1.0 INTRODUCTION

1.1 Wet Weather Plan Objectives

The ALCOSAN Consent Decree (CD)[1-1] entered on January 23, 2008 called for the submittal of ALCOSAN's Wet Weather Plan (WWP or Plan) to the regulatory agencies; the United States Environmental Protection Agency (USEPA), the Pennsylvania Department of Environmental Protection (PaDEP), and the Allegheny County Health Department (ACHD) by January 30, 2013. The purpose of the WWP is to identify wastewater infrastructure improvements needed to meet CD requirements and to recommend an implementation plan. The CD requirements are predicated by the objectives of the Clean Water Act (CWA) and associated Combined Sewer Overflow Control Policy (CSO Policy).[1-2] These collective regulations describe water quality improvement goals and requirements for developing a WWP. Two primary objectives include:

- Elimination of Sanitary Sewer Overflows (SSOs)
- Control of Combined Sewer Overflows (CSOs)

In accomplishing these key objectives, the WWP should:

- Identify wastewater infrastructure needs through 2046
- As required by the 2008 CD, complete construction and begin operating all necessary improvements by September 30, 2026
- Improve water quality in the rivers and streams
- Help protect designated waterway uses such as recreation, aquatic life, and drinking water supplies

The program also aims to:

- Employ an inclusive and collaborative stakeholder involvement process
- Recommend cost effective, affordable, and equitable solutions
- Achieve broad-based public and municipal support
- Achieve regulatory compliance and support for the compliance strategy
- Support the subsequent development of a regional Pennsylvania Sewage Facilities Act (Act 537) Plan
- Encourage sustainable wet weather management through green stormwater infrastructure (GSI) and other source control measures.

[1-1] Civil Action 7-0737.

[1-2] EPA (U.S. Environmental Protection Agency). 1994 Combined Sewer Overflow (CSO) Control Policy. FRL-4732-7. Federal Register 59(75).

1.2 Plan Context

Figure 1-1: Raw sewage discharging into Saw Mill Run, circa 1950

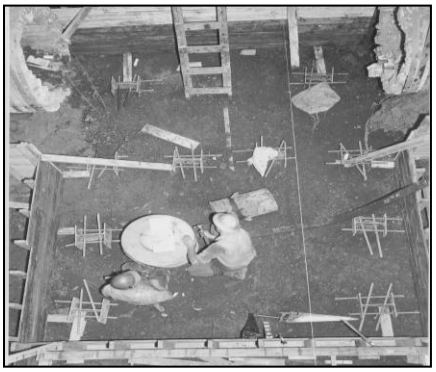


Figure 1-2: ALCOSAN's regional conveyance system intercepted existing municipal sewers

Figure 1-3: Construction of the shallow cut portions of the ALCOSAN interceptor system

Historical Context: In 1937, in response to the demands of various stakeholders including conservation groups and public health groups, the Pennsylvania General Assembly passed the Clean Streams Act. This act gave the Sanitary Water Board the power to issue and enforce waste treatment orders to all municipalities and most industries, notably excluding acid drainage from coal mines. Faced by a state law that provided the state authority with enforcement powers, the city and other western Pennsylvania towns were forced to seriously consider means to reduce their river pollution. In June 1945, orders were issued to the City of Pittsburgh and 101 other Pennsylvania municipalities, including more than 90 Allegheny County industries, to cease the discharge of untreated wastes into state waterways. State officials decreed that these communities comply with the treatment orders by May of 1947.

The county commissioners proceeded to survey affected Allegheny County municipalities to determine if they would support the incorporation of a special district government authority to plan and implement a waste disposal program. As a result of a set of meetings sponsored by the county commissioners with Allegheny County municipalities, a pro-authority consensus developed. This provided the support that the county commissioners needed and in March 1946, the Secretary of the Commonwealth of Pennsylvania officially approved the formation of the Allegheny County Sanitary Authority (ALCOSAN).

The ALCOSAN research staff conducted a number of studies and made several recommendations during 1945 and 1946 regarding the creation of an integrated sewage treatment system using activated sludge technology. An investigation by ALCOSAN showed that county municipalities with a population of 678,000 and industries collectively discharged 65 million gallons of wastewater per day. The research staff recommended that a single plant (located on a site situated on the north bank of the Ohio River north of Pittsburgh) would be more cost effective than multiple plants and lead to fewer siting and odor objections from local populations.

