WASTEWATER

D-

Aging wastewater management systems discharge billions of gallons of untreated sewage into Pennsylvania's surface waters each year. In fact, Pennsylvania has the most combined sewer overflows (CSOs) of any state. The Commonwealth must invest $28 billion over the next 20 years to repair existing systems, meet clean water standards and build or expand existing systems to meet increasing demands. While investment needs are estimated to cost to 87 times the cost of the Pittsburgh Penguin's Consol Energy Center, funding has decreased. The Pennsylvania Infrastructure Investment Authority's (PENNVEST) budget in 2013 for grant and loan awards for sewer projects is $335 million dollars, less than 25 percent of the required annual investment. In 2013, Pennsylvania's appropriation from the federal Clean Water Act also decreased to $53 million.

BACKGROUND

Clean and safe water is critical for human health, a healthy environment, and the economy. Wastewater is any water that has been adversely affected in quality by human influence. Municipal wastewater is usually conveyed in a combined sewer or sanitary sewer and treated at a wastewater treatment plant. Treated wastewater is discharged into receiving water. Wastewaters generated in areas without access to centralized sewer systems rely on on-lot wastewater systems.. These typically comprise a septic tank, drain field, and optionally an on-site treatment system. Advances in wastewater treatment, initially made at the turn of the 20th century and greatly expanded in the 1970s, helped alleviate epidemics of typhoid, cholera, and other waterborne diseases and improved the environmental health of the Commonwealth's waters. To have a clean water, investments must address all the water system areas - wastewater, drinking water, and stormwater - to be effective. Today Pennsylvania needs an estimated $28 billion of investment to replace and upgrade its current aging wastewater infrastructure to meet state and federal regulations and address issues critical to public health and safety.

Why are we now facing such a large financial burden for wastewater treatment systems that have performed their functions for decades? One reason is Pennsylvania's wastewater infrastructure is aging and in need of replacement as they reach the end of their intended lifespan. Treatment plants typically have an expected useful life of 20 to 50 years before they have to be rehabilitated or upgraded. Pipes have life cycles ranging from 15 to 100 years depending on soil conditions, pipe material, and capacity requirements. In some Pennsylvania cities, the oldest pipes were constructed in the 1800s and are now approaching 200 years of use. This is occurring at a time when funding for wastewater has been continually decreasing. Nationally, the U.S. Environmental Protection Agency (EPA) indicates research and development expenditures on more efficient and affordable technologies in water and wastewater treatment have decreased by half since the early 1970s. Without adequate spending on

the state's wastewater infrastructure, we risk losing the environmental gains achieved over the last three decades.

CONDITIONS AND CAPACITY

Water Quality

Under Section 303(d) of the Clean Water Act, states are required to develop lists of impaired waters, meaning they are too polluted or otherwise degraded to meet the water quality standards set by the Commonwealth. Every two years, the Pennsylvania Department of Environmental Protection (PADEP) produces a monitoring and assessment report characterizing the condition of Pennsylvania's surface waters. The *2012 Pennsylvania Integrated Water Quality Monitoring and Assessment Report* assessed 98% of the state's approximately 86,000 miles of streams and rivers and found:

- Of these 16,644 miles (19%) were classified as impacted due to on-lot sewer systems, stormwater runoff, agricultural activities, abandoned mine drainage (AMD), and wastewater discharges.
- Of the state's 161,455 acres of lakes, 50% acres were assessed and 17,331 acres (21%) were reported to be impaired.

The Clean Water Act requires that each state establish priority rankings for waters on the impairment list and develop Total Maximum Daily Loads (TMDLs) for these waters. A TMDL is a calculation of the maximum amount of a pollutant that a water body can receive every 24 hours and still safely meet water quality standards. As of 2012:

- 9,801 miles of Pennsylvania's streams and rivers still require TMDLs in addition to the 6,490 miles that currently have approved TMDLs.
- 5,420 acres of the state's lakes still require TMDLs in addition to the 11,366 acres that currently have approved TMDLs.

