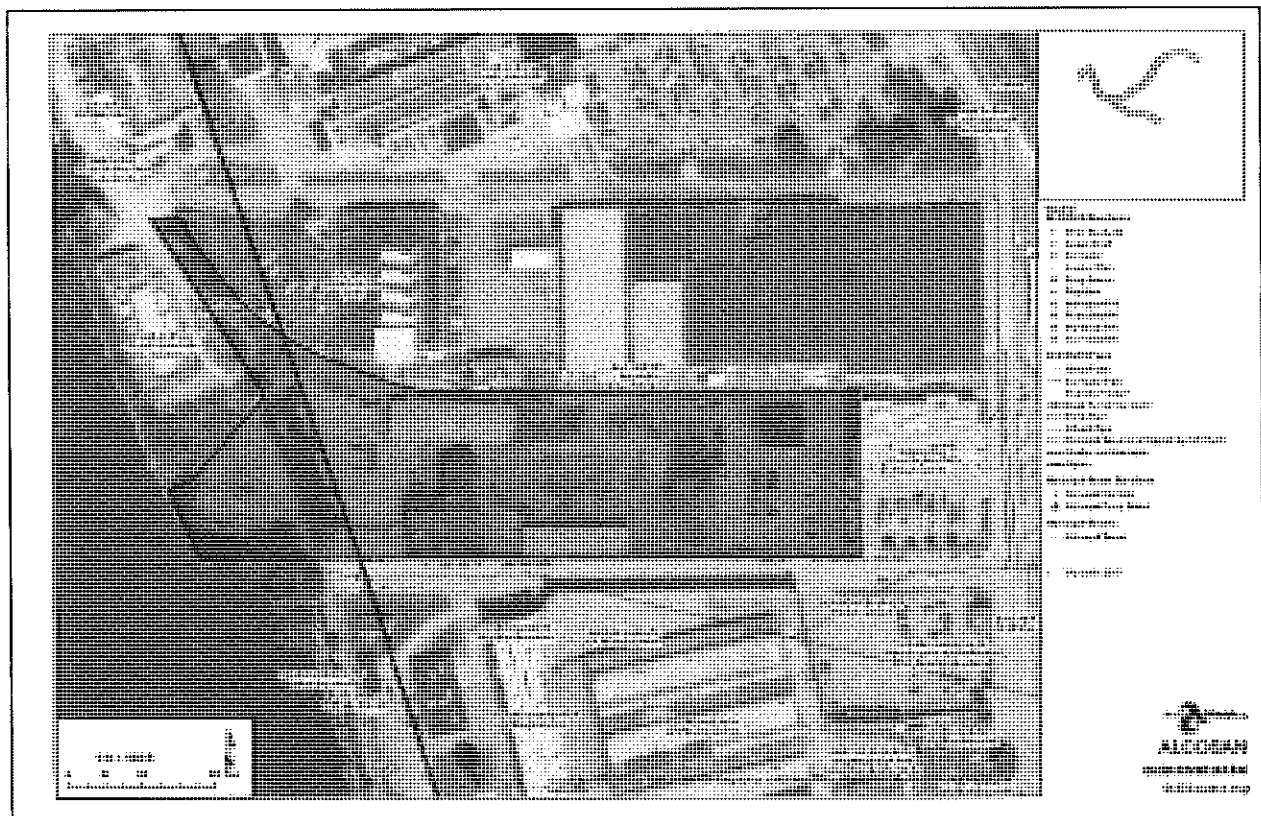


Figure 2-5: Valspar Site Required Area

Figure 2-6 provides a bird's eye, 3-dimensional view of the site buildings for the Valspar Site.



Figure 2-6: Valspar Site Bird's Eye View

3.0 ALTERNATIVES DEVELOPMENT

3.1 GENERAL APPROACH TO TREATMENT FACILITIES LAYOUT

The general approach to the EHRT facility layout was to provide the required facilities for treatment within a compact footprint. The facility will utilize a flow path that does not introduce hydraulic restrictions or unnecessary channel length to convey flow from one process to the next. To accomplish this, the settling tanks will be situated directly adjacent to the disinfection channels. The tank dimensions, as well as the disinfection channel length and width, will be adjusted until the dimensions provide the preferred ratios, velocities, and contact times as discussed in Section 2. Addition of the polymer and coagulant chemicals will be accomplished in a serpentine flowline prior to the settling tanks. Sodium hypochlorite will be added at the upstream end of the disinfection channel, and sodium bisulfite will be added at the end of the disinfection channel, and just upstream of the effluent weir, for dechlorination.

Flows will be conveyed by gravity from the headworks to the EHRT settling tanks via the influent channel. Flow distribution between the tanks will be accomplished using multiple automated inlet gates. The inlet gates will be downward opening and will be normally open. The open/close status of the inlet gates will be operator selectable, providing flexibility to direct flow to individual tanks. For example, by manually setting the inlet gates, one tank could be filled first to capture the first flush. Once this tank is near full, the inlet gates to the remaining tanks would open, and if the decision is to retain this first flush, the inlet gates to the “first flush tank” would be closed. The effluent from the settling tanks will enter the treated effluent channel and be routed to the disinfection tank.

The settling tanks that follow the influent channel provide the opportunity for coagulated and flocculated solids to settle out. Experience has shown that the following assumptions should be made relative to the settling tank compartments:

- Optimum dimensions and length to width ratios typically range from 2:1 up to 4:1.
- The side water depth (SWD) of the settling tanks needs to be greater than 12 feet. A depth of 15 feet has been assumed.
- A minimum of 2 compartments is required for the settling tanks.

Discharge from the settling tanks will be routed to the disinfection tank channel. Disinfection will be accomplished through chlorination with sodium hypochlorite, with 10 minutes of contact time required for the maximum design flow rate. Dechlorination with sodium bisulfite will follow to meet discharge total residual chlorine requirements. Based on experience, a 10:1 ratio of the channel length to width will provide a sufficient plug flow condition.

The settled solids must be removed in a timely manner at the end of the storm event to prepare the EHRT facility for the next storm event. A floor slope of 1.5% to 2.0% will promote flushing and cleaning of the tank. Once the tank has been dewatered, a series of flushing gates will be used to clean the tank

of accumulated solids. The facility layouts will also be configured to provide optimal flowlines for flushing settled solids to a dewatering pump station.

3.1.1 Configuration

As shown in **Figure 3-1**, the configuration of the 60 MGD EHRT will have a mostly square orientation because of its smaller required footprint. Additionally, **Figure 3-1** shows the major process areas of the EHRT. The flushing chambers for the settling basins are located below the basin effluent overflow weirs and are not shown. In this configuration, the disinfection channels run parallel to the settling tank flow. This configuration fits on all three alternative sites, and provides ample clearances for construction equipment and staging areas.

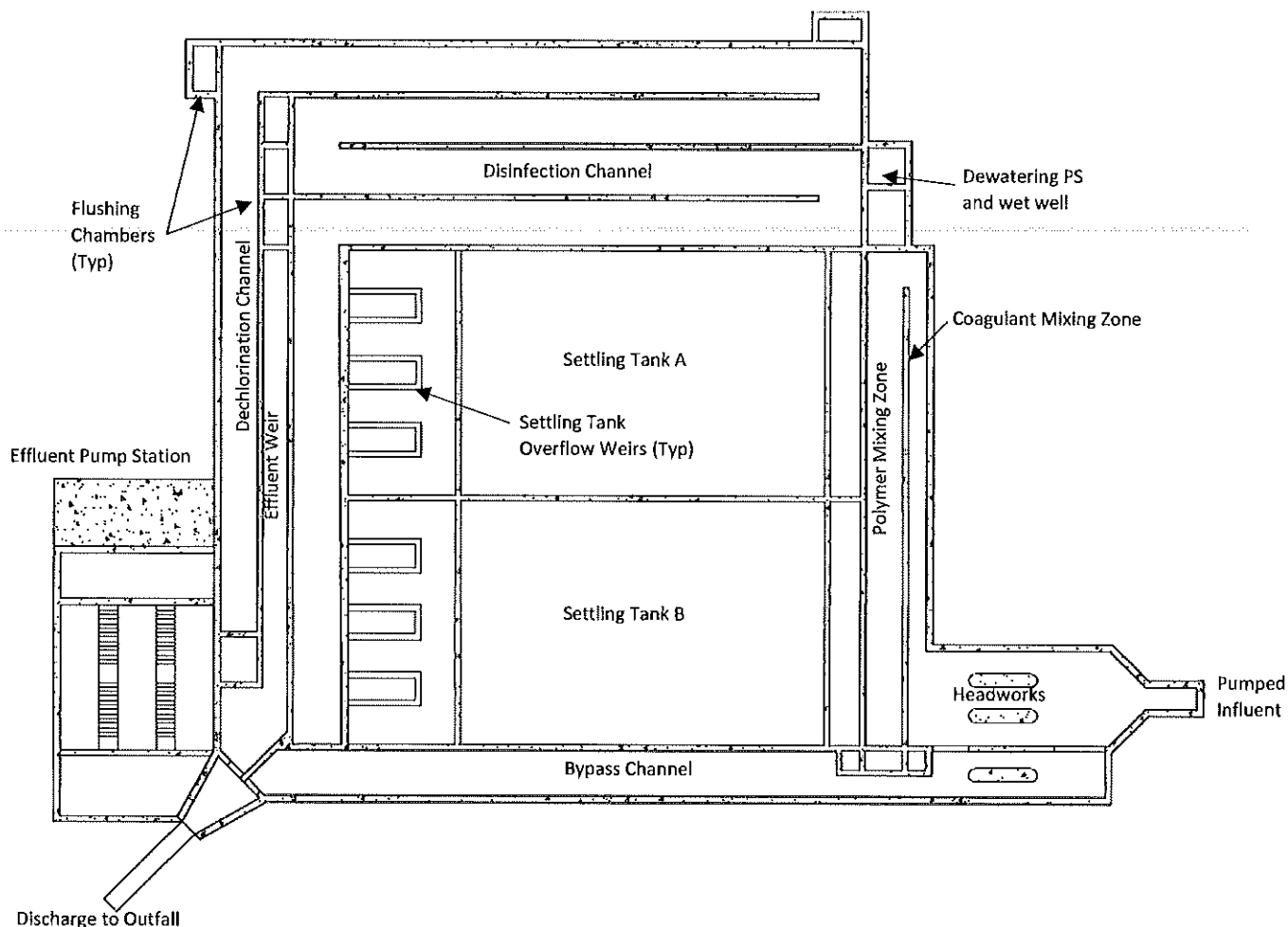


Figure 3-1: 60 MGD EHRT General Layout

A similar, square footprint of the 120 MGD EHRT will not fit on any of the three sites while still providing adequate space for construction equipment, laydown and staging. **Figure 3-2** displays the proposed 120 MGD EHRT's elongated rectangular configuration and identifies the major process components. The

flushing chambers for the settling basins are located below the basin effluent overflow weirs and are not shown. In this configuration, the disinfection channels run perpendicular to the settling tank flow. Additionally, an extra channel is required to provide flushing of the disinfection channels.

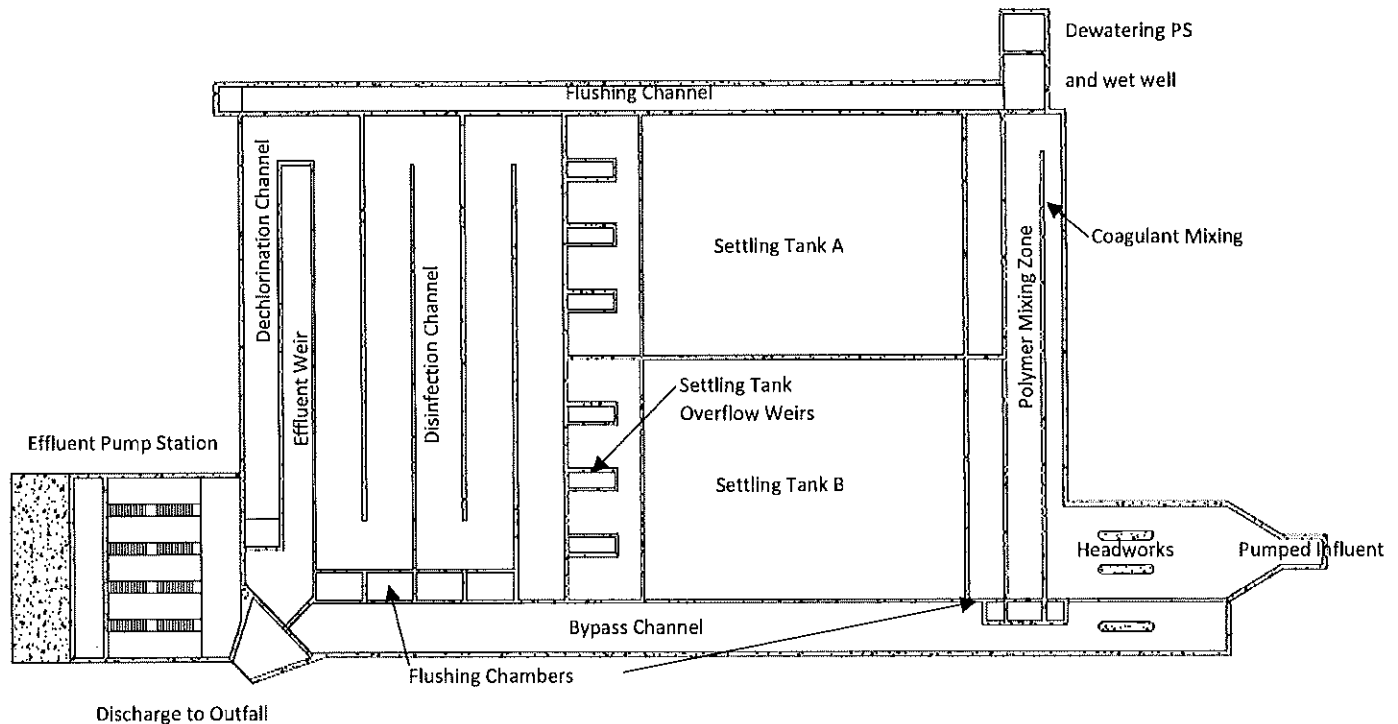


Figure 3-2: 120 MGD EHRT General Layout

Figure 3-3 provides the typical flow diagram for the 60 MGD EHRT. The red arrows indicate the primary flow path for treatment. **Figure 3-4** provides the typical flushing diagram for the 60 MGD EHRT. Green arrows represent the flushing flow path to remove settled solids.

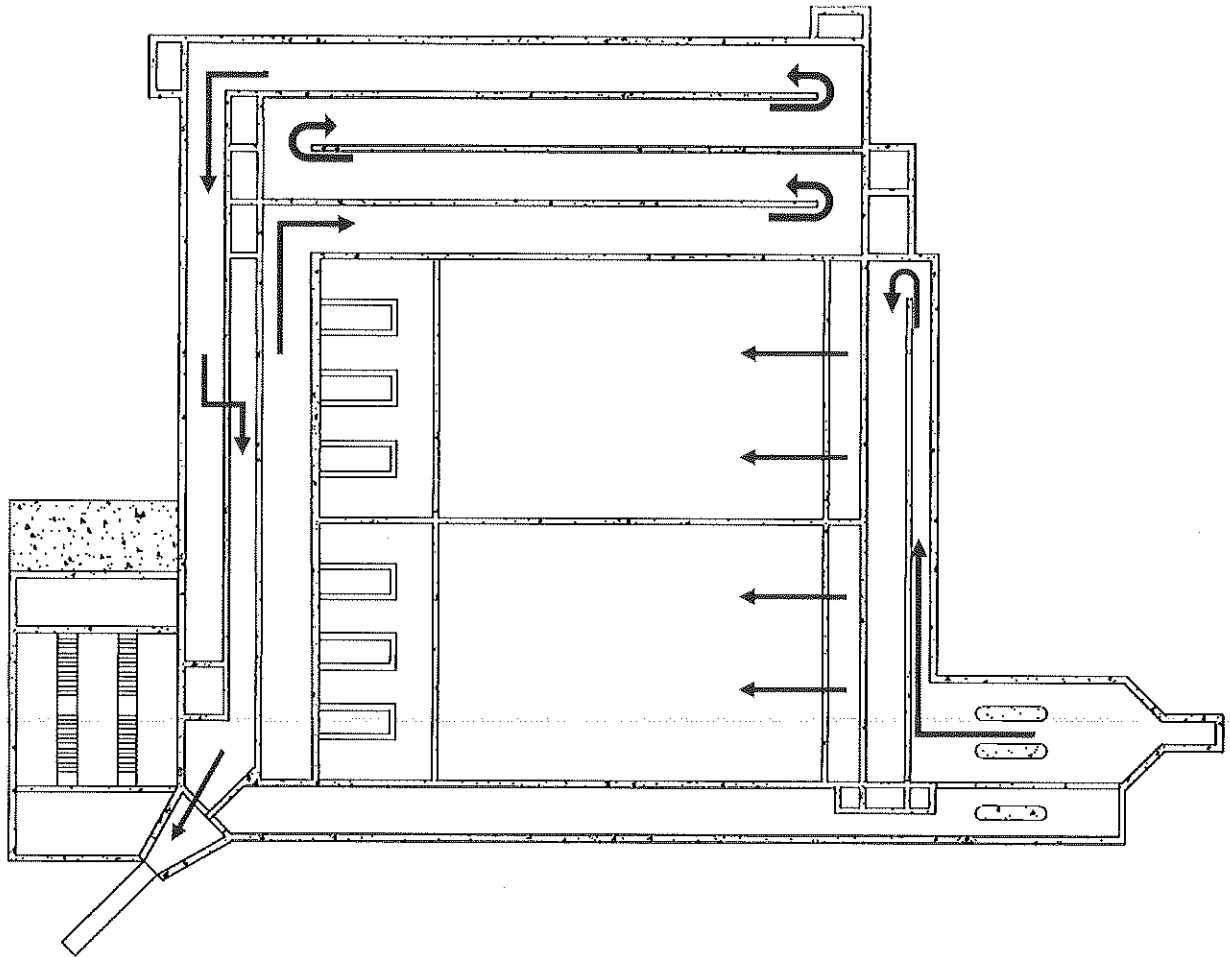


Figure 3-3: EHRT Flow Diagram

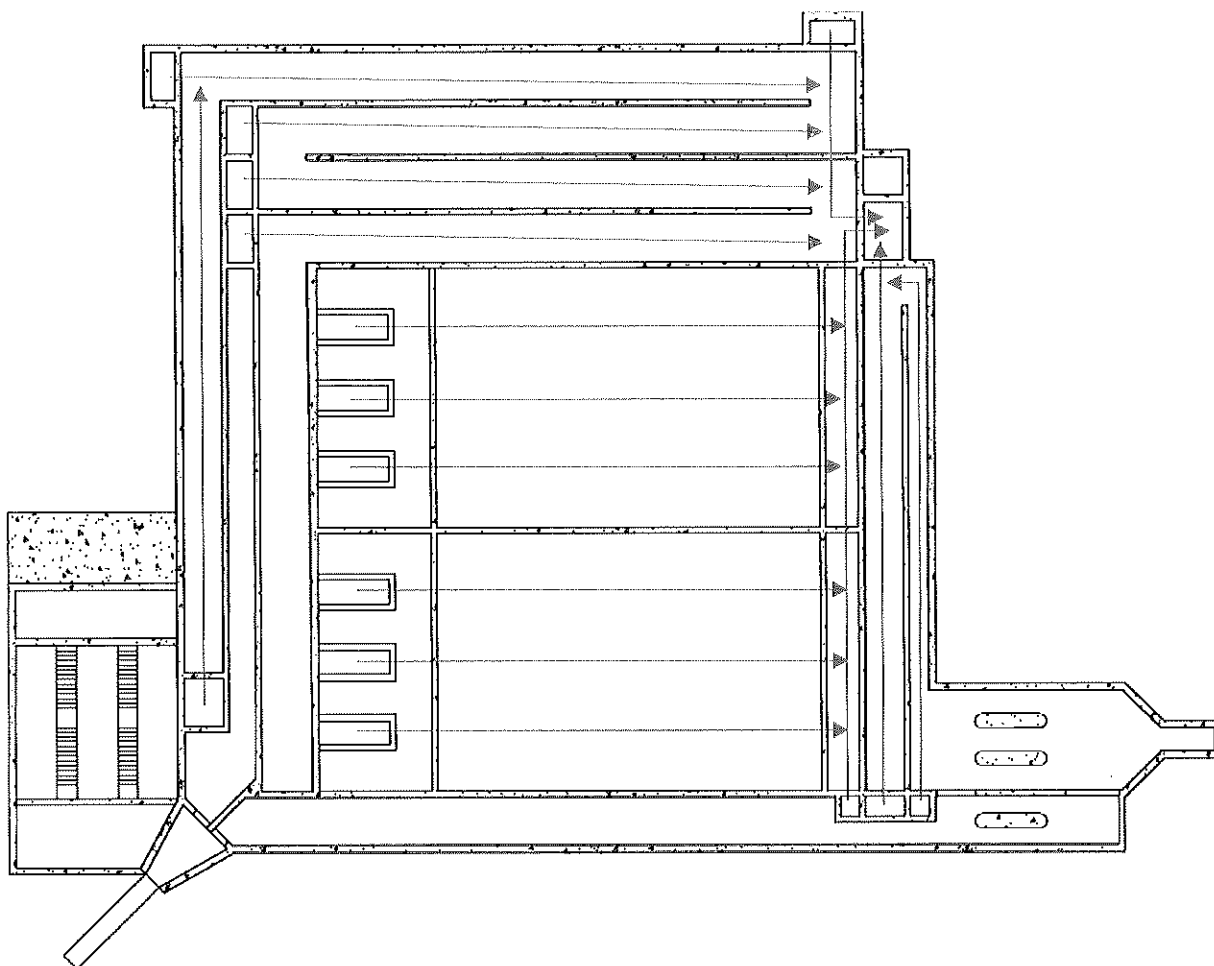


Figure 3-4: EHRT Flushing Diagram

Figure 3-5 provides a 3-D representation of the typical 60 MGD EHRT layout with the major components of the EHRT labeled. As indicated in **Figure 3-2**, the major components of the 2 EHRTs are nearly identical, just differing in size and location. **Figure 3-6** displays a detailed view of the flushing components at the effluent overflow weirs of the settling tanks.

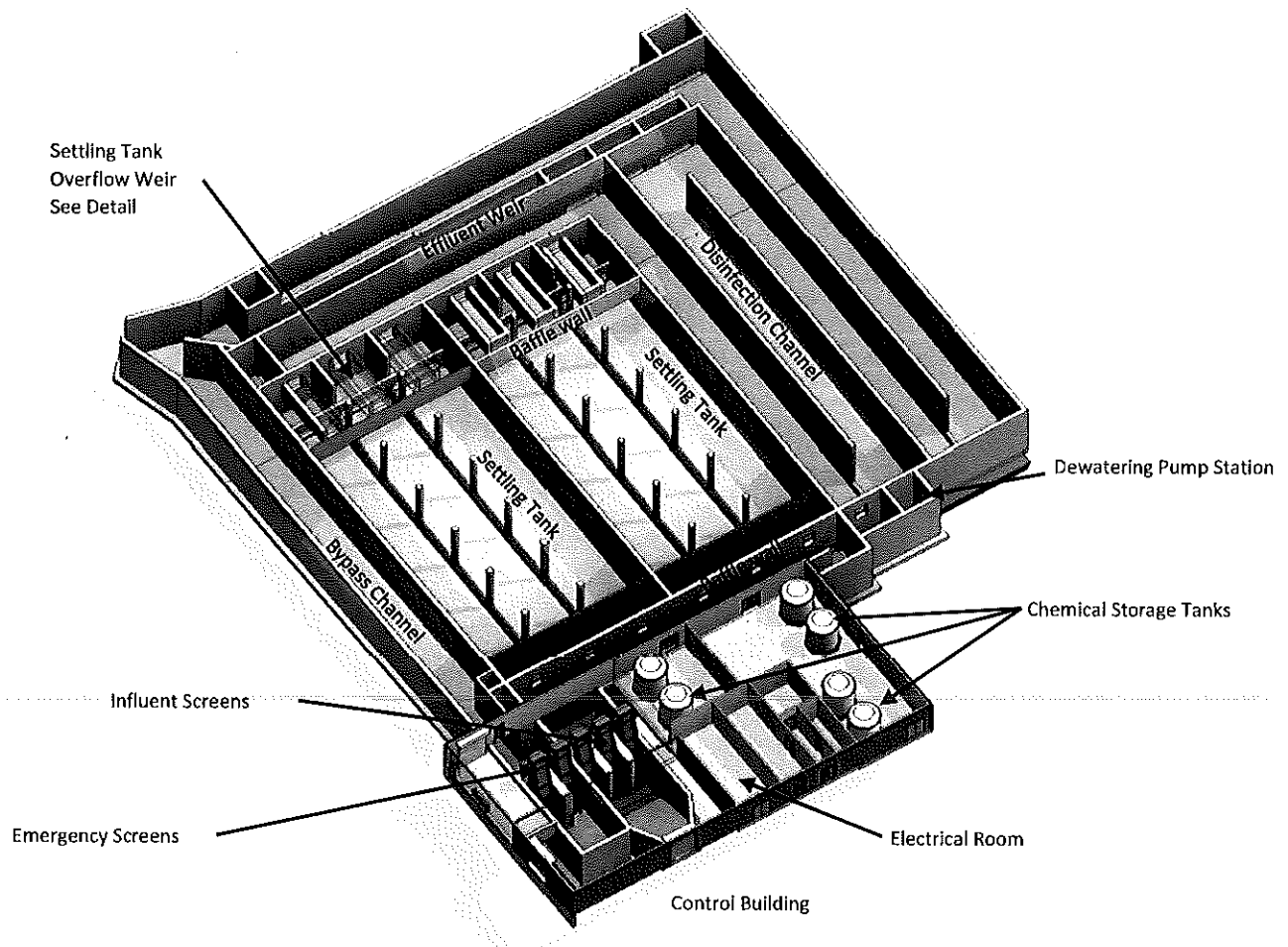


Figure 3-5: 60 MGD EHRT 3D Graphic

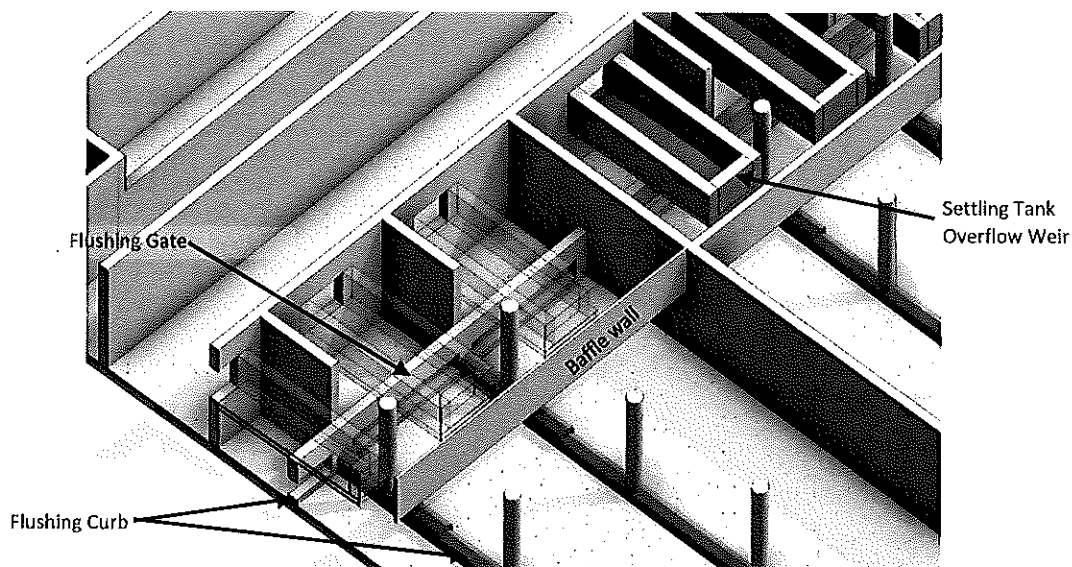


Figure 3-6: 60 MGD EHRT 3D Flushing Detail

3.1.2 Process Scheme

The process scheme for the EHRT facilities is displayed in **Figure 3-7**. Flow from the WW PS conveyed to the EHRT will pass through influent screens prior to a mixing zone where coagulant and flocculant polymer are added to enhance solids settling. Discharge from the settling tanks will be disinfected as it is conveyed through a contact chamber. After that, flow will be dechlorinated prior to being discharged to the river.

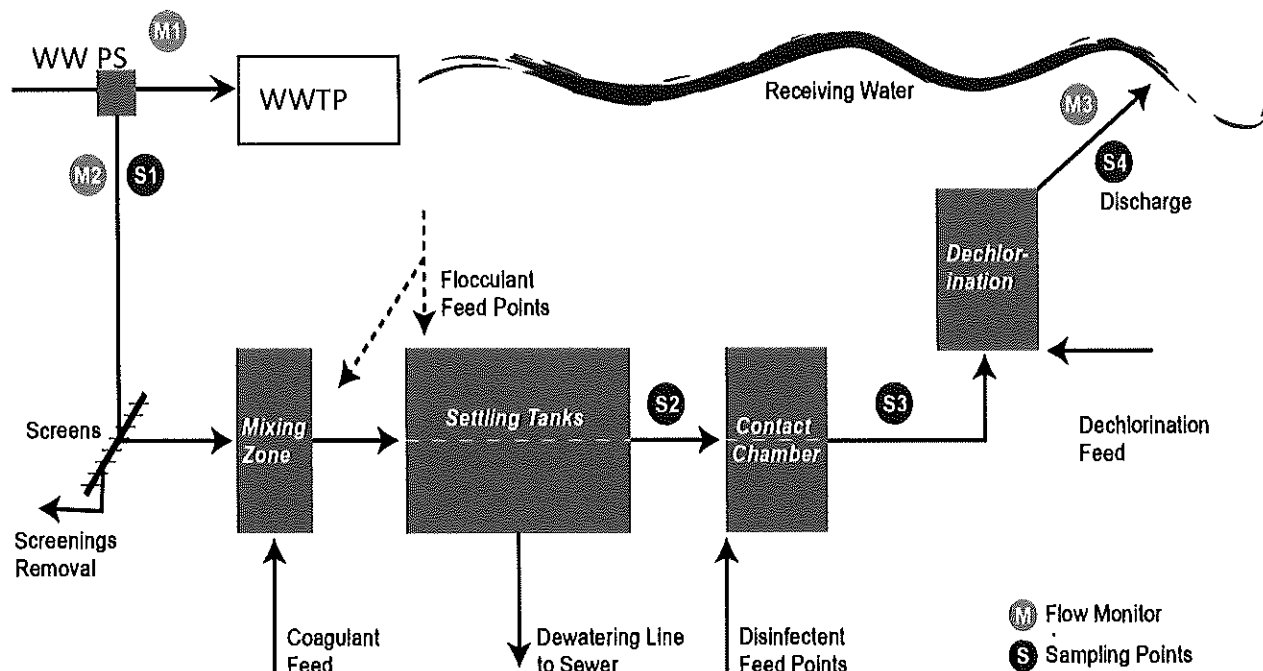


Figure 3-7: EHRT Process Scheme

Flow monitors will measure the influent and effluent of the facility. The flow monitoring equipment is intended to provide accurate flow data from start of basin filling operation until the cessation of flow into and out of the EHRT. Two different types of data are required: data for NPDES permit reporting and data for effective operation of the facility. These two data requirements result in the need to use a “system” of flow monitoring for the facility that includes the use of flow meters, level sensors and flow over weirs to provide important data for use in NPDES permit reporting and controlling chemical feed systems.

Automatic samplers located at the influent and discharge points will provide information to demonstrate compliance with regulatory requirements. Additional sampling points downstream of the settling tanks and disinfection channel will provide process monitoring for TSS and residual chlorine respectively to better define the influent and the performance of the EHRT.

3.1.3 Site Orientation

Facility layout details are site and alternative specific. In general, the proposed sites are rectangular with the proposed facilities situated so that the flow path from the influent to effluent of the facility for each

of the alternatives is parallel to the long (length) side of the property. To conform with PADEP's Domestic Wastewater Facilities Manual, the facility equipment and tanks will be protected from the 100-year flood by either locating the Control Building above or outside of the 100-year floodplain elevation.

For all alternatives, the depth of the tanks is anticipated to be approximately 20 feet to the invert, with total excavation depth to subgrade at approximately 25 feet. Shoring/sheeting is anticipated because of the excavation depth and proximity of existing structures and utilities. To be consistent with other foundations at the existing WWTP, auger cast piles are assumed to extend from the bottom of the structure to bedrock. Information obtained from the Phase 1 boring program near the alternative sites showed bedrock at a depth of 50 feet. For all alternatives, most of the excavated material is assumed to be hauled and disposed of offsite. Full depth aggregate backfill will be used around the proposed structures and, because of their location in roadways, above the proposed force mains and sewers.

In accordance with ALCOSAN's preferences and common practice in other similar metropolitan areas with satellite facilities throughout the United States, the EHRT tank facilities will be situated underground with a roof and cover. For all the alternatives, the EHRT tank elevations were set such that the top of concrete is 3 feet below grade to mitigate potential odor or aesthetic issues. The top of the tanks will be structurally sufficient to support earth loads and heavy equipment. This concept design of the EHRT set the effluent weir elevation 4 feet below top of concrete. Ground elevation for the sites is between approximately EL 723 ft to 725 ft, making the effluent weir elevation between EL 716 ft and 718 ft. According to PADEP's Domestic Wastewater Facilities Manual, and to be consistent with the treatment provided at the WWTP, the facility is required to be fully operational and accessible during the 25-year flood, which is at EL 721.7 at the nearby WWTP. Additionally, the 10-year flood is at EL 719.1 ft, requiring an effluent pump station at the EHRT to convey the facility discharge when river levels are elevated. According to the WWP, the normal surface pool elevation of the Ohio River in the Pittsburgh Pool is EL 710 ft. It is anticipated that during lower river levels and smaller storm events, the facilities will be able to drain completely by gravity.

3.2 ALTERNATIVES

Common to all alternatives is the WWPS and a force main to convey flow from the WWPS to the WWTP influent. Construction cost for WWPS is based on the program cost indicated in the Interim Measures Wet Weather Plan (\$148M). The construction cost is determined by subtracting the non-construction cost elements itemized in CDM-Smith's memo *Baseline Capital Budget for the Interim Measures Wet Weather Plan* (Sept 20, 2017) and escalating the construction cost with the ENR index to 2017 dollars.

For the purposes of this evaluation each alternative is identified by the treatment capacity of the EHRT and the location of the EHRT. The alternative nomenclature is "Alternative [Capacity][Location]", where capacity is either "1" for the 60 MGD EHRT or "2" for the 120 MGD EHRT, and location is either "A" for the Western Penitentiary site, "B" for the trucking site, or "C" for the Valspar site. For easy reference, the 60 MGD EHRTs are illustrated in blue, and the 120 MGD EHRTs are illustrated in magenta.

3.2.1 Base Alternative – 600 MGD Wet Weather Treatment at WWTP

The Baseline Alternative consists of expansion at the WWTP to provide treatment of wet weather flows up to 600 MGD and a new 120 MGD WWPS. The scope of the wet weather improvements at the WWTP is described in Section 1.1. The WWPS is required for this and all the other alternatives because the existing Main Pump Station has a firm capacity of 480 MGD. The new pump station will discharge through a new 72-inch PCCP force main into a new discharge chamber at the Main Pump Station. This discharge chamber will be hydraulically connected to the existing discharge chamber to allow all 600 MGD from both pump stations to be routed to the headworks. The configurations and development of the base alternative were provided by the Plant Program Manager. In addition, the configurations of the required plant upgrades to achieve 480 MGD and 540 MGD of plant wet weather capacities that would coincide with the combined 600 MGD total wet weather capacities for the 6 alternatives described below were also developed the Plant Program Manager.

3.2.2 Alternative 1A – 60 MGD EHRT at Western Penitentiary Site

Alternative 1A consists of expansion at the WWTP to provide treatment of wet weather flows up to 540 MGD, a new 120 MGD WWPS, and a 60 MGD EHRT facility. The proposed wet weather improvements at the WWTP are altered from the Baseline Alternative primarily by reducing the East (New) Headworks from 7 screens and grit tanks to 6 (along with associated support systems), by reducing the new Primary Tanks from 2 to 1 (along with associated primary sludge pumping systems), and by changing the wet weather bypass control from a fixed weir concept to a modulating sluice gate concept. No change in the disinfection chemical storage and handling facilities are necessary.

The new 60 MGD EHRT facility will be located at the Western Penitentiary Site. The proposed facility is located with a 30-foot buffer from the existing buildings to remain and the existing 144-inch CSO line that traverses the site to provide adequate construction clearances and access. As noted in Section 2.5, and according to the FEMA flood maps, the majority of the Western Penitentiary Site is in the 100-year floodplain. Conforming to PADEP's Domestic Wastewater Facilities Manual, the elevation of the first floor of the Control Building will be set above the 100-year floodplain elevation at this location of EL 724 feet to protect the screening and chemical equipment.

Included in Alternative 1A is the demolition of several large masonry buildings, between 1 and 3 stories in height. The EHRT is located on the property to the northern end away from 2 approximately 6-story masonry buildings to avoid higher property acquisition and demolition costs. Included in the demolition costs is the permanent removal of two 20-foot long sections of the existing guard wall (approximately 25 feet tall) that surrounds the site, at the northern and southern access points. These access points will serve as construction access, and following construction, these will become the permanent gated security access points to the EHRT facility. A paved access road will run adjacent to the original Western Penitentiary, from Westhall to Doerr, and will also provide access to the outfall sewer and structures.

Demolition of the existing structures will be difficult because of the age and inaccessibility of the Western Penitentiary Site, and the risk of unforeseen conditions is considerably higher than the other sites evaluated. A difficulty factor of 30% was added to the demolition cost for Alternative 1A.

The 60 MGD EHRT has a generally square layout, with the proposed control building located at the northern end of the property, running east to west. **Figure 3-8** shows the facility layout of the 60 MGD EHRT on the Western Penitentiary Site. The proposed layout configuration provides the least amount of interferences between the proposed and existing facilities, including sewers, influent force main, and outfall.

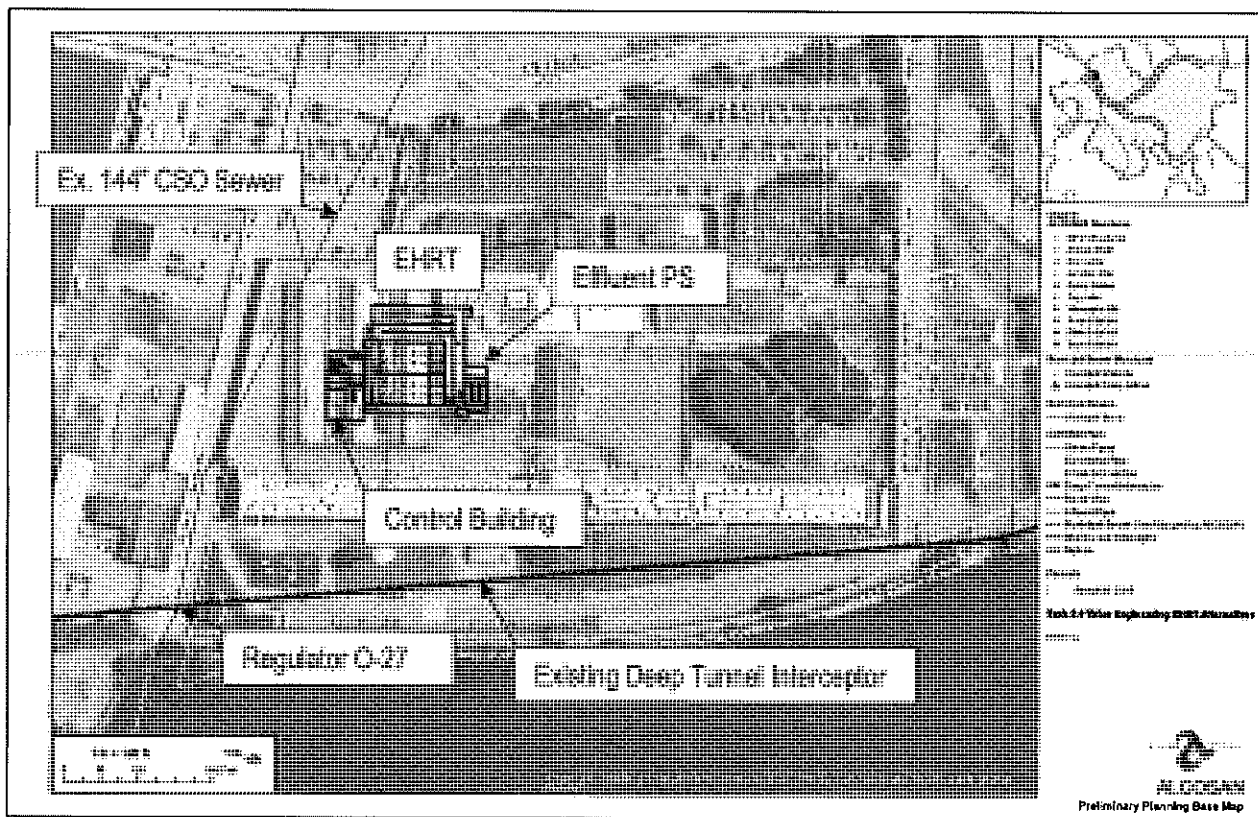


Figure 3-8: Alternative 1A – 60 MGD EHRT Western Penitentiary Site Facility Layout

A proposed 54-inch PCCP force main will convey wet weather flow from the proposed WWPS at the existing Woods Run WWTP, across Tracey Street, through a City of Pittsburgh parcel, through private property identified as the Valspar Site, then onto Westhall Street, and finally to the EHRT on the Western Penitentiary Site. The influent force main is proposed to be on the south side of Westhall Street to avoid the 144-inch combined sewer located in the center of Westhall Street. In lieu of obtaining easements from the City of Pittsburgh and Valspar site owners, it may be possible to locate the influent force main within the easement of the existing deep tunnel interceptor. Discharge from the facility will be conveyed through a 72-inch PCCP outfall sewer, south along the proposed access road adjacent to the original Western Penitentiary and then west to the Ohio River along Doerr Street. A new outfall is

proposed into the Ohio River. This route avoids interferences with the proposed influent force main and the existing 144-inch CSO line located in Westhall Street.

Shoring/sheeting will be required for construction of the outfall sewer because of the 25-foot depth of the sewer and proximity to the original Western Penitentiary, remaining buildings, location in the roadway, and elevated water table. A 12-inch PVC dewatering force main is proposed to convey the flushing water from the facility to a proposed 24-inch dewatering gravity sewer between the existing 144-inch combined sewer and the proposed influent force main. The dewatering sewer will convey the flushing water to the WWTP by connection to the interceptor compartment of the existing Regulator O-27 on Westhall Street. **Figure 3-9** displays the piping layout for Alternative 1A.

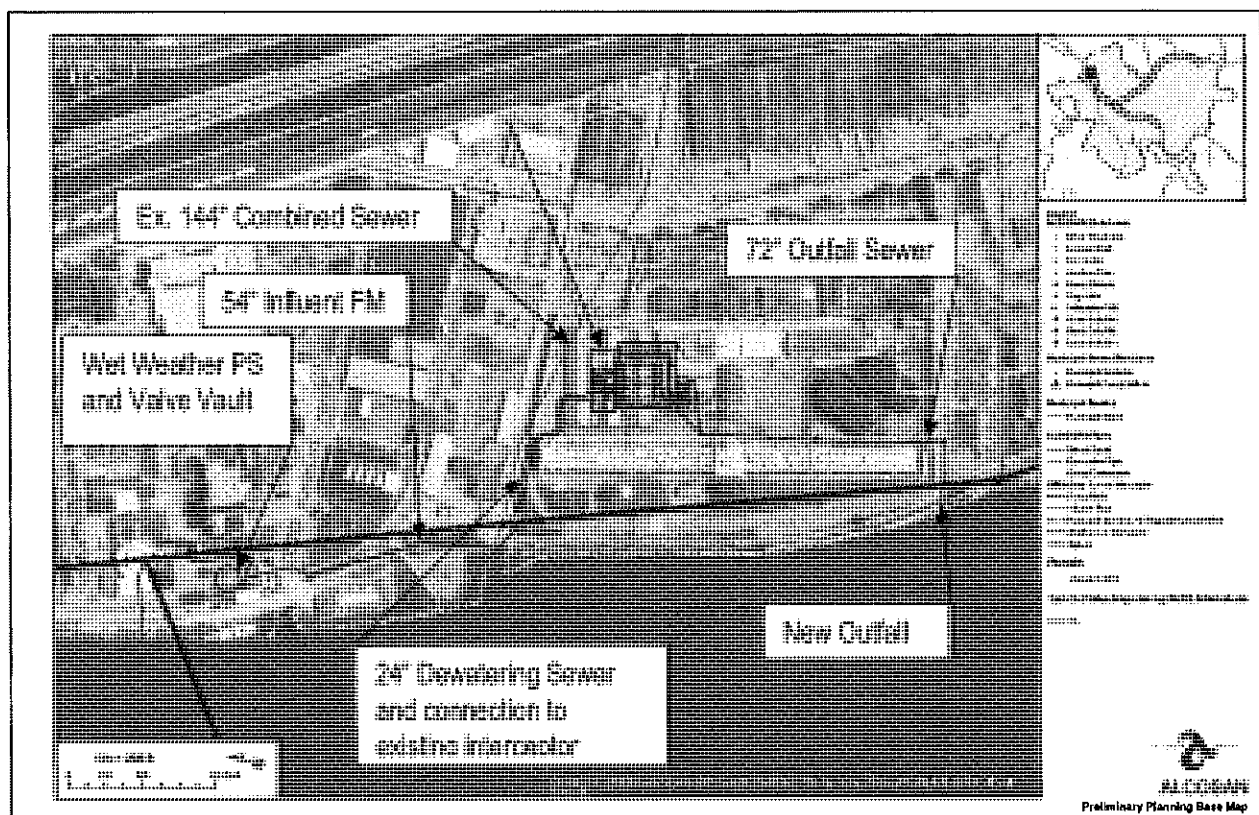


Figure 3-9: Alternative 1A – 60 MGD EHRT Western Penitentiary Site Piping Layout

3.2.3 Alternative 1B – 60 MGD EHRT at Trucking Site

Alternative 1B consists of expansion at the WWTP to provide treatment of wet weather flows up to 540 MGD, a new 120 MGD WWPS, and a 60 MGD EHRT facility. The proposed wet weather improvements at the WWTP are altered from the Baseline Alternative primarily by reducing the East (New) Headworks from 7 screens and grit tanks to 6 (along with associated support systems), by reducing the new Primary Tanks from 2 to 1 (along with associated primary sludge pumping systems), and by changing the wet weather bypass control from a fixed weir concept to a modulating sluice gate concept. No change in the disinfection chemical storage and handling facilities are necessary.