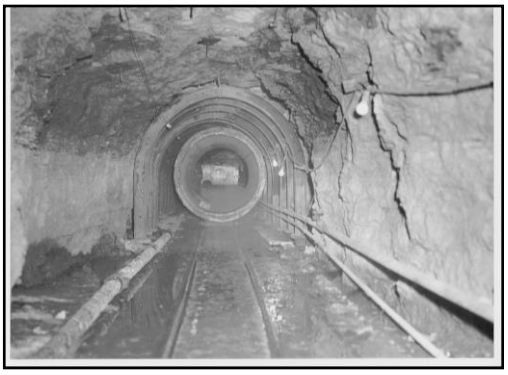


Figure 1-4: Construction of the deep tunnel portions of the ALCOSAN interceptor system

ALCOSAN contracted the construction of an extensive intercepting sewer system (consisting of deep tunnel and shallow-cut interceptors), connecting various outfalls throughout the service district and transporting waste to the treatment works. Because the building of interceptors promised extensive disruptions to transportation and industrial activity and because of US Army Corps of Engineers permitting issues along the main rivers, ALCOSAN officials recommended rock-bore, deep tunnel sewer construction. Individual municipalities would be responsible for owning and maintaining their own collection systems that would now convey flow to the ALCOSAN interceptor system. Under the system planned by the authority, flows to the ALCOSAN system would be regulated by diversion structures.

The original ALCOSAN primary treatment plant and interceptor system was designed and constructed in the 1950s. It was placed into operation in 1959. Wastewater treatment significantly improved water quality across the region. However, it did not completely remedy all pollution discharges from the wastewater collection and conveyance system, particularly those occurring during wet weather. The combined sewer systems (CSS) for the City of Pittsburgh and other municipalities remained, and continued discharging untreated sewage mixed with stormwater during wet weather. Sanitary sewer systems (SSS) received significant quantities of groundwater infiltration and stormwater inflow from leaking pipe joints. Common construction practices at the time also directed stormwater from connected roof drains, foundation drains, and downspouts to SSS and contributed to SSOs. Although the construction of the wastewater conveyance and treatment system made great progress towards reducing water pollution, large volumes of dilute wastewater continued discharging during wet weather and still do today.

Standard Municipal Agreements were developed in the late 1940s requiring the municipalities to convey their sewage to specified points of connection to ALCOSAN's interceptor sewers. The municipalities could bill retail users directly or utilize ALCOSAN as the billing agent, but were responsible for any delinquent balances. The service agreements cannot be terminated before the payment of all outstanding ALCOSAN debt. Service Agreements entered into since 1993 impose limitations on the type and volume of flows from municipalities, including extraneous flows such as inflow and infiltration (I/I).

In the years following its founding, ALCOSAN built additional facilities and improved its treatment processes. The service area expanded as several new municipalities signed agreements to receive wastewater treatment from the ALCOSAN system, including portions of the Municipality of Penn Hills and Robinson Township. In anticipation of the more stringent discharge limitations that were ultimately imposed under the CWA amendments of 1972, the design of secondary treatment began in the late 1960s and the secondary treatment facilities were put into operation in 1973. Upgrading bio-solids handling and disposal methods and industrial pretreatment programs were the focus of the 1980s. Odor control was initiated in the 1990s