Wastewater Treatment Systems

Pennsylvania has approximately 10,000 permitted wastewater systems treating municipal and industrial waste. Additionally there are numerous commercial and industrial facilities that treat their own waste and discharge directly into the Commonwealth's waterways. While a precise count of these facilities was not readily found, all are permitted and regulated by PADEP under the National Pollutant Discharge Elimination System (NPDES). The operations and conditions at these treatment facilities are routinely inspected by PADEP, however the conditions of the buried pipes that convey the sewage to these facilities is much more difficult to determine. Many of the pipes in PA's oldest cities remain brick or clay, having been constructed at the turn of the 20th century. There is no requirement for sewer systems to inspect and assess the condition of their pipes and to be able to quantify the total length of pipes that are need of rehabilitation.

There are 9,471 combined sewer outfalls (CSOs) in 32 states, 1,569 of which are in Pennsylvania—the most in any state across the U.S.! The PADEP has identified 152 communities in the Commonwealth that are currently operating with CSO discharges.

When sewers were first installed in Pennsylvania, combined sewage systems were used to convey sewage and stormwater to the nearest waterway. These systems provided a great convenience to cities and towns. Sewage and industrial waste was commonly disposed of into waterways as a matter of course. At the time, streams and rivers were not thought of as ecosystems or recreational areas, but instead were used for transport and waste removal. Since post WWII, wastewater systems were constructed to separately handle sewage and stormwater. It is only relatively recently that the public perception of waterways has changed to conceptualize waterways as recreation, conservation, and preservation areas. PADEP has reported that wastewater handling and treatment, which includes municipal point source discharges, on-site wastewater treatment, package plants, industrial point source discharge and combined sewer overflows, are implicated in the impairment of 937 stream miles.

Wastewater quality standards require the removal of containments from wastewater, and several industries such as agriculture, livestock, and pharmaceuticals result in higher levels of containments that must be removed from wastewater in order to reduce risk to the public water supply. Concentrated animal feed operations are growing in size and number in Pennsylvania. Economies of scale and modern technologies are driving the establishment of these new concentrated livestock and poultry operations.

Non-point Source Pollution and On-lot Septic Systems

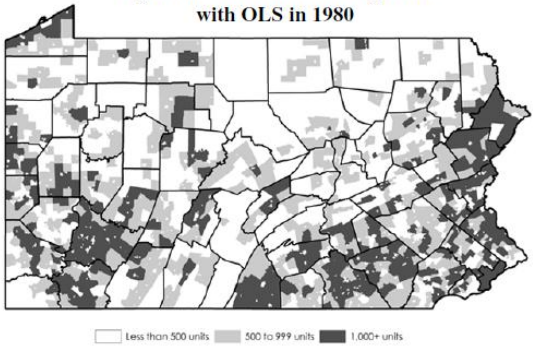
In addition to permitted wastewater systems, which are classified as point source discharges, the Commonwealth's waterways also receive pollution from non-point sources. Unlike point source pollution, which comes from pipes, the causes of non-point source pollution can be difficult to define or quantify. Sometimes referred to as "pollution runoff", non-point source pollution is generally caused by stormwater runoff across the land or infiltration of pollutants into the groundwater. Examples of non-point source pollution would be runoff from a farm field or from a highway.

PADEP has reported that runoff, including urban runoff and storm sewers, road runoff, and small residential runoff, is implicated in the impairment of 4,103 stream miles and 4,422 lake-acres in Pennsylvania. Additionally, abandoned mine drainage is responsible for the impairment of 5,596 stream miles and 377 lake-acres; non-point source discharges from agricultural activities are implicated in the impairment of an additional 5,705 stream miles and 14,313 lake-acres.

According to a 2008 study conducted by the Center for Rural Pennsylvania, more than 1.3 million homes or about 25 percent of all housing units in the state use on-lot septic systems (OLS). No statewide data are available on the percentage of these OLS that are failing to function as intended. Additionally, no data are available as to the associated remediation costs for homeowners. National failure rates for onsite sewage treatment and disposal systems are reported at 10 percent annually by USEPA; however, estimates of failure rates in Pennsylvania range upwards of 20 percent due to the frequent occurrence of soil conditions unsuitable for on-lot systems. PADEP has reported that onsite systems failures are implicated in 205 impaired stream miles and