The new 60 MGD EHRT facility will be located at the Trucking Site with a 30-foot buffer from Eckert Street, Beaver Avenue, and the adjacent railroad to provide adequate construction clearances and access. As noted in Section 2.5, and according to the FEMA flood maps, a small portion of the Trucking Site along Eckert Street was identified as being in the 100-year floodplain. The Control Building was located outside of the boundary of the 100-year floodplain.

Alternative 1B includes the demolition of the entire building structure located on the site. The proposed EHRT facility will be located on the northern end of the property, closer to the WWTP and proposed WWPS. Two paved entrances with access to Beaver Avenue will be provided during construction, and following construction, these will become the permanent gated security access points to the EHRT facility.

The 60 MGD EHRT control building will be located on the northern end of the property, running east to west. **Figure 3-10** shows the facility layout of the 60 MGD EHRT on the Trucking Site. The proposed layout configuration provides the least amount of interferences between the proposed and existing facilities, including sewers, influent force main, and outfall.

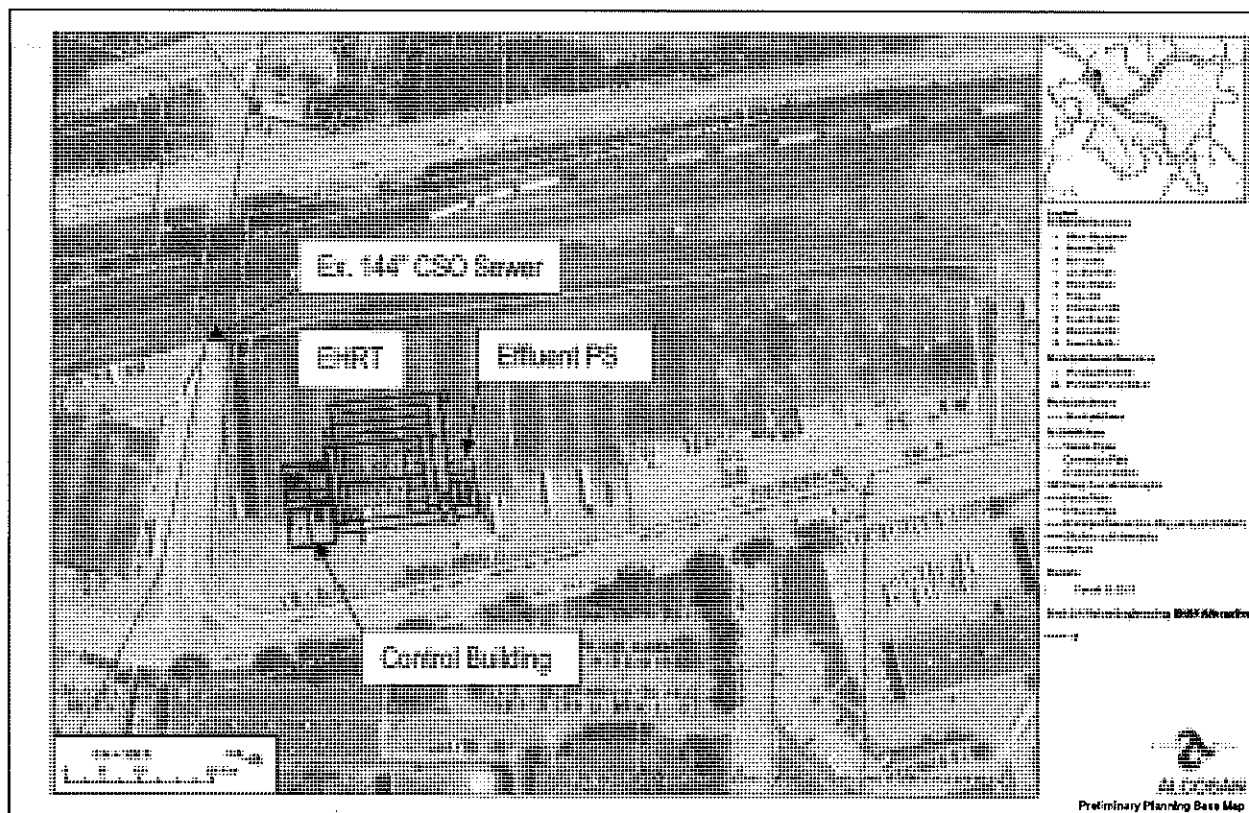


Figure 3-10: Alternative 1B – 60 MGD EHRT Trucking Site Facility Layout

The proposed 54-inch PCCP force main will convey wet weather flow from the proposed WWPS at the existing Woods Run WWTP, across Tracey Street, through a City of Pittsburgh parcel, through private property identified above as the Valspar Site, then east along Westhall Street, south along Beaver

Avenue, and finally to the EHRT on the Trucking Site. The influent force main is proposed to be on the south side of Westhall Street to avoid the 144-inch combined sewer located in the center of Westhall Street. Discharge from the facility will be conveyed through a 72-inch PCCP outfall sewer, south along the proposed access road and parallel to Beaver Avenue, then west to the Ohio River along Doerr Street. A new outfall is proposed into the Ohio River. This route avoids interferences with the proposed influent force main and the existing 144-inch CSO line located in Westhall Street.

Because of the 25-foot depth of the outfall sewer, location in the roadway, and elevated water table, shoring/sheeting will be required for construction of the sewer. A 12-inch PVC dewatering force main is proposed to convey the flushing water from the facility to a proposed 24-inch dewatering gravity sewer between the existing 144-inch combined sewer and the proposed influent force main. The dewatering sewer will convey the flushing water to the WWTP by connection to the interceptor compartment of the existing Regulator O-27 on Westhall Street. **Figure 3-11** displays the piping layout for Alternative 1B.

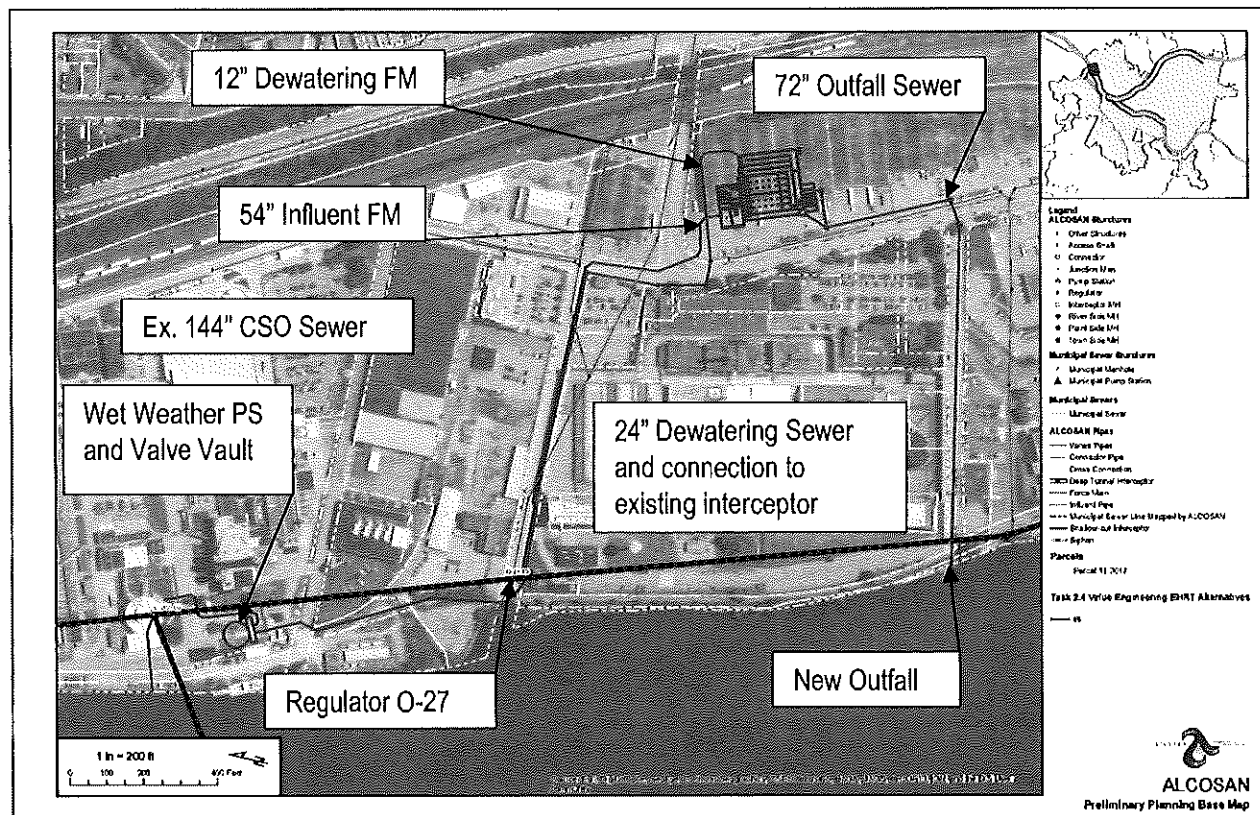


Figure 3-11: Alternative 1B – 60 MGD EHRT Trucking Site Piping Layout

3.2.4 Alternative 1C – 60 MGD EHRT at Valspar Site

Alternative 1C consists of expansion at the WWTP to provide treatment of wet weather flows up to 540 MGD, a new 120 MGD WWPS, and a 60 MGD EHRT facility. The proposed wet weather improvements at the WWTP are altered from the Baseline Alternative primarily by reducing the East (New) Headworks from 7 screens and grit tanks to 6 (along with associated support systems), by reducing the new Primary Tanks from 2 to 1 (along with associated primary sludge pumping systems), and by changing the wet

weather bypass control from a fixed weir concept to a modulating sluice gate concept. No change in the disinfection chemical storage and handling facilities are necessary.

The new 60 MGD EHRT facility will be located at the Valspar Site with a 25-foot buffer from the existing buildings to remain to the north to provide adequate construction clearances and access. As noted in Section 2.5. and according to the FEMA flood maps, some portions of the Valspar Site along Westhall Street were identified as being in the 100-year floodplain. Conforming to PADEP's Domestic Wastewater Facilities Manual, the elevation of the first floor of the Control Building will be set above the 100-year floodplain elevation to protect the screening and chemical equipment.

Alternative 1C includes the demolition of the small masonry building and one of the metal buildings on the site, with the remaining buildings undisturbed by construction activities. The proposed EHRT facility will be located on the eastern end of the property, closer to the ALCOSAN Training Facility to avoid demolition of the 3-story masonry building on the site. Two paved entrances to Westhall Street Avenue will provide access points during construction, and following construction, these will become the permanent gated security access points to the EHRT facility.

The 60 MGD EHRT control building will be located toward the center of the disturbed area of the required property. **Figure 3-12** shows the facility layout of the 60 MGD EHRT on the Valspar Site. The proposed layout configuration provides the least amount of interferences between the proposed and existing facilities, including sewers, influent force main, and outfall.

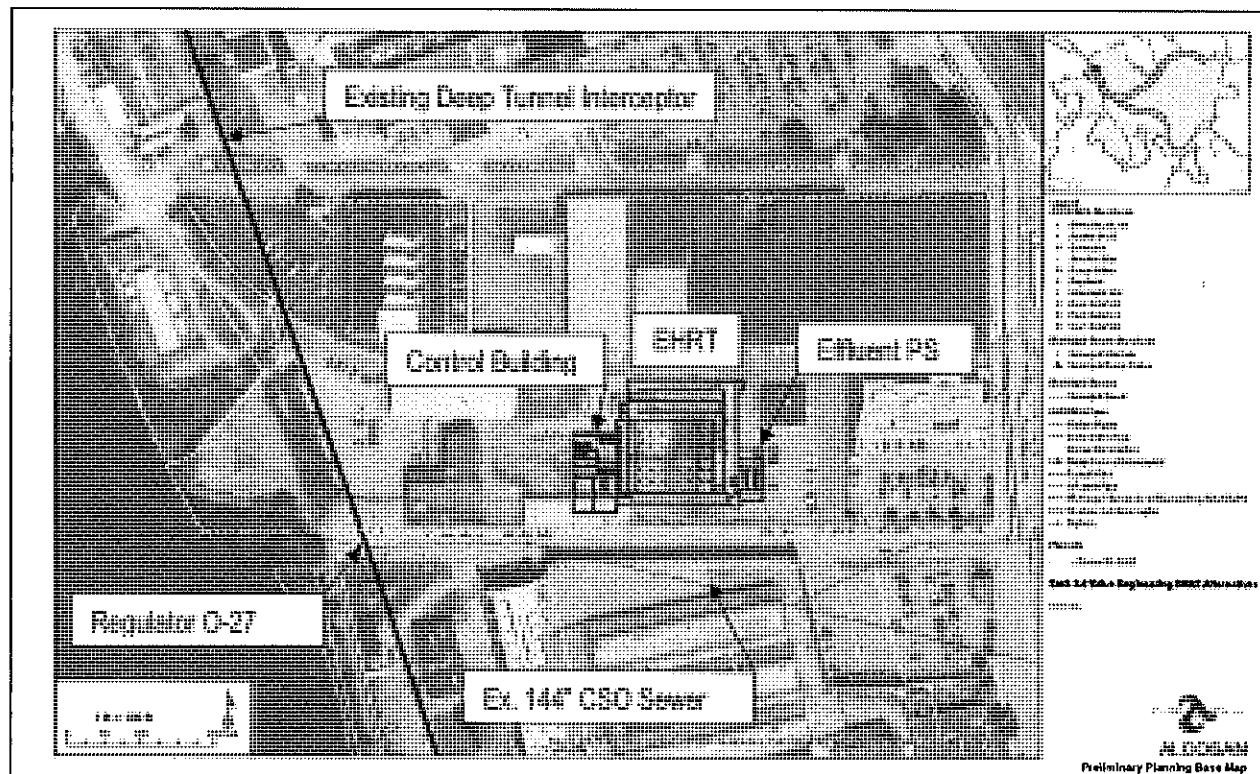


Figure 3-12: Alternative 1C – 60 MGD EHRT Valspar Site Facility Layout

The proposed 54-inch PCCP force main will convey wet weather flow from the proposed WWPS at the Woods Run WWTP, across Tracey Street, through a City of Pittsburgh parcel, through private property identified above as the Valspar Site, then east along Westhall Street to the EHRT on the Valspar Site. The influent force main is proposed to be on the south side of Westhall Street to avoid the 144-inch combined sewer located in the center of Westhall Street. Discharge from the facility is conveyed through a 72-inch PCCP outfall sewer, directly west to the Ohio River along Westhall Street and parallel to the north of the existing 144-inch combined sewer. A new outfall is proposed into the Ohio River. This route avoids crossing the existing 144-inch CSO line located in Westhall Street.

Shoring/sheeting will be required for construction of the outfall sewer because of the 25 feet plus depth of the sewer, proximity to the existing 144-inch sewer and remaining existing structures, location in the roadway, and elevated water table. A 12-inch PVC dewatering force main is proposed to convey the flushing water from the facility to a proposed 24-inch dewatering gravity sewer between the existing 144-inch combined sewer and the proposed influent force main. The dewatering sewer will convey the flushing water to the WWTP by connection to the interceptor compartment of the existing Regulator O-27 on Westhall Street. Figure 3-13 displays the piping layout of Alternative 1C.

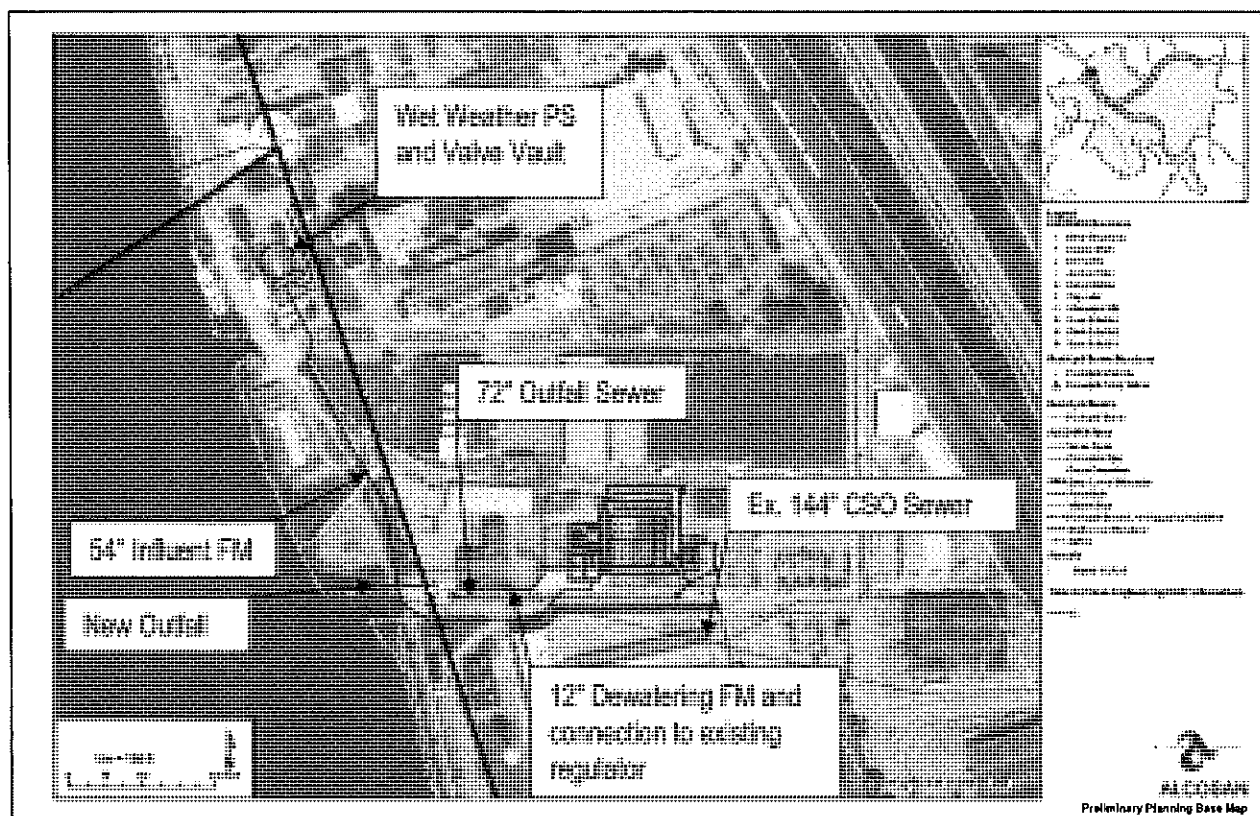


Figure 3-13: Alternative 1C – 60 MGD EHRT Valspar Site Piping Layout

3.2.5 Alternative 2A – 120 MGD EHRT at Western Penitentiary Site

Alternative 2A consists of expansion at the WWTP to provide treatment of wet weather flows up to 480 MGD, a new 120 MGD WWPS, and a 120 MGD EHRT facility. The wet weather improvements at the

WWTP are altered from the Baseline Alternative primarily by reducing the East (New) Headworks from 7 screens and grit tanks to 5 (along with associated support systems), by not constructing any new Primary Tanks or associated primary sludge pumping systems, and by changing the wet weather bypass control from a fixed weir concept to a modulating sluice gate concept. No change in the disinfection chemical storage and handling facilities are necessary.

The new 120 MGD EHRT facility will be located at the Western Penitentiary Site with a 30-foot buffer from the existing buildings to remain and the existing 144-inch CSO line that traverses the site to provide adequate construction clearances and access. As noted in Section 2.5. and according to the FEMA flood maps, the majority of the Western Penitentiary Site is in the 100-year floodplain. Conforming to PADEP's Domestic Wastewater Facilities Manual, the elevation of the first floor of the Control Building will be set above the 100-year floodplain elevation of EL 724 at this location to protect the screening and chemical equipment.

Included in Alternative 2A is the demolition of several large masonry buildings, between 1 and 3 stories in height. The EHRT is located on the property to the northern end away from 2 approximately 6-story masonry buildings to avoid higher property acquisition and demolition costs. Included in the demolition costs is the permanent removal of two 20-foot long sections of the existing guard wall (approximately 25 feet tall) that surrounds the site, at the northern and southern access points. These access points will serve as construction access, and following construction, these will become the permanent gated security access points to the EHRT facility. A paved access road will run adjacent to the original Western Penitentiary, from Westhall to Doerr, and will also provide access to the outfall sewer and structures.

Demolition of the existing structures will be difficult because of the age and inaccessibility of the Western Penitentiary Site, and the risk of unforeseen conditions is considerably higher than the other sites evaluated. A difficulty factor of 30% was added to the demolition cost for Alternative 2A.

The 120 MGD EHRT has a rectangular layout, with the proposed control building located at the northern end of the property, and the tankage laying north to south. Influent flow will enter the EHRT on the north and treated discharge will exit from the southern end of the facility. **Figure 3-14** shows the facility layout of the 120 MGD EHRT on the Western Penitentiary Site. The proposed layout configuration provides the least amount of interferences between the proposed and existing facilities, including sewers, influent force main, and outfall.

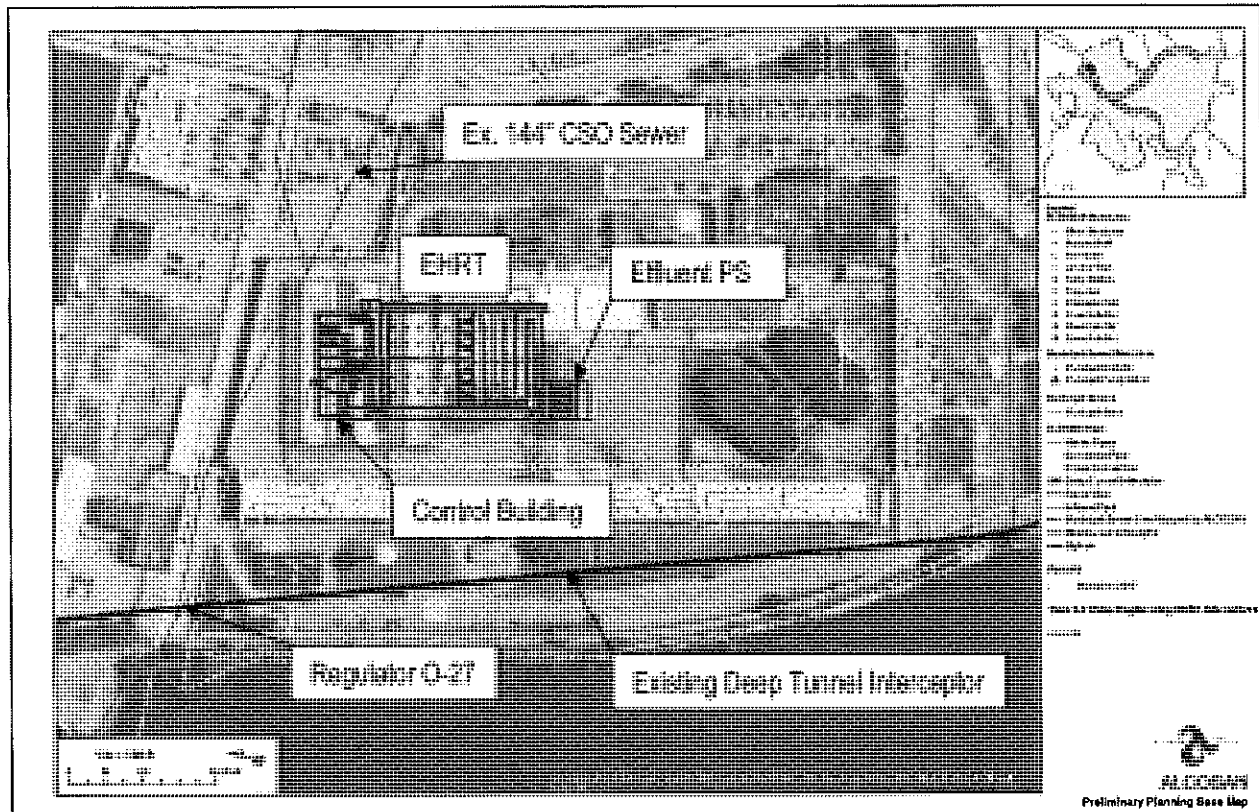


Figure 3-14: Alternative 2A – 120 MGD EHRT Western Penitentiary Site Facility Layout

A proposed 66-inch PCCP force main will convey wet weather flow from the proposed WWPS at the existing Woods Run WWTP, across Tracey Street, through a City of Pittsburgh parcel, through private property identified as the Valspar Site, then onto Westhall Street, and finally to the EHRT on the Western Penitentiary Site. The influent force main is proposed to be on the south side of Westhall Street to avoid the 144-inch combined sewer located in the center of Westhall Street. In lieu of obtaining easements from the City of Pittsburgh and Valspar site owners, it may be possible to locate the influent force main within the easement of the existing deep tunnel interceptor. Discharge from the facility will be conveyed through a 96-inch PCCP outfall sewer, south along the proposed access road adjacent to the original Western Penitentiary and then west to the Ohio River along Doerr Street. A new outfall is proposed into the Ohio River. This route avoids interferences with the proposed influent force main and the existing 144-inch CSO line located in Westhall Street.

Shoring/sheeting will be required for construction of the outfall sewer because of the 25-foot depth of the sewer and proximity to the original Western Penitentiary, remaining buildings, location in the roadway, and elevated water table. A 12-inch PVC dewatering force main is proposed to convey the flushing water from the facility to a proposed 24-inch dewatering gravity sewer between the existing 144-inch combined sewer and the proposed influent force main. The dewatering sewer will convey the flushing water to the WWTP by connection to the interceptor compartment of the existing Regulator O-27 on Westhall Street. **Figure 3-15** displays the piping layout of Alternative 2A.

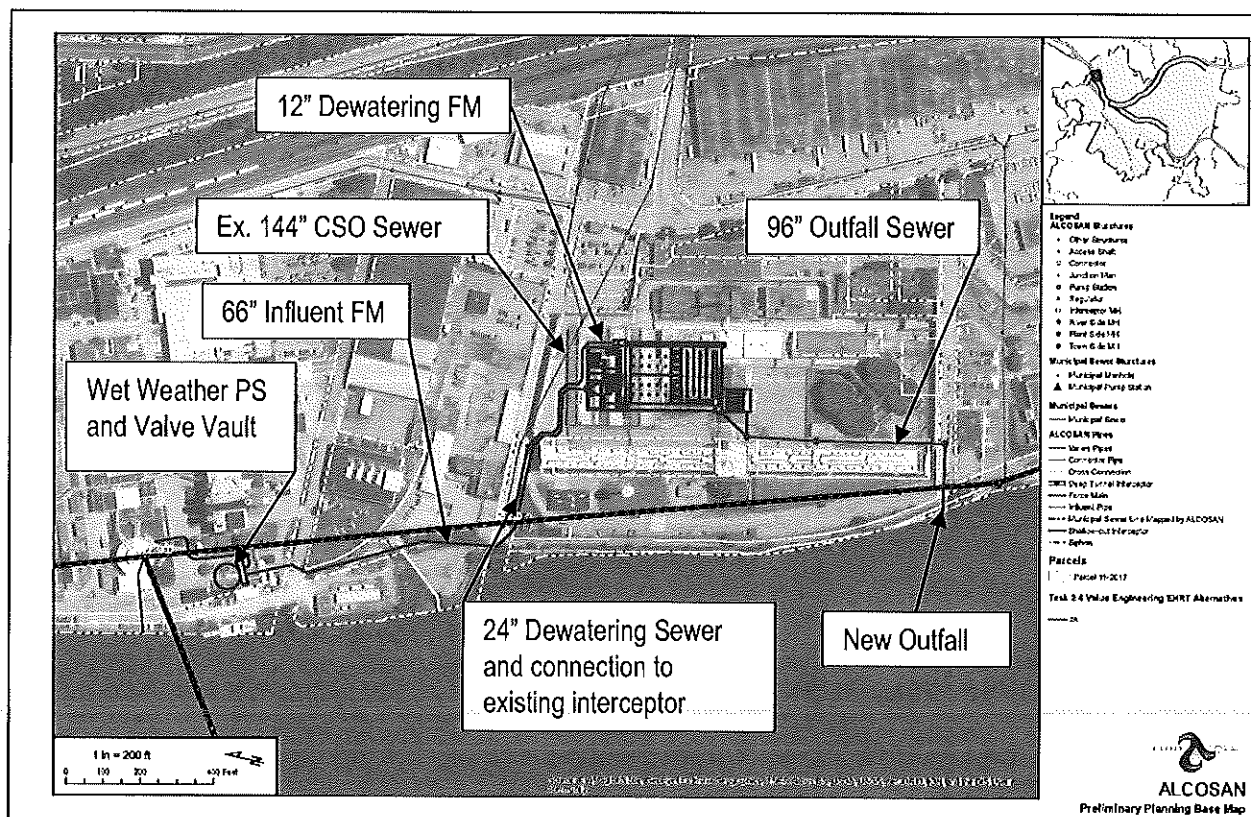


Figure 3-15: Alternative 2A – 120 MGD EHRT Western Penitentiary Site Piping Layout

3.2.6 Alternative 2B – 120 MGD EHRT at Trucking Site

Alternative 2A consists of expansion at the WWTP to provide treatment of wet weather flows up to 480 MGD, a new 120 MGD WWPS, and a 120 MGD EHRT facility. The wet weather improvements at the WWTP are altered from the Baseline Alternative primarily by reducing the East (New) Headworks from 7 screens and grit tanks to 5 (along with associated support systems), by not constructing any new Primary Tanks or associated primary sludge pumping systems, and by changing the wet weather bypass control from a fixed weir concept to a modulating sluice gate concept. No change in the disinfection chemical storage and handling facilities are necessary.

The new 120 MGD EHRT facility will be located at the Trucking Site. The proposed facility is situated with a 30-foot buffer from Eckert Street, Beaver Avenue and the adjacent railroad to provide adequate construction clearances and access. As noted in Section 2.5, and according to the FEMA flood maps, a small portion of the Trucking Site along Eckert Street was identified as being in the 100-year floodplain. The Control Building was located outside of the boundary of the 100-year floodplain.

Alternative 2B includes the demolition of the entire building structure located on the site. The proposed EHRT facility will be located on the northern end of the property, closer to the WWTP and proposed WWPS. Two paved entrances with access to Beaver Avenue will be provided during construction, and

following construction, these will become the permanent gated security access points to the EHRT facility.

The 120 MGD EHRT control building will be located on the northern end of the property with the tankage running to the south. The influent flow enters the facility on the north and treated flow discharges from the south end of the facility. **Figure 3-16** displays the facility layout of the 120 MGD EHRT on the Trucking Site. The proposed layout configuration provides the least amount of interferences between the proposed and existing facilities, including sewers, influent force main, and outfall.

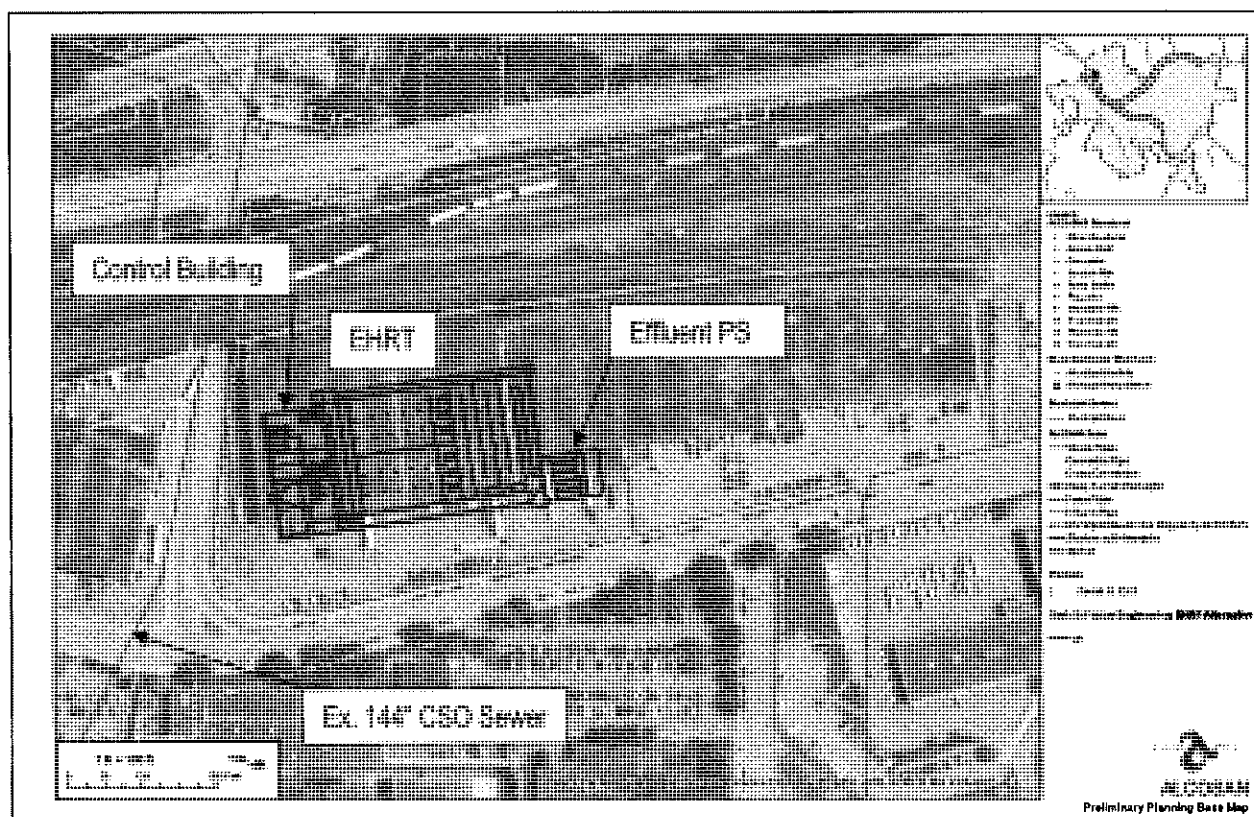


Figure 3-16: Alternative 2B – 120 MGD EHRT Trucking Site Facility Layout

The proposed 66-inch PCCP force main will convey wet weather flow from the proposed WWPS at the existing Woods Run WWTP, across Tracey Street, through a City of Pittsburgh parcel, through private property identified as the Valspar Site, then east along Westhall Street, south along Beaver Avenue, and finally to the EHRT on the Trucking Site. The influent force main is proposed to be on the south side of Westhall Street to avoid the 144-inch combined sewer located in the center of Westhall Street. Discharge from the facility will be conveyed through a 96-inch PCCP outfall sewer, south along the proposed access road and parallel to Beaver Avenue, then west to the Ohio River along Doerr Street. A new outfall is proposed into the Ohio River. This routing avoids interferences with the proposed influent force main and the existing 144-inch CSO line located in Westhall Street.

Shoring/sheeting will be required for construction of the outfall sewer because of the 25-foot depth of the sewer, location in the roadway, and elevated water table. A 12-inch PVC dewatering force main is proposed to convey the flushing water from the facility to a proposed 24-inch dewatering gravity sewer between the existing 144-inch combined sewer and the proposed influent force main. The dewatering sewer will convey the flushing water to the WWTP by connection to the interceptor compartment of the existing Regulator O-27 on Westhall Street. Figure 3-17 displays the piping layout of Alternative 2B.

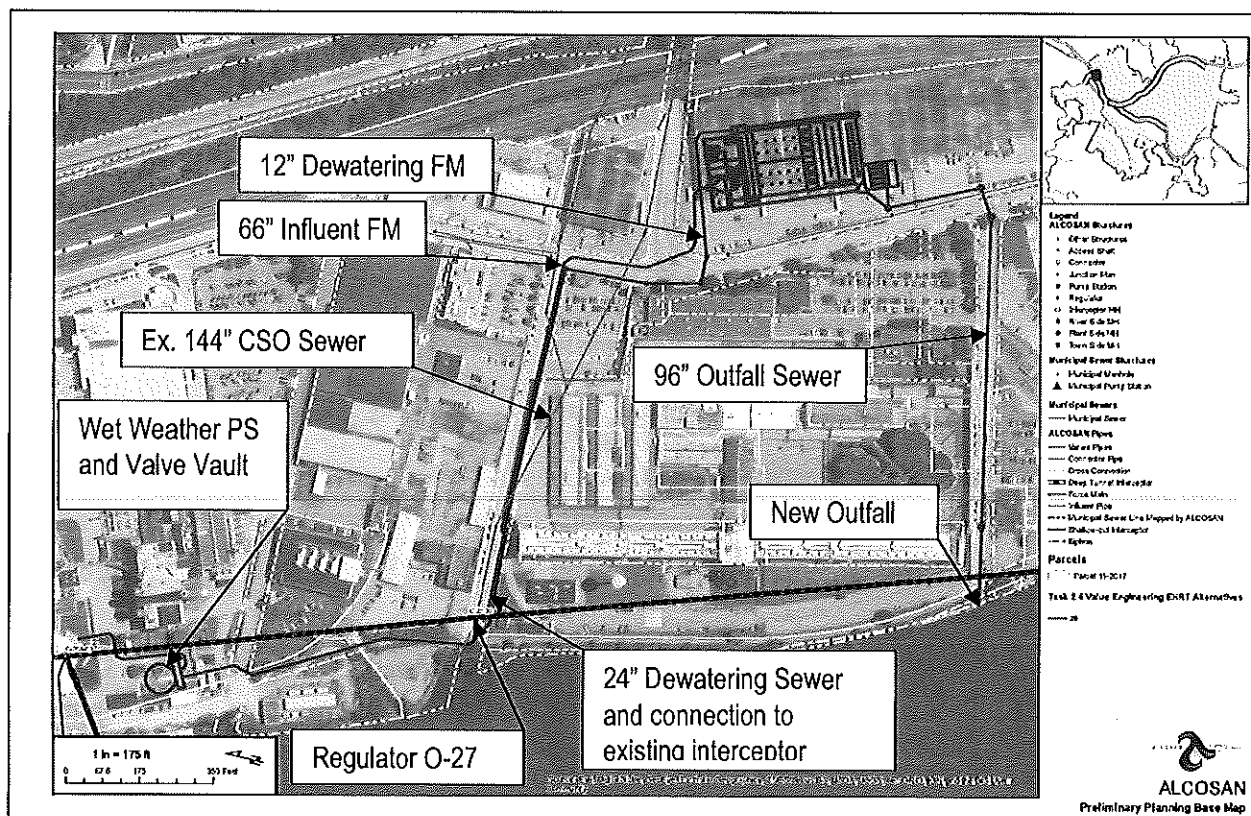


Figure 3-17: Alternative 2B – 120 MGD EHRT Trucking Site Piping Layout

3.2.7 Alternative 2C – 120 MGD EHRT at Valspar Site

Alternative 2C consists of expansion at the WWTP to provide treatment of wet weather flows up to 480 MGD, a new 120 MGD WWPS, and a 120 MGD EHRT facility. The proposed wet weather improvements at the WWTP are altered from the Baseline Alternative primarily by reducing the East (New) Headworks from 7 screens and grit tanks to 5 (along with associated support systems), by not constructing any new Primary Tanks or associated primary sludge pumping systems, and by changing the wet weather bypass control from a fixed weir concept to a modulating sluice gate concept. No change in the disinfection chemical storage and handling facilities are necessary.

The new 120 MGD EHRT facility will be located at the Valspar Site with a 25-foot buffer from the existing buildings to remain to the north to provide adequate construction clearances and access. As noted in Section 2.5, and according to the FEMA flood maps, some portions of the Valspar Site along Westhall Street were identified as being in the 100-year floodplain. Conforming to PADEP's Domestic Wastewater

Facilities Manual, the elevation of the first floor of the Control Building will be set above the 100-year floodplain elevation to protect the screening and chemical equipment.

Alternative 2C includes the demolition of a 3-story masonry building, 2 metal buildings and a small masonry building, with the remaining buildings undisturbed by construction activities. The proposed EHRT facility will be located to the eastern end of the property, closer to the ALCOSAN Training Facility with the control building to the center of the proposed site for easier access to the dumpster screenings. Two paved entrances to Westhall Street Avenue will provide access points during construction, and following construction, these will become the permanent gated security access points to the EHRT facility.

The 120 MGD EHRT control building shall be located toward the center of the disturbed area of the required property, with the tankage running west to east. Influent to the facility will be on the west with the effluent to the east. **Figure 3-18** displays the facility layout of the 120 MGD EHRT on the Valspar Site. The proposed layout configuration provides the least amount of interferences between the proposed and existing facilities, including sewers, influent force main, and outfall.

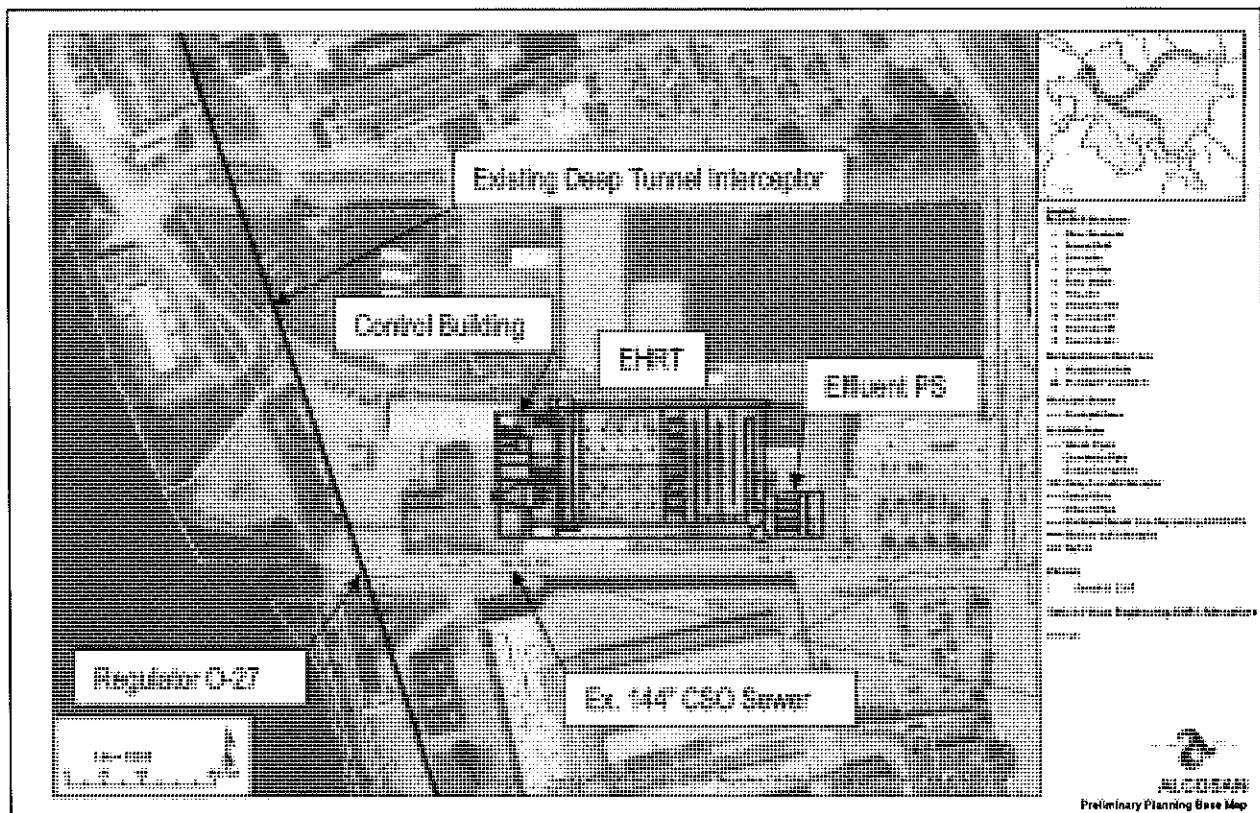


Figure 3-18: Alternative 2C – 120 MGD EHRT Valspar Site Facility Layout

The proposed 66-inch PCCP force main will convey wet weather flow from the proposed WWPS at the existing Woods Run WWTP, across Tracey Street, through a City of Pittsburgh parcel, through private property identified as the Valspar Site, then east along Westhall Street to the EHRT on the Valspar Site.

The influent force main is proposed on the south side of Westhall Street to avoid the 144-inch combined sewer located in the center of Westhall Street. Discharge from the facility is conveyed through a 96-inch PCCP outfall sewer, directly west to the Ohio River along Westhall Street and parallel to the north of the existing 144-inch combined sewer. A new outfall is proposed into the Ohio River. This routing avoids crossing the existing 144-inch CSO line located in Westhall Street.

Shoring/sheeting will be required for construction of the outfall sewer because of the 25-foot plus depth of the sewer, proximity to the existing 144-inch sewer and remaining existing structures, location in the roadway and elevated water table. A 12-inch PVC dewatering force main is proposed to convey the flushing water from the facility to a proposed 24-inch dewatering gravity sewer between the existing 144-inch combined sewer and the proposed influent force main. The dewatering sewer will convey the flushing water to the WWTP by connection to the interceptor compartment of the existing Regulator O-27 on Westhall Street. Figure 3-19 displays the piping layout of Alternative 2C.