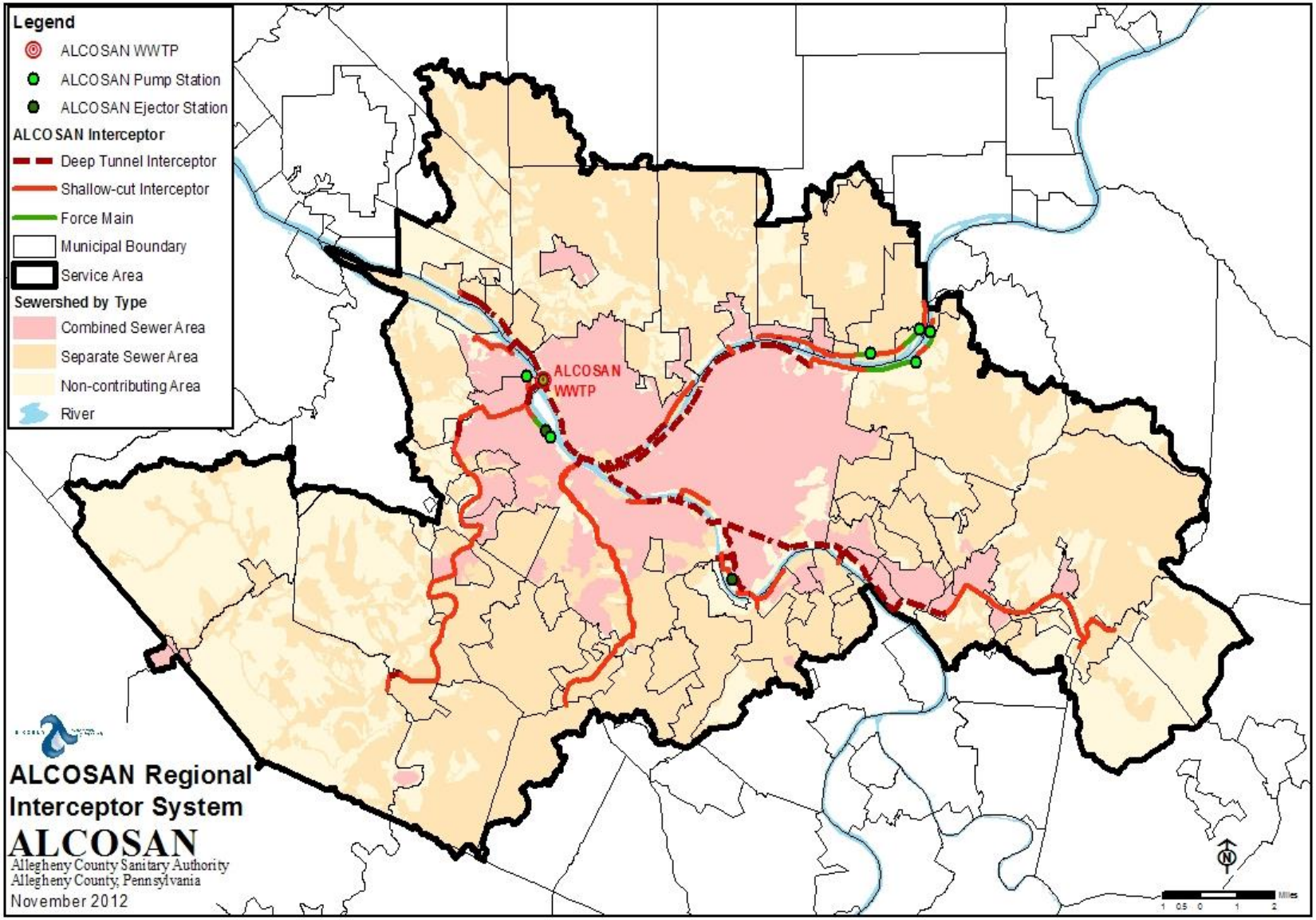
Figure 1-5: ALCOSAN's wastewater treatment plant

As ALCOSAN approached the end of the 20th Century, the plant was approaching its hydraulic capacity of 200 million gallons per day (mgd) and was in need of further odor control improvements. It also faced the emerging wet weather capacity regulations being proposed by the CSO Policy. Beginning in 1994, plans were developed to control odors emanating from the plant and to expand the plant hydraulic capacity in phases. Construction of the Phase I plant expansion and odor control improvements was completed in 2003. The expanded plant capacity has enabled ALCOSAN to maximize the use of the existing deep tunnel interceptor sewers, thereby helping to reduce overflows.

ALCOSAN has also maintained an active capital improvement program for its regional conveyance interceptor system. Example projects include the expansion of the Allegheny River interceptor system and construction of the Sandy Creek pump station to serve Penn Hills, the installation of a parallel interceptor to reduce overflows from the Saw Mill Run interceptor, the upgrading and rehabilitation of the pump stations within the ALCOSAN system, and the construction of new access shafts along its deep tunnel interceptor system to facilitate preventative maintenance.

Current ALCOSAN Context: ALCOSAN currently serves an area of approximately 300 square miles which includes all or portions of the combined and separate sewered collection systems that are owned and operated by 83 customer municipalities. ALCOSAN owns and operates approximately 88.5 miles of interceptor. There are over 300 regulator structures along the ALCOSAN interceptor system, as well as six pumping stations and two ejector stations that are owned and operated by ALCOSAN. All treatment is provided at the 250 mgd plant located on the North Side of the City of Pittsburgh near Woods Run. A map of the ALCOSAN service area, interceptor system and the location of the treatment plant and pumping facilities are shown on Figure 1-6.

Figure 1-6: ALCOSAN Regional Interceptor System



1.3 Regulatory Framework

General Regulatory Context: ALCOSAN has been consistently in compliance with its National Pollutant Discharge Elimination System (NPDES) permit for the ALCOSAN treatment plant and permitted combined sewer outfalls. The permit requires secondary treatment and imposes limits on organic waste (carbonaceous biochemical oxygen demand), total suspended solids, ammonia nitrogen, fecal coliform and residual chlorine. Treatment plant effluent limits are consistently met at current plant flows. The annual average daily flow at the treatment plant for 2010 was 185 million gallons per day (mgd). To show the variance of average flow from year to year, average annual flows over the past decade are provided in Table 1-1. Monthly average flows typically range from a low of 160 mgd during dryer months to a high of 220 mgd during wetter months.