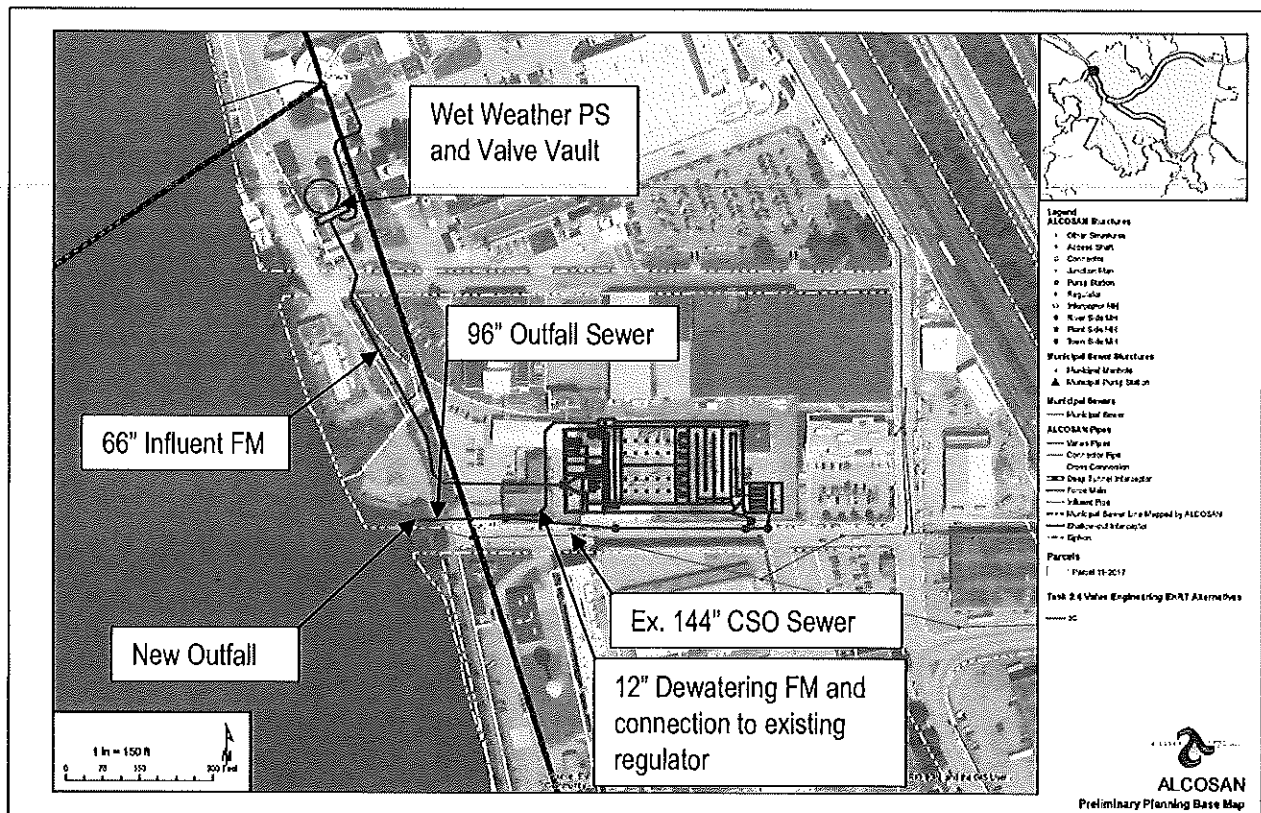


Figure 3-19: Alternative 2C – 120 MGD EHRT Valspar Site Piping Layout

4.0 EVALUATION PROCESS

An evaluation process was developed to evaluate both economic and non-economic criteria of the various treatment alternatives. This section outlines the details of this process.

4.1 COSTING METHODOLOGIES

Costing methodology used in this alternative evaluation followed the guidelines and methodology described in the WWTP PM's *Wet Weather Plant Expansion Capital Project S430: Cost Estimate Guidelines – Revision A* (April 21, 2017) to be consistent with the costs developed by the Plant Program Manager. Two conceptual estimating processes were used in the development of the construction cost estimates:

1. Physical Dimensions Method was used for estimating quantities of concrete, excavation, shoring, backfill, pipe, restoration, demolition, building, products and equipment.
2. Ratio/Factor Method used for plumbing/HVAC and electrical costs as a percentage of the total cost.

CAD and Excel software were used for takeoff and calculation of quantities. Additionally, excel spreadsheets were used to apply unit cost to individual items, and organize and present the results. Quantities in the spreadsheets are expressed in items under the applicable CSI specification division with appropriate units of measure. Takeoffs involved examination of the individual items in the alternative layouts to account for all products, equipment, materials and the associated work. Where applicable, the unit prices for individual items (such as concrete, excavation, shoring, restoration, backfill, pipe and building products) provided by the WWTP PM were used. For equipment costs, when vendor costs were not available, recent cost estimates, estimating experience or escalated costs from other projects using the appropriate ENR index values were used to be consistent in relative cost comparisons. The probable construction costs provided herein are in 2017 dollars. **Appendix A** contains a summary of construction costs for the wet weather improvements at the WWTP that were provided by the WWTP PM. **Appendix B** contains detailed construction cost breakdowns of each of the Alternatives.

4.1.1 Construction Costs

The probable construction cost estimates provided in this alternatives analysis are considered Class 4 estimates as defined by the AACEI, having a project definition of 1% to 15% and accuracy range of -30% to +50% and is consistent with the costing developed by the WWTP PM. Additionally, to be consistent with the WWTP Plant Expansion cost estimates, **Table 4-1** provides the following cost markups that have been applied to develop the total construction costs of the alternatives.

4.1.1.1 Mobilization/Demobilization

Mobilization and demobilization costs cover contractor's pre- and postconstruction expenses and the cost of preparatory work and operations (such as moving equipment on and off site and staging). Examples of mobilization items include Contractor's offices, shops, plants, storage areas, obtaining required permits, and other incidental items required for the start of the work.

4.1.1.2 Bonds and Insurance

A contractor considering a bid must look at insurance and bonding requirements, payment provisions, and potential project cash flow scenarios to determine if they have the necessary financial capability to perform the work and successfully complete the project. There are several types of construction bonds, including bid bonds, performance and payment bonds, labor and material bonds, construction lien bonds, and warranty bonds, that could be applicable to the Work depending on the Contract Documents. For this estimate, only performance and payment bonds are included. Similarly, several types of project specific insurances, including builders risk, all risk, and general liability, can be required by the Contract Documents; however, for this estimate, all the insurance types are amalgamated into a single percentage.

4.1.1.3 Overhead and Profit

Overhead or indirect costs are defined as those costs needed for the management of the work not allocated for specific project items such as home office operations, costs for distributed fleets vehicles, business taxes, executive salaries etc. that are not directly accountable or tangible to the project but are necessary for the business to remain solvent. The overhead and profit percentages vary significantly from small to large contracts and based on market conditions. Small contracts can see overhead and profit as high as 20 to 25% of the total construction cost. For large contracts, such as the alternatives considered in this evaluation, this markup is typically 15%.

4.1.1.4 Taxes

A project is sales tax exempt for process, and anything that is constructed not related to process is not sales tax exempt. The alternatives considered in this evaluation are all process related; therefore, no allowance for taxes is included.

4.1.1.5 Estimating Contingency

An estimating contingency is often applied to the construction cost estimate to account for items that are not known or are required but not yet developed far enough along to be quantifiable to the estimator. This contingency is applied to the estimate based on the level of project definition. For a Class 4 estimate, an estimating contingency of 40% is typical.

4.1.1.6 Escalation

Escalation is the method used to allow for price changes (increases/decreases) during the life of the contract. It is directly linked to, and estimated per the project schedule and is usually calculated to the mid-point of construction. Escalation is not a contingency. It excludes fluctuations in currency but includes inflation. Because the construction contracts have not been defined or scheduled through time yet, for this estimate, an escalation markup will not be applied to any of the alternatives.

Table 4-1: Construction Cost Markups

Mark Up	Percentage
Mobilization/Demobilization	5%
Bonds	2%
Insurance	1%
Overhead and Profit	15%
Taxes	Tax Exemption
Estimating Contingency	40%
Escalation	Not Included

4.1.2 Property Acquisition Costs

Property acquisition costs were assumed to require acquisition of property via purchase for construction and long-term access for maintenance and operations. Property acquisition costs were determined using the 2017 Allegheny County Real Estate Assessment website data for Land and Building Values in combination with engineering judgment on the required acreage, building square footage and existing building condition. **Table 4-2** summarizes the required acreage and anticipated property acquisition costs for each site.

Table 4-2: Property Acquisition Acreage and Costs

Site	Acquisition Area	Acquisition Cost
Western Penitentiary Site	5.7 acres	\$24.0 M
Trucking Site	7.87 acres	\$8.8 M
Valspar Site	4.9 acres	\$2.2 M

4.1.3 Program Costs

To be consistent with the WWTP PM estimates, non-construction program cost elements were applied to the total construction costs to develop the program costs for each alternative. **Table 4-3** displays the program cost factors, as provided by the WWTP PM. Appendix B contains a summary of the total construction and program costs for all the Alternatives.

Table 4-3: Program Cost Elements	
Element	% of Construction Cost
Engineering	10%
Construction Management	15%
ALCOSAN Costs	5%
Legal and Administrative	10%

4.1.4 Operations and Maintenance Costs

As part of the overall alternatives evaluation for the EHRT facility and WWPS, annual costs of ownership of the facilities comprising each alternative were developed. These annual costs include the operations, maintenance, and other non-program costs that should be considered in determining the actual cost of each alternative, beyond the initial program cost.

Annual O&M costs were determined for both the 60 MGD and 120 MGD EHRT facilities, and both options included costs for the WWPS. A variety of factors were considered in the O&M costs, including:

- Operations labor costs
- Maintenance labor costs
- Power and electrical costs
- Chemical costs
- Maintenance parts
- Equipment re-builds

The labor rates that were utilized in the analyses were based upon the WWTP PM's *Wet Weather Plant Expansion Capital Project S430: Cost Estimate Guidelines – Revision A* (April 21, 2017). The labor rates were multiplied by a factor of 1.7 to account for items such as benefits, etc. Power unit costs and chemical costs were also based on this source. An updated cost for ferric chloride was determined based on discussions with a local provider.

One of the main contributing factors to the O&M costs for the facilities is how often the facilities will be in use. This in turn is dependent on the number of storm events and volume of flow that are anticipated to be conveyed to the facilities for treatment. To estimate the number of events handled by the WWPS and the EHRT facilities, the data summarized by the PMO memo titled *Operating Statistics for Value Engineering O&M Cost Estimates*, dated 10/27/17, was utilized. This memo provides a table summarizing the flow threshold at the wet well, the number of wet weather events exceeding this threshold, the duration of the events, and the total overflow volume of the events. Since the option of providing either 60 MGD or 120 MGD of off-site treatment capacity is being analyzed for the EHRT facilities, only flows from events exceeding 540 MGD (for the 60 MGD facility) and 480 MGD (for the 120 MGD facility) were considered. This was considered a conservative approach that would limit the extent of required operational costs for the remote satellite facilities that would only see wet weather flows

above the available capacities of the Woods Run WWTP. **Table 4-4** illustrates the data provided in the PMO memo.

Table 4-4: Flow Operating Statistics for EHRT and Plant			
Flow Threshold (MGD) at Wet Well	Number of Events	Duration (Hours)	Volume (MG)
>295	54	1,462	6,381
>480	25	126	337
>540	9	60	122
>600	5	38	2

The two rows of interest are therefore for the flow thresholds >480 MGD (for the 120 MGD facility) and flow thresholds >540 MGD (for the 60 MGD facility).

Maintenance labor hours and operations labor hours were estimated for both the 60 MGD and 120 MGD EHRT facilities, with hours for the WWPS being included in each analysis. Maintenance labor categories include time for a supervisor, electrician, mechanic, instrument technician, general laborer, data analyst, and clerk. Operations labor hours were based on the number and duration of events. These hours were based on similar cost estimates that were done on other facilities of comparable size. These labor summary breakdowns are included in **Appendix C**.

A variety of non-labor O&M costs were considered. Chemical costs were included for the EHRT facility, and are based on the volume of flow (in millions of gallons) projected to be treated at the facility. Chemical costs are provided for ferric chloride, polymer, sodium hypochlorite, and sodium bisulfide, which are typical chemicals that are utilized in the EHRT process. A breakdown of the chemical costs is included in **Appendix C**.

Power/electrical costs are a significant non-labor costs for both the EHRT and WWPS, and projected power costs for both the EHRT facilities and WWPS were calculated. These costs are based upon the power requirements for the variety of equipment that are needed for each facility, which was calculated either by the total kilowatts required for the operation of the equipment or the horsepower of the equipment in use. This value was multiplied by a projected run time for that piece of equipment to determine its total power cost, and all those power costs were then combined to determine an overall power/electrical cost for the facility. A breakdown of the power/electrical costs is included in **Appendix C**.

The final item that was considered in the overall O&M costs was the cost associated with “non-annual maintenance” items for the WWPS. There are operations and maintenance costs associated with the equipment in the pump station that do not occur on an annual basis, such as pump rebuilds and part replacements (impellers, bearings, etc.). The cost for those items was included in the year in which it

was anticipated that the repair would occur. A breakdown of the non-annual maintenance items is included in **Appendix C**.

The annual O&M costs for treating additional wet weather flows at the WWTP were also considered. These costs were also based on the data provided in the PMO memo titled *Operating Statistics for Value Engineering O&M Cost Estimates*, dated 10/27/17. For the purposes of the VE Study, only O&M costs associated with the wet weather bypass operations were estimated (all flows greater than 295 MGD). As a result, costs for secondary treatment and final disinfection and other normal WWTP activities were not included in the analysis. The O&M costs included operations labor, power, chemical usage, sampling and monitoring labor, and post-event cleaning labor, plus the solids handling costs for the additional solids generated. Capacity at the WWTP is assumed to be utilized first prior to initiating EHRT operations. Based on the Wet Weather Operating Statistics furnished, the WWTP handles the majority of bypass volume and bypass events while EHRT facilities treat peaks in excess of the WWTP capacity. These O&M costs were supplied by the WWTP PM and are provided in **Appendix A**.

4.1.5 Life Cycle Costs

Life cycle costs for each alternative were calculated to determine a comparative cost of ownership for each alternative over a defined period of time. The life cycle costs are the sum of the initial costs (that is, the total program capital costs for each alternative) and the net present worth of the annual costs (that is, the annual O&M costs for each alternative). To calculate the net present worth, several assumptions were made, in accordance with the *Cost Estimate Guidelines – Revision A* (April 21, 2017):

- The analysis period for all alternatives is 20 years, regardless of the useful life of any of the assets.
- The inflation rate is 3 percent.
- The cost of money is based on the current municipal bond index rate for 20-year municipal bonds. For this analysis, 2.5 percent is used.
- No salvage values are assumed.

The calculation began with inflating the annual O&M costs over the analysis period. The non-annual maintenance costs were then added to the inflated O&M costs in the appropriate years. Because the annual O&M costs varied from year to year, a net present worth is calculated, which is defined as the value of a future variable stream of cash flows in today's dollars. The formula used to determine the net present worth is:

$$NPW = \sum_{t=0}^N \frac{net\ worth_t}{(1+i)^t}$$

Where the net worth is the net cash flow (for this analysis all cash flows are costs and are assumed positive), t is the time of the net cash flow, i is the cost of money (2.5% for this analysis), and N is the total number of periods (20 years for this analysis).

4.2 EVALUATION CRITERIA METRICS AND SCORING

Although life cycle cost is a primary factor in the alternatives evaluation process, this was not the sole criteria used. An evaluation approach using both economic and non-cost criteria was employed to compare alternatives. The non-cost criteria used for this analysis was consistent with criteria used in the previous WWP efforts. These criteria included Economic, Community, Public Health and Environment, Operations and Maintenance and Implementation and Construction related top level criteria. Criteria attributes were also used within these categories as detailed below. The relative weighting of the main criteria was set equal at 20% for all 5 criteria. Impacts on the surrounding community and on the environment, operational impacts, and constructability were considered. Evaluation criteria were developed to assess the overall impacts of each alternative. The following sections briefly describe each criterion, how the criteria were weighted, and how scoring was assigned to each. In general, criteria attributes were scored on a scale of 1 (worst case) to 5 (best case), and scores of 1, 3, and 5 were defined for each attribute to assist with scoring. Integer scores of 1, 2, 3, 4, and 5 were used to allow for some granularity and flexibility in the scoring, in cases where an alternative does not meet the strict definition of a 1, 3, or 5.

4.2.1 Economic

The economic criterion evaluates the life cycle cost of each alternative, which includes both the initial construction costs and the O&M costs over a 20-year period. The highest life cycle cost alternative was assigned a score of 1.0, and the lowest life cycle cost alternative was assigned a score of 5.0. The remaining alternatives were assigned a score between 1.0 and 5.0 proportional to their life cycle cost relative to the high and low life cycle costs. The economic criterion was weighted as 20% of the total evaluation score.

4.2.2 Community

The community impact criterion was divided into two attributes— (1) Aesthetics, Odors, and Disruptions, and (2) Green Leave-Behinds. The community impact criterion was weighted as 20% of the total evaluation score, and this weight was divided between the two attributes equally.

4.2.2.1 Aesthetics, Odors, and Disruptions

Aesthetics, odors, and disruptions were considered for the long-term impacts of each alternative on the surrounding community. Each alternative will have a useful life spanning decades, and this attribute includes the visual and odor impacts on the community and whether the alternative creates a long-term disruption, for example, permanently closing a street or disturbing a public park. The following scoring guidelines were used:

5. No long-term disruptions or odors anticipated. Alternative improves aesthetics of the site for the surrounding community.
3. Some long-term disruptions or potential for odors. Alternative does not impact aesthetics of surrounding area.
1. Long term disruptions anticipated. Active sustained odor control required. Alternative has negative aesthetic impact to surrounding area.

4.2.2.2 Green Leave-Behinds

The green leave-behinds attribute includes the potential to install green infrastructure that can be a benefit to both the environment and to the community, for example, a rain garden. The following scoring guidelines were used:

5. Alternative is an excellent candidate for green leave behind.
3. Alternative has limited green leave-behind potential.
1. Alternative has no green leave-behind potential.

4.2.3 Public Health and Environmental

The public health and environmental criterion was divided into two attributes— (1) Meet Levels of Control (LOC) Objectives and (2) Meet Future Regulatory Requirements. The public health and environmental criterion was weighted as 20% of the total evaluation score, and this weight was divided between the two attributes equally.

4.2.3.1 Meet LOC Objectives

This attribute includes the ability of each alternative to meet the regulatory required level of control (for example, NPDES requirements). The following scoring guidelines were used:

5. Alternative exceeds the LOC objectives.
3. Alternative meets the LOC objectives.
1. Alternative does not meet the LOC objectives.

4.2.3.1 Meet Future Regulatory Requirements

Reduction of NPDES permit limits for various regulated parameters or addition of new regulated parameters to permits as they are renewed has become common. This attribute includes the ability of the alternative to be modified to meet future regulatory requirements. The following scoring guidelines were used:

5. Alternative's facilities are easily expandable, and its operations are flexible enough to be adjusted for more stringent regulations.
3. Alternative's facilities are difficult to expand, but its operations can be adjusted for more stringent regulations.

1. Alternative's facilities cannot be expanded, and its operations cannot be adjusted for more stringent regulations.

4.2.4 Operation and Maintenance

The operation and maintenance criterion was divided into two attributes— (1) Reliability and (2) Operating Complexity. The operation and maintenance criterion was weighted as 20% of the total evaluation score, and this weight was divided between the two attributes equally.

4.2.4.1 Reliability

The reliability attribute includes the redundancy inherent to each alternative, both in terms of facility volume, that is, number of redundant treatment tanks, and of equipment redundancy, for example, standby pumps. The following scoring guidelines were used:

5. Alternative's firm capacity supported by redundant tankage and equipment.
3. Alternative's firm capacity supported by redundant equipment but not redundant tankage.
1. Alternative features no redundant equipment or tankage.

4.2.4.2 Operating Complexity

The operating complexity attribute includes the impact of the alternative on ALCOSAN staff. Factors such as similarity to existing treatment processes, personnel training requirements, and distance to any satellite facilities are considered. The following scoring guidelines were used:

5. Alternative uses the same treatment schemes as the existing WWTP and requires minimal additional training. The treatment facility is located at the existing WWTP.
3. Alternative uses similar treatment schemes as the existing WWTP and requires additional operator and maintenance training. The treatment facility is located off-site and relatively close to the WWTP.
1. Alternative uses different treatment scheme as the existing WWTP and requires additional operator and maintenance training. The treatment facility is located off-site and relatively far from the WWTP.

4.2.5 Implementation and Construction

The implementation and construction criterion was divided into two attributes— (1) Constructability (Risk) and (2) Ease of Property/Easement Acquisition. The implementation and construction criterion was weighted as 20% of the total evaluation score, and this weight was divided between the two attributes equally.

4.2.5.1 Constructability

The constructability attribute includes the difficulty and risk inherent to the construction of each alternative. Risk herein is defined qualitatively as a combination of the probability of a construction issue occurring and the consequence of that construction issue. Each of the alternatives involves a

significant amount of excavation, which brings the risk of unforeseen conditions, along with the risk to surrounding facilities, buildings, utilities, roadways, etc. Significant and difficult shoring and dewatering of the excavation may be required because of each alternative's proximity to the Ohio River. The following scoring guidelines were used:

5. Alternative has a low probability of construction issues occurring, and these issues have a low consequence.
3. Alternative has a medium probability of construction issues occurring, and these issues have a medium consequence.
1. Alternative has a high probability of construction issues occurring and these issues have a high consequence.

4.2.5.2 Ease of Property/Easement Acquisition

This attribute includes the relative ease or difficulty that may be faced to acquire the necessary property and/or easements to construct each alternative. The following scoring guidelines were used:

5. Alternative does not require any additional property or easements for construction.
3. Alternative requires additional property or easements, and these can be obtained at fair market value.
1. Alternative requires additional property or easements, and no apparent property or easement is available.

4.2.6 Evaluation Matrix

The evaluation criteria can be summarized in a single matrix, as illustrated in **Table 4-5**. This matrix was used to input raw scores for each attribute for each alternative. The scores are then multiplied by the assigned weight for each attribute and the weighted scores for each alternative are summed to determine a total weighted score for each alternative. The alternative with the highest weighted score is identified as the best alternative.

Table 4-5: Alternative Evaluation Matrix

Criteria and Total Weight	Attribute	Attribute Weight	Definition of Rating
Economic (20%)	Life-cycle cost (\$M)	20%	5 = Lowest life-cycle cost alternative. 1 = Highest life-cycle cost alternative.
Community (20%)	Aesthetics, Odors, Disruption	10%	5 = No long-term disruption or odors anticipated. Improved aesthetics for surrounding areas. 3 = Some long-term disruptions or potential for odors. No improved aesthetics to surrounding area. 1 = Long term disruptions; active sustained odor control required; negative aesthetic impact to surrounding area.
	Green leave-behinds	10%	5 = Excellent candidate for green leave behind. 3 = Limited green-leave-behind potential. 1 = No green leave-behind potential.
Public Health and Environmental (20%)	Meet LOC objectives	10%	5 = Exceeds LOC objectives 3 = Meets LOC objectives 1 = Does not meet LOC objectives
	Meet future regulatory requirements	10%	5 = Easily expandable, and operations flexible enough to be adjusted for more stringent regulations. 3 = Difficult expansion, and operations can be adjusted for more stringent regulations. 1 = No expandability or operational flexibility to adjust for more stringent regulations.
Operation and Maintenance (20%)	Reliability (e.g., redundancy)	10%	5 = Firm capacity supported by redundant tankage and equipment. 3 = Firm capacity supported by redundant equipment but not redundant tankage. 1 = No redundant equipment or tankage.
	Operating complexity (e.g., facility location, additional training)	10%	5 = Uses same plant treatment schemes with minimal additional training and located at WWTP. 3 = Uses same plant treatment schemes. Off-site satellite treatment relatively close to WWTP. Requires additional training. 1 = Uses same plant treatment schemes. Off-site satellite treatment far from WWTP. Requires additional training.
Implementation and Construction (20%)	Constructability (Risk)	10%	5 = Low probability of construction issue and low consequence. 3 = Medium probability of construction issue and medium consequence. 1 = High probability of construction issue and high consequence.
	Ease of property/easement acquisition	10%	5 = No additional site required. 3 = Requires additional site at fair market value. 1 = Requires additional site and no apparent property available.

5.0 ALTERNATIVES EVALUATION

5.1 EVALUATION

As noted previously, the construction cost and annual O&M costs for each alternative were estimated. These costs were used to determine the life cycle cost for each alternative over the planning period. The life cycle costs for all alternatives were then scored as described previously. Parallel to these activities, each alternative was evaluated against the non-cost criteria and assigned a score for each attribute. The life cycle cost scores and the non-cost criteria scores were weighted and summed for each alternative to determine an overall weighted evaluation score. The life cycle costs and overall evaluated scores for each alternative are discussed in the following sections. **Table 5-1** at the end of this section summarizes the construction and program capital costs, present worth of operations and maintenance costs, and life cycle costs for the alternatives considered in this evaluation. **Table 5-2** at the end of this section summarizes the evaluation of the alternatives. **Appendix D** provides the details of the evaluations for each alternative, including weighted scores and justification for the assigned raw scores.

5.1.1 Baseline Alternative – 600 MGD Wet Weather Treatment at WWTP

The Baseline Alternative consists of wet weather improvements at the Woods Run WWTP such that up to 600 MGD of wet weather flow can be treated at the WWTP and a new 120 MGD WWPS constructed to supplement the Main Pump Station. No off-site satellite EHRT facility is included in this alternative.

The life cycle cost for the Baseline Alternative is estimated at \$593.4M. The overall weighted evaluation score for this alternative is 4.1.

5.1.2 Alternative 1A – 60 MGD EHRT at Western Penitentiary Site

Alternative 1A consists of wet weather improvements at the Woods Run WWTP such that 540 MGD of wet weather can be treated at the WWTP; a new off-site, 60 MGD EHRT constructed at the Western Penitentiary site for wet weather treatment of flows that exceed the WWTP capacity; and a new 120 MGD WWPS constructed to supplement the Main Pump Station.

The life cycle cost for Alternative 1A is estimated at \$660.0M. The overall weighted evaluation score for this alternative is 2.4.

5.1.3 Alternative 1B – 60 MGD EHRT at Trucking Site

Alternative 1B consists of wet weather improvements at the Woods Run WWTP such that 540 MGD of wet weather can be treated at the WWTP; a new off-site, 60 MGD EHRT constructed at the Trucking site for wet weather treatment of flows that exceed the WWTP capacity; and a new 120 MGD WWPS constructed to supplement the Main Pump Station.

The life cycle cost for Alternative 1B is estimated at \$650.8M. The overall weighted evaluation score for this alternative is 2.5.

5.1.4 Alternative 1C – 60 MGD EHRT at Valspar Site

Alternative 1C consists of wet weather improvements at the Woods Run WWTP such that 540 MGD of wet weather can be treated at the WWTP; a new off-site, 60 MGD EHRT constructed at the Valspar site for wet weather treatment of flows that exceed the WWTP capacity; and a new 120 MGD WWPS constructed to supplement the Main Pump Station.

The life cycle cost for Alternative 1C is estimated at \$623.3M. The overall weighted evaluation score for this alternative is 2.8.

5.1.5 Alternative 2A – 120 MGD EHRT at Western Penitentiary Site

Alternative 2A consists of wet weather improvements at the Woods Run WWTP such that 480 MGD of wet weather can be treated at the WWTP; a new off-site, 120 MGD EHRT constructed at the Western Penitentiary site for wet weather treatment of flows that exceed the WWTP capacity; and a new 120 MGD WWPS constructed to supplement the Main Pump Station.

The life cycle cost for Alternative 2A is estimated at \$656.7M. The overall weighted evaluation score for this alternative is 2.4.

5.1.6 Alternative 2B – 120 MGD EHRT at Trucking Site

Alternative 2B consists of wet weather improvements at the Woods Run WWTP such that 480 MGD of wet weather can be treated at the WWTP; a new off-site, 120 MGD EHRT constructed at the Trucking site for wet weather treatment of flows that exceed the WWTP capacity; and a new 120 MGD WWPS constructed to supplement the Main Pump Station.

The life cycle cost for Alternative 2B is estimated at \$647.6M. The overall weighted evaluation score for this alternative is 2.5.

5.1.7 Alternative 2C – 120 MGD EHRT at Valspar Site

Alternative 2C consists of wet weather improvements at the Woods Run WWTP such that 480 MGD of wet weather can be treated at the WWTP; a new off-site, 120 MGD EHRT constructed at the Valspar site for wet weather treatment of flows that exceed the WWTP capacity; and a new 120 MGD WWPS constructed to supplement the Main Pump Station.

The life cycle cost for Alternative 2C is estimated at \$626.1M. The overall weighted evaluation score for this alternative is 2.8.

5.2 EVALUATION SUMMARY

Table 5-1 summarizes the construction and program costs, present worth of operations and maintenance costs and life cycle costs for the 7 alternatives considered in this analysis.

Table 5-2 summarizes the evaluation for the 7 alternatives considered in this analysis. The Baseline Alternative ranks as the best alternative with a weighted score of 4.1. The next best alternative is Alternative 2C (120 MGD EHRT at the Valspar site) with a weighted score of 2.8.

Appendix D provides the details of the evaluations for each alternative, including weighted scores and justification for the assigned raw scores.

Table 5-1: Life Cycle Cost Summary (2017 \$)							
	Baseline - WWTP Improvements for 600 MGD	Alternative 1A – WWTP Expansion for 540 MGD, WWPS at WWTP, 60 MGD EHRT at Western Penitentiary	Alternative 1B – WWTP Expansion for 540 MGD, WWPS at WWTP, 60 MGD EHRT at Trucking Site	Alternative 1C – WWTP Expansion for 540 MGD, WWPS at WWTP, 60 MGD EHRT at Valspar Site	Alternative 2A – WWTP Expansion for 480 MGD, WWPS at WWTP, 120 MGD EHRT at Western Penitentiary	Alternative 2B – WWTP Expansion for 480 MGD, WWPS at WWTP, 120 MGD EHRT at Trucking Site	Alternative 2C – WWTP Expansion for 480 MGD, WWPS at WWTP, 120 MGD EHRT at Valspar Site
WWTP Wet Weather Expansion Program Cost (\$M) ¹	\$393.6	\$343.2	\$343.2	\$343.2	\$306.4	\$306.4	\$306.4
Wet Weather Pump Station Program Costs (\$M) ²	\$171.0	\$171.0	\$171.0	\$171.0	\$171.0	\$171.0	\$171.0
VE Satellite EHRT Facility Program Costs (\$M)	\$0.0	\$114.7	\$105.5	\$78.0	\$146.3	\$137.2	\$115.7
Present Worth of WWTP Wet Weather Expansion O&M Costs (\$M) ¹	\$21.6	\$20.1	\$20.1	\$20.1	\$18.3	\$18.3	\$18.3
Present Worth of Wet Weather Pump Station O&M Costs (\$M)	\$7.2	\$7.2	\$7.2	\$7.2	\$7.2	\$7.2	\$7.2
Present Worth of VE Satellite EHRT O&M Costs (\$M)	\$0.0	\$3.8	\$3.8	\$3.8	\$7.5	\$7.5	\$7.5
Total Life Cycle Cost Total (\$M)	\$593.4	\$660.0	\$650.8	\$623.3	\$656.7	\$647.6	\$626.1

Notes:

- 1. Cost estimate prepared by the WWTP PM.
- 2. WWPS program costs determined from the Interim Measures Wet Weather Plan. Refer to Section 3.2.

Table 5-2: Alternative Evaluation Scoring Summary										
Criteria and Total Weight	Attribute	Attribute Weight	Definition of Rating	Rating						
				Baseline - WWTP Upgrade to 600 MGD	Alternative 1A – WWTP Upgrade to 540 MGD, EHRT @ 60 MGD at Western Penitentiary	Alternative 1B – WWTP Upgrade to 540 MGD, EHRT @ 60 MGD at Trucking	Alternative 1C – WWTP Upgrade to 540 MGD, EHRT @ 60 MGD at Valspar	Alternative 2A – WWTP Upgrade to 480 MGD, EHRT @ 120 MGD at Western Penitentiary	Alternative 2B – WWTP Upgrade to 480 MGD, EHRT @ 120 MGD at Trucking	Alternative 2C – WWTP Upgrade to 480 MGD, EHRT @ 120 MGD at Valspar
Economic (20%)	Life-cycle cost (\$M)	20%	5 = Lowest life-cycle cost alternative. 1 = Highest life-cycle cost alternative.	\$593.4	\$660.0	\$650.8	\$623.3	\$656.7	\$647.6	\$626.1
				5.0	1.0	1.6	3.2	1.2	1.7	3.2
Community (20%)	Aesthetics, Odors, Disruption	10%	5 = No long-term disruption or odors anticipated. Improved aesthetics for surrounding areas. 3 = Some long-term disruptions or potential for odors. No improved aesthetics to surrounding area. 1 = Long term disruptions; active sustained odor control required; negative aesthetic impact to surrounding area.	5	3	2	2	3	2	2
	Green leave-behinds	10%	5 = Excellent candidate for green leave behind. 3 = Limited green-leave-behind potential. 1 = No green leave-behind potential.	2	3	3	3	3	3	3
Public Health and Environmental (20%)	Meet LOC objectives	10%	5 = Exceeds LOC objectives 3 = Meets LOC objectives 1 = Does not meet LOC objectives	3	3	3	3	3	3	3
	Meet future regulatory requirements	10%	5 = Easily expandable, and operations flexible enough to be adjusted for more stringent regulations. 3 = Difficult expansion, and operations can be adjusted for more stringent regulations. 1 = No expandability or operational flexibility to adjust for more stringent regulations.	3	3	3	3	3	3	3
Operation and Maintenance (20%)	Reliability (e.g., redundancy)	10%	5 = Firm capacity supported by redundant tankage and equipment. 3 = Firm capacity supported by redundant equipment but not redundant tankage. 1 = No redundant equipment or tankage.	5	3	3	3	3	3	3
	Operating complexity (e.g., facility location, additional training)	10%	5 = Uses same plant treatment schemes with minimal additional training and located at WWTP. 3 = Uses same plant treatment schemes. Off-site satellite treatment relatively close to WWTP. Requires additional training. 1 = Uses same plant treatment schemes. Off-site satellite treatment far from WWTP. Requires additional training.	5	2	2	2	2	2	2
Implementation and Construction (20%)	Constructability (Risk)	10%	5 = Low probability of construction issue and low consequence. 3 = Medium probability of construction issue and medium consequence. 1 = High probability of construction issue and high consequence.	3	2	3	3	2	3	3
	Ease of property/easement acquisition	10%	5 = No additional site required. 3 = Requires additional site at fair market value. 1 = Requires additional site and no apparent property available.	5	3	3	3	3	3	3
Weighted Evaluation Score				4.1	2.4	2.5	2.8	2.4	2.5	2.8

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSION

The alternatives evaluation demonstrated that the Baseline Alternative is the highest ranked alternative. The LCC analysis indicated that the Baseline Alternative has the lowest overall NPW, at \$593.4M, which is consistently lower than any of the other alternatives, particularly when considering the incremental costs difference for achieving wet weather treatment for flows between 480 MGD and 600 MGD.

This is because underlying all the estimated costs are the costs for increasing the WWTP secondary treatment capacity to 295 MGD and the total WWTP treatment capacity to 480 MGD. Costs for these treatment capacity increases did not change from one alternative to another. This fixed cost is the program capital cost for the WWTP wet weather expansion to 480 MGD, which is \$306.4M, plus the present worth of the expansion's O&M cost, which is \$18.3M, for a total life cycle cost of the expansion of \$324.7M. This analysis is based on the incremental cost associated with treating 60 MGD or 120 MGD of additional wet weather flow at the WWTP. Based on the cost analysis, an incremental life cycle cost of \$38.6M is required to increase the plant capacity from 480 MGD to 540 MGD. An incremental life cycle cost of \$90.5M is required to increase the plant capacity from 480 MGD to 600 MGD. Comparatively, for the EHRTs, the life cycle cost for 60 MGD of treatment ranges from \$81.8M to \$118.5M, and for 120 MGD treatment it ranges from \$123.2M to \$153.8M, all depending on location of the EHRT facility.

Furthermore, incorporating non-cost criteria into the evaluation demonstrated that the Baseline Alternative is more favorable than the other evaluated alternatives. This is especially apparent in terms of:

- Community impacts (aesthetics, odors, and long-term disruptions), where the Baseline Alternative is clearly superior because the work would be contained within the existing WWTP site.
- O&M (reliability and operating complexity), because the Baseline Alternative would provide full redundancy of unit processes and equipment, and because it uses the same treatment processes currently being used at the WWTP, not requiring any additional personnel training for O&M.
- Implementation and construction, in terms of property and easement acquisition, because the work of the Baseline Alternative is located entirely within ALCOSAN-owned property and does not require purchase of additional property.

6.2 RECOMMENDED ALTERNATIVE

Because of its lower life cycle cost and its greater scoring once non-cost criteria are considered, the Baseline Alternative (upgrading the wet weather treatment capacity of the WWTP to 600 MGD) is the recommended alternative.

APPENDIX A. WWTP WET WEATHER IMPROVEMENTS PROGRAM COSTS, OPERATIONS AND MAINTENANCE COSTS, AND LIFE CYCLE COST SUMMARIES

ALLEGHENY COUNTY SANITARY AUTHORITY WET WEATHER PLANT EXPANSION PROGRAM CAPITAL PROJECT \$430 OPINION OF PROBABLE CONSTRUCTION COSTS					
Item	480 MGD		540 MGD		600 MGD
	Cost	Remarks	Cost	Remarks	Cost
Auxiliary Pump Station					
Auxiliary Pump Station	By PMO	120 MGD pump station at plant site	By PMO	60 MGD pump station at plant site	By PMO
Force Main to Discharge Chamber	\$313,056	300 LF 72 inch Diameter PCCP	\$313,056	300 LF 72 inch Diameter PCCP	\$313,056
Preliminary Treatment					
Main Pump Station Modifications/Overflow Structures	\$3,812,592		\$3,812,592		\$3,812,592
Auxiliary Pump Station Discharge Chamber	\$1,000,000	No Auxiliary Pump Station discharge	\$1,000,000	Assumed Cost	\$1,000,000
Influent Flow Monitoring	\$1,009,883		\$1,009,883		\$1,009,883
Influent Conduits to East Headworks	\$13,161,781	108-inch PCCP to East Headworks	\$13,511,066	108-inch and 54-inch PCCP to East Headworks	\$13,797,952
West Headworks (Existing)	\$0	No changes to existing Headworks	\$0	No changes to existing Headworks	\$0
East Headworks (New)	\$30,647,000	Cost based on 5 screens and 5 grit tanks (240 MGD)	\$37,644,000	Cost based on 6 screens and 6 grit tanks (300 MGD)	\$44,502,394
Primary Influent Conduits from East Headworks	\$7,541,142		\$7,541,142		\$7,541,142
Primary Treatment					
New Laboratory Building	\$10,000,000	Assumed Cost	\$10,000,000	Assumed Cost	\$10,000,000
Primary Tanks E4 and E5	\$0	No new primary tanks	\$18,245,000	1 Primary Tank; Sitework included	\$36,490,000
Primary Sludge Pump Station E2	\$0		\$390,000		\$390,000
Secondary Treatment					
River Wall	\$4,097,275		\$4,097,275		\$4,097,275
Final Tanks EPS-9 and WFS-9	\$22,008,225	Sitework included	\$22,008,225	Sitework included	\$22,008,225
RAS Pump Station W3	\$2,760,000		\$2,760,000		\$2,760,000

ALLEGHENY COUNTY SANITARY AUTHORITY WET WEATHER PLANT EXPANSION PROGRAM CAPITAL PROJECT S430 OPINION OF PROBABLE CONSTRUCTION COSTS						
Item	480 MGD		540 MGD		600 MGD	
	Cost	Remarks	Cost	Remarks	Cost	Remarks
Existing RAS Pumping and Piping Improvements	\$6,760,000	Included \$2.5 M to replace existing RAS piping	\$6,760,000	Included \$2.5 M to replace existing RAS piping	\$6,760,000	Included \$2.5 M to replace existing RAS piping
Final Disinfection						
River Wall	\$10,970,000		\$10,970,000		\$10,970,000	
New Contact Tank	\$22,170,000	Stewwork included	\$22,170,000	Stewwork included	\$22,170,000	Stewwork included
Chemical Building	\$3,940,000		\$3,940,000		\$3,940,000	
Post Aeration	\$3,870,000		\$3,870,000		\$3,870,000	
Effluent Flow Metering Structure	\$0	Not required by PADEP	\$0	Not required by PADEP	\$0	Not required by PADEP
Effluent Pump Station	\$0	Not required by PADEP	\$0	Not required by PADEP	\$0	Not required by PADEP
Secondary Effluent Conduit	\$5,450,000		\$5,450,000		\$5,450,000	
Pipe Gallery	\$4,730,000		\$4,730,000		\$4,730,000	
Wet Weather Disinfection						
Existing Contact Tank Modifications	\$4,130,000	185 MGD Peak Bypass Rate	\$4,130,000	245 MGD Peak Bypass Rate	\$4,130,000	305 MGD Peak Bypass Rate
Chemical Building	\$3,650,000	Chemical storage & feed based on 6,045 MG annually	\$3,650,000	Chemical storage & feed based on 6,260 MG annually	\$3,650,000	Chemical storage & feed based on 6,380 MG annually
Wet Weather Bypass Control	\$4,500,000	Based on modulating sluice gate concept	\$4,500,000	Based on modulating sluice gate concept	\$15,060,000	Based on fixed weir concept
Thickening						
Thickening Centrifuges and Appurtenances	\$17,440,000		\$17,440,000		\$17,440,000	
Odor Control						
Primary Odor Control System	\$110,000	Localized Hypo Loop Improvements	\$110,000	Localized Hypo Loop Improvements	\$110,000	Localized Hypo Loop Improvements
Headworks Odor Control System	\$2,300,000	Two Stage Wet Scrubber with Hypo Loop Improvements	\$2,300,000	Two Stage Wet Scrubber with Hypo Loop Improvements	\$2,300,000	Two Stage Wet Scrubber with Hypo Loop Improvements

ALLEGHENY COUNTY SANITARY AUTHORITY WET WEATHER PLANT EXPANSION PROGRAM CAPITAL PROJECT \$430 OPINION OF PROBABLE CONSTRUCTION COSTS					
Item	480 MGD		540 MGD		600 MGD
	Cost	Remarks	Cost	Remarks	Cost
5KV and 15KV Electrical Distribution					
13.8 KV Substation	\$560,000	Add Sections to Bus A, B, C	\$560,000	Add Sections to Bus A, B, C	\$560,000
Substation #3 (Compressor Building)	\$3,910,000	Replace Unit Sub #11	\$3,910,000	Replace Unit Sub #11	\$3,910,000
Substation #4 (Energy Recovery)	\$1,490,000	Centrifuges	\$1,490,000	Centrifuges	\$1,490,000
Substations #1 (Admin Annex), #2 (Rack & Chlor Bldg) and #12 (Effluent Water)	\$1,820,000	Refeed Sub #1 & 2 from USS#4; Replace Sub #12	\$1,820,000	Refeed Sub #1 & 2 from USS#4; Replace Sub #12	\$1,820,000
Existing Process Equipment Replacement/Parts					
Existing Process Equipment Replacement/Parts	\$25,000,000	Preliminary Condition Assessment Estimate	\$25,000,000	Preliminary Condition Assessment Estimate	\$25,000,000
Opinion of Probable Construction Cost	\$218,837,897		\$245,132,238		\$281,082,518
Estimating Accuracy:					
Max +30%	\$284,489,267		\$318,671,909		\$365,407,274
Min -20%	\$175,070,318		\$196,105,790		\$224,866,015
Program Costs:					
Engineering @10%	\$21,883,790		\$24,513,224		\$28,108,252
Construction Management @15%	\$52,825,685		\$56,769,836		\$42,162,378
ALCOSAN Costs @5%	\$10,941,895		\$12,256,612		\$14,054,126
Owners Contingency @10%	\$21,883,790		\$24,513,224		\$28,108,252
Total Construction and Program Cost:	\$306,373,056		\$343,185,133		\$393,515,526

Notes:

1. All costs are in 2017 dollars; ENR Construction Cost for Pittsburgh 9983.79
2. All costs are burdened and include a factor of 62.1% for Mobilization, Bonds, Insurance, Overhead, Profit, and an estimating contingency.
3. Cost estimates are based on Alternatives Analysis Phase Draft Technical Memorandums (AACE Class 4 estimate with a level of project definition between 1% and 15%)
4. Auxiliary Pump Station is based on the Hydraulic Expansion Technical Memorandum TM HE-12 cost of \$25,134,200 times a present to future factor of 1.97359 (1994 cost at 3% inflation)

ALLEGHNEY COUNTY SANITARY AUTHORITY WET WEATHER PLANT EXPANSION PROGRAM CAPITAL PROJECT \$430 ANNUAL O&M COSTS									
Primary Treatment (Additional Primary Tanks for Wet Weather Operations)									
Power									
Power for primary tank sludge collectors, cross collectors, and primary sludge pumps not included in O&M analysis.									
Solids Disposal:									
	Annual Volume	Influent TSS ⁽⁵⁾	Ferric Chloride Dosage	FeCl ₃ ·Fe(OH) ₃	Effluent TSS ⁽⁶⁾	Chemical Solids Production	Operations Labor Rate	Annual Cost	Solids to Disposal ⁽⁷⁾
EHRT TSS Solids Generation ⁽⁴⁾									
Peak WWTP Bypass Flow Rate = 120 MGD	337 MG	82 mg/l	115 dry tons		29 mg/l	41 dry tons			74 dry tons \$ 14,896.07
Peak WWTP Bypass Flow Rate = 60 MGD	122 MG	82 mg/l	42 dry tons		29 mg/l	15 dry tons			27 dry tons \$ 5,392.64
Peak WWTP Bypass Flow Rate = 0 MGD	- MG	82 mg/l	- dry tons		29 mg/l	0 dry tons			- dry tons \$ -
EHRT Chemical Solids Production ⁽⁴⁾									
Peak WWTP Bypass Flow Rate = 120 MGD	337 MG	30 mg/l	42 dry tons	0.67		28 dry tons		\$ 5,649.27	\$ 5,649.27
Peak WWTP Bypass Flow Rate = 60 MGD	122 MG	30 mg/l	15 dry tons	0.67		10 dry tons		\$ 2,045.13	\$ 2,045.13
Peak WWTP Bypass Flow Rate = 0 MGD	- MG	30 mg/l	- dry tons	0.67		- dry tons		\$ -	\$ -
WWTP Solids Generated									
Peak WWTP Bypass Flow Rate = 185 MGD	6,044 MG	82 mg/l	2,067 dry tons		29 mg/l	731 dry tons			1,336 dry tons \$ 267,157
Peak WWTP Bypass Flow Rate = 245 MGD	6,259 MG	82 mg/l	2,140 dry tons		29 mg/l	757 dry tons			1,383 dry tons \$ 276,660
Peak WWTP Bypass Flow Rate = 305 MGD	6,381 MG	82 mg/l	2,182 dry tons		29 mg/l	772 dry tons			1,410 dry tons \$ 282,053
(4) Assumes solids from EHRT returned to WWTP for processing									
(5) Assumes 82 mg/l influent TSS loading based on Wet Weather Data Analysis for period of August 2014 through July 2016									
(6) Assumes 65% TSS removal in primary tanks									
(7) Assumes \$200/dry ton disposal cost									
Subtotal Solids Disposal									
\$ 287,702 \$ 284,098 \$ 282,053									
Labor									
Labor Rate = \$37/hr x 1.7 Benefits Factor =	\$ 62.9	No. of Events	Startup/Shutdown Effort	Crew	Annual Hours	Operations Labor Rate	Annual Cost		
Wet Weather Primary Tank Operations ⁽⁸⁾									
480 MGD [3 Additional Primary Tanks]	29 ev/yr	9 hrs/ev	2 men		522 hrs/yr	\$62.90 /hr	\$32,834		
540 MGD [4 Additional Primary Tanks]	45 ev/yr	12 hrs/ev	2 men		1080 hrs/yr	\$62.90 /hr	\$67,932		
600 MGD [5 Additional Primary Tanks]	54 ev/yr	15 hrs/ev	2 men		1620 hrs/yr	\$62.90 /hr	\$101,898		\$101,898
(8) Assume 3 Primary Tanks in services at 295 MGD									
Subtotal Labor									
\$32,834 \$67,932 \$101,898									

ALLEGHENY COUNTY SANITARY AUTHORITY WET WEATHER PLANT EXPANSION PROGRAM CAPITAL PROJECT 5430 ANNUAL O&M COSTS										
Wet Weather Bypass Disinfection										
Power										
Power for sodium hypochlorite, sodium bisulfite and defoamer feed equipment not included in O&M analysis.										
Motor Size	Power kwh	Days of Operation	Annual kwh	Power Cost						
140 HP	140 kwh	100 d	336,000 kwh	\$ 0.068 /kwh	\$ 22,848	\$22,848	\$22,848	\$22,848	\$22,848	\$22,848
HVAC for Wet Weather Chemical Storage and Feed Building (9)										
Heating (winter months only)										
Summer (SF = 15 HP/EF = 5 HP)	20.0 HP	180 d	64,454 kwh	\$ 0.068 /kwh	\$ 4,383	\$4,383	\$4,383	\$4,383	\$4,383	\$4,383
Winter (SF = 7.5 HP/EF = 5 HP)	12.5 HP	180 d	40,284 kwh	\$ 0.068 /kwh	\$ 2,739	\$2,739	\$2,739	\$2,739	\$2,739	\$2,739
(9) Power requirements for heating and ventilation were based on similarly sized facility for the NEORSD Southern WWTC										
Subtotal Power					\$29,970	\$29,970	\$29,970	\$29,970	\$29,970	\$29,970
Chemicals										
Sodium Hypochlorite										
Peak WWTP Bypass Flow Rate = 185 MGD	10 mg/l	6,044 MG	10.2 lbs/gal	12.5%	395,349	\$0.638	\$252,232	\$252,232	\$252,232	\$252,232
Peak WWTP Bypass Flow Rate = 245 MGD	10 mg/l	6,259 MG	10.2 lbs/gal	12.5%	409,412	\$0.638	\$261,205	\$261,205	\$261,205	\$261,205
Peak WWTP Bypass Flow Rate = 305 MGD	10 mg/l	6,381 MG	10.2 lbs/gal	12.5%	417,392	\$0.638	\$266,296	\$266,296	\$266,296	\$266,296
Sodium Bisulfite										
Peak WWTP Bypass Flow Rate = 185 MGD	1.46 mg/l	6,044 MG	11.3 lbs/gal	38.0%	66,419	\$0.103	\$6,841	\$6,841	\$6,841	\$6,841
Peak WWTP Bypass Flow Rate = 245 MGD	1.68 mg/l	6,259 MG	11.3 lbs/gal	38.0%	68,781	\$0.103	\$7,084	\$7,084	\$7,084	\$7,084
Peak WWTP Bypass Flow Rate = 305 MGD	1.63 mg/l	6,381 MG	11.3 lbs/gal	38.0%	70,122	\$0.103	\$7,223	\$7,223	\$7,223	\$7,223
Defoamer										
Peak WWTP Bypass Flow Rate = 185 MGD	1 mg/l	6,044 MG	11.26 lbs/gal	50.0%	39,535	\$0.550	\$21,744	\$21,744	\$21,744	\$21,744
Peak WWTP Bypass Flow Rate = 245 MGD	1 mg/l	6,259 MG	11.26 lbs/gal	50.0%	40,941	\$0.550	\$22,518	\$22,518	\$22,518	\$22,518
Peak WWTP Bypass Flow Rate = 305 MGD	1 mg/l	6,381 MG	11.26 lbs/gal	50.0%	41,739	\$0.550	\$22,957	\$22,957	\$22,957	\$22,957
Subtotal Chemicals							\$280,818	\$280,818	\$280,818	\$280,818
Labor										
Labor Rate = \$37/hr x 1.7 Benefits Factor =	\$ 62.9									
Bypass Sampling and Monitoring										
Peak WWTP Bypass Flow Rate = 185 MGD	1336 hours	334 ea	2 hr/sample	668 \$	62.9 \$/hr	\$42,017	\$42,017	\$42,017	\$42,017	\$42,017
Peak WWTP Bypass Flow Rate = 245 MGD	1402 hours	351 ea	2 hr/sample	701 \$	62.9 \$/hr	\$44,093	\$44,093	\$44,093	\$44,093	\$44,093
Peak WWTP Bypass Flow Rate = 305 MGD	1462 hours	366 ea	2 hr/sample	731 \$	62.9 \$/hr	\$45,980	\$45,980	\$45,980	\$45,980	\$45,980
(10) Based on one grab sample every 4 hours										
Post Event Tank Cleaning										
Peak WWTP Bypass Flow Rate = 185 MGD	29 ev/yr	8 hrs/ev	2 men	464 hrs/yr	\$62.90 /hr	\$29,186	\$29,186	\$29,186	\$29,186	\$29,186
Peak WWTP Bypass Flow Rate = 245 MGD	45 ev/yr	8 hrs/ev	2 men	720 hrs/yr	\$62.90 /hr	\$44,580	\$44,580	\$44,580	\$44,580	\$44,580
Peak WWTP Bypass Flow Rate = 305 MGD	54 ev/yr	8 hrs/ev	2 men	864 hrs/yr	\$62.90 /hr	\$54,346	\$54,346	\$54,346	\$54,346	\$54,346
Subtotal Labor							\$71,203	\$71,203	\$71,203	\$71,203
Total Annual Wet Weather Operating Cost 2017 Dollars										
							\$867,794	\$867,794	\$867,794	\$867,794

ALLEGHNEY COUNTY SANITARY AUTHORITY WET WEATHER PLANT EXPANSION PROGRAM CAPITAL PROJECT S430 PRESENT WORTH ANALYSIS				
Year	Index	480 MGD Future O&M Cost	540 MGD Future O&M Cost	600 MGD Future O&M Cost
2018	1.030	\$893,828	\$979,380	\$1,052,693
2019	1.061	\$920,643	\$1,008,762	\$1,084,274
2020	1.093	\$948,262	\$1,039,024	\$1,116,802
2021	1.126	\$976,710	\$1,070,195	\$1,150,307
2022	1.159	\$1,006,011	\$1,102,301	\$1,184,816
2023	1.194	\$1,036,192	\$1,135,370	\$1,220,360
2024	1.230	\$1,067,277	\$1,169,431	\$1,256,971
2025	1.267	\$1,099,296	\$1,204,514	\$1,294,680
2026	1.305	\$1,132,275	\$1,240,650	\$1,333,521
2027	1.344	\$1,166,243	\$1,277,869	\$1,373,526
2028	1.384	\$1,201,230	\$1,316,205	\$1,414,732
2029	1.426	\$1,237,267	\$1,355,691	\$1,457,174
2030	1.469	\$1,274,385	\$1,396,362	\$1,500,889
2031	1.513	\$1,312,617	\$1,438,253	\$1,545,916
2032	1.558	\$1,351,995	\$1,481,400	\$1,592,293
2033	1.605	\$1,392,555	\$1,525,842	\$1,640,062
2034	1.653	\$1,434,332	\$1,571,618	\$1,689,264
2035	1.702	\$1,477,362	\$1,618,766	\$1,739,942
2036	1.754	\$1,521,682	\$1,667,329	\$1,792,140
2037	1.806	\$1,567,333	\$1,717,349	\$1,845,904
NPV =		\$18,272,922	\$20,021,902	\$21,520,676

Notes:

1. Annual Costs Inflated at 3.0% for 20 years
2. Discount Rate = 2.5%

APPENDIX B. PROGRAM COST SUMMARIES AND BREAKDOWNS

ALCOSAN - PRELIMINARY PLANNING - TASK 2.4 VALUE ENGINEERING OPINION OF PROBABLE PROGRAM COST ALTERNATIVES SUMMARY 11/21/2017							
	Baseline - WWTP Improvements for 400 MGD	Alternative 1A - WWTP Expansion for 540 MGD, WWTPS at WWTP, 50 MGD EHRT at Pileon	Alternative 1B - WWTP Expansion for 540 MGD, WWTPS at WWTP, 50 MGD EHRT at Trucking Site	Alternative 1C - WWTP Expansion for 540 MGD, WWTPS at WWTP, 50 MGD EHRT at Valpar Site	Alternative 2A - WWTP Expansion for 400 MGD, WWTPS at WWTP, 120 MGD EHRT at Pileon	Alternative 2B - WWTP Expansion for 400 MGD, WWTPS at WWTP, 120 MGD EHRT at Trucking Site	Alternative 2C - WWTP Expansion for 400 MGD, WWTPS at WWTP, 120 MGD EHRT at Valpar Site
WWTP Wet Weather Expansion Total Program Cost (\$M)	\$393.52	\$343.19	\$343.19	\$343.19	\$306.37	\$306.37	\$306.37
120 MGD Wet Weather Pump Station Program Cost (\$M)	\$171.00	\$171.00	\$171.00	\$171.00	\$171.00	\$171.00	\$171.00
VE Satellite EHRT Facility Program Costs (\$M)	\$0.00	\$114.70	\$105.50	\$78.00	\$146.30	\$137.20	\$115.50
Program Cost Total (\$M)	\$564.52	\$628.89	\$619.69	\$592.19	\$623.67	\$614.57	\$592.87

Notes:

1. All costs are in 2017 dollars; ENR Construction Cost for Pittsburgh 9983.79
2. All construction costs are burdened and include a factor of 62.1% for Mobilization, Bonds, Insurance, Overhead, Profit, and an estimating contingency.
3. Cost estimates are consistent with the WWTP PM's Cost Estimating Guidelines - Revision A (April 21, 2017) (ACEC Class 4 estimate with a level of project definition between 1% and 15%)
4. Program costs include a factor of 40% for Engineering, Construction Management, ALCOSAN costs and an estimating contingency.

ALCOSAN - PRELIMINARY PLANNING - TASK 2.4 VALUE ENGINEERING
OPINION OF PROBABLE CONSTRUCTION COST
Baseline

WWTP Wet Weather Expansion to 600 MGD

Item	Description	Total Cost
1	WWTP Wet Weather Expansion to 600 MGD Program Cost ¹	\$393,515,526
2	120 MGD Wet Weather Pump Station Program Cost ²	\$171,000,000
2017 Total Construction and Program Cost		\$564,515,526

Notes:

- 1- WWTP wet weather upgrade program costs provided by WWTP PM.
- 2 - Program cost for Wet Weather Pump Station based on capital cost indicated in the Interim Measures Wet Weather Plan (\$148M). Construction cost is determined by subtracting the non-construction cost elements itemized in CDM-Smith's memo **Baseline Capital Budget for the Interim Measures Wet Weather Plan** (Sept 20, 2017) and escalating the construction cost with ENR index to 2017 dollars. Program costs then developed by applying the program cost elements provided by the WWTP PM.

ALCOSAN - PRELIMINARY PLANNING - TASK 2.4 VALUE ENGINEERING
OPINION OF PROBABLE CONSTRUCTION COST
ALTERNATIVE 1A
WW PS at WWTP and 60 MGD EHRT at Prison Site

Item	Description			Total Cost
1	WWTP Wet Weather Expansion to 540 MGD Program Costs ¹			\$343,185,133
2	120 MGD Wet Weather Pump Station Program Costs ²			\$171,000,000
	Subtotal			\$514,185,133
Alternative 1A Construction Costs				
Item	Description	Material	Labor and Equipment	Total Cost
	Site Work for EHRT at Prison Site and WW PS at WWTP ³	\$5,200,000	\$5,800,000	\$11,000,000
	60 MGD EHRT ⁴	\$14,700,000	\$9,800,000	\$24,500,000
	Subtotal			\$35,500,000
	Mobilization and Demobilization	5.0%		\$1,800,000
	Permitting	0.1%		\$100,000
	Overhead	11.0%		\$4,000,000
	Profit	4.0%		\$1,500,000
	Estimating and Design Contingencies	40.0%		\$14,200,000
	Bonding	1.0%		\$400,000
	Insurance	1.0%		\$400,000
	Property Acquisition ⁵			\$24,000,000
	Subtotal			\$81,900,000
VE Satellite EHRT Program Costs ⁶				
	Engineering	10%		\$8,200,000
	Construction Management	15%		\$12,300,000
	ALCOSAN Costs	5%		\$4,100,000
	Owners Contingency	10%		\$8,200,000
	Subtotal			\$32,800,000
3	Alternative 1A - 60 MGD EHRT Program Costs			\$114,700,000
	2017 Total Construction and Program Cost ⁷			\$628,900,000

Notes:

- 1- WWTP wet weather upgrade construction costs provided by WWTP PM.
- 2- Construction cost for Wet Weather Pump Station based on capital cost indicated in the Interim Measures Wet Weather Plan (\$148M). Construction cost is determined by subtracting the non-construction cost elements itemized in CDM-Smith's memo Baseline Capital Budget for the Interim Measures Wet Weather Plan (Sept 20, 2017) and escalating the construction cost with ENR index to 2017 dollars.
- 3- Site work includes site demolition, restoration, fore mains (except to proposed WWTP Main Pump Station discharge chamber), gravity sewers, outfall sewer and new outfall structure.
- 4- EHRT conforms to Ten State Standards and provides equivalent treatment as WWTP.
- 5- Property acquisition costs developed using 2017 county assessment data. Land cost determined by percentage of parcel required for permanent acquisition. Building cost determined based on engineering judgement of estimated total square footage of building and/or building condition.
- 6- Program cost elements provided by WWTP PM.
- 7- VE Alternative Construction and Program Costs rounded up to the \$100,000.

ALCOSAN - PRELIMINARY PLANNING - TASK 2.4 VALUE ENGINEERING
OPINION OF PROBABLE CONSTRUCTION COST
ALTERNATIVE 1B
WW PS at WWTP and 60 MGD EHRT at Trucking Site

Item	Description	Total Cost		
1	WWTP Wet Weather Expansion to 540 MGD Program Costs ¹	\$343,185,133		
2	120 MGD Wet Weather Pump Station Program Costs ²	\$171,000,000		
	Subtotal	\$514,185,133		
Alternative 1B Construction Costs				
Item	Description	Material	Labor and Equipment	Total Cost
	Site Work for EHRT at Trucking Site and WW PS at WWTP ³	\$7,700,000	\$8,500,000	\$16,200,000
	60 MGD EHRT ⁴	\$14,700,000	\$9,800,000	\$24,500,000
	Subtotal			\$40,700,000
	Mobilization and Demobilization	5.0%		\$2,100,000
	Permitting	0.1%		\$100,000
	Overhead	11.0%		\$4,500,000
	Profit	4.0%		\$1,700,000
	Estimating and Design Contingencies	40.0%		\$16,300,000
	Bonding	1.0%		\$500,000
	Insurance	1.0%		\$500,000
	Property Acquisition ⁵			\$8,800,000
	Subtotal			\$75,200,000
VE Satellite EHRT Program Costs ⁶				
	Engineering	10%		\$7,600,000
	Construction Management	15%		\$11,300,000
	ALCOSAN Costs	5%		\$3,800,000
	Owners Contingency	10%		\$7,600,000
	Subtotal			\$30,300,000
3	Alternative 1B - 60 MGD EHRT Program Costs	\$105,500,000		
	2017 Total Construction and Program Cost ⁷	\$619,700,000		

Notes:

- 1- WWTP wet weather upgrade construction costs provided by WWTP PM.
- 2- Construction cost for Wet Weather Pump Station based on capital cost indicated in the Interim Measures Wet Weather Plan (\$148M). Construction cost is determined by subtracting the non-construction cost elements itemized in CDM-Smith's memo *Baseline Capital Budget for the Interim Measures Wet Weather Plan* (Sept 20, 2017) and escalating the construction cost with ENR index to 2017 dollars.
- 3- Site work includes site demolition, restoration, force mains (except to proposed WWTP Main Pump Station discharge chamber), gravity sewers, outfall sewer and new outfall structure.
- 4- EHRT conforms to Ten State Standards and provides equivalent treatment as WWTP.
- 5- Property acquisition costs developed using 2017 county assessment data. Land cost determined by percentage of parcel required for permanent acquisition. Building cost determined based on engineering judgement of estimated total square footage of building and/or building condition.
- 6- Program cost elements provided by WWTP PM.
- 7- VE Alternative Construction and Program Costs rounded up to the \$100,000.

ALCOSAN - PRELIMINARY PLANNING - TASK 2.4 VALUE ENGINEERING
OPINION OF PROBABLE CONSTRUCTION COST
ALTERNATIVE 1C
WW PS at WWTP and 60 MGD EHRT at Valspar Site

Item	Description	Total Cost		
1	WWTP Wet Weather Expansion to 540 MGD Program Costs ¹	\$343,185,133		
2	120 MGD Wet Weather Pump Station Program Costs ²	\$171,000,000		
	Subtotal	\$514,185,133		
Alternative 1C Construction Costs				
Item	Description	Material	Labor and Equipment	Total Cost
	Site Work for EHRT at Valspar Site and WW PS at WWTP ³	\$3,900,000	\$4,300,000	\$8,200,000
	60 MGD EHRT ⁴	\$14,700,000	\$9,800,000	\$24,500,000
	Subtotal			\$32,700,000
	Mobilization and Demobilization	5.0%		\$1,700,000
	Permitting	0.1%		\$100,000
	Overhead	11.0%		\$3,600,000
	Profit	4.0%		\$1,400,000
	Estimating and Design Contingencies	40.0%		\$13,100,000
	Bonding	1.0%		\$400,000
	Insurance	1.0%		\$400,000
	Property Acquisition ⁵			\$2,200,000
	Subtotal			\$55,600,000
VE Satellite EHRT Program Costs ⁶				
	Engineering	10%		\$5,600,000
	Construction Management	15%		\$8,400,000
	ALCOSAN Costs	5%		\$2,800,000
	Owners Contingency	10%		\$5,600,000
	Subtotal			\$22,400,000
3	Alternative 1C - 60 MGD EHRT Program Costs	\$78,000,000		
	2017 Total Construction and Program Cost ⁷	\$592,200,000		

Notes:

- 1- WWTP wet weather upgrade construction costs provided by WWTP PM.
- 2- Construction cost for Wet Weather Pump Station based on capital cost indicated in the Interim Measures Wet Weather Plan (\$148M). Construction cost is determined by subtracting the non-construction cost elements itemized in CDM Smith's memo Baseline Capital Budget for the Interim Measures Wet Weather Plan (Sept 20, 2017) and escalating the construction cost with ENR index to 2017 dollars.
- 3- Site work includes site demolition, restoration, force mains (except to proposed WWTP Main Pump Station discharge chamber), gravity sewers, outfall sewer and new outfall structure.
- 4- EHRT conforms to Ten State Standards and provides equivalent treatment as WWTP.
- 5- Property acquisition costs developed using 2017 county assessment data. Land cost determined by percentage of parcel required for permanent acquisition. Building cost determined based on engineering judgement of estimated total square footage of building and/or building condition.
- 6- Program cost elements provided by WWTP PM.
- 7- VE Alternative Construction and Program Costs rounded up to the \$100,000.

**ALCOSAN - PRELIMINARY PLANNING - TASK 2.4 VALUE ENGINEERING
OPINION OF PROBABLE CONSTRUCTION COST
ALTERNATIVE 2A**

WW PS at WWTP and 120 MGD EHRT at Prison Site

Item	Description	Total Cost		
1	WWTP Wet Weather Expansion to 480 MGD Program Costs ¹	\$306,373,056		
2	120 MGD Wet Weather Pump Station Program Costs ²	\$171,000,000		
	Subtotal	\$477,373,056		
Alternative 2A Construction Costs				
Item	Description	Material	Labor and Equipment	Total Cost
	Site Work for EHRT at Prison Site and WW PS at WWTP ³	\$4,900,000	\$6,300,000	\$11,200,000
	60 MGD EHRT ⁴	\$22,300,000	\$15,900,000	\$38,200,000
	Subtotal			\$49,400,000
	Mobilization and Demobilization	5.0%		\$2,500,000
	Permitting	0.1%		\$100,000
	Overhead	11.0%		\$5,500,000
	Profit	4.0%		\$2,000,000
	Estimating and Design Contingencies	40.0%		\$19,800,000
	Bonding	1.0%		\$500,000
	Insurance	1.0%		\$500,000
	Property Acquisition ⁵			\$24,000,000
	Subtotal			\$104,300,000
VE Satellite EHRT Program Costs ⁶				
	Engineering	10%		\$10,500,000
	Construction Management	15%		\$15,700,000
	ALCOSAN Costs	5%		\$5,300,000
	Owners Contingency	10%		\$10,500,000
	Subtotal			\$42,000,000
3	Alternative 2A - 120 MGD EHRT Program Costs	\$146,300,000		
	2017 Total Construction and Program Cost ⁷	\$623,700,000		

Notes:

- 1- WWTP wet weather upgrade construction costs provided by WWTP PM.
- 2- Construction cost for Wet Weather Pump Station based on capital cost indicated in the Interim Measures Wet Weather Plan (\$148M). Construction cost is determined by subtracting the non-construction cost elements itemized in CDM-Smith's memo Baseline Capital Budget for the Interim Measures Wet Weather Plan (Sept 20, 2017) and escalating the construction cost with ENR index to 2017 dollars.
- 3- Site work includes site demolition, restoration, force mains (except to proposed WWTP Main Pump Station discharge chamber), gravity sewers, outfall sewer and new outfall structure.
- 4- EHRT conforms to Ten State Standards and provides equivalent treatment as WWTP.
- 5- Property acquisition costs developed using 2017 county assessment data. Land cost determined by percentage of parcel required for permanent acquisition. Building cost determined based on engineering judgement of estimated total square footage of building and/or building condition.
- 6- Program cost elements provided by WWTP PM.
- 7- VE Alternative Construction and Program Costs rounded up to the \$100,000.

**ALCOSAN - PRELIMINARY PLANNING - TASK 2.4 VALUE ENGINEERING
OPINION OF PROBABLE CONSTRUCTION COST
ALTERNATIVE 2B
WW PS at WWTP and 120 MGD EHRT at Trucking Site**

Item	Description	Total Cost		
1	WWTP Wet Weather Expansion to 480 MGD Program Costs ¹	\$306,373,056		
2	120 MGD Wet Weather Pump Station Program Costs ²	\$171,000,000		
	Subtotal	\$477,373,056		
Alternative 2A Construction Costs				
Item	Description	Material	Labor and Equipment	Total Cost
	Site Work for EHRT at Trucking Site and WW PS at WWTP ³	\$7,700,000	\$8,900,000	\$16,600,000
	120 MGD EHRT ⁴	\$22,300,000	\$15,900,000	\$38,200,000
	Subtotal			\$54,800,000
	Mobilization and Demobilization	5.0%		\$2,800,000
	Permitting	0.1%		\$100,000
	Overhead	11.0%		\$6,100,000
	Profit	4.0%		\$2,200,000
	Estimating and Design Contingencies	40.0%		\$22,000,000
	Bonding	1.0%		\$600,000
	Insurance	1.0%		\$600,000
	Property Acquisition ⁵			\$8,800,000
	Subtotal			\$98,000,000
VE Satellite EHRT Program Costs ⁶				
	Engineering	10%		\$9,800,000
	Construction Management	15%		\$14,700,000
	ALCOSAN Costs	5%		\$4,900,000
	Owners Contingency	10%		\$9,800,000
	Subtotal			\$39,200,000
3	Alternative 2B - 120 MGD EHRT Program Costs	\$137,200,000		
	2017 Total Construction and Program Cost ⁷	\$614,600,000		

Notes:

- 1- WWTP wet weather upgrade construction costs provided by WWTP PM.
- 2 - Construction cost for Wet Weather Pump Station based on capital cost indicated in the *Interim Measures Wet Weather Plan* (\$148M). Construction cost is determined by subtracting the non-construction cost elements itemized in CDM Smith's memo *Baseline Capital Budget for the Interim Measures Wet Weather Plan* (Sept 20, 2017) and escalating the construction cost with ENR index to 2017 dollars.
- 3 - Site work includes site demolition, restoration, force mains (except to proposed WWTP Main Pump Station discharge chamber), gravity sewers, outfall sewer and new outfall structure.
- 4 - EHRT conforms to Ten State Standards and provides equivalent treatment as WWTP.
- 5 - Property acquisition costs developed using 2017 county assessment data. Land cost determined by percentage of parcel required for permanent acquisition. Building cost determined based on engineering judgement of estimated total square footage of building and/or building condition.
- 6 - Program cost elements provided by WWTP PM.
- 7 - VE Alternative Construction and Program Costs rounded up to the \$100,000.

ALCOSAN - PRELIMINARY PLANNING - TASK 2.4 VALUE ENGINEERING
OPINION OF PROBABLE CONSTRUCTION COST
ALTERNATIVE 2C
WW PS at WWTP and 120 MGD EHRT at Valspar Site

Item	Description	Total Cost		
1	WWTP Wet Weather Expansion to 480 MGD Program Costs ¹	\$306,373,056		
2	120 MGD Wet Weather Pump Station Program Costs ²	\$171,000,000		
	Subtotal	\$477,373,056		
Alternative 2C Construction Costs				
Item	Description	Material	Labor and Equipment	Total Cost
	Site Work for EHRT at Valspar Site and WW PS at WWTP ³	\$4,900,000	\$6,300,000	\$11,200,000
	120 MGD EHRT ⁴	\$22,300,000	\$15,900,000	\$38,200,000
	Subtotal			\$49,400,000
	Mobilization and Demobilization	5.0%		\$2,500,000
	Permitting	0.1%		\$100,000
	Overhead	11.0%		\$5,500,000
	Profit	4.0%		\$2,000,000
	Estimating and Design Contingencies	40.0%		\$19,800,000
	Bonding	1.0%		\$500,000
	Insurance	1.0%		\$500,000
	Property Acquisition ⁵			\$2,200,000
	Subtotal			\$82,500,000
VE Satellite EHRT Program Costs ⁶				
	Engineering	10%		\$8,300,000
	Construction Management	15%		\$12,400,000
	ALCOSAN Costs	5%		\$4,200,000
	Owners Contingency	10%		\$8,300,000
	Subtotal			\$33,200,000
3	Alternative 2C - 120 MGD EHRT Program Costs	\$115,700,000		
	2017 Total Construction and Program Cost ⁷	\$593,100,000		

Notes:

- 1- WWTP wet weather upgrade construction costs provided by WWTP PM.
- 2- Construction cost for Wet Weather Pump Station based on capital cost indicated in the Interim Measures Wet Weather Plan (\$148M). Construction cost is determined by subtracting the non-construction cost elements itemized in CDM-Smith's memo *Baseline Capital Budget for the Interim Measures Wet Weather Plan* (Sept 20, 2017) and escalating the construction cost with ENR index to 2017 dollars.
- 3- Site work includes site demolition, restoration, force mains (except to proposed WWTP Main Pump Station discharge chamber), gravity sewers, outfall sewer and new outfall structure.
- 4- EHRT conforms to Ten State Standards and provides equivalent treatment as WWTP.
- 5- Property acquisition costs developed using 2017 county assessment data. Land cost determined by percentage of parcel required for permanent acquisition. Building cost determined based on engineering judgement of estimated total square footage of building and/or building condition.
- 6- Program cost elements provided by WWTP PM.
- 7- VE Alternative Construction and Program Costs rounded up to the \$100,000.

ALCOSAN - PRELIMINARY PLANNING - TASK 2.4 VALUE ENGINEERING
OPINION OF PROBABLE CONSTRUCTION COST
60 MGD EHRT
Facility Unit Price Breakdown

			MATERIAL		LABOR AND EQUIPMENT		TOTAL		
Description	Units	Quantity	Unit \$	Cost	Unit \$	Cost	Total Unit \$	TOTAL COST	% OF TOTAL
60 MGD EHRT - Facility Cost									
Division 1 - General Conditions									
General Conditions (included in Mob/Demob markup)									
Division 2 - Existing Conditions									
Demolish / Site Clearing / Disposal / Temporary Construction Allowance - Included in Site Work									
Dewatering Allowance	LS	1	\$100,000.00	\$100,000.00	\$225,000.00	\$225,000.00	\$325,000.00	\$325,000.00	1.3%
Division 3 - Concrete									
Cast-In-Place Concrete									
Cast-In-Place Concrete - 15" Thick Elevated Slab	CY	1,583	\$392.00	\$620,666.67	\$308.00	\$487,666.67	\$700.00	\$1,108,333.33	4.5%
Cast-In-Place Concrete - 60" Slab	CY	5,405	\$392.00	\$2,118,828.99	\$308.00	\$1,664,794.21	\$700.00	\$3,783,623.20	15.5%
Cast-In-Place Concrete - 15" Thick Walls, 15' High	CY	1,167	\$392.00	\$457,333.33	\$308.00	\$359,333.33	\$700.00	\$816,666.67	3.3%
Cast-In-Place Concrete - 18" Thick Walls, 15' High	CY	981	\$392.00	\$376,763.97	\$308.00	\$296,020.97	\$700.00	\$672,774.94	2.8%
Cast-In-Place Concrete - 18" Thick Walls, 25' High	CY	183	\$392.00	\$71,865.08	\$308.00	\$56,465.42	\$700.00	\$128,330.50	0.5%
Cast-In-Place Concrete - 18" Thick Screw Pump Shaft	CY	85	\$392.00	\$33,338.24	\$308.00	\$26,194.33	\$700.00	\$59,532.56	0.2%
Hollow Core Slab (Building Roof)	SF	4,500	\$9.85	\$44,325.00	\$1.47	\$6,615.00	\$11.32	\$50,940.00	0.2%
Beams	CY	220	\$392.00	\$86,112.96	\$308.00	\$67,660.19	\$700.00	\$153,773.15	0.6%
Miscellaneous	CY	100	\$392.00	\$39,200.00	\$308.00	\$30,800.00	\$700.00	\$70,000.00	0.3%
Miscellaneous (Wastage)	CY	500		\$0.00	\$101.88	\$50,937.70	\$101.88	\$50,937.70	0.2%
Waterstop / Misc. Accessories	LF	1,000	\$2.29	\$2,292.20	\$10.19	\$10,187.54	\$12.48	\$12,479.74	0.1%
Grouting Equipment / Channels Allowance	LS	1	\$20,000.00		\$5,000.00	\$5,000.00	\$25,000.00	\$25,000.00	0.1%
Division 4 - Masonry									
Unit Mason Construction	SF	10,800	\$13.16	\$142,128.00	\$8.78	\$94,824.00	\$21.94	\$236,952.00	1.0%
Division 5 - Metals									
Aluminum Handrail Allowance	LF	300	\$57.65	\$17,295.00	\$18.21	\$5,463.00	\$75.86	\$22,758.00	0.1%
Access Platform Allowance	SF	200	\$165.00	\$33,000.00	\$40.00	\$8,000.00	\$205.00	\$41,000.00	0.2%
Aluminum Ladders	VF	200	\$140.00	\$28,000.00	\$55.00	\$11,000.00	\$195.00	\$39,000.00	0.2%
Skylight Hatches	EA	5	\$16,000.00	\$80,000.00	\$1,600.00	\$8,000.00	\$17,600.00	\$88,000.00	0.4%
Floor Hatches	EA	10	\$5,000.00	\$50,000.00	\$1,550.00	\$15,500.00	\$6,550.00	\$66,500.00	0.3%
Miscellaneous Metals Allowance	EA	1	\$20,000.00	\$20,000.00	\$10,000.00	\$10,000.00	\$30,000.00	\$30,000.00	0.1%
Division 6 - Wood, Plastics, Composites									
NOT USED									
Division 7 - Thermal and Moisture									
Dampproofing - Walls	SF	7,500	\$0.74	\$5,550.00	\$0.12	\$900.00	\$0.86	\$6,450.00	0.0%
1" Rigid Insulation - Walls	SF	7,500	\$1.00	\$7,500.00	\$0.58	\$4,350.00	\$1.58	\$11,850.00	0.0%
Membrane Roof	SF	7,500	\$2.82	\$21,150.00	\$1.42	\$10,650.00	\$4.24	\$31,800.00	0.1%
Division 8 - Openings									
Windows and Glazings	SF	100	\$76.38	\$7,638.00	\$8.49	\$849.00	\$84.87	\$8,487.00	0.0%
Roll Up Aluminum Door (10'x12')	EA	1	\$7,640.66	\$7,640.66	\$1,477.19	\$1,477.19	\$9,117.85	\$9,117.85	0.0%
Fiberglass Reinforced Plastic Doors, Single	EA	2	\$1,528.13	\$3,056.26	\$254.69	\$509.38	\$1,782.82	\$3,565.64	0.0%

			MATERIAL		LABOR AND EQUIPMENT		TOTAL		
Description	Units	Quantity	Unit \$	Cost	Unit \$	Cost	Total Unit \$	TOTAL COST	% OF TOTAL
60 MGD EHRT - Facility Cost									
Fiberglass Reinforced Plastic Doors, Double	EA	9	\$3,565.64	\$32,090.76	\$254.69	\$2,292.20	\$3,820.33	\$34,382.95	0.1%
Hollow Metal Doors, Hardware, Frames - Double	EA	1	\$1,222.50	\$1,222.50	\$254.69	\$254.69	\$1,477.19	\$1,477.19	0.0%
Division 9 - Finishes									
Painting (Wall, Ceilings and Chemical Containment Areas) Allowance	LS	1	\$50,000.00	\$50,000.00	\$25,000.00	\$25,000.00	\$75,000.00	\$75,000.00	0.3%
Pipe Painting Allowance	LS	1	\$5,000.00	\$5,000.00	\$7,500.00	\$7,500.00	\$12,500.00	\$12,500.00	0.1%
Suspended Acoustical Ceiling	SF	320	\$2.21	\$707.42	\$2.08	\$665.04	\$4.29	\$1,372.47	0.0%
Division 10 - Specialties									
NOT USED									
Division 11 - Equipment									
NOT USED									
Division 12 - Furnishings									
NOT USED									
Division 13 - Special Construction									
NOT USED									
Division 14 - Conveying Equipment									
NOT USED									
Division 21 - Fire Suppression									
Fire Protection System Allowance	LS	1	\$18,000.00	\$18,000.00	\$10,000.00	\$10,000.00	\$28,000.00	\$28,000.00	0.1%
Division 22 - Plumbing									
Plumbing Allowance	LS	1	\$114,000.00	\$114,000.00	\$76,000.00	\$76,000.00	\$190,000.00	\$245,000.00	1.0%
Emergency Shower / Eye Wash	EA	4	\$6,000.00	\$24,000.00	\$1,650.00	\$6,600.00	\$7,650.00	\$30,600.00	0.1%
Division 23 - HVAC									
HVAC Allowance	LS	1	\$175,000.00	\$175,000.00	\$125,000.00	\$125,000.00	\$300,000.00	\$300,000.00	1.2%
Odor Control Ductwork and Support	LS	1	\$132,000.00	\$132,000.00	\$16,600.00	\$16,600.00	\$148,600.00	\$148,600.00	0.6%
Odor Control	LS	1	\$500,000.00	\$500,000.00	\$50,000.00	\$50,000.00	\$550,000.00	\$550,000.00	2.3%
Division 25 - Integrated Automation									
NOT USED									
Division 26 - Electrical									
Electrical Allowance	LS	1	\$1,422,000.00	\$1,422,000.00	\$948,000.00	\$948,000.00	\$2,370,000.00	\$2,925,000.00	12.0%
Division 27 - Communications									
NOT USED									
Division 28 - Electronic Safety and Security									
NOT USED									

			MATERIAL		LABOR AND EQUIPMENT		TOTAL		
Description	Units	Quantity	Unit \$	Cost	Unit \$	Cost	Total Unit \$	TOTAL COST	% OF TOTAL
60 MGD EHRT - Facility Cost									
Division 31 - Earthwork									
Excavation	CY	32,916		\$0.00	\$12.73	\$419,025.49	\$12.73	\$419,025.49	1.7%
Backfill	CY	6,421		\$0.00	\$19.10	\$122,850.16	\$19.10	\$122,850.16	0.5%
Select Fill	CY	2,588	\$45.00	\$116,439.39	\$12.29	\$31,800.89	\$57.29	\$148,240.28	0.6%
Haul Off	CY	33,119		\$0.00	\$40.00	\$1,324,745.17	\$40.00	\$1,324,745.17	5.4%
Temporary Sheetting/Shoring	SF	24,503	\$80.00	\$1,960,273.48	\$80.00	\$1,960,273.48	\$160.00	\$3,920,546.93	16.0%
Auger Cast Piles	VF	4,568	\$87.00	\$397,372.50	\$58.00	\$264,915.00	\$145.00	\$662,287.50	2.7%
Division 32 - Exterior Improvements									
NOT USED									
Division 33 - Utilities									
Gas Supply Relocation/Connection Allowance	LS	1	\$20,000.00		\$5,000.00	\$5,000.00	\$25,000.00	\$25,000.00	0.1%
NOT USED									
Division 34 - Transportation									
NOT USED									
Division 35 - Waterway and Marine Construction									
Influent Gates (4' x 4')	EA	6	\$25,000.00	\$150,000.00	\$2,000.00	\$12,000.00	\$27,000.00	\$182,000.00	0.7%
Flushing Gates	EA	16	\$33,000.00	\$528,000.00	\$3,325.00	\$53,200.00	\$38,325.00	\$581,200.00	2.4%
Flushing Sluice Gates	EA	5	\$44,600.00	\$223,000.00	\$3,325.00	\$16,625.00	\$47,925.00	\$239,625.00	1.0%
Weir (Fixed) Gates	LS	1	\$10,350.00	\$10,350.00	\$2,770.00	\$2,770.00	\$13,120.00	\$13,120.00	0.1%
Stop Logs Allowance	LS	1	\$70,000.00	\$70,000.00	\$0.00	\$0.00	\$70,000.00	\$70,000.00	0.3%
Effluent Gate (6' x 6')	EA	2	\$40,000.00	\$80,000.00	\$5,000.00	\$10,000.00	\$45,000.00	\$90,000.00	0.4%
Division 40 - Process Interconnections									
Ductile Iron Pipe Allowance	LS	1	\$50,000.00	\$50,000.00	\$15,000.00	\$15,000.00	\$65,000.00	\$65,000.00	0.3%
Chemical Piping Allowance	LS	1	\$35,000.00	\$35,000.00	\$5,000.00	\$5,000.00	\$40,000.00	\$40,000.00	0.2%
Water Supply System Allowance	LS	1	\$25,000.00	\$25,000.00	\$3,000.00	\$3,000.00	\$28,000.00	\$28,000.00	0.1%
Sanitary Drainage System Allowance	LS	1	\$20,000.00	\$20,000.00	\$2,500.00	\$2,500.00	\$22,500.00	\$22,500.00	0.1%
Valves Allowance	LS	1	\$75,000.00	\$75,000.00	\$20,000.00	\$20,000.00	\$95,000.00	\$95,000.00	0.4%
Instrumentation Allowance	LS	1	\$350,000.00	\$350,000.00	\$250,000.00	\$250,000.00	\$600,000.00	\$600,000.00	2.5%
Division 41 - Material Processing and Handling Equipment									
Screenings Conveyor	EA	1	\$75,000.00	\$75,000.00	\$7,500.00	\$7,500.00	\$82,500.00	\$82,500.00	0.3%
Bridge Crane - 5 Ton / Track / Supports	EA	1	\$100,000.00	\$100,000.00	\$10,000.00	\$10,000.00	\$110,000.00	\$110,000.00	0.5%
Influent Screens	EA	3	\$400,000.00	\$1,200,000.00	\$20,000.00	\$60,000.00	\$420,000.00	\$1,260,000.00	5.2%
Emergency Screens	EA	2	\$300,000.00	\$600,000.00	\$30,000.00	\$60,000.00	\$330,000.00	\$660,000.00	2.7%
Induction Mixers									
Disinfectant	EA	2	\$40,000.00	\$80,000.00	\$5,000.00	\$10,000.00	\$45,000.00	\$90,000.00	0.4%
Dechlorination	EA	1	\$40,000.00	\$40,000.00	\$5,000.00	\$5,000.00	\$45,000.00	\$45,000.00	0.2%
Division 42- Process Heating, Cooling and Drying Equipment									
NOT USED									
Division 43- Process Gas and Liquid Handling, Purification and Storage Equipment									
Polyethylene Storage Tank:									
Coagulant (Ferric Chloride), 5,000 gallons	EA	2	\$17,800.00	\$35,600.00	\$2,000.00	\$4,000.00	\$19,800.00	\$39,600.00	0.2%
Disinfectant, 5,000 gallons	EA	2	\$21,700.00	\$43,400.00	\$2,200.00	\$4,400.00	\$23,900.00	\$47,800.00	0.2%

Description	Units	Quantity	MATERIAL		LABOR AND EQUIPMENT		TOTAL		
			Unit \$	Cost	Unit \$	Cost	Total Unit \$	TOTAL COST	% OF TOTAL
60 MGD EHRT - Facility Cost									
Dechlorination, 5,000 gallons	EA	2	\$16,600.00	\$33,200.00	\$3,000.00	\$6,000.00	\$19,600.00	\$39,200.00	0.2%
Division 44 - Pollution and Waste Control Equipment									
NOT USED									
Division 45 - Industry Specific Manufacturing Equipment									
NOT USED									
Division 46 - Water and Wastewater Equipment									
Dewatering Pumps and Controls (Quote Based on 3 Submersible Pumps)	LS	1	\$100,000.00	\$100,000.00	\$10,000.00	\$10,000.00	\$110,000.00	\$110,000.00	0.5%
Chemical Feed Pumps (Positive Displacement)									
Coagulant (Ferric Chloride)	EA	2	\$7,500.00	\$15,000.00	\$995.00	\$1,990.00	\$8,495.00	\$16,990.00	0.1%
Disinfectant (Sodium Hypochlorite)	EA	2	\$15,000.00	\$30,000.00	\$1,660.00	\$3,320.00	\$16,660.00	\$33,320.00	0.1%
Dechlorination	EA	2	\$7,500.00	\$15,000.00	\$885.00	\$1,770.00	\$8,385.00	\$16,770.00	0.1%
Chemical Recirculation Pumps (Centrifugal)									0.0%
Coagulant (Ferric Chloride)	EA	1	\$8,000.00	\$8,000.00	\$940.00	\$940.00	\$8,940.00	\$8,940.00	0.0%
Disinfectant (Sodium Hypochlorite)	EA	1	\$8,000.00	\$8,000.00	\$940.00	\$940.00	\$8,940.00	\$8,940.00	0.0%
Dechlorination	EA	1	\$8,000.00	\$8,000.00	\$940.00	\$940.00	\$8,940.00	\$8,940.00	0.0%
Flocculant (Polymer) Pump and Mixer System	EA	2	\$65,000.00	\$130,000.00	\$940.00	\$1,880.00	\$65,940.00	\$131,880.00	0.5%
Automatic Refrigerated Samplers	EA	2	\$8,300.00	\$16,600.00	\$885.00	\$1,770.00	\$9,185.00	\$18,370.00	0.1%
Sample Pumps	EA	6	\$3,900.00	\$23,400.00	\$885.00	\$5,310.00	\$4,785.00	\$28,710.00	0.1%
Chemical Sump Pumps	EA	4	\$7,200.00	\$28,800.00	\$995.00	\$3,980.00	\$8,195.00	\$32,780.00	0.1%
Effluent Screw Pumps	EA	3	\$266,000.00	\$798,000.00	\$66,500.00	\$199,500.00	\$332,500.00	\$997,500.00	4.1%
Division 48 - Electrical Power Generation									
Backup Generator Allowance	LS	1	\$350,000.00	\$350,000.00	\$100,000.00	\$100,000.00	\$450,000.00	\$450,000.00	1.8%
Sub-Totals									
				\$14,680,000.00		\$9,750,000.00		\$24,430,000.00	