Table 1-1: Average Daily Flow at the ALCOSAN Treatment Plant

Year	Average Daily Flow (mgd)	Year	Average Daily Flow (mgd)
2001	180	2006	182
2002	190	2007	192
2003	202	2008	195
2004	211	2009	188
2005	180	2010	185

Due to its regulatory status as a major permittee under the NPDES, ALCOSAN was required to enter into a CD relating to the control of overflows from its regional conveyance interceptor system. The ALCOSAN CD, entered on January 23, 2008, requires the development of a plan for the elimination of SSOs, the control of CSOs pursuant to the CSO Policy and to provide conveyance and treatment capacity for municipal flows generated within the ALCOSAN service area and conveyed to the ALCOSAN interceptor system.

CSO Policy Phase I Activities: The CSO Policy established a two-phased approach to addressing CSO controls through municipal NPDES[1-3] permits. Under Phase 1 of the CSO Policy, the NPDES permits of combined municipal wastewater systems require the permittee to:

> "… have a thorough understanding of its sewer system, the response of the system to various precipitation events, the characteristics of the overflows and the water quality impacts that result from CSOs."

[1-3] National Pollutant Discharge Elimination System pursuant to Section 402 of the Clean Water Act.

This requirement was implemented through ALCOSAN's NPDES permit issued in 1995.[1-4] Under the permit ALCOSAN submitted two documents to the PaDEP:

- *System Inventory and Characterization Report (September 1995)*– documenting the physical nature and configuration of ALCOSAN's regional conveyance interceptor system and wastewater treatment plant; and
- *System Hydraulic and Hydrologic Report (March 1996)* - documenting the hydraulic operation of the regional conveyance interceptor system within the context of the region's hydrologic and meteorological characteristics.

ALCOSAN has continuously refined and updated the data and the analysis that were documented in these reports.

ALCOSAN's NPDES Permit also required ALCOSAN to document implementation of the CSO Policy's *Nine Minimum Controls* (NMCs). The NMCs are identified in the CSO Policy as minimum technology based controls that can be used to address CSO problems without extensive engineering studies or significant construction costs prior to the implementation of long-term control measures.[1-5]

ALCOSAN submitted its documentation of implementation of the NMCs in September of 1996; which was subsequently approved by the PaDEP. Pursuant to paragraph 93 of ALCOSAN's CD, ALCOSAN submitted updated documentation of the implementation of its NMCs in the *Draft Revised Nine Minimum Controls Plan (June 2008)*.

Under the CSO Policy, the final component of a Phase 1 NPDES permit for combined sewered municipalities is the development of a Long-Term Control Plan (LTCP). ALCOSAN completed and submitted to the regulatory agencies a *Regional Long Term Wet Weather Control Concept Plan* in March of 1999. It provided a framework for controlling CSOs and eliminating SSOs along the ALCOSAN regional conveyance system by using expanded conveyance capacities, storage for peak flow shaving and satellite treatment at key locations along the main rivers in conjunction with an increased wet weather treatment plant capacity. The concept plan was ultimately superseded by the January 2008 CD requirement to prepare a more comprehensive WWP that included intensive coordination with customer municipalities.

Paralleling ALCOSAN's requirements, Phase 1 NPDES permits were issued to the municipalities within the ALCOSAN service area with combined sewer systems pursuant to the CSO Policy in the 1990s. The requirement for the development of LTCPs will be met through the development of Municipal Feasibility Studies (MFS) under the Consent Order and Agreements described below.

1-4 PA0025984 Part C paragraph 10 (page 14e of 14)

1-5 This description was included by Michael B Cook, USEPA Director of Wastewater Management in his cover letter accompanying the 1995 Combined Sewer Overflows – Guidance for Nine Minimum Controls [EPA 832-B-95-003]

Municipal Orders: Beginning in 1997, the USEPA began investigating municipalities in the ALCOSAN service area for sewage overflow violations of the CWA which resulted in the negotiation of Orders. The municipalities within the ALCOSAN service area with sanitary sewerage were placed under Administrative Orders (AOs) from the Allegheny County Health Department (ACHD). Those with combined sewerage were issued Consent Order and Agreements (COAs) from the Pennsylvania Department of Environmental Protection (PaDEP). In both cases, the municipalities were required to participate and cooperate with ALCOSAN in the development of the WWP, including:

- Establishing with ALCOSAN the quantity and rate of sewage flow from the Municipality to its point(s) of connection with the ALCOSAN Regional Conveyance System;
- Establish, with ALCOSAN how the municipalities will manage their respective flows; and
- The development of a feasibility study with an alternatives analysis evaluating the Municipality's options to address any overflows within the municipality's collection system. If the municipality's control strategy included the conveyance of its wet weather flows to ALCOSAN's Regional Conveyance System, the feasibility study was to also address the conveyance capacities of the trunk sewers connecting the municipality to the ALCOSAN system.

The municipal orders required ALCOSAN customer municipalities to develop and provide information that would be necessary to develop a regional WWP and MFS, including:

- Completing physical surveys, visual inspections, and closed-circuit television internal inspections of the sewer systems that are tributary to the ALCOSAN sewer system; and
- Preparing and submitting an updated comprehensive sewer map of the sewer systems that are tributary to the ALCOSAN sewer system; and
- Conducting a hydraulic design capacity evaluation of its sewer system; and
- For municipalities with CSS, determining and providing the frequency, volume, and duration of CSOs on an average annual basis.

The municipal orders also required ALCOSAN customer municipalities to complete activities that would impact the quantity and rate of wastewater flow conveyed to the ALCOSAN sewer system, including:

- For municipalities with separate sewer systems, testing all structures to identify any illicit roof leader, yard drain, and driveway drain connections to its sewer system and requiring corrective actions to remove these illegal connections; and
- Removing streams and springs connected to the sewer lines; and
- Repairing all significant structural defects and defects that cause a sewer blockage, basement flooding, or other public health nuisance; and

This WWP addresses the elimination of SSOs and the control of CSOs from ALCOSAN's Conveyance and Treatment System, including overflow structures located at the points of connection with the municipal collection sewer systems. The WWP does not directly address the elimination or control of overflows within the municipal collection systems. However, upon full implementation, it will provide for the hydraulic capacity to accept additional wet weather flows from the municipalities which may be conveyed to the ALCOSAN Conveyance and Treatment System pursuant to MFS to be completed under the separate compliance orders described above.

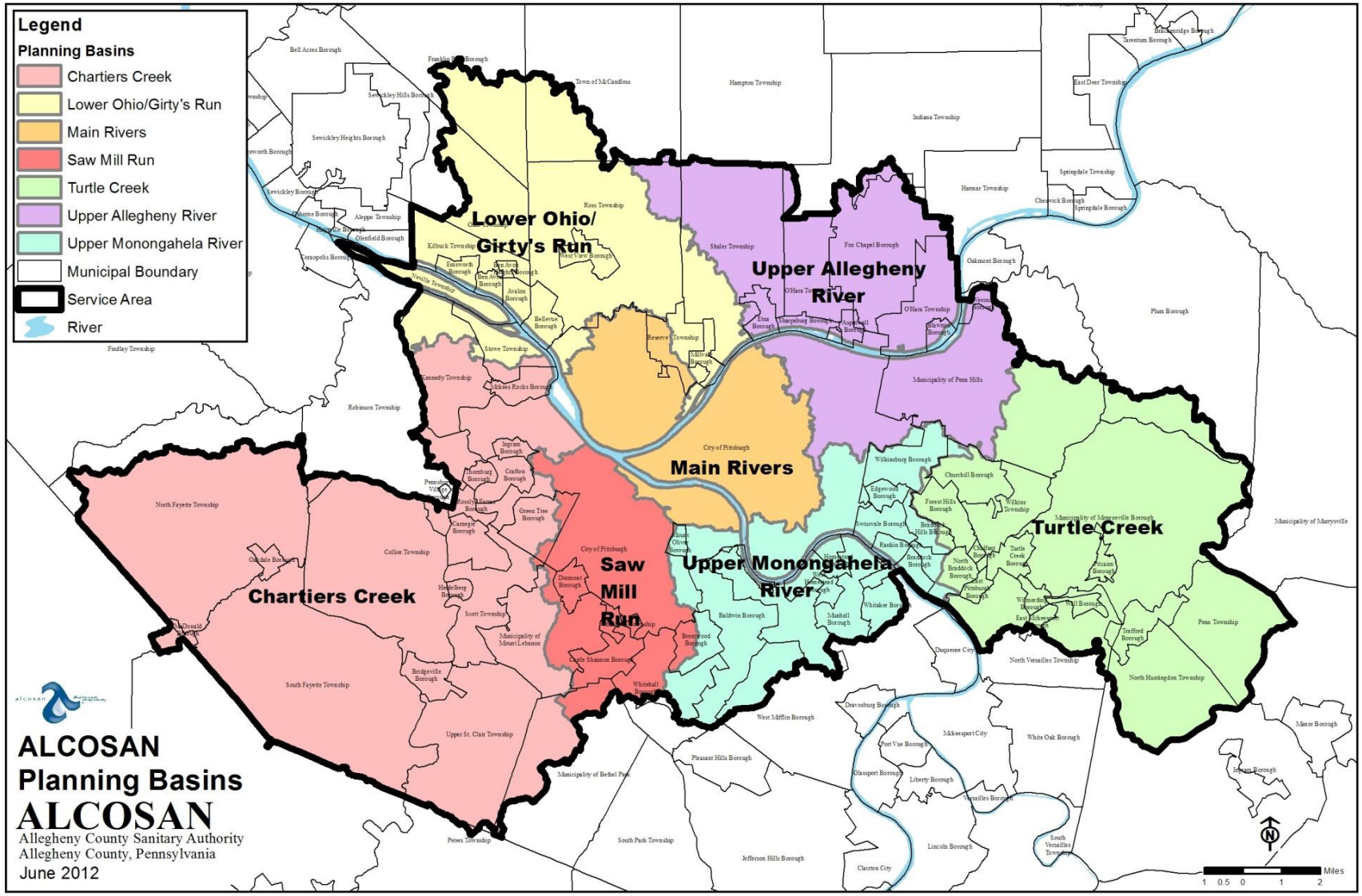
Because the Municipal Orders require submission of MFS six months after submission of this WWP, ALCOSAN worked closely with their customer municipalities throughout the development of the WWP to incorporate preliminary municipal planning information in the analysis of regional control strategies. ALCOSAN proceeded with the expectation that municipal control strategies would continue to evolve and warrant modifications to the elements of the regional plan. Subsequent to submission of the Draft WWP in January 2013, the municipalities submitted their MFS to the regulatory agencies. Thereafter, PaDEP issued new municipal orders requiring the municipalities to evaluate source reduction and submit Source Reduction Studies by December 2017.