ALCOSAN - PRELIMINARY PLANNING - TASK 2.4 VALUE ENGINEERING
OPINION OF PROBABLE CONSTRUCTION COST
120 MGD EHRT
Facility Unit Price Breakdown

			MATERIAL		LABOR AND EQUIPMENT		TOTAL		
Description	Units	Quantity	Unit \$	Cost	Unit \$	Cost	Total Unit \$	TOTAL COST	% OF TOTAL
120 MGD EHRT - Facility Cost									
Division 1 - General Conditions									
General Conditions (Included in Mob/Demob markup)									
Division 2 - Existing Conditions									
Demolish / Site Clearing / Disposal / Temporary Construction Allowance - Included in Site Work									
Dewatering Allowance	LS	1	\$155,000.00	\$155,000.00	\$400,000.00	\$400,000.00	\$555,000.00	\$555,000.00	1.5%
Division 3 - Concrete									
Cast-in-Place Concrete									
Cast-In-Place Concrete - 15" Thick Elevated Slab	CY	2,868	\$392.00	\$1,123,370.37	\$308.00	\$882,648.15	\$700.00	\$2,006,018.52	5.3%
Cast-In-Place Concrete - 60" Slab	CY	10,696	\$392.00	\$4,192,942.32	\$308.00	\$3,294,454.68	\$700.00	\$7,487,397.00	19.7%
Cast-In-Place Concrete - 15" Thick Walls, 15' High	CY	2,167	\$392.00	\$849,333.33	\$308.00	\$667,333.33	\$700.00	\$1,516,666.67	4.0%
Cast-In-Place Concrete - 18" Thick Walls, 15' High	CY	1,444	\$392.00	\$566,222.22	\$308.00	\$444,888.89	\$700.00	\$1,011,111.11	2.7%
Cast-In-Place Concrete - 18" Thick Walls, 25' High	CY	242	\$392.00	\$94,731.74	\$308.00	\$74,432.08	\$700.00	\$169,163.83	0.4%
Cast-In-Place Concrete - 18" Thick Screw Pump Shaft	CY	142	\$392.00	\$55,863.74	\$308.00	\$43,657.22	\$700.00	\$99,220.96	0.3%
Hollow Core Slab (Building Roof)	SF	5,800	\$9.85	\$57,130.00	\$1.47	\$8,526.00	\$11.32	\$65,656.00	0.2%
Beams	CY	420	\$392.00	\$164,730.74	\$308.00	\$129,431.30	\$700.00	\$294,162.04	0.8%
Miscellaneous	CY	150	\$392.00	\$58,800.00	\$308.00	\$46,200.00	\$700.00	\$105,000.00	0.3%
Miscellaneous (Wastage)	CY	695		\$0.00	\$101.88	\$70,803.41	\$101.88	\$70,803.41	0.2%
Waterstop / Misc. Accessories	LF	1,650	\$2.29	\$3,782.12	\$10.19	\$16,809.44	\$12.48	\$20,591.67	0.1%
Grouting Equipment / Channels Allowance	LS	1	\$30,000.00		\$10,000.00	\$10,000.00	\$40,000.00	\$40,000.00	0.1%
Division 4 - Masonry									
Unit Mason Construction	SF	13,860	\$13.16	\$182,397.60	\$8.78	\$121,690.80	\$21.94	\$304,088.40	0.8%
Division 5 - Metals									
Aluminum Handrail Allowance	LF	400	\$57.65	\$23,060.00	\$18.21	\$7,284.00	\$75.86	\$30,344.00	0.1%
Access Platform Allowance	SF	200	\$165.00	\$33,000.00	\$40.00	\$8,000.00	\$205.00	\$41,000.00	0.1%
Aluminum Ladders	VF	200	\$140.00	\$28,000.00	\$55.00	\$11,000.00	\$195.00	\$39,000.00	0.1%
Skylight Hatches	EA	5	\$18,000.00	\$80,000.00	\$1,800.00	\$8,000.00	\$17,600.00	\$88,000.00	0.2%
Floor Hatches	EA	10	\$5,000.00	\$50,000.00	\$1,550.00	\$15,500.00	\$6,550.00	\$66,500.00	0.2%
Miscellaneous Metals Allowance	LS	1	\$35,000.00	\$35,000.00	\$15,000.00	\$15,000.00	\$50,000.00	\$50,000.00	0.1%
Division 6 - Wood, Plastics, Composites									
NOT USED									
Division 7 - Thermal and Moisture									
Dampproofing - Walls	SF	8,500	\$0.74	\$6,290.00	\$0.12	\$1,020.00	\$0.86	\$7,310.00	0.0%
1" Rigid Insulation - Walls	SF	8,500	\$1.00	\$8,500.00	\$0.58	\$4,930.00	\$1.58	\$13,430.00	0.0%
Membrane Roof	SF	8,500	\$2.82	\$23,870.00	\$1.42	\$12,070.00	\$4.24	\$36,040.00	0.1%
Division 8 - Openings									
Windows and Glazings	SF	100	\$76.38	\$7,638.00	\$8.49	\$849.00	\$84.87	\$8,487.00	0.0%
Roll Up Aluminum Door (10'x12')	EA	1	\$8,300.00	\$8,300.00	\$1,600.00	\$1,600.00	\$9,900.00	\$9,900.00	0.0%
Fiberglass Reinforced Plastic Doors, Single	EA	2	\$1,660.00	\$3,320.00	\$275.00	\$550.00	\$1,935.00	\$3,870.00	0.0%
Fiberglass Reinforced Plastic Doors, Double	EA	9	\$3,900.00	\$35,100.00	\$275.00	\$2,475.00	\$4,175.00	\$37,575.00	0.1%

Description	Units	Quantity	MATERIAL		LABOR AND EQUIPMENT		TOTAL		
			Unit \$	Cost	Unit \$	Cost	Total Unit \$	TOTAL COST	% OF TOTAL
120 MGD EHRT - Facility Cost									
Hollow Metal Doors, Hardware, Frames - Double	EA	1	\$1,300.00	\$1,300.00	\$275.00	\$275.00	\$1,575.00	\$1,575.00	0.0%
Division 9 - Finishes									
Painting (Wall, Ceilings and Chemical Containment Areas)	LS	1	\$60,000.00	\$60,000.00	\$40,000.00	\$40,000.00	\$100,000.00	\$100,000.00	0.3%
Pipe Painting Allowance	LS	1	\$6,600.00	\$6,600.00	\$10,000.00	\$10,000.00	\$16,600.00	\$16,600.00	0.0%
Suspended Acoustical Ceiling	SF	320	\$2.21	\$707.42	\$2.08	\$665.04	\$4.29	\$1,372.47	0.0%
Division 10 - Specialties									
NOT USED									
Division 11 - Equipment									
NOT USED									
Division 12 - Furnishings									
NOT USED									
Division 13 - Special Construction									
NOT USED									
Division 14 - Conveying Equipment									
NOT USED									
Division 21 - Fire Suppression									
Fire Protection System Allowance	LS	1	\$24,000.00	\$24,000.00	\$15,400.00	\$15,400.00	\$39,400.00	\$39,400.00	0.1%
Division 22 - Plumbing									
Plumbing Allowance	LS	1	\$180,000.00	\$180,000.00	\$120,000.00	\$120,000.00	\$300,000.00	\$385,000.00	1.0%
Emergency Shower / Eye Wash	EA	4	\$6,000.00	\$24,000.00	\$1,650.00	\$6,600.00	\$7,650.00	\$30,600.00	0.1%
Division 23 - HVAC									
HVAC Allowance	LS	1	\$210,000.00	\$210,000.00	\$140,000.00	\$140,000.00	\$350,000.00	\$350,000.00	0.9%
Odor Control Ductwork and Support	LS	1	\$166,000.00	\$166,000.00	\$22,100.00	\$22,100.00	\$188,100.00	\$188,100.00	0.5%
Odor Control	LS	1	\$680,000.00	\$680,000.00	\$66,300.00	\$66,300.00	\$746,300.00	\$746,300.00	2.0%
Division 25 - Integrated Automation									
NOT USED									
Division 26 - Electrical									
Electrical Allowance	LS	1	\$2,160,000.00	\$2,160,000.00	\$1,440,000.00	\$1,440,000.00	\$3,600,000.00	\$4,620,000.00	12.1%
Division 27 - Communications									
NOT USED									
Division 28 - Electronic Safety and Security									
NOT USED									

Description	Units	Quantity	MATERIAL		LABOR AND EQUIPMENT		TOTAL		
			Unit \$	Cost	Unit \$	Cost	Total Unit \$	TOTAL COST	% OF TOTAL
120 MGD EHRT - Facility Cost									
Division 31 - Earthwork									
Excavation	CY	60,000		\$0.00	\$12.73	\$763,800.00	\$12.73	\$763,800.00	2.0%
Backfill	CY	11,000		\$0.00	\$19.10	\$210,100.00	\$19.10	\$210,100.00	0.6%
Select Fill	CY	4,200	\$45.00	\$189,000.00	\$12.29	\$51,618.00	\$57.29	\$240,618.00	0.6%
Haul Off	CY	61,250		\$0.00	\$40.00	\$2,450,000.00	\$40.00	\$2,450,000.00	6.4%
Temporary Sheetting/Shoring	SF	31,500	\$80.00	\$2,520,000.00	\$80.00	\$2,520,000.00	\$160.00	\$5,040,000.00	13.2%
Auger Cast Piles	VF	7,600	\$87.00	\$661,200.00	\$58.00	\$440,800.00	\$145.00	\$1,102,000.00	2.9%
Division 32 - Exterior Improvements									
NOT USED									
Division 33 - Utilities									
Gas Supply Relocation/Connection Allowance	LS	1	\$20,000.00		\$5,000.00	\$5,000.00	\$25,000.00	\$25,000.00	0.1%
NOT USED									
Division 34 - Transportation									
NOT USED									
Division 35 - Waterway and Marine Construction									
Influent Gates (4' x 4')	EA	6	\$25,000.00	\$150,000.00	\$2,000.00	\$12,000.00	\$27,000.00	\$162,000.00	0.4%
Flushing Gates	EA	18	\$33,000.00	\$528,000.00	\$3,325.00	\$53,200.00	\$36,325.00	\$581,200.00	1.5%
Flushing Sluice Gates	EA	12	\$44,600.00	\$535,200.00	\$3,325.00	\$39,900.00	\$47,925.00	\$575,100.00	1.5%
Weir (Fixed) Gates	LS	1	\$10,350.00	\$10,350.00	\$2,770.00	\$2,770.00	\$13,120.00	\$13,120.00	0.0%
Stop Logs Allowance	LS	1	\$70,000.00	\$70,000.00	\$0.00	\$0.00	\$70,000.00	\$70,000.00	0.2%
Effluent Gate (10' x 10')	EA	2	\$60,000.00	\$120,000.00	\$7,500.00	\$15,000.00	\$67,500.00	\$135,000.00	0.4%
Division 40 - Process Interconnections									
Ductile Iron Pipe Allowance	LS	1	\$60,700.00	\$60,700.00	\$19,200.00	\$19,200.00	\$79,900.00	\$79,900.00	0.2%
Chemical Piping Allowance	LS	1	\$50,000.00	\$50,000.00	\$6,000.00	\$6,000.00	\$56,000.00	\$56,000.00	0.1%
Water Supply System Allowance	LS	1	\$27,600.00	\$27,600.00	\$3,600.00	\$3,600.00	\$31,200.00	\$31,200.00	0.1%
Sanitary Drainage System Allowance	LS	1	\$22,100.00	\$22,100.00	\$2,800.00	\$2,800.00	\$24,900.00	\$24,900.00	0.1%
Valves Allowance	LS	1	\$106,200.00	\$106,200.00	\$36,000.00	\$36,000.00	\$142,200.00	\$142,200.00	0.4%
Instrumentation Allowance	LS	1	\$470,000.00	\$470,000.00	\$315,000.00	\$315,000.00	\$785,000.00	\$785,000.00	2.1%
Division 41 - Material Processing and Handling Equipment									
Screenings Conveyor	EA	1	\$105,000.00	\$105,000.00	\$10,500.00	\$10,500.00	\$115,500.00	\$115,500.00	0.3%
Bridge Crane - 5 Ton / Track / Supports	EA	1	\$100,000.00	\$100,000.00	\$10,000.00	\$10,000.00	\$110,000.00	\$110,000.00	0.3%
Influent Screens	EA	3	\$600,000.00	\$1,800,000.00	\$30,000.00	\$90,000.00	\$630,000.00	\$1,890,000.00	5.0%
Emergency Screens	EA	2	\$375,000.00	\$750,000.00	\$50,000.00	\$100,000.00	\$425,000.00	\$850,000.00	2.2%
Induction Mixers									
Disinfectant	EA	2	\$60,000.00	\$120,000.00	\$6,900.00	\$13,800.00	\$66,900.00	\$133,800.00	0.4%
Dechlorination	EA	1	\$60,000.00	\$60,000.00	\$6,900.00	\$6,900.00	\$66,900.00	\$66,900.00	0.2%
Division 42- Process Heating, Cooling and Drying Equipment									
NOT USED									
Division 43- Process Gas and Liquid Handling, Purification and Storage Equipment									
Polyethylene Storage Tank:									
Coagulant (Ferric Chloride), 5,000 gallons	EA	2	\$17,800.00	\$35,600.00	\$2,000.00	\$4,000.00	\$19,800.00	\$39,600.00	0.1%
Disinfectant, 5,000 gallons	EA	2	\$21,700.00	\$43,400.00	\$2,200.00	\$4,400.00	\$23,900.00	\$47,800.00	0.1%
Dechlorination, 5,000 gallons	EA	2	\$16,600.00	\$33,200.00	\$3,000.00	\$6,000.00	\$19,600.00	\$39,200.00	0.1%

				MATERIAL		LABOR AND EQUIPMENT		TOTAL	
Description	Units	Quantity	Unit \$	Cost	Unit \$	Cost	Total Unit \$	TOTAL COST	% OF TOTAL
120 MGD EHRT - Facility Cost									
Division 44 - Pollution and Waste Control Equipment									
NOT USED									
Division 45 - Industry Specific Manufacturing Equipment									
NOT USED									
Division 46 - Water and Wastewater Equipment									
Dewatering Pumps and Controls (Quote Based on 3 Submersible Pumps)	LS	1	\$130,100.00	\$130,100.00	\$15,500.00	\$15,500.00	\$145,600.00	\$145,600.00	0.4%
Chemical Feed Pumps (Positive Displacement)				\$0.00		\$0.00	\$0.00	\$0.00	0.0%
Coagulant (Ferric Chloride)	EA	2	\$12,150.00	\$24,300.00	\$995.00	\$1,990.00	\$13,145.00	\$26,290.00	0.1%
Disinfectant (Sodium Hypochlorite)	EA	2	\$19,800.00	\$39,600.00	\$1,660.00	\$3,320.00	\$21,460.00	\$42,920.00	0.1%
Dechlorination	EA	2	\$9,400.00	\$18,800.00	\$885.00	\$1,770.00	\$10,285.00	\$20,570.00	0.1%
Chemical Recirculation Pumps (Centrifugal)				\$0.00		\$0.00	\$0.00	\$0.00	0.0%
Coagulant (Ferric Chloride)	EA	1	\$12,100.00	\$12,100.00	\$940.00	\$940.00	\$13,040.00	\$13,040.00	0.0%
Disinfectant (Sodium Hypochlorite)	EA	1	\$12,100.00	\$12,100.00	\$940.00	\$940.00	\$13,040.00	\$13,040.00	0.0%
Dechlorination	EA	1	\$12,100.00	\$12,100.00	\$940.00	\$940.00	\$13,040.00	\$13,040.00	0.0%
Flocculant (Polymer) Pump and Mixer System	EA	2	\$88,300.00	\$176,600.00	\$940.00	\$1,880.00	\$89,240.00	\$178,480.00	0.5%
Automatic Refrigerated Samplers	EA	2	\$8,300.00	\$16,600.00	\$885.00	\$1,770.00	\$9,185.00	\$18,370.00	0.0%
Sample Pumps	EA	6	\$3,900.00	\$23,400.00	\$885.00	\$5,310.00	\$4,785.00	\$28,710.00	0.1%
Chemical Sump Pumps	EA	4	\$7,200.00	\$28,800.00	\$995.00	\$3,980.00	\$8,195.00	\$32,780.00	0.1%
Effluent Screw Pumps	EA	5	\$266,000.00	\$1,330,000.00	\$66,500.00	\$332,500.00	\$332,500.00	\$1,662,500.00	4.4%
Division 48 - Electrical Power Generation									
Backup Generator Allowance	LS	1	\$450,000.00	\$450,000.00	\$150,000.00	\$150,000.00	\$600,000.00	\$600,000.00	1.6%
Sub-Totals				\$22,210,000.00		\$15,880,000.00		\$38,090,000.00	

ALCOSAN - PRELIMINARY PLANNING - TASK 2.4 VALUE ENGINEERING
OPINION OF PROBABLE CONSTRUCTION COST
Alternative 1A - WW PS at WWTP and 60 MGD EHRT at Western Penitentiary Site
Civil/ Site Work Unit Price Breakdown

Description	Units	Quantity	MATERIAL		LABOR AND EQUIPMENT		TOTAL		% OF TOTAL
			Unit \$	Cost	Unit \$	Cost	Total Unit \$	TOTAL COST	
1A - WW PS at WWTP and 60 MGD EHRT at Western Penitentiary Site - Civil/Site Work									
Division 1 - General Conditions									
General Conditions (Included in Mob/Demob markup)									
Division 2 - Existing Conditions									
Demolish Concrete / Brick Buildings / Guard Wall	SF	75,600	\$0.00	\$0.00	\$5.00	\$378,000.00	\$5.00	\$378,000.00	3.5%
Demolition Difficulty Allowance - Western Penitentiary Site (30%)	ls	1			\$113,400.00	\$113,400.00	\$113,400.00	\$113,400.00	1.0%
Temporary Bypass Pumping Allowance	ls	1	\$30,000.00	\$30,000.00	\$20,000.00	\$20,000.00	\$50,000.00	\$50,000.00	0.5%
Traffic Control Allowance	ls	1		\$0.00	\$100,000.00	\$100,000.00	\$100,000.00	\$100,000.00	0.9%
Division 3 - Concrete									
Concrete Outfall - 1.5' Thick, 20' x 20'	CY	22	\$392.00	\$8,711.11	\$308.00	\$6,844.44	\$700.00	\$15,555.56	0.1%
Additional Concrete for Building in Floodplain	CY	80	\$392.00	\$31,360.00	\$308.00	\$24,640.00	\$700.00	\$56,000.00	0.5%
Precast Meter Vault	EA	2	\$7,753.32	\$15,506.63	\$1,550.66	\$3,101.33	\$9,303.98	\$18,607.96	0.2%
Concrete Sidewalk	SF	500	\$4.00	\$2,000.00	\$3.00	\$1,500.00	\$7.00	\$3,500.00	0.0%
Division 4 - Masonry									
NOT USED									
Division 5 - Metals									
NOT USED									
Division 6 - Wood, Plastics, Composites									
NOT USED									
Division 7 - Thermal and Moisture									
NOT USED									
Division 8 - Openings									
NOT USED									
Division 9 - Finishes									
NOT USED									
Division 10 - Specialties									
NOT USED									
Division 11 - Equipment									
NOT USED									
Division 12 - Furnishings									
NOT USED									

				MATERIAL		LABOR AND EQUIPMENT		TOTAL	
Description	Units	Quantity	Unit \$	Cost	Unit \$	Cost	Total Unit \$	TOTAL COST	% OF TOTAL
1A - WW PS at WWTP and 60 MGD EHRT at Western Penitentiary Site - Civil/Site Work									
Division 13 - Special Construction									
NOT USED									
Division 14 - Conveying Equipment									
NOT USED									
Division 21 - Fire Suppression									
NOT USED									
Division 22 - Plumbing									
NOT USED									
Division 23 - HVAC									
NOT USED									
Division 25 - Integrated Automotlon									
NOT USED									
Division 26 - Electrical									
NOT USED									
Division 27 - Communications									
NOT USED									
Division 28 - Electronic Safety and Security									
NOT USED									
Division 31 - Earthwork									
Excavation	CY	1,700		\$0.00	\$12.73	\$21,641.00	\$12.73	\$21,641.00	0.2%
Backfill	CY	170		\$0.00	\$19.10	\$3,247.00	\$19.10	\$3,247.00	0.0%
Haul Off	CY	18,000		\$0.00	\$40.00	\$720,000.00	\$40.00	\$720,000.00	6.6%
Select Fill	CY	10,000	\$45.00	\$450,000.00	\$12.29	\$122,900.00	\$57.29	\$572,900.00	5.2%
Temporary Sheeting/Shoring	SF	34,000	\$80.00	\$2,720,000.00	\$80.00	\$2,720,000.00	\$160.00	\$5,440,000.00	49.7%
Division 32 - Exterior Improvements									
Grass Restoration	SY	10,667	\$0.45	\$4,800.00	\$2.36	\$25,173.33	\$2.81	\$29,973.33	0.3%
Rain Garden	SF	2,000	\$30.00	\$60,000.00	\$15.00	\$30,000.00	\$45.00	\$90,000.00	0.8%
Paving	SY	11,200	\$48.47	\$542,864.00	\$2.61	\$29,232.00	\$51.08	\$572,096.00	5.2%
10' Galvanized Chain Link Fence	LF	770	\$11.16	\$8,598.88	\$7.44	\$5,731.25	\$18.61	\$14,328.13	0.1%
10' Galvanized Chain Link Fence Gate	EA	2	\$775.33	\$1,550.66	\$516.89	\$1,033.78	\$1,292.22	\$2,584.44	0.0%
Division 33 - Utilities									
48" Diameter Manhole	EA	2	\$3,412.50	\$6,825.00	\$1,837.50	\$3,675.00	\$5,250.00	\$10,500.00	0.1%
96" Diameter Manhole	EA	3	\$7,312.50	\$21,937.50	\$3,937.50	\$11,812.50	\$11,250.00	\$33,750.00	0.3%
Site Chemical Piping - PVC Pipe	LS	1	\$25,844.39	\$25,844.39	\$2,584.44	\$2,584.44	\$28,428.83	\$28,428.83	0.3%
Water Supply System Allowance	LS	1	\$36,182.14	\$36,182.14	\$4,651.99	\$4,651.99	\$40,834.13	\$40,834.13	0.4%
24" PVC Dewatering Sewer	LF	220	\$234.00	\$51,480.00	\$126.00	\$27,720.00	\$360.00	\$79,200.00	0.7%

Description	Unit	Quantity	Unit \$	MATERIAL	LABOR AND EQUIPMENT		TOTAL		%
				Cost	Unit \$	Cost	Total Unit \$	TOTAL COST	
1A - WW PS at WWTP and 60 MGD EHRT at Western Penitentiary Site - Civil/Site Work									
12" PVC Dewatering FM	LF	500	\$195.00	\$97,500.00	\$105.00	\$52,500.00	\$300.00	\$150,000.00	1.4%
54" PCCP HRT Influent Forcemain	LF	1,280	\$314.00	\$401,920.00	\$129.00	\$165,120.00	\$443.00	\$567,040.00	5.2%
54" PCCP Bend	EA	12	\$5,000.00	\$60,000.00	\$500.00	\$6,000.00	\$5,500.00	\$66,000.00	0.6%
72" PCCP Outfall Sewer	LF	1,000	\$570.20	\$570,200.00	\$178.01	\$178,014.00	\$748.21	\$748,214.00	6.8%
Yard Hydrant	EA	5	\$1,292.22	\$6,461.10	\$3,359.77	\$16,798.85	\$4,651.99	\$23,259.95	0.2%
Division 34 - Transportation									
NOT USED									
Division 35 - Waterway and Marine Construction									
New Outfall into Ohio River	LS	1		\$0.00	\$1,000,000.00	\$1,000,000.00	\$1,000,000.00	\$1,000,000.00	9.1%
Division 40 - Process Interconnections									
NOT USED									
Division 41 - Material Processing and Handling Equipment									
NOT USED									
Division 42- Process Heating, Cooling and Drying Equipment									
NOT USED									
Division 43- Process Gas and Liquid Handling, Purification and Storage Equipment									
NOT USED									
Division 44 - Pollution and Waste Control Equipment									
NOT USED									
Division 45 - Industry Specific Manufacturing Equipment									
NOT USED									
Division 46 - Water and Wastewater Equipment									
NOT USED									
Division 48 - Electrical Power Generation									
NOT USED									
Sub-Totals				\$5,160,000.00		\$6,800,000.00		\$10,960,000.00	

ALCOSAN - PRELIMINARY PLANNING - TASK 2.4 VALUE ENGINEERING
OPINION OF PROBABLE CONSTRUCTION COST
Alternative 1B - WW PS at WWTP and 60 MGD EHRT at Trucking Site
Civil/ Site Work Unit Price Breakdown

			MATERIAL		LABOR AND EQUIPMENT		TOTAL		
Description	Units	Quantity	Unit \$	Cost	Unit \$	Cost	Total Unit \$	TOTAL COST	% OF TOTAL
1B - WW PS at WWTP and 60 MGD EHRT at Trucking Site - Civil/Site Work									
Division 1 - General Conditions									
General Conditions (included in Mob/Demob markup)									
Division 2 - Existing Conditions									
Demolish Concrete / Brick Buildings	SF	187,292	\$0.00	\$0.00	\$5.00	\$936,460.00	\$5.00	\$936,460.00	5.8%
Temporary Bypass Pumping Allowance	Is	1	\$30,000.00	\$30,000.00	\$20,000.00	\$20,000.00	\$50,000.00	\$50,000.00	0.3%
Traffic Control Allowance	Is	1		\$0.00	\$100,000.00	\$100,000.00	\$100,000.00	\$100,000.00	0.6%
Division 3 - Concrete									
Concrete Outfall - 1.5' Thick, 20' x 20'	CY	22	\$392.00	\$8,711.11	\$308.00	\$6,844.44	\$700.00	\$15,555.56	0.1%
Precast Meter Vault	EA	2	\$7,753.32	\$16,506.63	\$1,550.66	\$3,101.33	\$9,303.98	\$19,607.96	0.1%
Concrete Sidewalk	SF	2,000	\$4.00	\$8,000.00	\$3.00	\$6,000.00	\$7.00	\$14,000.00	0.1%
Division 4 - Masonry									
NOT USED									
Division 5 - Metals									
NOT USED									
Division 6 - Wood, Plastics, Composites									
NOT USED									
Division 7 - Thermal and Moisture									
NOT USED									
Division 8 - Openings									
NOT USED									
Division 9 - Finishes									
NOT USED									
Division 10 - Specialties									
NOT USED									
Division 11 - Equipment									
NOT USED									
Division 12 - Furnishings									
NOT USED									

				MATERIAL		LABOR AND EQUIPMENT		TOTAL		
Description	Unit	Quantity	Unit \$	Cost	Unit \$	Cost	Total Unit \$	TOTAL COST		% OF TOTAL
1B - WW PS at WWTP and 60 MGD EHRT at Trucking Site - Civil/Site Work										
Division 13 - Special Construction										
NOT USED										
Division 14 - Conveying Equipment										
NOT USED										
Division 21 - Fire Suppression										
NOT USED										
Division 22 - Plumbing										
NOT USED										
Division 23 - HVAC										
NOT USED										
Division 25 - Integrated Automation										
NOT USED										
Division 26 - Electrical										
NOT USED										
Division 27 - Communications										
NOT USED										
Division 28 - Electronic Safety and Security										
NOT USED										
Division 31 - Earthwork										
Excavation	CY	2,800		\$0.00	\$12.73	\$35,644.00	\$12.73	\$35,644.00		0.2%
Backfill	CY	280		\$0.00	\$19.10	\$5,348.00	\$19.10	\$5,348.00		0.0%
Haul Off	CY	31,000		\$0.00	\$40.00	\$1,240,000.00	\$40.00	\$1,240,000.00		7.7%
Select Fill	CY	17,000	\$45.00	\$765,000.00	\$12.29	\$208,930.00	\$57.29	\$973,930.00		6.1%
Temporary Sheetting/Shoring	SF	48,280	\$80.00	\$3,862,400.00	\$80.00	\$3,862,400.00	\$160.00	\$7,724,800.00		48.1%
Division 32 - Exterior Improvements										
Grass Restoration	SY	31,111	\$0.45	\$14,000.00	\$2.36	\$73,422.22	\$2.81	\$87,422.22		0.5%
Rain Garden	SF	2,000	\$30.00	\$60,000.00	\$15.00	\$30,000.00	\$45.00	\$90,000.00		0.6%
Paving	SY	14,900	\$48.47	\$722,203.00	\$2.61	\$38,889.00	\$51.08	\$761,092.00		4.7%
10' Galvanized Chain Link Fence	LF	2,800	\$11.16	\$31,261.37	\$7.44	\$20,840.91	\$18.61	\$52,102.29		0.3%
10' Galvanized Chain Link Fence Gate	EA	2	\$775.33	\$1,550.66	\$516.89	\$1,033.78	\$1,292.22	\$2,584.44		0.0%
Division 33 - Utilities										
48" Diameter Manhole	EA	6	\$3,412.50	\$20,475.00	\$1,837.50	\$11,025.00	\$5,250.00	\$31,500.00		0.2%
96" Diameter Manhole	EA	4	\$7,312.50	\$29,250.00	\$3,937.50	\$15,750.00	\$11,250.00	\$45,000.00		0.3%
Site Chemical Piping - PVC Pipe	LS	1	\$25,844.39	\$25,844.39	\$2,584.44	\$2,584.44	\$28,428.83	\$28,428.83		0.2%
Water Supply System Allowance	LS	1	\$36,182.14	\$36,182.14	\$4,651.99	\$4,651.99	\$40,834.13	\$40,834.13		0.3%
24" PVC Dewatering Sewer	LF	1,280	\$234.00	\$294,840.00	\$126.00	\$158,760.00	\$360.00	\$453,600.00		2.8%
12" PVC Dewatering FM	LF	500	\$195.00	\$97,500.00	\$105.00	\$52,500.00	\$300.00	\$150,000.00		0.9%

				MATERIAL		LABOR AND EQUIPMENT		TOTAL	
Description	Units	Quantity	Unit \$	Cost	Unit \$	Cost	Total Unit \$	TOTAL COST	% OF TOTAL
1B - WW PS at WWTP and 60 MGD EHRT at Trucking Site - Civil/Site Work									
Division 13 - Special Construction		2,300	\$314.00	\$722,200.00	\$129.00	\$296,700.00	\$443.00	\$1,018,900.00	6.3%
54" PCCP Bend	EA	16	\$5,000.00	\$80,000.00	\$500.00	\$8,000.00	\$5,500.00	\$88,000.00	0.5%
72" PCCP Outfall Sewer	LF	1,420	\$570.20	\$809,684.00	\$178.01	\$252,779.88	\$748.21	\$1,062,463.88	6.6%
Yard Hydrant	EA	5	\$1,292.22	\$6,461.10	\$3,359.77	\$16,798.85	\$4,661.99	\$23,259.95	0.1%
Division 34 - Transportation									
NOT USED									
Division 35 - Waterway and Marine Construction									
New Outfall into Ohio River	LS	1		\$0.00	\$1,000,000.00	\$1,000,000.00	\$1,000,000.00	\$1,000,000.00	6.2%
Division 40 - Process Interconnections									
NOT USED									
Division 41 - Material Processing and Handling Equipment									
NOT USED									
Division 42- Process Heating, Cooling and Drying Equipment									
NOT USED									
Division 43- Process Gas and Liquid Handling, Purification and Storage Equipment									
NOT USED									
Division 44 - Pollution and Waste Control Equipment									
NOT USED									
Division 45 - Industry Specific Manufacturing Equipment									
NOT USED									
Division 46 - Water and Wastewater Equipment									
NOT USED									
Division 48 - Electrical Power Generation									
NOT USED									
Sub-Totals				\$7,650,000.00		\$8,410,000.00		\$16,060,000.00	

ALCOSAN - PRELIMINARY PLANNING - TASK 2.4 VALUE ENGINEERING
OPINION OF PROBABLE CONSTRUCTION COST
Alternative 1C - WW PS at WWTP and 60 MGD EHRT at Valspar Site
Civil/ Site Work Unit Price Breakdown

			MATERIAL		LABOR AND EQUIPMENT		TOTAL		
Description	Units	Quantity	Unit \$	Cost	Unit \$	Cost	Total Unit \$	TOTAL COST	% OF TOTAL
1C - WW PS at WWTP and 60 MGD EHRT at Valspar Site - Civil/Site Work									
Division 1 - General Conditions									
General Conditions (included in Mob/Demob markup)									
Division 2 - Existing Conditions									
Demolish Concrete / Brick Buildings	SF	1,350	\$0.00	\$0.00	\$5.00	\$6,750.00	\$5.00	\$6,750.00	0.1%
Demolish Metal Buildings	SF	5,950	\$0.00	\$0.00	\$3.00	\$17,850.00	\$3.00	\$17,850.00	0.2%
Temporary Bypass Pumping Allowance	Is	1	\$30,000.00	\$30,000.00	\$20,000.00	\$20,000.00	\$50,000.00	\$50,000.00	0.8%
Traffic Control Allowance	Is	1		\$0.00	\$100,000.00	\$100,000.00	\$100,000.00	\$100,000.00	1.2%
Division 3 - Concrete									
Concrete Outfall - 1.5' Thick, 20' x 20'	CY	22	\$392.00	\$8,711.11	\$308.00	\$6,844.44	\$700.00	\$15,555.56	0.2%
Additional Concrete for Building in Floodplain	CY	80	\$392.00	\$31,360.00	\$308.00	\$24,640.00	\$700.00	\$56,000.00	0.7%
Precast Meter Vault	EA	2	\$7,753.32	\$15,506.63	\$1,550.66	\$3,101.33	\$9,303.98	\$18,607.96	0.2%
Concrete Sidewalk	SF	600	\$4.00	\$2,400.00	\$3.00	\$1,800.00	\$7.00	\$4,200.00	0.1%
Division 4 - Masonry									
NOT USED									
Division 5 - Metals									
NOT USED									
Division 6 - Wood, Plastics, Composites									
NOT USED									
Division 7 - Thermal and Moisture									
NOT USED									
Division 8 - Openings									
NOT USED									
Division 9 - Finishes									
NOT USED									
Division 10 - Specialties									
NOT USED									
Division 11 - Equipment									
NOT USED									

				MATERIAL		LABOR AND EQUIPMENT		TOTAL	
Description	Units	Quantity	Unit \$	Cost	Unit \$	Cost	Total Unit \$	TOTAL COST	% OF TOTAL
1C - WW PS at WWTP and 60 MGD EHRT at Valspar Site - Civil/Site Work									
Division 12 - Furnishings									
NOT USED									
Division 13 - Special Construction									
NOT USED									
Division 14 - Conveying Equipment									
NOT USED									
Division 21 - Fire Suppression									
NOT USED									
Division 22 - Plumbing									
NOT USED									
Division 23 - HVAC									
NOT USED									
Division 25 - Integrated Automation									
NOT USED									
Division 26 - Electrical									
NOT USED									
Division 27 - Communications									
NOT USED									
Division 28 - Electronic Safety and Security									
NOT USED									
Division 31 - Earthwork									
Excavation	CY	1,000		\$0.00	\$12.73	\$12,730.00	\$12.73	\$12,730.00	0.2%
Backfill	CY	100		\$0.00	\$19.10	\$1,910.00	\$19.10	\$1,910.00	0.0%
Haul Off	CY	16,000		\$0.00	\$40.00	\$640,000.00	\$40.00	\$640,000.00	7.8%
Select Fill	CY	9,000	\$45.00	\$405,000.00	\$12.29	\$110,610.00	\$57.29	\$515,610.00	6.3%
Temporary Sheetting/Shoring	SF	23,800	\$80.00	\$1,904,000.00	\$80.00	\$1,904,000.00	\$160.00	\$3,808,000.00	46.6%
Division 32 - Exterior Improvements									
Grass Restoration	SY	5,556	\$0.45	\$2,500.00	\$2.36	\$13,111.11	\$2.81	\$15,611.11	0.2%
Rain Garden	SF	1,000	\$30.00	\$30,000.00	\$15.00	\$15,000.00	\$45.00	\$45,000.00	0.6%
Paving	SY	7,800	\$48.47	\$378,066.00	\$2.61	\$20,358.00	\$51.08	\$398,424.00	4.9%
10' Galvanized Chain Link Fence	LF	1,400	\$11.16	\$15,630.69	\$7.44	\$10,420.46	\$18.61	\$26,051.14	0.3%
10' Galvanized Chain Link Fence Gate	EA	2	\$775.33	\$1,550.66	\$516.89	\$1,033.78	\$1,292.22	\$2,584.44	0.0%
Division 33 - Utilities									
96" Diameter Manhole	EA	2	\$7,312.50	\$14,625.00	\$3,937.50	\$7,875.00	\$11,250.00	\$22,500.00	0.3%
Site Chemical Piping - PVC Pipe	LS	1	\$25,844.39	\$25,844.39	\$2,584.44	\$2,584.44	\$28,428.83	\$28,428.83	0.3%
Water Supply System Allowance	LS	1	\$36,182.14	\$36,182.14	\$4,651.99	\$4,651.99	\$40,834.13	\$40,834.13	0.5%

Description			MATERIAL		LABOR AND EQUIPMENT		TOTAL		
	Units	Quantity	Unit \$	Cost	Unit \$	Cost	Total Unit \$	TOTAL COST	% OF TOTAL
1C - WW PS at WWTP and 60 MGD EHRT at Valspar Site - Civil/Site Work									
12" PVC Dewatering FM	LF	600	\$195.00	\$117,000.00	\$105.00	\$63,000.00	\$300.00	\$180,000.00	2.2%
54" PCCP HRT Influent Forcemain	LF	1,240	\$314.00	\$389,360.00	\$129.00	\$159,960.00	\$443.00	\$549,320.00	6.7%
54" PCCP Bend	EA	12	\$5,000.00	\$60,000.00	\$600.00	\$6,000.00	\$5,500.00	\$66,000.00	0.8%
72" PCCP Outfall Sewer	LF	700	\$570.20	\$399,140.00	\$178.01	\$124,609.80	\$748.21	\$823,749.80	6.4%
Yard Hydrant	EA	5	\$1,292.22	\$6,461.10	\$3,359.77	\$16,798.85	\$4,651.99	\$23,259.95	0.3%
Division 34 - Transportation									
NOT USED									
Division 35 - Waterway and Marine Construction									
New Outfall Into Ohio River	LS	1		\$0.00	\$1,000,000.00	\$1,000,000.00	\$1,000,000.00	\$1,000,000.00	12.2%
Division 40 - Process Interconnections									
NOT USED									
Division 41 - Material Processing and Handling Equipment									
NOT USED									
Division 42 - Process Heating, Cooling and Drying Equipment									
NOT USED									
Division 43 - Process Gas and Liquid Handling, Purification and Storage Equipment									
NOT USED									
Division 44 - Pollution and Waste Control Equipment									
NOT USED									
Division 45 - Industry Specific Manufacturing Equipment									
NOT USED									
Division 46 - Water and Wastewater Equipment									
NOT USED									
Division 48 - Electrical Power Generation									
NOT USED									
Sub-Totals				\$3,680,000.00		\$4,300,000.00		\$8,180,000.00	

ALCOSAN - PRELIMINARY PLANNING - TASK 2.4 VALUE ENGINEERING
OPINION OF PROBABLE CONSTRUCTION COST
Alternative 2A - WW PS at WWTP and 120 MGD EHRT at Western Penitentiary Site
Civil/ Site Work Unit Price Breakdown

			MATERIAL		LABOR AND EQUIPMENT		TOTAL		
Description	Units	Quantity	Unit \$	Cost	Unit \$	Cost	Total Unit \$	TOTAL COST	% OF TOTAL
2A - WW PS at WWTP and 120 MGD EHRT at Western Penitentiary Site - Civil/Site Work									
Division 1 - General Conditions									
General Conditions (included in Mob/Demob markup)									
Division 2 - Existing Conditions									
Demolish Concrete / Brick Buildings / Guard Wall	SF	115,478	\$0.00	\$0.00	\$5.00	\$677,390.00	\$5.00	\$677,390.00	5.2%
Demolition Difficulty Allowance - Western Penitentiary Site (30%)	LS	1			\$173,217.00	\$173,217.00	\$173,217.00	\$173,217.00	1.6%
Temporary Bypass Pumping Allowance	LS	1	\$45,000.00	\$45,000.00	\$30,000.00	\$30,000.00	\$75,000.00	\$75,000.00	0.7%
Traffic Control Allowance	LS	1		\$0.00	\$100,000.00	\$100,000.00	\$100,000.00	\$100,000.00	0.9%
Division 3 - Concrete									
Concrete Outfall - 1.5' Thick, 30' x 20'	CY	33	\$392.00	\$13,066.67	\$308.00	\$10,266.67	\$700.00	\$23,333.33	0.2%
Additional Concrete for Building in Floodplain	CY	102	\$392.00	\$40,071.11	\$308.00	\$31,484.44	\$700.00	\$71,555.56	0.6%
Precast Meter Vault	EA	2	\$7,753.32	\$15,506.63	\$1,550.66	\$3,101.33	\$9,303.98	\$18,607.96	0.2%
Concrete Sidewalk	SF	500	\$4.00	\$2,000.00	\$3.00	\$1,500.00	\$7.00	\$3,500.00	0.0%
Division 4 - Masonry									
NOT USED									
Division 5 - Metals									
NOT USED									
Division 6 - Wood, Plastics, Composites									
NOT USED									
Division 7 - Thermal and Moisture									
NOT USED									
Division 8 - Openings									
NOT USED									
Division 9 - Finishes									
NOT USED									
Division 10 - Specialties									
NOT USED									
Division 11 - Equipment									
NOT USED									
Division 12 - Furnishings									
NOT USED									

			MATERIAL		LABOR AND EQUIPMENT		TOTAL		
Description	Units	Quantity	Unit \$	Cost	Unit \$	Cost	Total Unit \$	TOTAL COST	% OF TOTAL
2A - WW PS at WWTP and 120 MGD EHRT at Western Penitentiary Site - Civil/Site Work									
<i>Division 13 - Special Construction</i>									
NOT USED									
<i>Division 14 - Conveying Equipment</i>									
NOT USED									
<i>Division 21 - Fire Suppression</i>									
NOT USED									
<i>Division 22 - Plumbing</i>									
NOT USED									
<i>Division 23 - HVAC</i>									
NOT USED									
<i>Division 25 - Integrated Automation</i>									
NOT USED									
<i>Division 26 - Electrical</i>									
NOT USED									
<i>Division 27 - Communications</i>									
NOT USED									
<i>Division 28 - Electronic Safety and Security</i>									
NOT USED									
<i>Division 31 - Earthwork</i>									
Excavation	CY	1,700		\$0.00	\$12.73	\$21,641.00	\$12.73	\$21,641.00	0.2%
Backfill	CY	170		\$0.00	\$19.10	\$3,247.00	\$19.10	\$3,247.00	0.0%
Haul Off	CY	20,000		\$0.00	\$40.00	\$800,000.00	\$40.00	\$800,000.00	7.2%
Select Fill	CY	11,000	\$45.00	\$495,000.00	\$12.29	\$135,190.00	\$57.29	\$630,190.00	5.6%
Temporary Sheetpiling/Shoring	SF	28,900	\$80.00	\$2,312,000.00	\$80.00	\$2,312,000.00	\$160.00	\$4,624,000.00	41.4%
<i>Division 32 - Exterior Improvements</i>									
Grass Restoration	SY	13,444	\$0.45	\$6,050.00	\$2.36	\$31,728.89	\$2.81	\$37,778.89	0.3%
Rain Garden	SF	2,000	\$30.00	\$60,000.00	\$15.00	\$30,000.00	\$45.00	\$90,000.00	0.8%
Paving	SY	11,300	\$48.47	\$547,711.00	\$2.81	\$29,493.00	\$51.08	\$577,204.00	5.2%
10' Galvanized Chain Link Fence	LF	950	\$11.16	\$10,606.54	\$7.44	\$7,071.02	\$18.61	\$17,677.56	0.2%
10' Galvanized Chain Link Fence Gate	EA	2	\$775.33	\$1,550.66	\$516.89	\$1,033.78	\$1,292.22	\$2,584.44	0.0%
<i>Division 33 - Utilities</i>									
48" Diameter Manhole	EA	2	\$3,412.50	\$6,825.00	\$1,837.50	\$3,675.00	\$5,250.00	\$10,500.00	0.1%
120" Diameter Manhole	EA	3	\$9,750.00	\$29,250.00	\$5,250.00	\$15,750.00	\$15,000.00	\$45,000.00	0.4%
Site Chemical Piping - PVC Pipe	LS	1	\$25,844.39	\$25,844.39	\$3,533.78	\$3,533.78	\$29,378.16	\$29,378.16	0.3%
Water Supply System Allowance	LS	1	\$36,182.14	\$36,182.14	\$6,050.66	\$6,050.66	\$42,232.81	\$42,232.81	0.4%
24" PVC Dewatering Sewer	LF	220	\$234.00	\$51,480.00	\$128.00	\$27,720.00	\$360.00	\$79,200.00	0.7%
12" PVC Dewatering FM	LF	500	\$195.00	\$97,500.00	\$105.00	\$52,500.00	\$300.00	\$150,000.00	1.3%
66" PCCP EHRT Forcemain	LF	1,290	\$387.20	\$499,468.00	\$143.00	\$184,475.16	\$530.20	\$683,943.16	6.1%

Description	Units	Quantity	Unit \$	MATERIAL	LABOR AND EQUIPMENT		TOTAL			
				Cost	Unit \$	Cost	Total Unit \$	TOTAL COST	% OF TOTAL	
2A - WW PS at WWTP and 120 MGD EHRT at Western Penitentiary Site - Civil/Site Work										
66" PCCP Bend	EA	12	\$6,250.00	\$75,000.00	\$2,082.50	\$24,760.00	\$8,312.50	\$99,760.00	0.9%	
96" PCCP Outfall Sewer	LF	850	\$570.20	\$484,670.00	\$178.01	\$151,311.90	\$748.21	\$635,981.90	5.7%	
Yard Hydrant	EA	5	\$1,292.22	\$6,461.10	\$3,359.77	\$16,798.85	\$4,651.99	\$23,259.95	0.2%	
Division 34 - Transportation										
NOT USED										
Division 35 - Waterway and Marine Construction										
New Outfall into Ohio River	LS	1		\$0.00	\$1,500,000.00	\$1,500,000.00	\$1,500,000.00	\$1,500,000.00	13.4%	
Division 40 - Process Interconnections										
NOT USED										
Division 41 - Material Processing and Handling Equipment										
NOT USED										
Division 42- Process Heating, Cooling and Drying Equipment										
NOT USED										
Division 43- Process Gas and Liquid Handling, Purification and Storage Equipment										
NOT USED										
Division 44 - Pollution and Waste Control Equipment										
NOT USED										
Division 45 - Industry Specific Manufacturing Equipment										
NOT USED										
Division 46 - Water and Wastewater Equipment										
NOT USED										
Division 48 - Electrical Power Generation										
NOT USED										
Sub-Totals				\$4,870,000.00		\$6,290,000.00		\$11,160,000.00		

ALCOSAN - PRELIMINARY PLANNING - TASK 2.4 VALUE ENGINEERING
OPINION OF PROBABLE CONSTRUCTION COST
Alternative 2B - WW PS at WWTP and 120 MGD EHRT at Trucking Site
Civil/ Site Work Unit Price Breakdown

			MATERIAL		LABOR AND EQUIPMENT		TOTAL		
Description	Units	Quantity	Unit \$	Cost	Unit \$	Cost	Total Unit \$	TOTAL COST	% OF TOTAL
2B - WW PS at WWTP and 120 MGD EHRT at Trucking Site - Civil/Site Work									
Division 1 - General Conditions									
General Conditions (included in Mob/Demob markup)									
Division 2 - Existing Conditions									
Demolish Concrete / Brick Buildings	SF	187,292	\$0.00	\$0.00	\$5.00	\$936,480.00	\$5.00	\$936,460.00	5.7%
Temporary Bypass Pumping Allowance	ls	1	\$45,000.00	\$45,000.00	\$30,000.00	\$30,000.00	\$75,000.00	\$75,000.00	0.5%
Traffic Control Allowance	ls	1		\$0.00	\$100,000.00	\$100,000.00	\$100,000.00	\$100,000.00	0.6%
Division 3 - Concrete									
Concrete Outfall - 1.5' Thick, 20' x 20'	CY	33	\$392.00	\$13,066.67	\$308.00	\$10,266.67	\$700.00	\$23,333.33	0.1%
Precast Meter Vault	EA	2	\$7,753.32	\$15,606.63	\$1,550.66	\$3,101.33	\$9,303.98	\$18,607.96	0.1%
Concrete Sidewalk	SF	2,000	\$4.00	\$8,000.00	\$3.00	\$6,000.00	\$7.00	\$14,000.00	0.1%
Division 4 - Masonry									
NOT USED									
Division 5 - Metals									
NOT USED									
Division 6 - Wood, Plastics, Composites									
NOT USED									
Division 7 - Thermal and Moisture									
NOT USED									
Division 8 - Openings									
NOT USED									
Division 9 - Finishes									
NOT USED									
Division 10 - Specialties									
NOT USED									
Division 11 - Equipment									
NOT USED									
Division 12 - Furnishings									
NOT USED									

				MATERIAL		LABOR AND EQUIPMENT		TOTAL	
Description	Units	Quantity	Unit \$	Cost	Unit \$	Cost	Total Unit \$	TOTAL COST	% OF TOTAL
2B - WW PS at WWTP and 120 MGD EHRT at Trucking Site - Civil/Site Work									
Division 13 - Special Construction									
NOT USED									
Division 14 - Conveying Equipment									
NOT USED									
Division 21 - Fire Suppression									
NOT USED									
Division 22 - Plumbing									
NOT USED									
Division 23 - HVAC									
NOT USED									
Division 25 - Integrated Automation									
NOT USED									
Division 26 - Electrical									
NOT USED									
Division 27 - Communications									
NOT USED									
Division 28 - Electronic Safety and Security									
NOT USED									
Division 31 - Earthwork									
Excavation	CY	3,000		\$0.00	\$12.73	\$38,190.00	\$12.73	\$38,190.00	0.2%
Backfill	CY	300		\$0.00	\$19.10	\$5,730.00	\$19.10	\$5,730.00	0.0%
Haul Off	CY	36,000		\$0.00	\$40.00	\$1,440,000.00	\$40.00	\$1,440,000.00	8.7%
Select Fill	CY	19,000	\$45.00	\$855,000.00	\$12.29	\$233,510.00	\$57.29	\$1,088,510.00	6.6%
Temporary Sheetting/Shoring	SF	44,200	\$80.00	\$3,536,000.00	\$80.00	\$3,536,000.00	\$160.00	\$7,072,000.00	42.9%
Division 32 - Exterior Improvements									
Grass Restoration	SY	26,667	\$0.45	\$12,000.00	\$2.36	\$62,933.33	\$2.81	\$74,933.33	0.5%
Rain Garden	SF	2,000	\$30.00	\$60,000.00	\$15.00	\$30,000.00	\$45.00	\$90,000.00	0.5%
Paving	SY	15,400	\$48.47	\$746,438.00	\$2.61	\$40,194.00	\$51.08	\$786,632.00	4.8%
10' Galvanized Chain Link Fence	LF	2,800	\$11.16	\$31,261.37	\$7.44	\$20,840.91	\$18.61	\$52,102.29	0.3%
10' Galvanized Chain Link Fence Gate	EA	2	\$775.33	\$1,550.66	\$516.89	\$1,033.78	\$1,292.22	\$2,584.44	0.0%
Division 33 - Utilities									
48" Diameter Manhole	EA	7	\$3,412.50	\$23,887.50	\$1,837.50	\$12,862.50	\$5,250.00	\$36,750.00	0.2%
120" Diameter Manhole	EA	4	\$9,750.00	\$39,000.00	\$5,250.00	\$21,000.00	\$15,000.00	\$60,000.00	0.4%
Site Chemical Piping - PVC Pipe	LS	1	\$25,844.39	\$25,844.39	\$3,533.78	\$3,533.78	\$29,378.16	\$29,378.16	0.2%
Water Supply System Allowance	LS	1	\$36,182.14	\$36,182.14	\$6,050.66	\$6,050.66	\$42,232.81	\$42,232.81	0.3%
24" PVC Dewatering Sewer	LF	1,200	\$234.00	\$280,800.00	\$126.00	\$151,200.00	\$360.00	\$432,000.00	2.6%
12" PVC Dewatering FM	LF	500	\$195.00	\$97,500.00	\$105.00	\$52,500.00	\$300.00	\$150,000.00	0.9%
66" PCCP HRT Forcemain	LF	2,400	\$387.20	\$929,280.00	\$143.00	\$343,209.60	\$530.20	\$1,272,489.60	7.7%

Description	Units	Quantity	Unit \$	MATERIAL	LABOR AND EQUIPMENT		TOTAL		
				Cost	Unit \$	Cost	Total Unit \$	TOTAL COST	% OF TOTAL
2B - WW PS at WWTP and 120 MGD EHRT at Trucking Site - Civil/Site Work									
66" PCCP Bend	EA	16	\$6,250.00	\$100,000.00	\$2,062.50	\$33,000.00	\$8,312.50	\$133,000.00	0.8%
96" PCCP Outfall Sewer	LF	1,300	\$570.20	\$741,260.00	\$178.01	\$231,418.20	\$748.21	\$972,678.20	5.9%
Yard Hydrant	EA	5	\$1,292.22	\$6,461.10	\$3,359.77	\$16,798.85	\$4,651.89	\$23,259.95	0.1%
Division 34 - Transportation									
NOT USED									
Division 35 - Waterway and Marine Construction									
New Outfall into Ohio River	LS	1		\$0.00	\$1,500,000.00	\$1,500,000.00	\$1,500,000.00	\$1,500,000.00	9.1%
Division 40 - Process Interconnections									
NOT USED									
Division 41 - Material Processing and Handling Equipment									
NOT USED									
Division 42- Process Heating, Cooling and Drying Equipment									
NOT USED									
Division 43- Process Gas and Liquid Handling, Purification and Storage Equipment									
NOT USED									
Division 44 - Pollution and Waste Control Equipment									
NOT USED									
Division 45 - Industry Specific Manufacturing Equipment									
NOT USED									
Division 46 - Water and Wastewater Equipment									
NOT USED									
Division 48 - Electrical Power Generation									
NOT USED									
Sub-Totals				\$7,610,000.00		\$8,870,000.00		\$16,480,000.00	

ALCOSAN - PRELIMINARY PLANNING - TASK 2.4 VALUE ENGINEERING
OPINION OF PROBABLE CONSTRUCTION COST
Alternative 2C - WW PS at WWTP and 120 MGD EHRT at Valspar Site
Civil/ Site Work Unit Price Breakdown

			MATERIAL		LABOR AND EQUIPMENT		TOTAL		
Description	Units	Quantity	Unit \$	Cost	Unit \$	Cost	Total Unit \$	TOTAL COST	% OF TOTAL
2C - WW PS at WWTP and 120 MGD EHRT at Valspar Site - Civil/Site Work									
Division 1 - General Conditions									
General Conditions (Included in Mob/Demob markup)									
Division 2 - Existing Conditions									
Demolish Concrete / Brick Buildings	SF	14,715	\$0.00	\$0.00	\$5.00	\$73,575.00	\$5.00	\$73,575.00	0.7%
Demolish Metal Buildings	SF	14,403			\$3.00	\$43,209.00	\$3.00	\$43,209.00	0.4%
Temporary Bypass Pumping Allowance	is	1	\$45,000.00	\$45,000.00	\$30,000.00	\$30,000.00	\$75,000.00	\$75,000.00	0.8%
Traffic Control Allowance	is	1		\$0.00	\$100,000.00	\$100,000.00	\$100,000.00	\$100,000.00	1.0%
Division 3 - Concrete									
Concrete Outfall - 1.5' Thick, 20' x 20'	CY	33	\$392.00	\$13,086.67	\$308.00	\$10,266.67	\$700.00	\$23,333.33	0.2%
Additional Concrete for Building in Floodplain	CY	80	\$392.00	\$31,360.00	\$308.00	\$24,640.00	\$700.00	\$56,000.00	0.6%
Precast Meter Vault	EA	2	\$7,753.32	\$15,506.63	\$1,550.66	\$3,101.33	\$9,303.98	\$18,607.96	0.2%
Concrete Sidewalk	SF	600	\$4.00	\$2,400.00	\$3.00	\$1,800.00	\$7.00	\$4,200.00	0.0%
Division 4 - Masonry									
NOT USED									
Division 5 - Metals									
NOT USED									
Division 6 - Wood, Plastics, Composites									
NOT USED									
Division 7 - Thermal and Moisture									
NOT USED									
Division 8 - Openings									
NOT USED									
Division 9 - Finishes									
NOT USED									
Division 10 - Specialties									
NOT USED									
Division 11 - Equipment									
NOT USED									

Description	Unit	Quantity	Unit \$	MATERIAL	LABOR AND EQUIPMENT		TOTAL			
				Cost	Unit \$	Cost	Total Unit \$	TOTAL COST	% OF TOTAL	
2C - WW PS at WWTP and 120 MGD EHRT at Valspar Site - Civil/Site Work										
Division 12 - Furnishings										
NOT USED										
Division 13 - Special Construction										
NOT USED										
Division 14 - Conveying Equipment										
NOT USED										
Division 21 - Fire Suppression										
NDT USED										
Division 22 - Plumbing										
NDT USED										
Division 23 - HVAC										
NDT USED										
Division 25 - Integrated Automation										
NOT USED										
Division 26 - Electrical										
NOT USED										
Division 27 - Communications										
NOT USED										
Division 28 - Electronic Safety and Security										
NOT USED										
Division 31 - Earthwork										
Excavation	CY	1,300		\$0.00	\$12.73	\$16,549.00	\$12.73	\$16,549.00		0.2%
Backfill	CY	130		\$0.00	\$19.10	\$2,483.00	\$19.10	\$2,483.00		0.0%
Haul Off	CY	19,000		\$0.00	\$40.00	\$760,000.00	\$40.00	\$760,000.00		7.6%
Select Fill	CY	10,000	\$45.00	\$450,000.00	\$12.29	\$122,900.00	\$57.29	\$572,900.00		5.7%
Temporary Sheet piling/Shoring	SF	27,200	\$80.00	\$2,176,000.00	\$80.00	\$2,176,000.00	\$160.00	\$4,352,000.00		43.6%
Division 32 - Exterior Improvements										
Grass Restoration	SY	13,333	\$0.45	\$6,000.00	\$2.36	\$31,466.67	\$2.81	\$37,466.67		0.4%
Rain Garden	SF	2,000	\$30.00	\$60,000.00	\$15.00	\$30,000.00	\$45.00	\$90,000.00		0.9%
Paving	SY	10,400	\$48.47	\$504,088.00	\$2.61	\$27,144.00	\$51.08	\$531,232.00		5.3%
10' Galvanized Chain Link Fence	LF	2,300	\$11.16	\$25,678.98	\$7.44	\$17,119.32	\$18.61	\$42,798.31		0.4%
10' Galvanized Chain Link Fence Gate	EA	2	\$775.33	\$1,550.66	\$516.89	\$1,033.78	\$1,292.22	\$2,584.44		0.0%
Division 33 - Utilities										
120" Diameter Manhole	EA	3	\$9,750.00	\$29,250.00	\$5,250.00	\$15,750.00	\$15,000.00	\$45,000.00		0.5%
Site Chemical Piping - PVC Pipe	LS	1	\$25,844.39	\$25,844.39	\$3,533.78	\$3,533.78	\$29,378.16	\$29,378.16		0.3%
Water Supply System Allowance	LS	1	\$36,182.14	\$36,182.14	\$6,050.66	\$6,050.66	\$42,232.81	\$42,232.81		0.4%

Description	Units	Quantity	MATERIAL		LABOR AND EQUIPMENT		TOTAL		
			Unit \$	Cost	Unit \$	Cost	Total Unit \$	TOTAL COST	% OF TOTAL
2C - WW PS at WWTP and 120 MGD EHRT at Valspar Site - Civil/Site Work									
12" PVC Dewatering FM	LF	600	\$195.00	\$117,000.00	\$105.00	\$63,000.00	\$300.00	\$180,000.00	1.8%
66" PCCP HRT Forcemain	LF	1,240	\$387.20	\$480,128.00	\$143.00	\$177,324.96	\$630.20	\$857,452.96	6.6%
66" PCCP Bend	EA	12	\$6,250.00	\$75,000.00	\$2,062.50	\$24,750.00	\$8,312.50	\$99,750.00	1.0%
96" PCCP Outfall Sewer	LF	800	\$570.20	\$456,160.00	\$178.01	\$142,411.20	\$748.21	\$598,571.20	6.0%
Yard Hydrant	EA	5	\$1,292.22	\$6,461.10	\$3,359.77	\$16,798.85	\$4,651.99	\$23,259.95	0.2%
Division 34 - Transportation									
NOT USED									
Division 35 - Waterway and Marine Construction									
New Outfall into Ohio River	LS	1		\$0.00	\$1,500,000.00	\$1,500,000.00	\$1,500,000.00	\$1,500,000.00	15.0%
Division 40 - Process Interconnections									
NOT USED									
Division 41 - Material Processing and Handling Equipment									
NOT USED									
Division 42- Process Heating, Cooling and Drying Equipment									
NOT USED									
Division 43- Process Gas and Liquid Handling, Purification and Storage Equipment									
NOT USED									
Division 44 - Pollution and Waste Control Equipment									
NOT USED									
Division 45 - Industry Specific Manufacturing Equipment									
NOT USED									
Division 46 - Water and Wastewater Equipment									
NOT USED									
Division 48 - Electrical Power Generation									
NOT USED									
Sub-Totals				\$4,560,000.00		\$5,430,000.00		\$9,990,000.00	

APPENDIX C. OPERATIONS AND MAINTENANCE COSTS AND NET PRESENT WORTH SUMMARIES/CALCULATIONS

120 MGD EHRT – O&M Cost Summary

Item	Units	Number of Units	Unit Cost	Cost
Operations Labor	Hours	841	\$62.90	\$52,899
Maintenance Labor				
Supervisor	Hours	329	\$71.40	\$23,491
Electrician	Hours	268	\$66.30	\$17,768
Mechanic	Hours	1,122	\$57.80	\$64,852
Instrument Tech.	Hours	498	\$66.30	\$33,017
Laborer	Hours	756	\$30.60	\$23,134
Data Analyst	Hours	328	\$57.80	\$18,958
Clerk	Hours	366	\$37.40	\$13,688
Power	kW-Hr.	329,161	\$0.07	\$22,383
Chemicals				
Ferric Chloride	Lbs.	84,317	\$0.30	\$25,295
Polymer	Lbs.	5,621	\$0.70	\$3,918
Sodium Hypochlorite	Gallons	26,767	\$0.64	\$17,078
Sodium Bisulfite	Lbs.	1,097	\$0.10	\$113
Non-Labor Cost*	L.S.	1		\$40,000
Annual O&M Cost				\$356,594
O&M Cost/Gallon**				\$0.000690

Year	Index	Future Cost
2018	1.03	\$367,291.82
2019	1.061	\$378,310.57
2020	1.093	\$389,659.89
2021	1.126	\$401,349.69
2022	1.159	\$413,390.18
2023	1.194	\$425,791.88
2024	1.230	\$438,565.64
2025	1.267	\$451,722.61
2026	1.305	\$465,274.29
2027	1.344	\$479,232.52
2028	1.384	\$493,609.49
2029	1.426	\$508,417.78
2030	1.469	\$523,670.31
2031	1.513	\$539,380.42
2032	1.558	\$555,561.83
2033	1.605	\$572,228.69
2034	1.653	\$589,395.55
2035	1.702	\$607,077.42
2036	1.754	\$625,289.74
2037	1.806	\$644,048.43
NPV =		\$7,500,000

120 MGD EHRT – Operations Labor

Operations Labor Hours		Comments
Annual No. of Inspection Visits to EHRT for samples/year	32	Assume one inspection visit hour for every four hours of an event for sample collection, prep, and analysis.
Annual Labor Hours for On-Site Monitoring of EHRT	126	Assume one operator present during duration of event.
Annual Person-Hours for Flush/Clean-up and Inspection of EHRT After Each Event	400	2 persons for 8 hours each for post-event clean-up and inspection per event.
Annual No. of Hours for Dry Weather Period Activities	208	Activities include sampling to check chemical strengths, equipment inspection/testing, submittal of maintenance work requests, grounds-keeping, QA/QC analytical and empirical EHRT performance data for recreation season report to regulatory agency, etc. Assume 8 hours bi-weekly.
Annual Hours for Regulatory Reporting	75	25 overflow events x 3 hours reporting per event.
Total Annual Operations Labor Hours	841	
Labor Hourly Rate	\$62.90	
Total Annual Operations Labor Cost	\$52,899	
Non-Labor Expenses (Estimate)	\$40,000	

120 MGD EHRT – Maintenance Labor

Preventive, Reactive and Emergency Maintenance Tasks for EHRT - Hours																
Type	Equipment or Asset Group	FREQUENCY							Supervisor	Electrician	Mechanic	Instrument Technician	Laborer	Data Analyst	Clerk	Totals
		D	W	M	Q	S	A									
PM	Level Sensors and Flowmeters			X				0.0	0.0	0.0	240.0	0.0	0.0	0.0	240.0	
PM	Bar Screens or Racks		X					0.0	60.0	130.0	0.0	0.0	0.0	0.0	190.0	
PM	Screenings Handling and Conveyors				X			0.0	6.0	10.0	0.0	0.0	0.0	0.0	16.0	
PM	Chemical Feed and Storage Tanks		X					0.0	0.0	250.0	0.0	0.0	0.0	0.0	250.0	
PM	Sampling System / Lab Analysis			X				0.0	0.0	34.0	48.0	0.0	0.0	0.0	82.0	
PM	Air Monitoring, Odor Control, Gas Detection			X				0.0	16.0	88.0	64.0	0.0	0.0	0.0	168.0	
PM	Basin Cleaning and Flushing, Valves and Equip.				X			0.0	0.0	76.0	0.0	0.0	0.0	0.0	76.0	

PM	Dewatering, Pumped or by Gravity									0.0	172.0	0.0	0.0	0.0	0.0	172.0
PM	Instrument and Controls								x	0.0	0.0	80.0	0.0	0.0	0.0	80.0
PM	Gates, Valves, and Actuators							x		0.0	120.0	0.0	0.0	0.0	0.0	240.0
PM	Back-up Power							x		0.0	20.0	20.0	0.0	0.0	0.0	160.0
PM	Computer Maintenance Management System									0.0	0.0	0.0	260.0	0.0	0.0	260.0
AM	Regulatory Notification							x		30.0	0.0	0.0	0.0	0.0	0.0	30.0
PM	Grounds Maint., Housekeep. Security and Equip.								x	0.0	0.0	0.0	600.0	0.0	0.0	600.0
RM	Reactive Maintenance-All								x	52.0	60.0	20.0	140.0	60.0	60.0	422.0
EM	Emergency Maintenance-All								x	16.0	2.0	2.0	8.0	4.0	2.0	38.0
AM	Office Paperwork (Invoices, Receipts, POs)								x	0.0	0.0	0.0	0.0	0.0	300.0	300.0
AM	Personnel Management								x	225.0	0.0	0.0	0.0	0.0	0.0	225.0
AM	Staff Training								x	6.0	60.0	24.0	8.0	4.0	4.0	118.0
	Total Hours									329.0	268.0	498.0	756.0	328.0	366.0	3,667.0

120 MGD EHRT – Chemical Costs ¹

Ferric Chloride			
			Unit
	Design Ferric Dose	30	mg/L
	Annual Usage	84,317	lbs
	Unit Cost ²	\$0.30	per lb
	Annual Cost	\$25,295	per year

Polymer			
			Unit
	Polymer Dose	2	mg/L
	Annual Usage	5,621	lbs
	Unit Cost	\$0.70	per lb
	Annual Cost	\$3,918	per year

Sodium Hypochlorite			
			Unit
	Sodium Hypochlorite Dose (avg)	10	mg/L
	Annual Usage	28,106	lbs
		44,612	gal
		26,767	gal of 12.5% sodium hypo
	Unit Cost	\$0.64	per gal
	Annual Cost	\$17,078	per year

Sodium Bisulfite			
			Unit
	Sodium Bisulfite Dose	1.679	mg/L
	Annual Usage	4,719	lbs
		1,097	gal
	Unit Cost	\$0.10	per lb
	Annual Cost	\$486	per year

Total Chemical Cost			
	Total Chemical Cost	\$46,777	
	Say:	\$50,000	

Notes:

1. Except where noted, chemical unit costs obtained from WWTP PM Cost Estimate Guidelines.
2. Unit cost based on 2017 quote from Pittsburgh area chemical supplier (Univar).

120 MGD EHRT – Electrical/Power Costs

Power Requirements			No.	kW/unit	Total kW	HP/unit	Total HP	Hours	HP-Hrs	kW-Hrs		Comments
Lighting/Misc. power requirements												
	Exterior		12	0.25	3			3650		10,950		Assume average 10 hours/night lighting x 365 days.
	Lighting/Misc. power requirements		1	4.5	4.5			126		567		Annual hydrograph: Hours of influent flow into EHRT. Assume 1.5 kW for sampler and pumps, 1 kW for operation of end devices for process control, and 2 kW for other misc. power requirements.
	Lighting/Misc. power requirements		1	23.5	23.5			126		2,961		Hours for operator facility inspection from Operations Labor worksheet.
	Lighting/Misc. power requirements		1	23.5	23.5			2376		55,836		Power requirements for routine maintenance periods.
	Fire, security, emergency equipment & communication systems		1	11.3	11.3			8760		98,988		These systems are powered 24/7. Fire detection system, security (intrusion) system, emergency eye-wash (heated), telephone, UPS, SCADA, A/C for SCADA equipment.
Odor control			1		80			766		61,280		Hours based on Operations labor hours minus regulatory reporting hours.
Influent Gates			6		22.4	5	30	4.17	125	93		25 annual events; gates open once and close once; 5-minute travel time each way.
Chemical Systems												
	Coagulant											
		Feed pumps (positive displacement)	2		1.5	1	2	126.00	252	188		Annual Hydrograph: 126 hours flows enter EHRT
		Mixers, induction units	2		29.8	20	40	126	5040	3,758		Annual Hydrograph: 126 hours flows enter EHRT
	Flocculant											
		Pump and mixer system	2		6.0	4	8	126	1008	752		Annual Hydrograph: 126 hours flows enter EHRT
	Disinfectant											
		Feed pumps (positive displacement)	2		3.0	2	4	126	504	376		Annual Hydrograph: 126 hours flows enter EHRT
		Mixers, induction units	2		29.8	20	40	126	5040	3,758		Annual Hydrograph: 126 hours flows enter EHRT
		Sodium Hypochlorite Recirculation Pump (Centrifugal)	1		1.5	2	2	126	252	188		Annual Hydrograph: 126 hours flows enter EHRT
Dechlorination												

120 MGD EHRT – Electrical/Power Costs

Power Requirements			No.	kW/unit	Total kW	HP/unit	Total HP	Hours	HP-Hrs	kW-Hrs	Comments
		Feed pumps (positive displacement)	2		3.0	2	4	126	504	376	Annual Hydrograph: 126 hours flows enter EHRT
		Mixers, induction units	2		29.8	20	40	126	5040	3,758	Annual Hydrograph: 126 hours flows enter EHRT
Screens, emergency			3		11.2	5	15	126	1890	1,409	Annual Hydrograph: 126 hours flows enter EHRT
Screens, influent			3		11.2	5	15	126	1890	1,409	Annual Hydrograph: 126 hours flows enter EHRT
Screenings conveyors			1		7.5	10	10	126	1260	940	Annual Hydrograph: 126 hours flows enter EHRT
Dewatering pumps											
	Submersible pumps		3		55.9	25	75	100	7500	5,593	Annual hydrograph: 25 wet weather events x 4 hours per event to dewater, flush and clean EHRT.
Screw pumps for high river level discharge			4		596.6	200	800	126	100800	75,167	4 of 6 screw pumps running to discharge flow into river (assumed worst case scenario, high river level during all duration of flow to basin).
Effluent gates to effluent screw pump station			2		7.5	5	10	4.17	41.7	31	25 annual events; gates open once and close once; 5-minute travel time each way.
Flushing system											
	Flushing gates		16		3.0	0.25	4	200	800	597	Gates to clean tanks and channels. Assume four flush cycles per event, 2 hours per cycle.
	Flushing sluice gates		12		44.7	5	60	4.17	250.00	186	Isolation sluice gates opened when flushing tanks and channels, closed when finished. Assume 5-minute gate travel time each way.

Total kW	986.6	Annual Power Use (kW-hr)			329,161
Power Cost (\$/KW)	\$0.068	Annual Power Cost	\$22,383		

60 MGD EHRT – O&M Cost Summary

Item	Units	Number of Units	Unit Cost	Cost
Operations Labor	Hours	454	\$62.90	\$28,557
Maintenance Labor				
Supervisor	Hours	216	\$71.40	\$15,422
Electrician	Hours	144	\$66.30	\$9,547
Mechanic	Hours	596	\$57.80	\$34,449
Instrument Tech.	Hours	258	\$66.30	\$17,105
Laborer	Hours	318	\$30.60	\$9,731
Data Analyst	Hours	188	\$57.80	\$10,866
Clerk	Hours	160	\$37.40	\$5,984
Power	kW-Hr.	209,981	\$0.068	\$14,279
Chemicals				
Ferric Chloride	Lbs.	30,524	\$0.30	\$9,157
Polymer	Lbs.	2,035	\$0.70	\$1,418
Sodium Hypochlorite	Gallons	9,690	\$0.64	\$6,182
Sodium Bisulfite	Lbs.	397	\$0.10	\$41
Non-Labor Cost*	L.S.	1		\$20,000
Annual O&M Cost				\$182,738
O&M Cost/Gallon**				\$0.001498

Year	Index	Future Cost
2018	1.03	\$188,220.14
2019	1.061	\$193,866.74
2020	1.093	\$199,682.75
2021	1.126	\$205,673.23
2022	1.159	\$211,843.43
2023	1.194	\$218,198.73
2024	1.230	\$224,744.69
2025	1.267	\$231,487.03
2026	1.305	\$238,431.64
2027	1.344	\$245,584.59
2028	1.384	\$252,952.13
2029	1.426	\$260,540.69
2030	1.469	\$268,356.91
2031	1.513	\$276,407.62
2032	1.558	\$284,699.85
2033	1.605	\$293,240.85
2034	1.653	\$589,395.55
2035	1.702	\$607,077.42
2036	1.754	\$320,432.19
2037	1.806	\$330,045.15
NPV =		\$3,800,000

60 MGD EHRT – Operations Labor

Operations Labor Hours		Comments
Annual No. of Inspection Visits to EHRT for samples/year	15	Assume one inspection visit hour for every four hours of an event for sample collection, prep, and analysis.
Annual Labor Hours for On-Site Monitoring of EHRT	60	Assume one operator present during duration of event.
Annual Person-Hours for Flush/Clean-up and Inspection of EHRT After Each Event	144	2 persons for 8 hours each for post-event clean-up and inspection per event.
Annual No. of Hours for Dry Weather Period Activities	208	Activities include sampling to check chemical strengths, equipment inspection/testing, submittal of maintenance work requests, grounds-keeping, QA/QC analytical and empirical EHRT performance data for recreation season report to regulatory agency, etc. Assume 8 hours bi-weekly.
Annual Hours for Regulatory Reporting	27	9 overflow events x 3 hours reporting per event.
Total Annual Operations Labor Hours	454	
Labor Hourly Rate	\$62.90	
Total Annual Operations Labor Cost	\$28,557	
Non-Labor Expenses (Estimate)	\$20,000	

60 MGD EHRT – Maintenance Labor

Type	Equipment or Asset Group	FREQUENCY							Preventive, Reactive and Emergency Maintenance Tasks for EHRT - Hours				
									Instrument Technician	Laborer	Data Analyst	Clerk	Totals
		D	W	M	T	F	S	A					
PM	Level Sensors and Flowmeters			x					140.0	0.0	0.0	0.0	140.0
PM	Bar Screens or Racks		x						0.0	0.0	0.0	0.0	104.0
PM	Screenings Handling and Conveyors				x				0.0	0.0	0.0	0.0	104.0
PM	Chemical Feed and Storage Tanks		x						0.0	0.0	0.0	0.0	124.0
PM	Sampling System / Lab Analysis			x					16.0	0.0	0.0	0.0	32.0
PM	Air Monitoring, Odor Control, Gas Detection			x					28.0	0.0	0.0	0.0	76.0
PM	Basin Cleaning and Flushing, Valves and Equip.				x				0.0	0.0	0.0	0.0	38.0

PM	Dewatering, Pumped or by Gravity							0.0	0.0	130.0	0.0	0.0	0.0	0.0	130.0
PM	Instrument and Controls							0.0	0.0	0.0	40.0	0.0	0.0	0.0	40.0
PM	Gates, Valves, and Actuators							0.0	60.0	54.0	0.0	0.0	0.0	0.0	114.0
PM	Back-up Power							0.0	8.0	54.0	8.0	0.0	0.0	0.0	70.0
PM	Computer Maintenance Management System							0.0	0.0	0.0	0.0	140.0	0.0	0.0	140.0
AM	Regulatory Notification							24.0	0.0	0.0	0.0	0.0	0.0	0.0	24.0
PM	Grounds Maint., Housekeep. Security and Equip.							0.0	0.0	0.0	0.0	250.0	0.0	0.0	250.0
RM	Reactive Maintenance-All							36.0	16.0	40.0	8.0	60.0	40.0	30.0	230.0
EM	Emergency Maintenance-All							12.0	2.0	4.0	2.0	4.0	4.0	2.0	30.0
AM	Office Paperwork (Invoices, Receipts, POs)							0.0	0.0	0.0	0.0	0.0	0.0	124.0	124.0
AM	Personnel Management							140.0	0.0	0.0	0.0	0.0	0.0	0.0	140.0
AM	Staff Training							4.0	6.0	24.0	16.0	4.0	4.0	4.0	62.0
	Total Hours							216.0	144.0	596.0	258.0	318.0	188.0	160.0	1,880.0

Second Amended Appendix A-22-b

60 MGD EHRT – Chemical Costs ¹

Ferric Chloride			Unit
	Design Ferric Dose	30	mg/L
	Annual Usage	30,524	lbs
	Unit Cost ²	\$0.30	per lb
	Annual Cost	\$9,157	per year

Polymer			Unit
	Polymer Dose	2	mg/L
	Annual Usage	2,035	lbs
	Unit Cost	\$0.70	per lb
	Annual Cost	\$1,418	per year

Sodium Hypochlorite			Unit
	Sodium Hypochlorite Dose (avg)	10	mg/L
	Annual Usage	10,175	lbs
		16,150	gal
		9,690	gal of 12.5% sodium hypo
	Unit Cost	\$0.64	per gal
	Annual Cost	\$6,182	per year

Sodium Bisulfite			Unit
	Sodium Bisulfite Dose	1.679	mg/L
	Annual Usage	1,708	lbs
		397	gal
	Unit Cost	\$0.10	per lb
	Annual Cost	\$176	per year

Total Chemical Cost			
	Total Chemical Cost	\$16,934	
	Say:	\$20,000	

Notes:

1. Except where noted, chemical unit costs obtained from WWTP PM Cost Estimate Guidelines.
2. Unit cost based on 2017 quote from Pittsburgh area chemical supplier (Univar).

60 MGD EHRT – Electrical/Power Costs

Power Requirements			No.	kW/unit	Total kW	HP/unit	Total HP	Hours	HP-Hrs	kW-Hrs	Comments
Lighting/Misc. power requirements											
	Exterior		12	0.25	3			3650		10,950	Assume average 10 hours/night lighting x 365 days.
	Lighting/Misc. power requirements		1	4.5	4.5			60		270	Annual hydrograph: Hours of influent flow into EHRT. Assume 1.5 kW for sampler and pumps, 1 kW for operation of end devices for process control, and 2 kW for other misc. power requirements.
	Lighting/Misc. power requirements		1	23.5	23.5			60		1,410	Hours for operator facility inspection from Operations Labor worksheet.
	Lighting/Misc. power requirements		1	23.5	23.5			2376		55,836	Power requirements for routine maintenance periods.
	Fire, security, emergency equipment & communication systems		1	11.3	11.3			8760		98,988	These systems are powered 24/7. Fire detection system, security (intrusion) system, emergency eye-wash (heated), telephone, UPS, SCADA, A/C for SCADA equipment.
Odor control			1		40			427		17,080	Hours based on Operations labor hours minus regulatory reporting hours.
Influent Gates			6		22.4	5	30	1.5	45	34	9 annual events; gates open once and close once; 5-minute travel time each way.
Chemical Systems											
	Coagulant										
		Feed pumps (positive displacement)	2		1.5	1	2	60	120	89	Annual Hydrograph: 60 hours flows enter EHRT
		Mixers, induction units	2		22.4	15	30	60	1800	1,342	Annual Hydrograph: 60 hours flows enter EHRT
	Flocculant										
		Pump and mixer system	2		6.0	4	8	60	480	358	Annual Hydrograph: 60 hours flows enter EHRT
	Disinfectant										
		Feed pumps (positive displacement)	2		3.0	2	4	60	240	179	Annual Hydrograph: 60 hours flows enter EHRT
		Mixers, induction units	2		22.4	15	30	60	1800	1,342	Annual Hydrograph: 60 hours flows enter EHRT

		Sodium Hypochlorite Recirculation Pump (Centrifugal)	1		1.5	2	2	60	120	89	Annual Hydrograph: 60 hours flows enter EHRT
	Dechlorination										
		Feed pumps (positive displacement)	2		3.0	2	4	60	240	179	Annual Hydrograph: 60 hours flows enter EHRT
		Mixers, induction units	2		22.4	15	30	60	1800	1,342	Annual Hydrograph: 60 hours flows enter EHRT
Screens, emergency			3		6.7	3	9	60	540	403	Annual Hydrograph: 60 hours flows enter EHRT
Screens, influent			3		6.7	3	9	60	540	403	Annual Hydrograph: 60 hours flows enter EHRT
Screenings conveyors			1		5.6	7.5	7.5	60	450	336	Annual Hydrograph: 60 hours flows enter EHRT
Dewatering pumps											
	Submersible pumps		3		33.6	15	45	36	1620	1,208	Annual hydrograph: 9 wet weather events x 4 hours per event to dewater, flush and clean EHRT.
Screw pumps for high river level discharge			2		298.3	200	400	60	24000	17,897	2 of 3 screw pumps running to discharge flow into river (assumed worst case scenario, high river level during all duration of flow to basin).
Effluent gates to effluent screw pump station			2		7.5	5	10	1.5	15	11	9 annual events; gates open once and close once; 5-minute travel time each way.
Flushing system											
	Flushing gates		16		3.0	0.25	4	72	288	215	Gates to clean tanks and channels. Assume four flush cycles per event, 2 hours per cycle.
	Flushing sluice gates		6		13.4	3	18	1.5	27	20	Isolation sluice gates opened when flushing tanks and channels, closed when finished. Assume 5-minute gate travel time each way.

Total kW	561.4
Power Cost (\$/KW)	\$0.068

Annual Power Use (kW-hr)			209,981
Annual Power Cost			\$14,279

Wet Weather Pump Station – O&M Cost Summary

Item	Units	Number of Units	Unit Cost	Cost
WW PS Operations Labor	Hours	82	\$ 62.90	\$5,158
WW PS Maintenance Labor				
Supervisor	Hours	48	\$71.40	\$3,427
Electrician	Hours	82	\$66.30	\$5,437
Mechanic	Hours	316	\$57.80	\$18,265
Instrument Tech.	Hours	190	\$66.30	\$12,597
Laborer	Hours	64	\$30.60	\$1,958
Data Analyst	Hours	184	\$57.80	\$10,635
Clerk	Hours	32	\$37.40	\$1,197
WW PS Power	kW-Hr.	220,635	\$0.068	\$15,003
WW PS HVAC Power	kW-Hr.	2,158,716	\$0.068	\$146,793
WW PS Maintenance Labor	Hours	916		\$53,516
Non-Labor Cost*	L.S.	1		\$30,000
Annual O&M Cost				\$303,986
O&M Cost/Gallon**				\$0.002492

Year	Index	Future Cost
2018	1.030	\$313,105.58
2019	1.061	\$322,498.75
2020	1.093	\$332,173.71
2021	1.126	\$342,138.92
2022	1.159	\$352,403.09
2023	1.194	\$362,975.18
2024	1.230	\$373,864.44
2025	1.267	\$385,080.37
2026	1.305	\$396,632.78
2027	1.344	\$408,531.76
2028	1.384	\$420,787.72
2029	1.426	\$433,411.35
2030	1.469	\$446,413.69
2031	1.513	\$459,806.10
2032	1.558	\$473,600.28
2033	1.605	\$487,808.29
2034	1.653	\$502,442.54
2035	1.702	\$517,515.82
2036	1.754	\$533,041.29
2037	1.806	\$549,032.53
NPV =		\$6,400,000

Wet Weather Pump Station – Operations Labor

Operations Labor Hours		Comments
Annual No. of Inspection Visits to upon starting of WW PS	32	Assume one inspection visit hour for every four hours of operation.
Annual Person-Hours for Wet Well Flushing Operations After Each Event	50	1 persons for 2 hours each for post-event clean-up per event.
Total Annual Operations Labor Hours	82	
Labor Hourly Rate	\$62.90	
Total Annual Operations Labor Cost	\$5,158	

Wet Weather Pump Station – Maintenance Labor

Type	Equipment or Asset Group	FREQUENCY							Electrician	Mechanic	Instrument Technician	Laborer	Data Analyst	Clerk	Totals
		D	W	M	Q	S	A	Supervisor							
PM	Level Sensors and Flowmeters			x				0.0	0.0	0.0	140.0	0.0	0.0	0.0	140.0
PM	Routine Inspection		x					0.0	0.0	104.0	0.0	0.0	0.0	0.0	104.0
PM	Check fluids and alignment				x			0.0	0.0	96.0	0.0	0.0	0.0	0.0	96.0
PM	Check packing					x		0.0	0.0	10.0	0.0	0.0	0.0	0.0	10.0
PM	Perform Comparative Field Tests						x	0.0	4.0	8.0	0.0	0.0	0.0	0.0	12.0
PM	Instrument and Controls				x			0.0	0.0	0.0	40.0	0.0	0.0	0.0	40.0
PM	Gates, Valves, and Actuators		x					0.0	60.0	54.0	0.0	0.0	0.0	0.0	114.0
PM	Computer Maint. Management System		x					0.0	0.0	0.0	0.0	0.0	140.0	0.0	140.0
RM	Reactive Maintenance-All						x	36.0	16.0	40.0	8.0	60.0	40.0	30.0	200.0
EM	Emergency Maintenance-All						x	12.0	2.0	4.0	2.0	4.0	4.0	2.0	30.0
	Total Hours							48.0	82.0	316.0	190.0	64.0	184.0	32.0	660.0
	Labor Rate							\$71.40	\$66.30	\$57.80	\$66.30	\$30.60	\$57.80	\$37.40	
	Total Cost							\$3,427.20	\$5,436.60	\$18,264.80	\$12,597.00	\$1,958.40	\$10,635.20	\$1,196.80	\$53,516.00

Wet Weather Pump Station – Non-Annual Maintenance Costs

Item	Period (yrs)	Cost
Main pump rebuilds	7	\$200,000
Flood pump rebuilds	7	\$50,000
Sump pump rebuilds	7	\$30,000

Maintenance Parts	Service life (yrs)	Unit cost (\$/pump)	# of Main pumps
Bearings, seals, & gaskets	10	\$2,000	5
Mechanical seals	7	\$4,000	5
Impellers	10	\$10,000	5
Wear Rings	7	\$3,500	5

Inflation =	3%
Discount Rate =	3%

	Year	2017 cost	Inflated Cost
1	2018	\$0	\$0
2	2019	\$0	\$0
3	2020	\$0	\$0
4	2021	\$0	\$0
5	2022	\$0	\$0
6	2023	\$0	\$0
7	2024	\$317,500	\$390,485
8	2025	\$0	\$0
9	2026	\$0	\$0
10	2027	\$60,000	\$80,635
11	2028	\$0	\$0
12	2029	\$0	\$0
13	2030	\$0	\$0
14	2031	\$317,500	\$480,247
15	2032	\$0	\$0
16	2033	\$0	\$0
17	2034	\$0	\$0
18	2035	\$0	\$0
19	2036	\$0	\$0
20	2037	\$60,000	\$108,367

NPV =	\$798,000.00

Wet Weather Pump Station – Electrical/Power Costs

Pump Station Power Costs			
Total Annual Volume Pumped =	337.00	MG	
TDH =	165	ft	
Typ Pump Efficiency =	85%		
Typ Motor Efficiency =	95%		
Typ VFD Efficiency =	98%		

$$\text{Power per MG pumped} = \frac{3.14 \times TDH}{Eff_{pump} Eff_{motor} Eff_{VFD}}$$

Power per MG pumped =	654.7	kW-hr/MG
Annual Pumping Power =	220,635	kW-hr
Annual Pumping Power Cost =	\$ 15,003.20	

Pump Station HVAC Costs ¹			
Continuous Power Demand (kW) =			238
Continuous Power Demand (hrs) =			8634
Pump ON Power Demand (kW) =			824
Pump ON Power Demand (hrs) =			126
Total Annual Power Use (kW-hr) =			2,158,716

$$\text{Annual HVAC Power Cost} = \$ 146,792.69$$

Note:

1. HVAC costs based on similarly sized pump station for Westerly Tunnel AFP, NEORSO.

APPENDIX D. ALTERNATIVE EVALUATION DETAILS

Table D-1: Baseline Alternative Life Cycle Cost

WWTP Wet Weather Expansion Total Program Cost (\$M) ¹	\$393.6
Wet Weather Pump Station Program Cost (\$M)	\$171.0
Satellite EHRT Facility Program Cost (\$M)	\$0.0
Total Capital Cost (\$M)	\$564.6
Net Present Worth of WWTP Wet Weather Expansion O&M Costs (\$M) ¹	\$21.6
Net Present Worth of Wet Weather Pump Station O&M Costs (\$M)	\$7.2
Net Present Worth of Satellite EHRT O&M Costs (\$M)	\$0.0
Total Net Present Worth of O&M Costs (\$M)	\$28.8
TOTAL LIFE CYCLE COSTS (\$M)	\$593.4

Notes:

1. Cost estimate prepared by the WWTP PM.

Table D-2: Baseline Alternative Evaluation Scoring

Criteria	Attribute	Attribute Weight	Score/LCC (\$M)	Weighted Score	Notes
Economic	Life Cycle Cost	20%	\$593.4	1.0	Weighted score is the LCC ranked from 1 to 5 compared to all other alternatives.
Community	Aesthetics, Odors, Disruption	10%	5	0.5	New facilities inside existing WWTP. No long-term disruptions anticipated.
	Green Leave-Behinds	10%	2	0.2	Limited opportunity for significant or publicly-accessible GLB.
Public Health and Environmental	Meet LOC Objectives	10%	3	0.3	Will meet LOC objectives
	Meet Future Regulatory Requirements	10%	3	0.3	Future expansion of WWTP beyond 600 MGD difficult, but operational changes (e.g., CEPT) could be implemented.
	Reliability	10%	5	0.5	Firm capacity of treatment units and equipment provided.