1.4 Wet Weather Plan Development Process and Planning Team

A comprehensive wet weather planning approach was established to develop this WWP that integrates municipal and regional control activities into a long-term solution for the ALCOSAN service area. ALCOSAN's approach in developing the WWP included dividing the service area into seven planning basins (Figure 1-7) to help assure the appropriate level of municipal coordination, and attention to local conditions and priorities. Planning basin teams, comprised of national and local engineering firms, were procured to develop wet weather control alternatives and facilities plans for each of the planning basins in coordination with the respective municipalities.

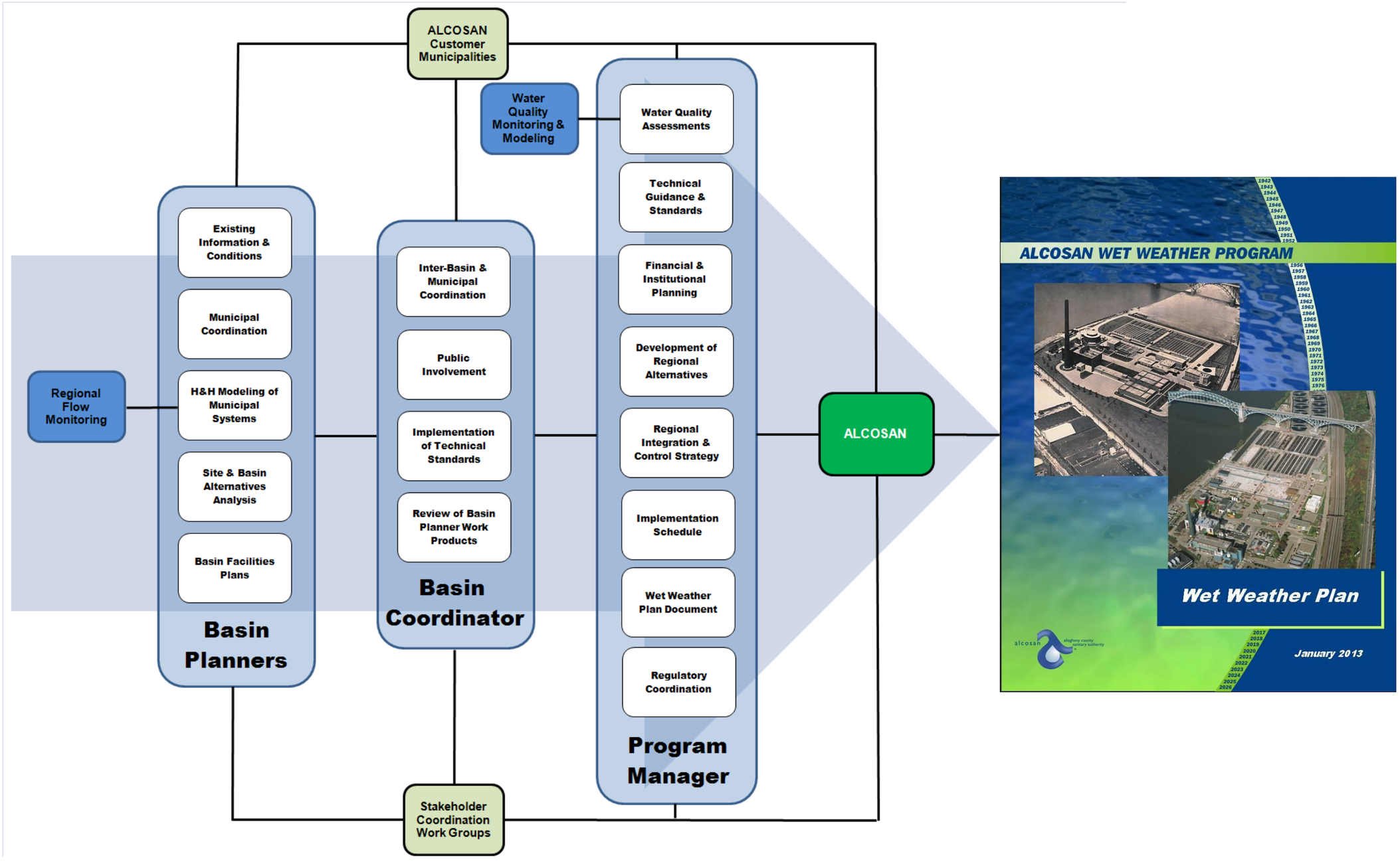
To facilitate basin alternatives integration and development of an overall system-wide control strategy, ALCOSAN procured the services of a Program Manager (PM). The PM directed the planning process, evaluated system-wide alternatives comprised of integrated basin alternatives and regional alternatives, conducted a water quality benefits analysis, and prepared the WWP. Concurrent with the basin planners'(BPs) evaluation of basin alternatives, the PM team analyzed regional wet weather overflow control facilities (regional tunnel, WWTP expansion) to be coupled with basin alternatives in the development of an overall system-wide control strategy. The PM team provided technical guidance, standards, and coordination. ALCOSAN also procured the services of a consulting engineering firm to provide inter-basin coordination. The Basin Coordinator (BC) provided the technical oversight and coordination of the BPs for conformance with standards and protocols across the seven planning basins. The BC also assisted ALCOSAN in coordinating the timely delivery and review of BP work products, and the facilitation of regional stakeholder coordination workgroups. The general allocation of the roles and responsibilities of these partners in the development of ALCOSAN's WWP are illustrated in Figure 1-8.

Figure 1-7: ALCOSAN Planning Basins



\MapArchivesByTask\Reports\2012 LTCP\Section1\Figure1-2

Figure 1-8: Wet Weather Plan Development Process and Planning Team



This page was intentionally left blank to facilitate double-sided printing

Coordination between ALCOSAN, the regulatory agencies, municipalities and consultant teams was critical in developing the WWP. ALCOSAN established and/or participated in several committees or work groups comprised (as applicable) of ALCOSAN management, the PM, the BC, the BPs, municipalities, regulatory agencies, and other stakeholders. The committees/work groups are listed below with their roles described in Section 2 of this WWP.

- Basin Planning Committees;
- Regional Stakeholders Work Group;
- Customer Municipal Advisory Committee;
- Flow Monitoring Working Group; and
- Feasibility Study Working Group.

The last two of the above groups included the participation of 3 Rivers Wet Weather, ACHD and PaDEP.

In developing the WWP with the participation of 83 customer municipalities, ALCOSAN recognized the importance of coordination and standardizing procedures, protocols, naming conventions and planning assumptions so that the work of multiple teams could be seamlessly integrated into a regional plan. Therefore, the wet weather planning approach included the development of a series of guidance documents that addressed technical standards and coordination procedures to facilitate collaborative development of the WWP. These memoranda were intended to minimize duplicative effort and maximize information/resource sharing.

1.5 Wet Weather Plan Document Organization

1.5.1 Organization of Wet Weather Plan Topics

The organization of ALCOSAN's WWP follows the general structure that has been used traditionally for municipal wastewater facility plans and as suggested in USEPA guidance[1-6] for the development of LTCPs. Table 1-2 shows the correlation between the ALCOSAN WWP contents and the topics covered in the USEPA LTCP guidance document.