Table D-2: Baseline Alternative Evaluation Scoring

Criteria	Attribute	Attribute Weight	Score/LCC (\$M)	Weighted Score	Notes
Operations and Maintenance	Operating Complexity	10%	5	0.5	Same treatment processes as currently used. No off-site facilities.
Implementation and Construction	Constructability (Risk)	10%	3	0.3	Depends on accuracy of record information. Construction issue could impact MOPO at WWTP.
	Ease of property/easement acquisition	10%	5	0.5	No additional property or easements required.
Weighted Evaluation Score: 4.1					

Table D-3: Alternative 1A Life Cycle Cost

WWTP Wet Weather Expansion Total Program Cost (\$M) ¹	\$343.2
Wet Weather Pump Station Program Cost (\$M)	\$171.0
Satellite EHRT Facility Program Cost (\$M)	\$114.7
Total Program Cost (\$M)	\$628.9
Net Present Worth of WWTP Wet Weather Expansion O&M Costs (\$M) ¹	\$20.1
Net Present Worth of Wet Weather Pump Station O&M Costs (\$M)	\$7.2
Net Present Worth of Satellite EHRT O&M Costs (\$M)	\$3.8
Total Net Present Worth of O&M Costs (\$M)	\$31.1
TOTAL LIFE CYCLE COSTS (\$M)	\$660.0

Notes:

1. Cost estimate prepared by the WWTP PM.

Table D-4: Alternative 1A Evaluation Scoring

Criteria	Attribute	Attribute Weight	Score/LCC (\$M)	Weighted Score	Notes
Economic	Life Cycle Cost	20%	\$660.0	0.2	Weighted score is the LCC ranked from 1 to 5 compared to all other alternatives.
Community	Aesthetics, Odors, Disruption	10%	3	0.3	New EHRT facility closer to public rights-of-way; traffic to/from may cause periodic disruptions.
	Green Leave-Behinds	10%	3	0.3	Limited opportunity for publicly-accessible GLB.
Public Health and Environmental	Meet LOC Objectives	10%	3	0.3	Will meet LOC objectives
	Meet Future Regulatory Requirements	10%	3	0.3	Future expansion of WWTP beyond 540 MGD or EHRT beyond 60 MGD difficult, but operational changes (e.g., CEPT) could be implemented.

Table D-4: Alternative 1A Evaluation Scoring

Criteria	Attribute	Attribute Weight	Score/LCC (\$M)	Weighted Score	Notes
Operations and Maintenance	Reliability	10%	3	0.3	EHRT provides redundancy of equipment but no redundancy of tankage.
	Operating Complexity	10%	2	0.2	EHRT is new treatment process, requiring additional training, and it is located off-site relatively close.
Implementation and Construction	Constructability (Risk)	10%	2	0.2	Significant excavation at Western Penitentiary site with potentially little record information. Proximity to river may require extensive dewatering.
	Ease of property/easement acquisition	10%	3	0.3	Purchase of additional property at Western Penitentiary site required. Easements between WWTP and Western Penitentiary site may be required.
Weighted Evaluation Score: 2.4					

Table D-5: Alternative 1B Life Cycle Cost

WWTP Wet Weather Expansion Total Program Cost (\$M) ¹	\$343.2
Wet Weather Pump Station Program Cost (\$M)	\$171.0
Satellite EHRT Facility Program Cost (\$M)	\$105.5
Total Program Cost (\$M)	\$619.7
Net Present Worth of WWTP Wet Weather Expansion O&M Costs (\$M) ¹	\$20.1
Net Present Worth of Wet Weather Pump Station O&M Costs (\$M)	\$7.2
Net Present Worth of Satellite EHRT O&M Costs (\$M)	\$3.8
Total Net Present Worth of O&M Costs (\$M)	\$31.1
TOTAL LIFE CYCLE COSTS (\$M)	\$650.8

Notes:

1. Cost estimate prepared by the WWTP PM.

Table D-6: Alternative 1B Evaluation Scoring

Criteria	Attribute	Attribute Weight	Score/LCC (\$M)	Weighted Score	Notes
Economic	Life Cycle Cost	20%	\$650.8	0.3	Weighted score is the LCC ranked from 1 to 5 compared to all other alternatives.
Community	Aesthetics, Odors, Disruption	10%	2	0.2	New EHRT facility closer to public rights-of-way; greater potential for odors; traffic to/from may cause periodic disruptions.
	Green Leave-Behinds	10%	3	0.3	Limited opportunity for publicly-accessible GLB.
	Meet LOC Objectives	10%	3	0.3	Will meet LOC objectives

Table D-6: Alternative 1B Evaluation Scoring

Criteria	Attribute	Attribute Weight	Score/LCC (\$M)	Weighted Score	Notes
Public Health and Environmental	Meet Future Regulatory Requirements	10%	3	0.3	Future expansion of WWTP beyond 540 MGD or EHRT beyond 60 MGD difficult, but operational changes (e.g., CEPT) could be implemented.
Operations and Maintenance	Reliability	10%	3	0.3	EHRT provides redundancy of equipment but no redundancy of tankage.
	Operating Complexity	10%	2	0.2	EHRT is new treatment process, requiring additional training, and it is located off-site relatively close.
Implementation and Construction	Constructability (Risk)	10%	3	0.3	Significant excavation at Trucking site (light industrial) with potentially little record information.
	Ease of property/easement acquisition	10%	3	0.3	Purchase of additional property at Trucking site required. Easements between WWTP and Trucking site may be required.
Weighted Evaluation Score: 2.5					

Table D-7: Alternative 1C Life Cycle Cost

WWTP Wet Weather Expansion Total Program Cost (\$M) ¹	\$343.2
Wet Weather Pump Station Program Cost (\$M)	\$171.0
Satellite EHRT Facility Program Cost (\$M)	\$78.0
Total Program Cost (\$M)	\$592.2
Net Present Worth of WWTP Wet Weather Expansion O&M Costs (\$M) ¹	\$20.1
Net Present Worth of Wet Weather Pump Station O&M Costs (\$M)	\$7.2
Net Present Worth of Satellite EHRT O&M Costs (\$M)	\$3.8
Total Net Present Worth of O&M Costs (\$M)	\$31.1
TOTAL LIFE CYCLE COSTS (\$M)	\$623.3

Notes:

1. Cost estimate prepared by the WWTP PM.

Table D-8: Alternative 1C Evaluation Scoring

Criteria	Attribute	Attribute Weight	Score/LCC (\$M)	Weighted Score	Notes
Economic	Life Cycle Cost	20%	\$623.3	0.6	Weighted score is the LCC ranked from 1 to 5 compared to all other alternatives.
Community	Aesthetics, Odors, Disruption	10%	2	0.2	New EHRT facility closer to public rights-of-way; greater potential for odors; traffic to/from may cause periodic disruptions.
	Green Leave-Behinds	10%	3	0.3	Limited opportunity for publicly-accessible GLB.
	Meet LOC Objectives	10%	3	0.3	Will meet LOC objectives

Table D-8: Alternative 1C Evaluation Scoring

Criteria	Attribute	Attribute Weight	Score/LCC (\$M)	Weighted Score	Notes
Public Health and Environmental	Meet Future Regulatory Requirements	10%	3	0.3	Future expansion of WWTP beyond 540 MGD or EHRT beyond 60 MGD difficult, but operational changes (e.g., CEPT) could be implemented.
Operations and Maintenance	Reliability	10%	3	0.3	EHRT provides redundancy of equipment but no redundancy of tankage.
	Operating Complexity	10%	2	0.2	EHRT is new treatment process, requiring additional training, and it is located off-site relatively close.
Implementation and Construction	Constructability (Risk)	10%	3	0.3	Significant excavation at Valspar site (light industrial) with potentially little record information. Proximity to river may require extensive dewatering.
	Ease of property/easement acquisition	10%	3	0.3	Purchase of additional property at Valspar site required. Easements between WWTP and Valspar site may be required.
Weighted Evaluation Score: 2.8					

Table D-9: Alternative 2A Life Cycle Cost

WWTP Wet Weather Expansion Total Program Cost (\$M) ¹	\$306.4
Wet Weather Pump Station Program Cost (\$M)	\$171.0
Satellite EHRT Facility Program Cost (\$M)	\$146.3
Total Program Cost (\$M)	\$623.7
Net Present Worth of WWTP Wet Weather Expansion O&M Costs (\$M) ¹	\$18.3
Net Present Worth of Wet Weather Pump Station O&M Costs (\$M)	\$7.2
Net Present Worth of Satellite EHRT O&M Costs (\$M)	\$7.5
Total Net Present Worth of O&M Costs (\$M)	\$33.0
TOTAL LIFE CYCLE COSTS (\$M)	\$656.7

Notes:

1. Cost estimate prepared by the WWTP PM.

Table D-10: Alternative 2A Evaluation Scoring

Criteria	Attribute	Attribute Weight	Score/LCC (\$M)	Weighted Score	Notes
Economic	Life Cycle Cost	20%	\$656.7	0.2	Weighted score is the LCC ranked from 1 to 5 compared to all other alternatives.
Community	Aesthetics, Odors, Disruption	10%	3	0.3	New EHRT facility closer to public rights-of-way; traffic to/from may cause periodic disruptions.
	Green Leave-Behinds	10%	3	0.3	Limited opportunity for publicly-accessible GLB.
Public Health and Environmental	Meet LOC Objectives	10%	3	0.3	Will meet LOC objectives
	Meet Future Regulatory Requirements	10%	3	0.3	Future expansion of WWTP beyond 480 MGD or EHRT beyond 120 MGD difficult, but operational changes (e.g., CEPT) could be implemented.

Table D-10: Alternative 2A Evaluation Scoring

Criteria	Attribute	Attribute Weight	Score/LCC (\$M)	Weighted Score	Notes
Operations and Maintenance	Reliability	10%	3	0.3	EHRT provides redundancy of equipment but no redundancy of tankage.
	Operating Complexity	10%	2	0.2	EHRT is new treatment process, requiring additional training, and it is located off-site relatively close.
Implementation and Construction	Constructability (Risk)	10%	2	0.2	Significant excavation at Western Penitentiary site with potentially little record information. Proximity to river may require extensive dewatering.
	Ease of property/easement acquisition	10%	3	0.3	Purchase of additional property at Western Penitentiary site required. Easements between WWTP and Western Penitentiary site may be required.
Weighted Evaluation Score: 2.4					

Table D-11: Alternative 2B Life Cycle Cost

WWTP Wet Weather Expansion Total Program Cost (\$M) ¹	\$306.4
Wet Weather Pump Station Program Cost (\$M)	\$171.0
Satellite EHRT Facility Program Cost (\$M)	\$137.2
Total Program Cost (\$M)	\$614.6
Net Present Worth of WWTP Wet Weather Expansion O&M Costs (\$M) ¹	\$18.3
Net Present Worth of Wet Weather Pump Station O&M Costs (\$M)	\$7.2
Net Present Worth of Satellite EHRT O&M Costs (\$M)	\$7.5
Total Net Present Worth of O&M Costs (\$M)	\$33.0
TOTAL LIFE CYCLE COSTS (\$M)	\$647.6

Notes:

1. Cost estimate prepared by the WWTP PM.

Table D-12: Alternative 2B Evaluation Scoring

Criteria	Attribute	Attribute Weight	Score/LCC (\$M)	Weighted Score	Notes
Economic	Life Cycle Cost	20%	\$647.6	0.3	Weighted score is the LCC ranked from 1 to 5 compared to all other alternatives.
Community	Aesthetics, Odors, Disruption	10%	2	0.2	New EHRT facility closer to public rights-of-way; greater potential for odors; traffic to/from may cause periodic disruptions.
	Green Leave-Behinds	10%	3	0.3	Limited opportunity for publicly-accessible GLB.
Public Health and Environmental	Meet LOC Objectives	10%	3	0.3	Will meet LOC objectives
	Meet Future Regulatory Requirements	10%	3	0.3	Future expansion of WWTP beyond 480 MGD or EHRT beyond 120 MGD difficult, but operational changes (e.g., CEPT) could be implemented.
Operations and Maintenance	Reliability	10%	3	0.3	EHRT provides redundancy of equipment but no redundancy of tankage.

Table D-12: Alternative 2B Evaluation Scoring

Criteria	Attribute	Attribute Weight	Score/LCC (\$M)	Weighted Score	Notes
Implementation and Construction	Operating Complexity	10%	2	0.2	EHRT is new treatment process, requiring additional training, and it is located off-site relatively close.
	Constructability (Risk)	10%	3	0.3	Significant excavation at Trucking site (light industrial) with potentially little record information.
	Ease of property/easement acquisition	10%	3	0.3	Purchase of additional property at Trucking site required. Easements between WWTP and Trucking site may be required.
Weighted Evaluation Score: 2.5					

Table D-13: Alternative 2C Life Cycle Cost

WWTP Wet Weather Expansion Total Program Cost (\$M) ¹	\$306.4
Wet Weather Pump Station Program Cost (\$M)	\$171.0
Satellite EHRT Facility Program Cost (\$M)	\$115.7
Total Program Cost (\$M)	\$593.1
Net Present Worth of WWTP Wet Weather Expansion O&M Costs (\$M) ¹	\$18.3
Net Present Worth of Wet Weather Pump Station O&M Costs (\$M)	\$7.2
Net Present Worth of Satellite EHRT O&M Costs (\$M)	\$7.5
Total Net Present Worth of O&M Costs (\$M)	\$33.0
TOTAL LIFE CYCLE COSTS (\$M)	\$626.1

Notes:

1. Cost estimate prepared by the WWTP PM.

Table D-14: Alternative 2C Evaluation Scoring

Criteria	Attribute	Attribute Weight	Score/LCC (\$M)	Weighted Score	Notes
Economic	Life Cycle Cost	20%	\$626.1	0.6	Weighted score is the LCC ranked from 1 to 5 compared to all other alternatives.
Community	Aesthetics, Odors, Disruption	10%	2	0.2	New EHRT facility closer to public rights-of-way; greater potential for odors; traffic to/from may cause periodic disruptions.
	Green Leave-Behinds	10%	3	0.3	Limited opportunity for publicly-accessible GLB.
Public Health and Environmental	Meet LOC Objectives	10%	3	0.3	Will meet LOC objectives
	Meet Future Regulatory Requirements	10%	3	0.3	Future expansion of WWTP beyond 480 MGD or EHRT beyond 120 MGD difficult, but operational changes (e.g., CEPT) could be implemented.

Table D-14: Alternative 2C Evaluation Scoring

Criteria	Attribute	Attribute Weight	Score/LCC (\$M)	Weighted Score	Notes
Operations and Maintenance	Reliability	10%	3	0.3	EHRT provides redundancy of equipment but no redundancy of tankage.
	Operating Complexity	10%	2	0.2	EHRT is new treatment process, requiring additional training, and it is located off-site relatively close.
Implementation and Construction	Constructability (Risk)	10%	3	0.3	Significant excavation at Valspar site (light industrial) with potentially little record information. Proximity to river may require extensive dewatering.
	Ease of property/easement acquisition	10%	3	0.3	Purchase of additional property at Valspar site required. Easements between WWTP and Valspar site may be required.
Weighted Evaluation Score: 2.8					

ALCOSAN Act 537 Special Study
Appendix G – Municipal and Public Comments

G-1	City of Pittsburgh and County / Regional Agencies	G-1
G-2	Municipalities & Municipal Authorities	G-15
G-3	Public Notification (Newspapers & Libraries)	G-39
G-4	Summary Document	G-49

A letter of transmittal and copies of the Act 537 Special Study and Summary Document were sent to the City of Pittsburgh, Allegheny County and regional agencies listed below in January of 2018. One response was received from the Allegheny County Health Department.

	<i>Page</i>
1 Letter to the Allegheny County Health Department	G-3
Comment Letter from the Allegheny County Health Department	G-5
2 ALCOSAN Response to ACHD Comment Letter	G-7
3 Letter to the Allegheny County Department of Economic Development	G-9
4 Letter to the Southwestern Pennsylvania Commission	G-11
5 Letter to the City of Pittsburgh Department of City Planning	G-13

G-1: Pittsburgh and County Agencies



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Finance & Administration*

Jan M. Oliver
*Director
Regional Conveyance*

Douglas A. Jackson, P.E.
*Director
Operations & Maintenance*

Jeanne Clark
*Director
Communications*

January 17, 2018

Mr. Mike Moskorisin
Chief, Public Drinking Water and Waste Management
Allegheny County Health Department
3901 Penn Avenue, Building #5
Pittsburgh, PA 15224-1347

Subject: ALCOSAN Act 537 Special Study

Dear Mr. Moskorisin:

In 1996, ALCOSAN completed an Act 537 Sewage Facilities Plan for upgrades to its Woods Run Wastewater Treatment Plant located at 3300 Preble Avenue in the City of Pittsburgh. The 537 Plan was adopted by the City of Pittsburgh and approved by the Pennsylvania Department of Environmental Protection (PaDEP).

The 537 Plan outlined the expansion of treatment capacity for anticipated growth/redevelopment and the framework to maximize flows to the plant during wet weather, thereby reducing sewage overflows within the City of Pittsburgh and ALCOSAN's other 82 customer municipalities. The 537 Plan called for the expansion of the secondary (biological) and wet weather treatment capacity.

Attached please find a copy of an Act 537 Special Study recently completed by ALCOSAN. The purpose of the Special Study is to supplement the 1996 Act 537 Plan and to reflect ALCOSAN's current strategy for the expansion of wet weather treatment capacity at the Woods Run Wastewater Treatment Plant. This expansion will be a key element of ALCOSAN's Clean Water Plan. As detailed in the Act 537 Special Study, secondary treatment capacity will be expanded to 295 mgd and primary treatment will be expanded to 480 mgd initially and to 600 mgd ultimately to provide wet weather capacity.

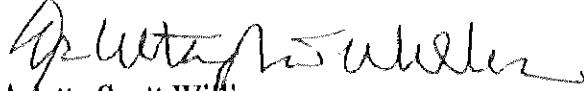
The 1996 Act 537 Plan will remain in effect and upon PaDEP approval will be supplemented by the Act 537 Special Study. The Act 537 planning process is required by the regulations under Title 25 Pa. Code Chapter 71, Administration of Sewage Facilities Planning Program. The regulations in Chapter 71.31 (b) require a review and comment on the Act 537 Special Study by the City of Pittsburgh Planning Department the Southwestern Pennsylvania Commission and the Allegheny County Departments of Health and Economic development. Over the next 60 days starting January 17, 2018 and ending March 17, 2018, comments may be submitted to our Director of Communications, Jeanne Clark (jeanne.clark@alcosan.org).

Mr. Mike Moskorisin
January 17, 2018
Page Two

Please feel free to contact me or our Director of Engineering & Construction,
David Borneman, P.E. (412-734-8369) with any questions you may have
regarding the Special Study.

Sincerely,

ALLEGHENY COUNTY SANITARY AUTHORITY


Arletta Scott Williams
Executive Director

Enclosure

Copies:

D. Borneman, ALCOSAN
A. Tamilia, ALCOSAN
J. Clark, ALCOSAN
T. Dupuis, CDM Smith

COUNTY OF



ALLEGHENY

RICH FITZGERALD
COUNTY EXECUTIVE

February 6, 2018

Ms. Arletta Scott Williams, Executive
Director ALCOSAN
3300 Preble Avenue
Pittsburgh, PA 15233

RE: ALCOSAN Act 537 Plan Special Study - January 2018
City of Pittsburgh, Allegheny County

Dear Ms. Williams,

The Allegheny County Health Department (ACHD) has completed its review of the ALCOSAN Act 537 Plan Special Study dated January 2018, submitted on January 17, 2018. The Special Study information appears to be consistent with the Interim Wet Weather Plan and as noted, Consent Decree modifications are still being negotiated. The ACHD has no objection to the approval of this Special Study.

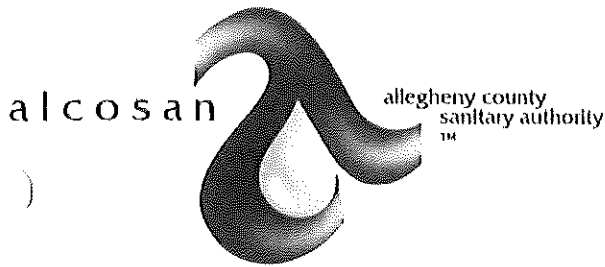
If you have any questions, feel free to contact me at 412-578-8382.

Michael J. Moskorisin, Program Manager
Water Pollution Control & Solid Waste Management

cc: DEP, Clean Water Program
Tom Flanagan, PA DEP (electronically)
Deborah Williamson PE, ACHD (electronically)
Norma Ruffing, ACHD (electronically)



KAREN HACKER, MD, MPH, DIRECTOR
ALLEGHENY COUNTY HEALTH DEPARTMENT
WATER POLLUTION CONTROL AND SOLID WASTE MANAGEMENT PROGRAM
3901 PENN AVENUE, BUILDING 5, PITTSBURGH, PA 15224-1318
PHONE: 412.578.8040 • FAX: 412.578.8053 • WWW.ACHD.NET



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*Director
Regional Conveyance*

Douglas A. Jackson, P.E.
*Director
Operations & Maintenance*

Jeanne Clark
*Director
Communications*

May 9, 2018

Michael J. Moskorisin
Program Manager
Allegheny County Health Department
Water Pollution Control and Solid Waste Management
3109 Penn Avenue, Building 5
Pittsburgh, PA 15224 - 1318

RE: Response to ALCOSAN's Act 537 Special Study Dated February 6, 2018

Dear Mr. Moskorisin,

Thank you for your thoughtful response to our Act 537 Special Study.

We very much appreciate your comments on and support for the Study as we move forward on our Clean Water Plan (formerly Wet Weather Plan). As you noted, the Study is consistent with the Interim Wet Weather Plan. While the updated Consent Decree is not yet finalized, we have every reason to expect that our work to expand the capacity of our plant will part of the new document.

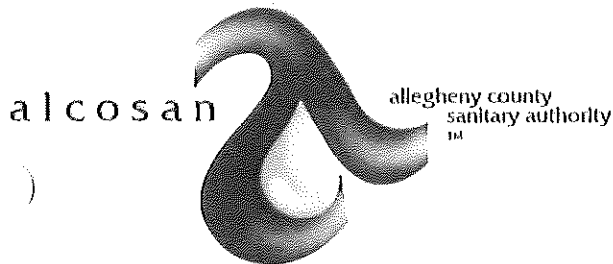
Again, thank you for your review and response to Act 537 Special Study.

Sincerely,
ALLEGHENY COUNTY SANITARY AUTHORITY

A handwritten signature in black ink, appearing to read "Arletta Scott Williams", written in a cursive style.

Arletta Scott Williams
Executive Director

CC: Pennsylvania Department of Environmental Protection Clean Water Program
Tom Flanagan, Pennsylvania Department of Environmental Protection
Deborah Williamson, PE, Allegheny County Health Department
Norma Ruffing, Allegheny County Health Department



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Jeanne Clark
*Director
Communications*

January 17, 2018

Mr. Bob Hurley
Director
Allegheny County Economic Development
One Chatham Center, Suite 900
Pittsburgh, PA 15219

Subject: ALCOSAN Act 537 Special Study

Dear Mr. Hurley:

In 1996, ALCOSAN completed an Act 537 Sewage Facilities Plan for upgrades to its Woods Run Wastewater Treatment Plant located at 3300 Preble Avenue in the City of Pittsburgh. The 537 Plan was adopted by the City of Pittsburgh and approved by the Pennsylvania Department of Environmental Protection (PaDEP).

The 537 Plan outlined the expansion of treatment capacity for anticipated growth/redevelopment and the framework to maximize flows to the plant during wet weather, thereby reducing sewage overflows within the City of Pittsburgh and ALCOSAN's other 82 customer municipalities. The 537 Plan called for the expansion of the secondary (biological) and wet weather treatment capacity.

Attached please find a copy of an Act 537 Special Study recently completed by ALCOSAN. The purpose of the Special Study is to supplement the 1996 Act 537 Plan and to reflect ALCOSAN's current strategy for the expansion of wet weather treatment capacity at the Woods Run Wastewater Treatment Plant. This expansion will be a key element of ALCOSAN's Clean Water Plan. As detailed in the Act 537 Special Study, secondary treatment capacity will be expanded to 295 mgd and primary treatment will be expanded to 480 mgd initially and to 600 mgd ultimately to provide wet weather capacity.

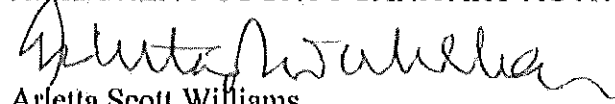
The 1996 Act 537 Plan will remain in effect and upon PaDEP approval will be supplemented by the Act 537 Special Study. The Act 537 planning process is required by the regulations under Title 25 Pa. Code Chapter 71, Administration of Sewage Facilities Planning Program. The regulations in Chapter 71.31 (b) require a review and comment on the Act 537 Special Study by the City of Pittsburgh Planning Department the Southwestern Pennsylvania Commission and the Allegheny County Departments of Health and Economic development. Over the next 60 days starting January 17, 2018 and ending March 17, 2018, comments may be submitted to our Director of Communications, Jeanne Clark (jeanne.clark@alcosan.org).

Mr. Bob Hurley
January 17, 2018
Page Two

Please feel free to contact me or our Director of Engineering & Construction,
David Borneman, P.E. (412-734-8369) with any questions you may have
regarding the Special Study.

Sincerely,

ALLEGHENY COUNTY SANITARY AUTHORITY

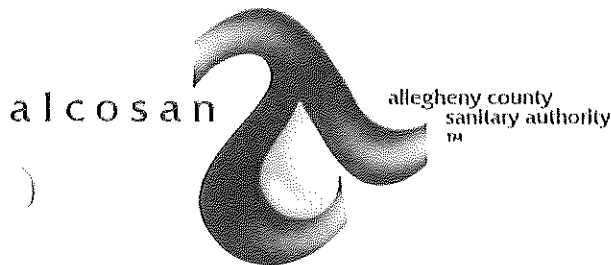


Arletta Scott Williams
Executive Director

Enclosure

Copies:

D. Borneman, ALCOSAN
A. Tamilia, ALCOSAN
J. Clark, ALCOSAN
T. Dupuis, CDM Smith



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Douglas A. Jackson, P.E.
*Director
Operations & Maintenance*

Jeanne Clark
*Director
Communications*

January 17, 2018

Mr. Jim Hassinger
President & CEO
Southwestern Pennsylvania Commission
Two Chatham Center, Suite 500
112 Washington Place
Pittsburgh, PA 15219

Subject: ALCOSAN Act 537 Special Study

Dear Mr. Hassinger:

In 1996, ALCOSAN completed an Act 537 Sewage Facilities Plan for upgrades to its Woods Run Wastewater Treatment Plant located at 3300 Preble Avenue in the City of Pittsburgh. The 537 Plan was adopted by the City of Pittsburgh and approved by the Pennsylvania Department of Environmental Protection (PaDEP).

The 537 Plan outlined the expansion of treatment capacity for anticipated growth/redevelopment and the framework to maximize flows to the plant during wet weather, thereby reducing sewage overflows within the City of Pittsburgh and ALCOSAN's other 82 customer municipalities. The 537 Plan called for the expansion of the secondary (biological) and wet weather treatment capacity.

Attached please find a copy of an Act 537 Special Study recently completed by ALCOSAN. The purpose of the Special Study is to supplement the 1996 Act 537 Plan and to reflect ALCOSAN's current strategy for the expansion of wet weather treatment capacity at the Woods Run Wastewater Treatment Plant. This expansion will be a key element of ALCOSAN's Clean Water Plan. As detailed in the Act 537 Special Study, secondary treatment capacity will be expanded to 295 mgd and primary treatment will be expanded to 480 mgd initially and to 600 mgd ultimately to provide wet weather capacity.

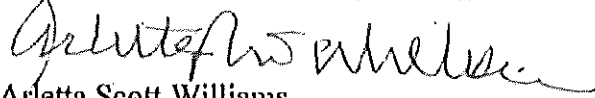
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Mr. Jim Hassinger
January 17, 2018
Page Two

Please feel free to contact me or our Director of Engineering & Construction,
David Borneman, P.E. (412-734-8369) with any questions you may have
regarding the Special Study.

Sincerely,

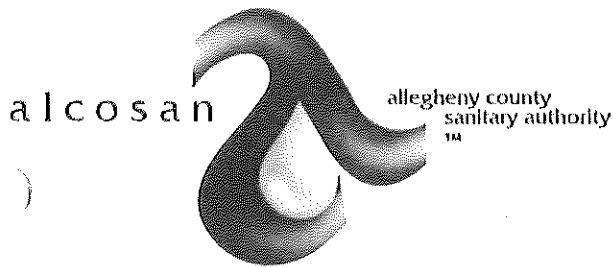
ALLEGHENY COUNTY SANITARY AUTHORITY


Arletta Scott Williams
Executive Director

Enclosure

Copies:

D. Borneman, ALCOSAN
A. Tamilia, ALCOSAN
J. Clark, ALCOSAN
T. Dupuis, CDM Smith



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*Director
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Jeanne Clark
*Director
Communications*

January 17, 2018

Raymond W. Gastil, AICP
Director
City of Pittsburgh, Department of City Planning
200 Ross Street
Pittsburgh, PA 15219

Subject: ALCOSAN Act 537 Special Study

Dear Mr. Gastil:

In 1996, ALCOSAN completed an Act 537 Sewage Facilities Plan for upgrades to its Woods Run Wastewater Treatment Plant located at 3300 Preble Avenue in the City of Pittsburgh. The 537 Plan was adopted by the City of Pittsburgh and approved by the Pennsylvania Department of Environmental Protection (PaDEP).

The 537 Plan outlined the expansion of treatment capacity for anticipated growth/redevelopment and the framework to maximize flows to the plant during wet weather, thereby reducing sewage overflows within the City of Pittsburgh and ALCOSAN's other 82 customer municipalities. The 537 Plan called for the expansion of the secondary (biological) and wet weather treatment capacity.

Attached please find a copy of an Act 537 Special Study recently completed by ALCOSAN. The purpose of the Special Study is to supplement the 1996 Act 537 Plan and to reflect ALCOSAN's current strategy for the expansion of wet weather treatment capacity at the Woods Run Wastewater Treatment Plant. This expansion will be a key element of ALCOSAN's Clean Water Plan. As detailed in the Act 537 Special Study, secondary treatment capacity will be expanded to 295 mgd and primary treatment will be expanded to 480 mgd initially and to 600 mgd ultimately to provide wet weather capacity.

The 1996 Act 537 Plan will remain in effect and upon PaDEP approval will be supplemented by the Act 537 Special Study. The Act 537 planning process is required by the regulations under Title 25 Pa. Code Chapter 71, Administration of Sewage Facilities Planning Program. The regulations in Chapter 71.31 (b) require a review and comment on the Act 537 Special Study by the City of Pittsburgh Planning Department the Southwestern Pennsylvania Commission and the Allegheny County Departments of Health and Economic development. Over the next 60 days starting January 17, 2018 and ending March 17, 2018, comments may be submitted to our Director of Communications, Jeanne Clark (jeanne.clark@alcosan.org).

Raymond W. Gastil, AICP

January 17, 2018

Page Two

Please feel free to contact me or our Director of Engineering & Construction, David Borneman, P.E. (412-734-8369) with any questions you may have regarding the Special Study.

Sincerely,

ALLEGHENY COUNTY SANITARY AUTHORITY



Arletta Scott Williams

Executive Director

Enclosure

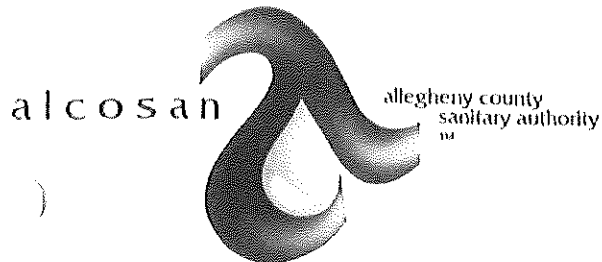
Copies:

D. Borneman, ALCOSAN
A. Tamilia, ALCOSAN
J. Clark, ALCOSAN
T. Dupuis, CDM Smith

A letter of transmittal and copies of the Act 537 Special Study and Summary Document were sent to the 83 ALCOSAN Customer Municipalities January of 2018. Responses were received from North Fayette Township and from the Pittsburgh Water and Sewer Authority.

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1 ALCOSAN Transmittal Letter to the Customer Municipalities	G-17
2 North Fayette Comment Letter and Attachments	G-19
3 ALCOSAN Response to North Fayette	G-33
4 Comment Letter from the Pittsburgh Water & Sewer Authority	G-35
5 ALCOSAN Response to PWSA	G-37

G-2: Municipalities & Authorities



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Douglas A. Jackson, P.E.
*Director
Operations & Maintenance*

Jeanne Clark
*Director
Communications*

To: Allegheny County Public Libraries
From: Arletta Scott Williams, Executive Director
Re: Opportunity for Public Comment on ALCOSAN Act 537 Special Study
Date: February 1, 2018

Enclosed please find a copy of an Act 537 Special Study recently completed by ALCOSAN. Please display this study for use by the public.

The purpose of the study is to amend ALCOSAN's Act 537 Sewage Facilities Plan for upgrades to its Woods Run Wastewater Treatment Plant (WWTP) located at 3300 Preble Avenue in the City of Pittsburgh. The plan was adopted in 1996 by the City of Pittsburgh as the host community for the WWTP, and approved by the Pennsylvania Department of Environmental Protection (PaDEP).

The 537 Plan outlined the expansion of treatment capacity for anticipated growth and redevelopment and to maximize flows to the plant during wet weather. The purpose was to reduce combined and sanitary sewer overflows within Pittsburgh and ALCOSAN's other 82 customer municipalities. The 537 Plan called for the expansion of the secondary (biological) and wet weather treatment capacity.

The Special Study reflects ALCOSAN's current strategy for the expansion of wet weather treatment capacity at the Woods Run WWTP. This expansion will be a key element of ALCOSAN's Clean Water Plan; secondary treatment capacity will be expanded to 295 mgd and primary treatment will be expanded to 480 mgd initially and to 600 mgd ultimately to provide wet weather capacity. The Act 537 Plan will remain in effect as amended upon PaDEP approval.

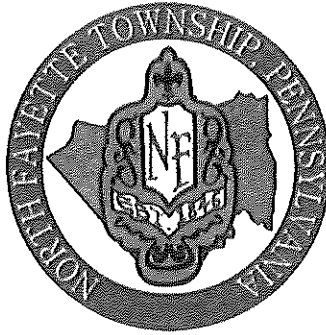
ALCOSAN is requesting review and comment from the general public over the next 30 days starting February 5, 2018 and ending March 7, 2018.

Comments may be submitted to ALCOSAN's Director of Communications Jeanne K. Clark (jeanne.clark@alcosan.org). Please feel free to contact ALCOSAN's Director of Engineering & Construction David Borneman, P.E. (412-734-8369) with any questions you may have regarding the Special Study.

Thank you.

BOARD OF SUPERVISORS

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JAMES MANGAN, *Vice-Chairman*
ROBERT DODDATO, *Treasurer*



TOWNSHIP MANAGER
Robert T. Grimm

SOLICITOR
Vincent A. Tucceri
519 Court Place, Pittsburgh, PA 15219

March 5, 2018

Ms. Jeanne K. Clark, Director of Communications
Allegheny County Sanitary Authority
330 Preble Avenue
Pittsburgh, PA 15233

Dear Ms. Clark,

We have had the opportunity to review the ALCOSAN Act 537 Special Study which will update the 1996 Act 537 Plan. While the Special Study focuses on the expansion of the Woods Run Wastewater Treatment Plant and expansion of treatment capacity, there are sections of the plan that impact the Customer Municipalities. Following review North Fayette Township wishes to provide comment upon certain portions of the draft plan based upon the Robinson Run Feasibility Study, submitted in July 2013, in accordance with the Administrative Consent Order entered into by the Township and the Allegheny County Health Department.

The draft Special Study indicates that the long-term plan calls for a 120 mgd expansion of the raw waste water pumping capacity. Further, the Interim Measures Wet Weather plan mentions adaptive management provisions which involve "obtaining municipal source flow reduction information from customer municipalities and assessing municipal flow reduction commitments in the studies that would merit the down-sizing or modification of the wet weather pump station".

The draft Special Study also mentions the economic impact of not expanding the wet weather capacity. The study noted that if there is no expansion, "municipalities would be unable to meet respective wet weather control obligations and Clean Water Act and Clean Streams Law". This would lead to "impediments to economic redevelopment and unproductive compliance penalties".

The Robinson Run Feasibility Study offered one solution that would provide some relief to the two above mentioned notations. In that alternative, North Fayette Township would construct a pump station to reroute the flow from that portion of the Township along the North Branch and Oakdale Road area to the Moon Township Municipal Authority (MTMA) regional treatment facility. This

alternative reduces flow to the Robinson Run Pump Station, the Chartiers Interceptor and ultimately the Woods Run Treatment plant.

This proposed alternative reduces the scope for upgrades to the pump station and thus the cost to our partner municipalities of Oakdale Borough, South Fayette Township and McDonald Borough (see enclosed executive summary of the Robinson Run Feasibility Study). The alternative would also allow North Fayette Township to cap its flow at its current level set in the March 21, 1991 agreement for treatment of sewage from a portion of the Township. The Township's interpretation of the agreement is any additional flow in excess of the 735K average daily flow is the responsibility of the Township to treat or make arrangement for treatment. The Solicitor for the Township submitted a letter to Ms. Williams, Executive Director on April 20, 2017 regarding this interpretation. The Township sent a copy of the letter to the Ms. Oliver, Director of Regional Conveyance on November 7, 2017.

The preferred alternative in the Feasibility Study appears to be consistent with the language in the Special Study draft and provides a viable alternative for reducing flow to the ALCOSAN system. With that in mind, North Fayette Township is requesting that this comment letter along with the attachments provided be included in the Special Study under North Fayette as an item to be completed to help the overall region for treatment and conveyance.

Following confirmation of its interpretation of language in the 1991 Agreement, North Fayette Township will authorize the preparation of the Act 537 Special Study to update its Act 537 Plan to reflect the intention to move forward with the preferred alternative in the feasibility study. We look forward to continuing to work with ALCOSAN to address flow reduction in the regional system.

Sincerely,



Robert T. Grimm
Township Manager

Cc: Board of Supervisors
Vincent Tucceri, Solicitor
Kevin Brett, Township Engineer (LSSE)

ROBINSON RUN FEASIBILITY STUDY REPORT
JULY 2013

1.0 Executive Summary

The Robinson Run Feasibility Study was developed to comply with the Administrative Consent Orders (ACOs) and Consent Order and Agreements (COAs) issued by the Allegheny County Health Department (ACHD) and the Pennsylvania Department of Environmental Protection (PaDEP) requirements to submit a feasibility study to the regulators within six (6) months of (ALCOSAN) submitting its regional Wet Weather Plan.

The Robinson Run sewershed consists of the sewage collection and conveyance systems located within the municipalities of North Fayette Township, Oakdale Borough, South Fayette Township and McDonald Borough that are tributary to the ALCOSAN Point-of-Connection (POC) C-45B-04 located in Scott Township. The communities located within the Robinson Run sewershed formed the Robinson Run Advisory Group (RRAG), which is comprised of representatives from North Fayette Township, South Fayette Township, McDonald Borough, and Oakdale Borough. This study was an effort of the RRAG and reflects input from all of the respective communities.

This Feasibility Study has two main objectives:

1. To project compliance with the requirements of the ACOs and COAs issued to each of the respective communities, and
2. To provide ALCOSAN with the information necessary for it to comply the requirements of its Consent Decree (CD).

Background

The Robinson Run sewershed consists of, in whole or in part, four (4) municipalities/authorities: 1) McDonald Borough/ McDonald Sewage Authority; 2) North Fayette Township; 3) South Fayette Township/Municipal Authority of the Township of South Fayette; and 4) Oakdale Borough. The sewage

generated within the Robinson Run sewershed is conveyed to the Oakdale Pump Station, whereby it is conveyed by forcemain and a gravity interceptor sewer to ALCOSAN's Chartiers Creek Interceptor. The sewershed is a mixed sewershed meaning that it contains three (3) separately sewer communities and one combined sewer community. Specifically, the Borough of McDonald is a combined sewer community while North Fayette Township, Oakdale Borough and South Fayette Township are all separately sewer communities.

Similar to the other communities tributary to ALCOSAN, in 2004, the communities located in the Robinson Run sewershed entered into ACO or COA with the ACHD and the PaDEP, respectively.

Existing Service Area

The individual municipal collection systems are tributary to a shared interceptor, which follows along Robinson Run, beginning at the McDonald Borough border to the Oakdale Pump Station. The pump station conveys sewage via an 18 inch-diameter forcemain to a 24 inch-diameter gravity interceptor that traverses through Collier Township to the ALCOSAN POC C-45B-04 near the intersection of Keystone Drive and Superior Street in Scott Township. The Robinson Run Sewershed is located within ALCOSAN's Chartiers Creek Planning Basin. The total Robinson Run Sewershed covers 20.3 square miles containing 65.6 miles of collector sewers, 2.08 miles of trunk sewers, 7.55 miles of interceptor sewer, and 1.77 miles of forcemain.

Contained within the Robinson Run Sewershed are fifteen (15) Combined Sewer Overflows (CSOs) and one (1) Separate Sewer Overflow (SSO). McDonald Borough contributes flow to the fifteen CSOs, while North Fayette Township, the Township of South Fayette, McDonald Borough, and Oakdale Borough contribute flow to the one SSO located at the Oakdale Pump Station. Table 3-7 provides information for the CSOs within the Robinson Run Sewershed. Table 3-8 provides information for the SSO within the Robinson Run Sewershed.

The Robinson Run System is broken down into Stage 1 and Stage 2 facilities. The Stage 1 Facilities include the interceptor sewer from the POC in Scott Township near the intersection of Keystone Drive and Superior Street to and including the Oakdale Pump station. The Stage 1 facilities also includes 0.60 miles of 24" gravity interceptor, which is located upstream of the Oakdale Pump Station to the center of Oakdale Borough, near Union Avenue Extension. The Stage 1 collection portion also comprises of 3.67 miles of gravity interceptor from the connection of the Oakdale Forcemain to the Interceptor through Collier Township to the POC. Stage 1 also includes 1.77 miles of forcemain from the Oakdale Pump Station to the gravity interceptor in Collier Township. These facilities service all four (4) Robinson Run entities and maintenance costs of these facilities are shared by all four (4) communities.

The Stage 2 facilities include 3.07 miles of gravity interceptor sewers from the center of Oakdale Borough to the downstream boundary of McDonald Borough in the vicinity of the Robinson Run Road Intersection with the Interceptor. These facilities are shared by North Fayette Township, South Fayette Township and McDonald Borough. Oakdale Borough has no building connections to the Stage 2 facilities. The Stage 2 interceptor ranges in size from 12" to 18" diameter pipe and contains approximately 16,200 linear feet of pipe.

A section of sewer extends from the center of Oakdale and parallels S.R. Route 978 to a manhole in the Oakdale Borough Park. This section carries the majority of North Fayette Township's flow contributing to the Robinson Run Interceptor Sewer. This section is considered a trunk sewer with limited connections and it has never been formally accepted as part of the joint facilities, furthermore neither North Fayette nor Oakdale takes formal responsibility for the section. This trunk ranges in size from 12" to 21" diameters and contains approximately 11,000 feet of pipe to the connection at the Stage 1 interceptor. This section is referred to the North Interceptor.

Figure 2-1 presents an overview of the Robinson Run Sewershed.

Alternatives

Five Alternatives were evaluated for both a 2-year and 10-year design storm for both Winter and Summer periods for the Robinson Run Sewershed to address identified capacity deficiencies.

Alternatives one (1) through three (3) all propose continual transport and treatment of sewage by ALCOSAN while Alternatives four (4) and five (5) present variations where all or parts of the Robinson Run Sewershed is removed from the ALCOSAN service area. The alternatives for the 10-year Winter design storm are summarized as follows:

- Alternative No. 1 – ALCOSAN Treatment (Pump Station Capacity = 9.0 mgd, 2.0 MG equalization tank, and conveyance increases)
 - Augment the capacity of approximately 4,950 linear feet of the existing north interceptor, which serves Oakdale Borough and North Fayette Township and approximately 2,850 linear feet of the Stage 1 Interceptor, which serves all four communities.
 - Upgrade the capacity of the existing Oakdale Pump Station to 9.0 mgd.
 - Construct a 2.0 MG storage basin at the Oakdale Pump Station to contain the flows in excess of 9 mgd, the capacity of the forcemain.
 - Repair portions of the existing Stage 1 forcemain and gravity interceptor.

The preliminary opinion of probable project costs for Alternative 1 is \$12.35 M.

- Alternative No. 2 – ALCOSAN Treatment (Pump Station Capacity = 17.3 mgd, and conveyance increases)
 - Augment the capacity of approximately 4,950 linear feet of the existing north interceptor, which serves Oakdale Borough and North Fayette Township and approximately 2,650 linear feet of the Stage 1 Interceptor, which serves all four communities.
 - Upgrade the capacity of the existing Oakdale Pump Station to 17.3 mgd.
 - Construct 9,325 linear feet of new 24-inch diameter forcemain.
 - Construct 19,115 linear feet of new 36-inch diameter gravity interceptor from the forcemain to the ALCOSAN POC.

The preliminary opinion of probable project costs for Alternative 2 is \$15.37 M.

- Alternative No. 3 – ALCOSAN Treatment

- Augment the capacity of approximately 4,950 linear feet of the existing north interceptor, which serves Oakdale Borough and North Fayette Township and approximately 2,650 linear feet of the Stage 1 Interceptor, which serves all four communities.
- Abandon the existing Oakdale Pump Station and forcemain and replace with gravity only conveyance interceptor. There are two variations for this portion as follows:
 - Alternative 3A (No pump station, gravity flow to POC, and conveyance increases):
 - Construct 34,440 linear feet of 36-inch diameter interceptor that would be designated within a Robinson Run exclusive easement following the existing stream bank and the Panhandle Trail to the existing POC of C-45B-04,
 - Alternative 3B (No Pump Station, gravity flow to POC with Collier Twp., and conveyance increases):
 - Construct 35,355 linear feet of 36-inch diameter interceptor that would, incorporate flow from Collier Township flow and instead connect at ALCOSAN POC of C-45B-08.