[1-6] USEPA Office of Water Combined Sewer Overflows – Guidance for Long-Term Control Plan, EPA 832-B-95-002, September 1995.

Table 1-2: Wet Weather Plan Correlation to USEPA Long-Term Control Plan Guidance

EPA Guidance Chapter	General Planning Topic	WWP Section	Key Topics
(2) System Characterization	Current System Characterization	3	Existing Systems & Conditions
		4	Hydrologic & Hydraulic Characterization
		5	Receiving Waters Characterization
		6	Financial and Institutional Assessment
(3) Development & Evaluation of Alternatives for CSO Control	Future Conditions	7	Population and Demographic Trends
			Land Use Trends
			Future Wastewater Flows
		6	Financial and Economic Trends
	Preliminary Screening of Alternatives	8	Screening and Evaluation of Control Technologies
			Screening and Evaluation of Potential Sites & Routes
			Development and Evaluation of Site Alternatives
	Alternatives Analysis	9	Assumptions and Standardizations
			Cost Estimation Tools and Protocols
			Regional Alternatives Development & Analysis
			Municipal Planning Information Coordination
			Basin Alternative Development & Analysis
			Water Quality Benefits Analysis
			Regional Integration
			System-Wide Alternative Development & Analysis
			Knee-of-Curve Analysis
			Financial Capability Impact Assessment
(4) Selection & Implementation of the Long-Term Plan	Public & Stakeholder Input	2	Municipal Coordination
			Stakeholder Participation
			Public Participation
			Documentation of Process Implementation
	Alternative Selection	9	Selected Control Strategy
			Recommended Phase 1 Plan
		11	Facility Performance Targets
			Documentation of Wet Weather Control Strategy
			Specification of Basin and Regional Control Facilities
	Implementation Plan	11	Implementation Scheduling
			Financing Plan
			Affordability and Financial Capability Assessment
			Institutional Assessment
			Preliminary Operating Plan
			Interim and Post-Construction Monitoring Plan
			Adaptive Management

1.5.2 Wet Weather Plan Format and Data Sources

This document should be viewed as self-contained and stand alone, intended to be in full conformance with the CSO Policy, USEPA guidance, and the requirements of ALCOSAN's CD. For reasons of sustainability and ease of access, this document has been designed for electronic distribution as a series of integrated portable document files (PDFs).

The wet weather control strategies recommended in this WWP reflect the culmination of data gathering, technical evaluations and alternatives analyses conducted by ALCOSAN. The WWP focuses on the facilities planning that occurred within the seven planning basins and the simultaneous development of integrated regional control strategies (e.g. expansion of the wet weather treatment capacity at the ALCOSAN wastewater treatment plant). This WWP documents how ALCOSAN proposes to eliminate SSOs from the ALCOSAN Conveyance and Treatment System and to control CSOs in compliance with the CWA, consistent with the CSO Policy.

To allow for a manageable and coherent narrative, the data and findings from numerous technical reports and data sets have been summarized and synthesized into the WWP. The primary source materials used in the WWP are listed in the bibliography. Other key references are indicated in the footnotes. The WWP and select referenced background materials are available from the ALCOSAN web-site. It is emphasized that the background materials provided are for reference only, and are not to be directly or by reference included as parts of this WWP as submitted pursuant to the CD.

1.6 Wet Weather Plan Revisions and Updates

There have been a number of changes made to this document since its release for public and municipal review and comment, and submission to the regulatory agencies. ALCOSAN's Draft WWP was released for public and municipal comment on July 31, 2012. Overall, the most prominent comments received related to the potential for utilizing GSI and other flow reduction measures as an alternative to the grey infrastructure (pipes, tanks and tunnels) proposed in the Draft WWP. A new Section 10, *Starting at the Source: How Our Region Can Work Together for Clean Water,* has been added in response to the many public comments on the subject.

Following submission of the Draft WWP to the regulatory agencies in January 2013, ALCOSAN and the agencies began negotiating an amended CD that fully embraces the use of GSI and inflow/infiltration (I/I) reduction and accepts the financial infeasibility of completing all CD requirements by 2026, as required by the 2008 CD. Through these discussions, the regulatory agencies' required a compliance strategy to proceed with the design and construction of an Interim Measures Wet Weather Plan (IWWP). A new Section 11, *Interim Measures Wet Weather Plan,* has been added describing the interim measures projects and implementation plan.

These changes and others are catalogued and summarized in a new Sub-Section 2.7, *WWP Revisions and Updates.*