The preliminary opinion of probable project costs for Alternative 3A and 3B is \$12.91M and \$13.22M, respectively. Alternative 3B is currently not being evaluated further since it requires the participation of Collier Township, which a firm confirmation has not been provided.

The fourth alternative is divided into three sub-alternatives. The first sub-alternative evaluates a dedicated sewage treatment plant (STP) for the Robinson Run service area, while the second and third sub-alternatives evaluate a new STP for a portion of the Robinson Run service area.

- Alternative No. 4A – Robinson Run Treatment (Robinson Run STP)

- Augment the capacity of approximately 4,950 linear feet of the existing north interceptor, which serves Oakdale Borough and North Fayette Township and approximately 2,850 linear feet of the Stage 1 Interceptor, which serves all four communities.
- Construction of a 1.75 mgd Sewage Treatment Plant in North Fayette at the location of the existing Oakdale Pump Station location and disconnecting Robinson Run from the ALCOSAN system.
- Abandon the existing Oakdale Pump Station, forcemain and gravity interceptor.
- Construct a 3.2 MG storage basin at the Sewage Treatment Plant.

The preliminary opinion of probable project costs for Alternative 4A is \$35.92 M.

- Alternative No. 4Ba – ALCOSAN/North Fayette Treatment (North Fayette Township STP, Pump Station Capacity = 9.0 mgd, 1.0 MG equalization tank, and conveyance increases):
 - Augment the capacity of approximately 2,850 linear feet of the Stage 1 Interceptor, which serves all four communities.
 - Construct a 0.47 mgd Sewage Treatment Plant and 0.11 MG storage basin to serve a portion of North Fayette Township.
 - Upgrade the capacity of the existing Oakdale Pump Station to 9.0 mgd.
 - Construct a 1.0 MG storage basin at the Oakdale Pump Station to contain the flows in excess of 9 mgd, the capacity of the forcemain.
 - Repair portions of the existing Stage 1 forcemain and gravity interceptor.

The preliminary opinion of probable project costs for Alternative 4Ba is \$16.53 M.

- Alternative No. 4Bb – ALCOSAN/North Fayette Treatment (North Fayette Township North Branch STP, Pump Station Capacity = 9.0 mgd, 1.3 MG equalization tank, and conveyance increases):
 - Augment the capacity of approximately 2,850 linear feet of the Stage 1 Interceptor, which serves all four communities.

- Construct a 0.35 mgd Sewage Treatment Plant and 0.15 MG storage basin to serve a portion of North Fayette Township.
- Upgrade the capacity of the existing Oakdale Pump Station to 9.0 mgd.
- Construct a 1.3 MG storage basin at the Oakdale Pump Station to contain the flows in excess of 9 mgd, the capacity of the forcemain.
- Repair portions of the existing Stage 1 forcemain and gravity interceptor.

The preliminary opinion of probable project costs for Alternative 4Bb is \$15.04 M.

Alternative 5 is divided into two sub-alternatives relating to treatment with Moon Township. Moon Township currently treats portions of North Fayette Township through their Montour Run system. In Alternative 5A, the flows from all of Robinson Run would be transported along Oakdale Road via forcemain and pumped into the Moon Township Municipal Authority (MTMA) system.

- Upgrade the existing Oakdale Pump Station to accommodate the future growth capacity.
- Construct a new forcemain to accommodate a full capture scenario from the Oakdale Pump Station for conveyance to Montour Run System.
- New construction of gravity sewer to convey flow to the Montour Run System.

After consultation with MTMA, it has been determined that Alternative 5A is not technically feasible and therefore has been removed from consideration.

In Alternative 5B, only the portion of North Fayette Township tributary to the intersection of North Branch and Oakdale Roads would be pumped up into the Moon Township treatment facility.

- Alternative No. 5B – ALCOSAN/North Fayette Treatment (North Fayette Township – North Branch to MTMA, Pump Station Capacity = 9.0 mgd, 1.0 MG equalization tank, and conveyance increases):
 - Construct a new 1.9 mgd Pump Station to convey flow from a portion of North Fayette Township tributary to the intersection of North Branch and Oakdale roads to MTMA.

- Construct 8,530 linear feet of 16-inch diameter forcemain and 5,820 linear feet of 15-inch diameter gravity sewer to convey flow from North Fayette Township to the existing MTMA intercepter.
- Augment the capacity of approximately 2,850 linear feet of the Stage 1 Interceptor, which serves all four communities.
- Upgrade the capacity of the existing Oakdale Pump Station to 9.0 mgd.
- Construct a 1.0 MG storage basin at the Oakdale Pump Station to contain the flows in excess of 9 mgd, the capacity of the forcemain.
- Repair portions of the existing Stage 1 forcemain and gravity intercepter.

The preliminary opinion of probable project costs for Alternative 5B is \$11.95 M.

The opinion of probable project cost by Alternative is summarized below in Table 1-1.

Table 1-1 Preliminary Opinion of Probable Project Costs

Alternative	Preliminary Opinion of Probable Project Costs (10-Year Winter Design Conditions)
Alternative 1 (Pump Station Capacity = 9.0 mgd, 2.0 MG equalization tank, and conveyance increases)	\$12,350,000
Alternative 2 (Pump Station Capacity = 17.3 mgd, and conveyance increases)	\$15,370,000
Alternative 3A (No pump station, gravity flow to POC, and conveyance increases)	\$12,910,000
Alternative 3B (No Pump Station, gravity flow to POC with Collier Twp., and conveyance increases)	\$13,220,000 (Excluded from further evaluation)
Alternative 4A (Robinson Run STP)	\$35,920,000
Alternative 4Ba (North Fayette Township STP, Pump Station Capacity = 9.0 mgd, 1.0 MG equalization tank, and conveyance increases)	\$16,530,000
Alternative 4Bb (North Fayette Township North Branch STP, Pump Station Capacity = 9.0 mgd, 1.3 MG equalization tank, and conveyance increases)	\$15,040,000
Alternative 5a (Robinson Run to MTMA)	Not Technically Feasible
Alternative 5b (North Fayette Township – North Branch to MTMA, Pump Station Capacity = 9.0 mgd, 1.0 MG equalization tank, and conveyance increases)	\$11,950,000

Based solely on capital costs of the Alternatives, the ranking is as follows:

1. Alternative 5b (North Fayette Township - North Branch to MTMA, Pump Station Capacity = 9.0 mgd, 1.0 MG equalization tank, and conveyance increases),
2. Alternative 1 (Pump Station Capacity = 9.0 mgd, 2.0 MG equalization tank, and conveyance increases),
3. Alternative 3A (No pump station, gravity flow to POC, and conveyance increases),
4. Alternative 4Bb (North Fayette Township North Branch STP, Pump Station Capacity = 9.0 mgd, 1.3 MG equalization tank, and conveyance increases),
5. Alternative 2 (Pump Station Capacity = 17.3 mgd, and conveyance increases),
6. Alternative 4Ba (North Fayette Township STP, Pump Station Capacity = 9.0 mgd, 1.0 MG equalization tank, and conveyance increases),
7. Alternative 4A (Robinson Run STP),
8. Alternative 3B (No Pump Station, gravity flow to POC with Collier Twp., and conveyance increases (Costed out, however not evaluated further)),
9. Alternative 5a (Robinson Run to MTMA (Technically Infeasible))

The top three alternatives were evaluated from July 2012 through submission of this Report. The evaluation took into consideration ALCOSAN's Wet Weather Plan, Operation and Maintenance costs, User Rate Analysis, Financial and Institutional Analyses, plus more detailed discussion with ALCOSAN. For planning purposes, ALCOSAN was advised in the draft July 2012 Feasibility Study to plan for downstream ALCOSAN facilities for accepting flow for Alternative 3A – Full Conveyance (10 Year Winter Design Storm).

Since submission of the draft Feasibility Study in July 2012, ALCOSAN has reported at several meetings with the RRAG that their downstream facilities do not have capacity for Alternative 3A – Full Conveyance (10 Year Winter Design Storm).

Section 8 of this Report documents the financial and institutional evaluation for the top three alternatives. Table 1-2 presents the results of the present worth analysis performed for the top three alternatives. Based upon this analysis and additional information presented in Section 8, essentially the

top three alternatives have similar financial impacts, within planning level estimates, to all entities. As such, it is the understanding of the RRAG technical group, that this Robinson Run Feasibility Study will form the basis for each of the municipal entities to approve a particular alternative that best fits the needs of that particular municipality.

Table 1-2 Summary of Present Worth

Alternative	Present Worth Value
Alternative 1 - RR L/S upgrade; 2.0 MG EQ Tank; Upsized Conveyance	\$37,443,000
Alternative 3a - Eliminate RR L/S; Upsized Gravity Conveyance to ALCOSAN POC	\$37,337,000
Alternative 5b - RR L/S Upgrade; 1.0 MG EQ Tank; NFI North Branch to MTMA	\$37,047,000

Section 11 provides example implementation schedules for the various alternatives.

GAITENS, TUCCERI & NICHOLAS, P.C.
ATTORNEYS AT LAW

FILE COPY

519 COURT PLACE
PITTSBURGH, PENNSYLVANIA 15219

(412) 391-6920
FAX (412) 391-1189

VINCENT A. TUCCERI, ESQUIRE
vtucceri@gtlnlaw.com

April 20, 2017

Arletta Scott Williams, Executive Director
ALCOSAN
3300 Preble Avenue
Pittsburgh, PA 15233

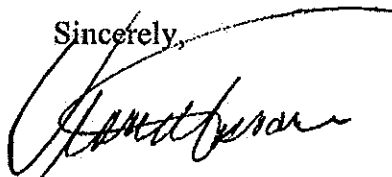
In Re: March 21, 1991 Alcosan/City of Pittsburgh/North Fayette Sewage Agreement

Dear Director Williams:

Please accept this follow up to North Fayette's June 2, 2016, meeting with Alcosan officials which I attended as Solicitor for North Fayette Township which also included Timothy Prevost, Manager of Wet Weather Programs. At that meeting, Mr. Prevost set forth Alcosan's interpretation of the above Agreement that Alcosan is the exclusive sewage treater for that portion of North Fayette's sanitary sewage with the geographic boundaries represented in that Agreement to the extent that North Fayette would transport a maximum of .735 MGD or a peak design flow of 1.838 MGD and that any sewage in excess of either of those limits would be the responsibility of North Fayette to treat or arrange for treatment. Following that meeting, we reviewed the Agreement and we agree with Alcosan's position in that regard.

In order to amend our 537 Plan to effectuate that understanding, we will need confirmation from you to that effect and I would therefore request that you provide same as quickly as possible.

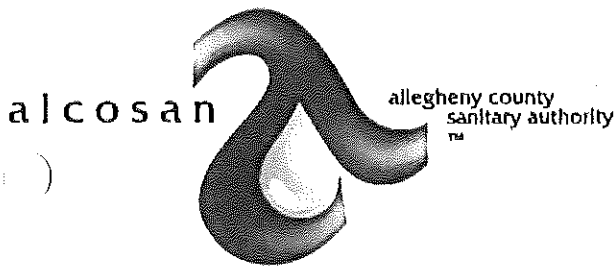
Sincerely,



Vincent A. Tucceri

VAT/drt

cc: Robert T. Grimm, Township Manager
Kevin Brett, P.E.
Lennon, Smith, Souleret Engineering, Inc.



Members of the Board

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Arletta Scott Williams
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Environmental Compliance*

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Jan M. Oliver
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Douglas A. Jackson, P.E.
*Director
Operations & Maintenance*

Jeanne Clark
*Director
Communications*

April 27, 2018

**Mr. Robert Grimm
Township Manager
North Fayette Township
400 North Branch Road
Oakdale, PA 15071**

Dear Mr. Grimm:

Thank you for your letter dated March 5th, 2018 concerning comments to the ALCOSAN Act 537 Special Study. We appreciate your comments and concerns. We agree that flow reduction should be taken into account as part of an integrated approach to solving the Wet Weather compliance issue. ALCOSAN has retained a Preliminary Planner to evaluate incorporating flow reduction opportunities. However, it is unlikely that flow reduction efforts could be of the magnitude that would eliminate the need to build some type of Wet Weather Pump Station, whether it be connected to a new tunnel or diverting flow from the existing treatment plant wet well. Recent work by the Preliminary Planner has confirmed that maximizing flow to the treatment plant to a wet weather capacity of 600 million gallons per day is one of the most cost effective components of the Clean Water Plan.

With regards to your comments about the Robinson Run Feasibility Study, the option that you were referring to was not the recommended approach. More importantly, the Robinson Run trunk sewer is slated for transfer of ownership to ALCOSAN as part of the ALCOSAN Regionalization effort. ALCOSAN will be revisiting all the recommended solutions for the transferred trunk sewers, including integrated approaches, before implementation of any of the recommended Feasibility Study Improvements.

Your referenced letter of April 20, 2017 contains additional issues more complicated than flow reduction and will be addressed in a separate response.

Sincerely,

ALLEGHENY COUNTY SANITARY AUTHORITY

**Arletta Scott Williams
Executive Director**



April 4, 2018

Ms. Arletta Williams
Executive Director
ALCOSAN
3300 Preble Avenue
Pittsburgh, PA 15233-1092

RE: Review of Draft ALCOSAN Wet Weather Program,
ALCOSAN Act 537 Plan Special Study Dated December 4, 2017

Dear Ms. Williams:

Pittsburgh Water and Sewer Authority (PWSA) has reviewed ALCOSAN's 537 Plan Update dated December 2017 which has been submitted to PWSA, as well as public stakeholders and Pittsburgh City Council for ratification and approval. Based upon a technical review of the Act 537 Plan Update by PWSA's consultant, we do not have any significant concerns at this time.

PWSA has reviewed the Act 537 Plan Update with respect to its consistency with: (1) overall environmental regulations, (2) the PWSA-City of Pittsburgh-ALCOSAN wet weather program-related agreements and Green First Plan (GSI), (3) the short and long-term impacts to the City and Region, and (4) the February 2018 version of the draft ALCOSAN/USEPA Consent Decree (CD). ALCOSAN's future conformance with their 537 Plan as written appears to address the primary goals of the City and PWSA for wet weather program Compliance as well as PWSA's City Wide "Green First" Program.

PWSA, the City, and ALCOSAN have previously agreed to common language/approaches to be added to the ALCOSAN CD to facilitate and maximize GSI and Infiltration/Inflow reduction into the Interim Wet Weather Plan (IWWP). PWSA looks forward to working closely with ALCOSAN as these evaluation and studies for both gray and green infrastructure are being performed to satisfy everyone's goals and expectations. PWSA also looks forward to our continued cooperation during regulatory negotiations that either ALCOSAN or PWSA has with the Regulators that would seek to modify or change any of these agreed to CD requirements.

We envision that our established Collaboration Agreement, the pending Final Amended USEPA/DOJ Consent Decree as well as PWSA's ongoing negotiations with ALCOSAN and the Regulators (PADEP and USEPA) will result in affordable,



cost effective, and sustainable water quality and community benefits for the entire region.

PWSA looks forward to a continued close working relationship with ALCOSCAN as we endeavor to mitigate water quality pollution sources and optimize our respective combined stormwater/wastewater collection system and sewerage treatment system. PWSA is committed to achieving a clean, healthy and safe environment for all our respective ratepayers.

Again, thank you for the opportunity to review ALCOSAN's Act 537 Plan Update. If you have any questions, please contact me.

Sincerely,

A handwritten signature in black ink, appearing to read "Robert A. Weimar", with a long, sweeping horizontal line extending to the right.

Robert A. Weimar, PE, BCEE
Interim Executive Director
Pittsburgh Water and Sewer Authority

cc. Mayor Bill Peduto, City of Pittsburgh
Mr. Daniel Gilman, Mayor's Chief of Staff
Pittsburgh City Council
PWSA Board of Directors
Debbie Lestitlan, PWSA Chief Counsel
Mr. David Borneman
Mr. Alex Sciulli
Mr. Chip Babst, Esq
Mr. Paul Calamita, Esq



April 30, 2018

Members of the Board

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Jack Shea
Rep. Harry Readshaw
John Weinstein
Corey O'Connor
Brenda L. Smith

Arletta Scott Williams
Executive Director

David W. Borneman, P.E.
*Director
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Finance & Administration*

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*Director
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Agas A. Jackson, P.E.
*Director
Operations & Maintenance*

Ieanne Clark
*Director
Communications*

Robert A. Weimer, PE, BCEE,
Interim Executive Director
Pittsburgh Water and Sewage Authority
Penn Liberty Plaza
1200 Penn Avenue
Pittsburgh, PA 15232

RE: Response to ALCOSAN's Act 537 Special Study Dated April 4, 2018

Dear Mr. Weimer,

Thank you for your thoughtful response to our Act 537 Special Study, based on a technical review by your consultant.

We very much appreciate your comments on and support for the Study and your willingness to work together with us as we move forward on our Clean Water Plan (formerly Wet Weather Plan).

As you noted, we have achieved much working together with our regulators to create an affordable, sustainable and robust green-first plan that will benefit the City of Pittsburgh and the entire region. Our work together means that we will reduce excess stormwater and groundwater into our system, and maximize the efficiency of the system, using both green and gray infrastructure. Your support for expanding our treatment plant will mean we can significantly reduce overflows by treating more flow, while also working to expand GSI and I & I source reduction projects.

We look forward to continuing to work with you in a cooperative and collegial manner as we protect the rivers that define us. Together our work will make the region an even better place to live, work and play, protect our environment and expand our economy.

Again, thank you for your thorough review and response to the Act 537 Special Study.

Sincerely,
ALLEGHENY COUNTY SANITARY AUTHORITY

Arletta Scott Williams
Executive Director

cc: Mayor William Peduto, City of Pittsburgh
Daniel Gilman, Chief of Staff, City of Pittsburgh
Pittsburgh City Council
Board of Directors, Pittsburgh Water and Sewer Authority
Board of Directors, ALCOSAN
Debbie Lestitian, PWSA Chief Corporate Counsel/Chief of Administration
David Borneman, ALCOSAN Director of Engineering and Construction
Alex Sciulli, ALEM Consulting, LLC
Chester R. Babst, III, Esq.
Paul Calamita, Esq.

Public notice advertisements were placed in the Pittsburgh Post-Gazette and in the New Pittsburgh Courier newspapers describing the purpose and scope of the Act 537 Special Study, its availability at public libraries, describing how comments could be submitted to ALCOSAN and the deadline for doing so. The list of libraries receiving copies of the study is provided herein on item 1, the Post-Gazette copy of the classified advertisement.

	<i>Page</i>
1 On-Line Registration Copy of Public Notice in the Pittsburgh Post-Gazette	G-41
2 Pittsburgh Post-Gazette Proof of Publication	G-43
3 Copy of Classified Ad in the New Pittsburgh Courier	G-45
4 Letter to Public Libraries.	G-47
5 Public Comment Letters - None Received	

G-3: Public Notification

Pittsburgh Post Gazette Classifieds

Other Legal Notices

Posted February 05, 2018

ALLEGHENY COUNTY SANITARTY AUT...

ALLEGHENY COUNTY SANITARTY AUTHORITY LEGAL NOTICE

In accordance with Title 25, Chapter 71 of the Pennsylvania Code, Allegheny County Sanitary Authority (ALCOSAN) is accepting written comments on the ALCOSAN Act 537 Special Study. This Special Study provides an update to the 1996 Act 537 Plan that was adopted by the City of Pittsburgh and approved by the Pennsylvania Department of Environmental Protection.

The purpose of the Special Study is to amend the 1996 Act 537 Plan to reflect ALCOSAN's current strategy for the expansion of wet weather treatment capacity at the Woods Run Wastewater Treatment Plant.

The entire Act 537 Special Study can be reviewed at the following locations: Andrew Bayne Memorial Public Library, Allegheny County Law Library, Avalon Public Library, Baldwin Borough Public Library, Bethel Park Public Library, Braddock Carnegie Library, Brentwood Library, Bridgeville Public Library, C. C. Mellor Memorial Library, Carnegie Free Library of Swissvale, Carnegie Library- Beechview, Carnegie Library- Brookline, Carnegie Library- Carrick, Carnegie Library- East Liberty, Carnegie Library- Hill District, Carnegie Library- Homewood, Carnegie Library- Knoxville, Carnegie Library- Lawrenceville, Carnegie Library- Main/Oakland, Carnegie Library- Mt. Washington, Carnegie Library- Pittsburgh/Allegheny, Carnegie Library- Sheraden, Carnegie Library- South Side, Carnegie Library- Squirrel Hill, Carnegie Library- West End, Carnegie Library- Woods Run, Carnegie Library of Homestead, Castle Shannon Library, Cooper-Siegel Community Library, Crafton Public Library, Dormont Public Library, F.O.R. Sto-Rax Library, Forest Hills Library, Green Tree Public Library, Lincoln Park Branch Library, Monroeville Public Library, Mt. Lebanon Public Library, North Versailles Library, Penn Hills Library, Pleasant Hills Public Library, Plum Borough Community Library, Robinson Township Library, Scott Township Public Library, Shaler North Hills Library, Sharpsburg Library, South Fayette Township Library, Turtle Creek Public Library, Upper St. Clair Township Library, Western Allegheny Community Library, Whitehall Public Library or on the ALCOSAN website at <http://www.alcosan.org>.

All comments must be in writing and submitted within 30 days of the date of publication of this notice to: Jeanne K. Clark, Director of Communications, ALCOSAN, 3300 Preble Avenue, Pittsburgh, Pennsylvania 15233 Jeanne.clark@alcosan.org. Written comments received during the review process will be included in the final submission to the Pennsylvania Department of Environmental Protection.

Commonwealth of Pennsylvania, County of Allegheny, ss E. Chmura, being duly sworn, deposes and says that the Pittsburgh Post-Gazette, a newspaper of general circulation published in the City of Pittsburgh, County and Commonwealth aforesaid, was established in 1993 by the merging of the Pittsburgh Post-Gazette and Sun-Telegraph and The Pittsburgh Press and the Pittsburgh Post-Gazette and Sun-Telegraph was established in 1960 and the Pittsburgh Post-Gazette was established in 1927 by the merging of the Pittsburgh Gazette established in 1786 and the Pittsburgh Post, established in 1842, since which date the said Pittsburgh Post-Gazette has been regularly issued in said County and that a copy of said printed notice or publication is attached hereto exactly as the same was printed and published in the regular editions and issues of the said Pittsburgh Post-Gazette a newspaper of general circulation on the following dates, viz:

05 of February, 2018

Affiant further deposes that he/she is an agent for the PG Publishing Company, a corporation and publisher of the Pittsburgh Post-Gazette, that, as such agent, affiant is duly authorized to verify the foregoing statement under oath, that affiant is not interested in the subject matter of the afore said notice or publication, and that all allegations in the foregoing statement as to time, place and character of publication are true.

COPY OF NOTICE OR PUBLICATION

ALLEGHENY COUNTY
SANITARY AUTHORITY
LEGAL NOTICE
In accordance with Title
25, Chapter 71 of the Penn-
sylvania Code, Allegheny
County Sanitary Authority
(ALCOSAN) is accepting
written comments on the
ALCOSAN Act 537 Special
Study. This Special Study
provides an update to the
1996 Act 537 Plan that was
adopted by the City of
Pittsburgh and approved
by the Pennsylvania De-
partment of Environmental
Protection.
The purpose of the Special
Study is to amend the
1996 Act 537 Plan to re-
flect ALCOSAN's current
strategy for the expansion
of wet weather treatment
capacity at the Woods Run
Wastewater Treatment
Plant.
The entire Act 537 Special
Study can be reviewed
at the following locations:
Andrew Bayne Memorial
Public Library, Allegheny
County Law Library, Aval-
on Public Library, Baldwin
Borough Public Library, Bo-
thel Park Public Library,
Braddock Carnegie Library,
Brentwood Library, Bridg-
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Kellor Memorial Library,
Carnegie Free Library of
Swissvale, Carnegie Li-
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Library- Lawrenceville,
Carnegie Library- Liberty
Main/Oakland, Carnegie
Library- Mt. Washington,
Carnegie Library- Pitts-
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Carnegie Library- Squirrel
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Lincoln Park Branch Li-
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Scott Township Public Li-
brary, Shaler North Hills Li-
brary, Sharpsburg Library,
South Fayette Township
Library, Turtle Creek Pub-
lic Library, Upper St. Clair
Township Library, Western
Allegheny Community Li-
brary, Whitehall Public Li-
brary or on the ALCOSAN
website at <http://www.alcosan.org>.
All comments must be
in writing and submitted
within 30 days of the date
of publication of this no-
tice to: Jeanne K. Clark, Di-
rector of Communications,
ALCOSAN, 3300 Preble Ave-
nue, Pittsburgh, Pennsyl-
vania 15203.
Written comments re-
ceived during the review
process will be included in
the final submission to the
Pennsylvania Department
of Environmental Protec-
tion.

PG PUBLI
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2201 S
CLINTON
Phone 4

I hereby cert
said notice.

Publisher's Receipt for Advertising Costs

NY, publisher of the Pittsburgh Post-Gazette, a newspaper of general circulation,
of the aforesaid advertising and publication costs and certifies that the same have

PG Publishing Company, a Corporation, Publisher of
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By

the original Proof of Publication and receipt for the Advertising costs in the subject matter of

Attorney For

CLASSIFIED

FEBRUARY 7-13, 2018

JOB OPPORTUNITIES

Help Wanted

PITTSBURGH VALLEY THEATRE TEACHING ARTIST

Create/facilitate dance and movement instruction. Document rest-dance work. Participate/facilitate professional development. Full description and to apply: goo.gvMxHq7

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Help Wanted

TEAM LEAD IT

Bayar U.S. LLC's Pittsburgh, PA, office seeks Team Lead IT to lead desktop & device mgmt processes following company governance & policies. Will also oversee partners to properly handle the life cycle & support processes of devices meeting agreed SLAs. Apply at <https://career.bayar.us/#15350>.

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In the Court of Common Pleas of Allegheny County, Pennsylvania, at the City of Pittsburgh, in and for the District of Allegheny, the undersigned, the Honorable Judge, do hereby certify that the following is a true and correct copy of the original as filed with the Court: **IN RE: ESTATE OF JAMES H. HARRIS, JR., DECEASED**. Cause No. 12-00000000-00000. Dated: February 7, 2018. By: **JOHN J. HARRIS, JR.**, Attorney at Law, 1000 Liberty Avenue, Pittsburgh, PA 15222.

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Legal Notices

COMBINED NOTICE OF FINDING OF NO SIGNIFICANT IMPACT AND NOTICE OF INTENT TO REQUEST RELEASE OF FUNDS

February 7, 2018
City of Pittsburgh-Dept. of City Planning
600 Ross Street
Pittsburgh, PA 15219
412-255-2211
These notices shall satisfy two separate but related procedural requirements for activities to be undertaken by the City of Pittsburgh.

REQUEST FOR RELEASE OF FUNDS
On or about February 23, 2018 the City of Pittsburgh ("City") will submit a request to the United States Department of Housing and Urban Development ("HUD") for the release of Community Development Block Grant funds under Title 1 of the Housing and Community Development Act of 1974, to undertake a project known as Townsend Park Renovation Project. The Townsend Park renovation project will include a renovation of the park with addition of new playground, half-court basketball, walking paths, and handicap accessibility, walk and landscape improvements. The location of the projects is Crivello St in the City of Pittsburgh's Elderly neighborhood. The total projected cost is estimated to be \$500,000.

FINDING OF NO SIGNIFICANT IMPACT
The City of Pittsburgh has determined that the project will have no significant impact on the human environment. Therefore, an Environmental Impact Statement under the National Environmental Policy Act of 1969 (NEPA) is not required. Additional project information is contained in the Final Record of Decision (FROD) on file at City of Pittsburgh 600 Ross Street, 2nd Floor, Pittsburgh, PA 15219 and may be examined or copied weekdays from 9:00 A.M. to 5:00 P.M.

PUBLIC COMMENTS
Any individual, group, or agency may submit written comments on the EIR for:

Michael Pennucci
City of Pittsburgh
600 Ross Street, 2nd Floor
Pittsburgh, PA 15219
412-255-2211

All comments received by February 22, 2018 will be considered by the City of Pittsburgh prior to submitting a request for release of funds. Comments should specify which notice they are addressing.

ENVIRONMENTAL CERTIFICATION
The City of Pittsburgh certifies to HUD that William Peduto in his capacity as Mayor, City of Pittsburgh, consents to accept the jurisdiction of the Federal Courts in an action brought to enforce responsibilities in relation to the environmental review process and that these responsibilities have been satisfied. HUD's approval of the certification satisfies its responsibilities under NEPA and related laws and authorities and allows the City of Pittsburgh to use program funds.

OBJECTIONS TO RELEASE OF FUNDS
HUD will accept objections to its release of funds and the City of Pittsburgh's certification for a period of fifteen days following the anticipated submission date or the actual receipt of the request (whichever is later) only if they are on one of the following bases: (a) the certification was not executed by the Certifying Officer of the City of Pittsburgh; (b) the City of Pittsburgh has not made a decision or failed to make a decision of finding required by HUD regulations at 24 CFR Part 58; (c) the grant recipient or other participants in the development process have committed fraud, incurred costs or undertaken activities not authorized by 24 CFR Part 58 before approval of a release of funds by HUD; or (d) another Federal agency acting pursuant to 40 CFR Part 1504 has submitted a written finding that the project is unsatisfactory from the standpoint of environmental quality. Objections must be prepared and submitted in accordance with the required procedures (24 CFR Part 58, Sec. 58.70) and shall be addressed to:

U.S. Department of Housing and Urban Development
Community Planning and Development Division
The Moorhead Federal Building
1000 Liberty Ave., 10th floor
Pittsburgh, PA 15222

Potential objections should contact HUD to verify the actual last day of the objection period.

WILLIAM PEDUTO
Mayor
City of Pittsburgh

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REQUEST FOR QUALIFICATIONS - ON-CALL CONSULTANCY SERVICES

The Southwestern Pennsylvania Corporation, a 501(c)(3) corporation, on behalf of the Southwestern Pennsylvania Commission, is soliciting Statements of Qualifications for "On-Call Consultancy Services." The selected Consultant will provide "on-call" delivery of a wide range of specialized support services as needed related to transportation planning and analysis; transit planning and analysis; data collection, database management and data analysis; travel demand analysis; public participation; meeting facilitation, marketing, and process development; economic development planning and analysis; Geographic Information Systems (GIS); and water resource planning. Contractors or terms of contractors will specify the areas of specialization for which they are being considered. A copy of the "On-Call Consultancy Services" RFP is available at www.spcpa.org. Copies are also available by sending a written request to:

On-Call Consultancy Services RFP
Southwestern Pennsylvania Corporation
Two Chatham Center, Suite 600
112 Washington Place
Pittsburgh, PA 15219-3451

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THE BOARD OF PUBLIC EDUCATION OF THE SCHOOL DISTRICT OF PITTSBURGH

Sealed bids will be received in the Office of the Chief Operations Officer, Room 25, Administration Building, 341 South Bellefield Avenue until 11:00 A.M., prevailing time February 13, 2018 and will be opened at the same hour for the purchase of the following equipment and supplies:

Custodial Small Equipment
Custodial Paper Products
Custodial Chemicals/Soaps
Packaging Materials
Printed Forms

General information regarding bids may be obtained at the Office of the Purchasing Agent, Service Center, 1305 Main Street, Pittsburgh, PA 15203. The bid documents are available on the School District's Purchasing web site at: <http://www.pghschools.org/pur> or by email at: info@pghschools.org. Check on bid opportunities under Quick Links. The Board of Public Education reserves the right to reject any and all bids, or select a single item from any bid.

M. Jordan
Purchasing Agent
We are an equal opportunity school district.

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ALLEGHENY COUNTY SANITARY AUTHORITY LEGAL NOTICE

In accordance with Title 26, Chapter 71 of the Pennsylvania Code, Allegheny County Sanitary Authority (ALCOSAN) is accepting written comments on the ALCOSAN Act 637 Special Study. This Special Study provides an update to the 1986 Act 637 Plan that was adopted by the City of Pittsburgh and approved by the Pennsylvania Department of Environmental Protection.

The purpose of the Special Study is to amend the 1986 Act 637 Plan to reflect ALCOSAN's current strategy for the expansion of wet weather treatment capacity at the Woods Run Wastewater Treatment Plant. The entire Act 637 Special Study can be reviewed at the following locations: Andrew Bayne Memorial Public Library, Allegheny County Law Library, Avon Public Library, Baldwin Borough Public Library, Bethel Park Public Library, Bradwood Carnegie Library, Brantwood Library, Bridgeville Public Library, C. O. Mohr Memorial Library, Carnegie Free Library of Swissvale, Carnegie Library-Beechview, Carnegie Library-Brookline, Carnegie Library-Carmichael, Carnegie Library-East Liberty, Carnegie Library-16th District, Carnegie Library-Homewood, Carnegie Library-Knoxville, Carnegie Library-Leaencroft, Carnegie Library-Malek, Carnegie Library-Mt. Washington, Carnegie Library-Pittsburgh/Allegheny, Carnegie Library-Sheridan, Carnegie Library-South Side, Carnegie Library-Squirrel Hill, Carnegie Library-West End, Carnegie Library-Woodbury, Carnegie Library of Homestead, Castle Shannon Library, Cooper-Gleason Community Library, Crafter Public Library, Doran Public Library, E.C. Roe Public Library, Forest Hills Library, Green Tree Public Library, Lincoln Park Branch Library, Monroeville Public Library, Mt. Lebanon Public Library, North Versailles Library, Penn Hills Library, Pleasant Hills Public Library, Plum Borough Community Library, Robinson Township Library, Ross Township Public Library, Shaler North Hills Library, Sharpshooter Library, South Fayette Township Library, Turtle Creek Public Library, Upper St. Clair Township Library, West Allegheny Community Library, Whitehall Public Library or on the ALCOSAN website at <http://www.alcosan.org>.

All comments must be in writing and submitted within 30 days of the date of publication of this notice to:

Director of Communications
3300 Public Avenue
Pittsburgh, Pennsylvania 15223
jeanne.clark@alcosan.org

Written comments received during the review process will be included in the final submission to the Pennsylvania Department of Environmental Protection.

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NOTICE OF FIDUCIARY ACCOUNTING

In the Court of Common Pleas of Allegheny County, Pennsylvania, at the City of Pittsburgh, in and for the District of Allegheny, the undersigned, the Honorable Judge, do hereby certify that the following is a true and correct copy of the original as filed with the Court: **IN RE: ESTATE OF JAMES H. HARRIS, JR., DECEASED**. Cause No. 12-00000000-00000. Dated: February 7, 2018. By: **JOHN J. HARRIS, JR.**, Attorney at Law, 1000 Liberty Avenue, Pittsburgh, PA 15222.

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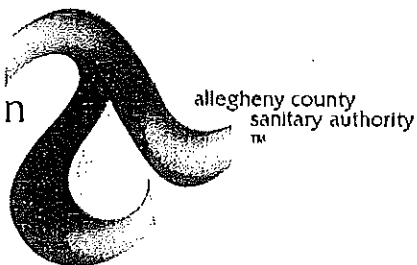
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THE ONLY G-45

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Jeanne Clark
*Director
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To: Allegheny County Public Libraries
From: Arletta Scott Williams, Executive Director
Re: Opportunity for Public Comment on ALCOSAN Act 537 Special Study
Date: February 1, 2018

Enclosed please find a copy of an Act 537 Special Study recently completed by ALCOSAN. Please display this study for use by the public.

The purpose of the study is to amend ALCOSAN's Act 537 Sewage Facilities Plan for upgrades to its Woods Run Wastewater Treatment Plant (WWTP) located at 3300 Preble Avenue in the City of Pittsburgh. The plan was adopted in 1996 by the City of Pittsburgh as the host community for the WWTP, and approved by the Pennsylvania Department of Environmental Protection (PaDEP).

The 537 Plan outlined the expansion of treatment capacity for anticipated growth and redevelopment and to maximize flows to the plant during wet weather. The purpose was to reduce combined and sanitary sewer overflows within Pittsburgh and ALCOSAN's other 82 customer municipalities. The 537 Plan called for the expansion of the secondary (biological) and wet weather treatment capacity.

The Special Study reflects ALCOSAN's current strategy for the expansion of wet weather treatment capacity at the Woods Run WWTP. This expansion will be a key element of ALCOSAN's Clean Water Plan; secondary treatment capacity will be expanded to 295 mgd and primary treatment will be expanded to 480 mgd initially and to 600 mgd ultimately to provide wet weather capacity. The Act 537 Plan will remain in effect as amended upon PaDEP approval.

ALCOSAN is requesting review and comment from the general public over the next 30 days starting February 5, 2018 and ending March 7, 2018.

Comments may be submitted to ALCOSAN's Director of Communications Jeanne K. Clark (jeanne.clark@alcosan.org). Please feel free to contact ALCOSAN's Director of Engineering & Construction David Borneman, P.E. (412-734-8369) with any questions you may have regarding the Special Study.

Thank you.

G-4: Summary Document

A quick guide to ALCOSAN's Act 537 Special Study

ALCOSAN is the Clean Water Agency for most of Allegheny County, serving 823,600 people in 83 municipalities

In 1996, ALCOSAN developed its Act 537 Plan – as required by the Pennsylvania Department of Environmental Protection (PaDEP) – to expand and update its Wood Run Wastewater Treatment Plant on Pittsburgh's North Side. That plan was approved by the City of Pittsburgh (as the host community) and by PaDEP.

That original plan protected our neighbors and wildlife and made ALCOSAN a healthier and more pleasant member of the community. It expanded the capacity of the plant, put millions of dollars of odor control in place and upgraded the technology used to clean the wastewater. As a result, ALCOSAN is able to recycle up to 250 million gallons of clean water daily, returning it to the Ohio River, cleaner than the Ohio itself is.

Upgrading the Upgrade

Several subsequent upgrades have made the plant more efficient, including the installation of more efficient pumps in the main pump station and adding capacity for flows during rainstorms and heavy snowmelt. But it was clear – as ALCOSAN was negotiating a comprehensive Clean Water Plan with the federal, state and county governments – that more needed to be done.

- During heavy rain and snowmelt, the system is overwhelmed.
- Stormwater and groundwater mixes with sewage and goes into our rivers and streams.
- These discharges, which total about 9 billion gallons annually, create health risks.
- Federal, state and county laws and regulations require action to fix this problem.

ALCOSAN's Act 537 Special Study shows the path forward to help reduce overflows through expanding the treatment plant.

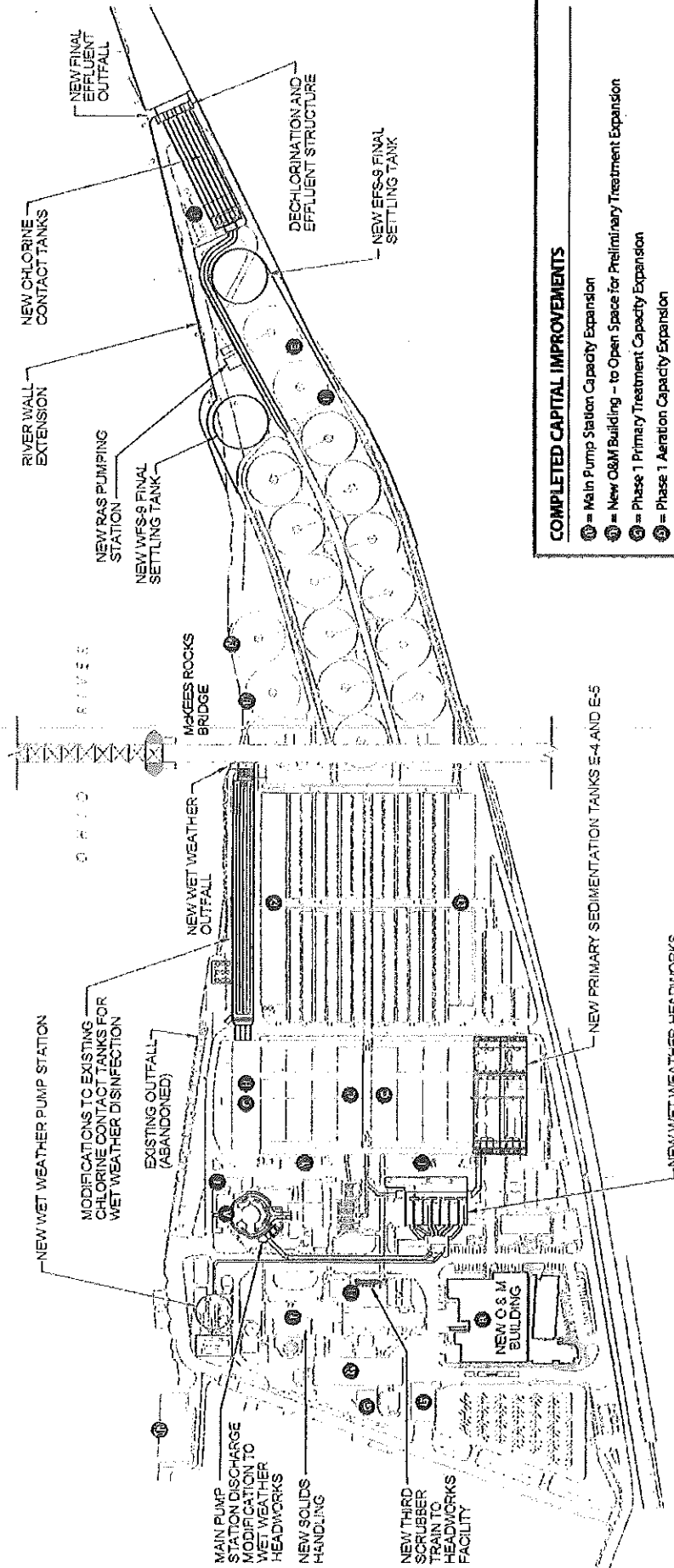
This Special Study amends the 537 Plan to reflect ALCOSAN's current strategy for the expansion of wet weather treatment capacity at the Woods Run WWTP. This expansion is a key element of ALCOSAN's Clean Water Plan; secondary treatment capacity will be expanded to 295 mgd and primary treatment will be expanded to 480 mgd initially and to 600 mgd ultimately to provide wet weather capacity.



Clean Water Program

January 2018

ALCOSAN Woods Run Wastewater Treatment Plant Act 537 Capital Improvements



Remaining Capital Improvements (Act 537 Special Study)
are shown in blue.



Additional upgrades are being studied and sustainable practices will be incorporated in the plant expansion, including:

- Incorporating lowest energy and operating costs
- Integrating renewal or replacement of current equipment as part of the design
- Examination of disinfection technologies to reduce cost and use of chemicals
- Protection of wildlife in and near the plant
- Turbines at outfall may be used to generate electricity and
- Green stormwater technology will be incorporated on new buildings and facilities.

ALCOSAN will work with its neighbors to reduce the impact on local residents

- Increased local traffic is likely to be biggest impact
- Design begins 2018
- Construction begins 2019
- Estimated capital cost is \$335 Million

It's your turn to weigh in!



ALCOSAN is asking the public to comment on the special study. You can read the entire study at local news and online at www.alcosan.org. Comments will be accepted from February 5, 2018, to March 7, 2018. Written comments received during the review process will be included in the final submission to the Pennsylvania Department of Environmental Protection.

All comments must be submitted in writing to:
 Jeanne R. Clark
 Director of Communications
 ALCOSAN
 3100 Fiddle Avenue
 Philadelphia, Pennsylvania 19133
 Jeanne.Clark@alcosan.org



City of Pittsburgh

510 City-County Building
414 Grant Street
Pittsburgh, PA 15219

Certified Copy

Resolution: 381

File Number: 2018-0490

Enactment Number: 381

SPONSOR /S: Mr. O'Connor

Resolution adopting and submitting a revision of the Official Sewage Facilities Plan of the City of Pittsburgh, Allegheny County, Pennsylvania.

WHEREAS, Section 5 of the Act of January 24, 1966, P.L. 1535, No. 537, known as the "Pennsylvania Sewage Facilities Act" or "Act 537," as amended, and the Rules and Regulations of the Department of Environmental Protection ("Department") adopted thereunder, Chapter 71 of Title 25 of the Pennsylvania Code, requires the City of Pittsburgh to adopt an Official Sewage Facilities Plan providing for sewage services adequate to prevent contamination of waters and/or environmental health hazards with sewage wastes, and to revise said plan whenever it is necessary to meet the sewage disposal needs of the City of Pittsburgh, and

WHEREAS, the Allegheny County Sanitary Authority has prepared an Act 537 Special Study as an update to its existing Act 537 Plan, which provides for sewage facilities in a portion of the City of Pittsburgh, and

The alternative of choice to be implemented is the expansion of the Wood Run Wastewater Treatment Plant. The key implementation activities/dates include increasing the plant wet weather treatment capacity to 600 million gallons per day on or before December 31, 2027.

WHEREAS, the City of Pittsburgh finds that the Facility Plan described above conforms to applicable zoning, subdivision, other municipal ordinances and plans and to a comprehensive program of pollution control and water quality management.

NOW, THEREFORE, BE IT RESOLVED that the Council of the City of Pittsburgh hereby adopt and submit to the Department of Environmental Protection for its approval as a revision to the "Official Plan" of the City of Pittsburgh, the above referenced Facility Plan. The City of Pittsburgh assures the Department of the complete and timely implementation of the said plan as required by law. (Section 5, Pennsylvania Sewage Facility Act, as amended).

I, _____, Chief Clerk, City of Pittsburgh Council, hereby certify that the foregoing is a true copy of the Pittsburgh City Council Resolution No. _____, adopted _____, 20____.

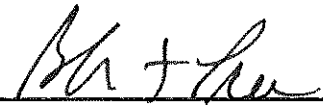
File Number: 2018-0490

Enactment Number: 381

Any Resolution or Ordinance or part thereof conflicting with the provisions of this Resolution is hereby repealed so far as the same affects this Resolution.

I certify that this is a true copy of Resolution No. 381, passed by Council on 6/19/2018, approved by the Mayor on 6/28/2018. Effective Date 6/28/2018.

Attest:



Brenda F. Pree, City Clerk

July 11, 2018

Date Certified