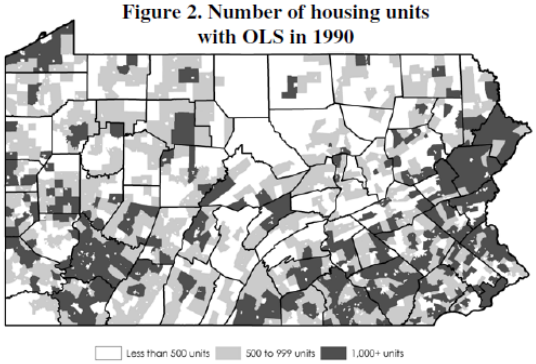
3,310 impacted lake–acres. Contamination of groundwater and surface water by failing or substandard septic systems is a considerable risk in much of Pennsylvania due to the state's geology, soils, land development patterns, and large number of aging systems. PADEP's Bureau of Point and Non-Point Source Management oversees the licensing for Sewage Enforcement Officers (SEOs) but no longer compensate the SEOs or municipality that employs them for required training. As shown in the figures below, the number of OLS has grown between the 1980 census and 1990 census. PADEP anticipates an increase in the number of OLS.

Figure 1. Number of housing units with OLS in 1980



Source: U.S. Census Bureau

Figure 2. Number of housing units with OLS in 1990



Source: U.S. Census Bureau

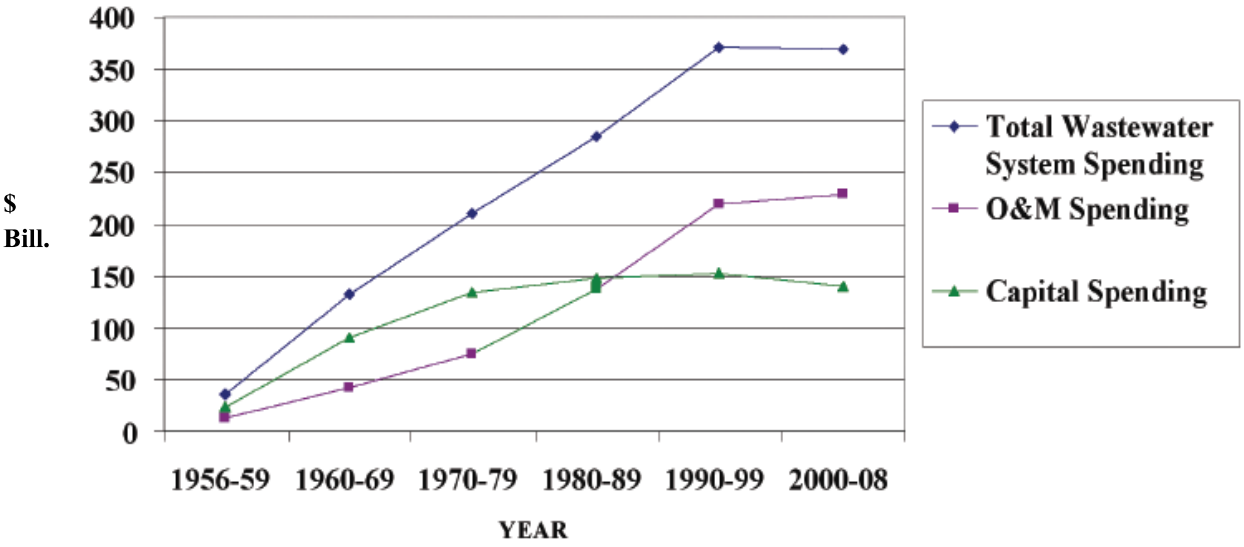
Gas Extraction

Pennsylvania is rich in natural gas, and water is used in the gas extraction process creating wastewater that must be treated in a new manner. Hydraulic fracturing is used to extract the gas and typically contains dissolved solids, and in 2009, DEP investigated sources of Total Dissolved Solids (TDS) and enacted statewide TDS limits. Since the majority of sewage treatment plants are not equipped to remove TDS, the new limits require new treatment technologies be identified, evaluated, and permitted for removal of TDS at sewage treatment plants if they are to receive waste products from the gas extraction industry.

Funding

Recent regulatory and fiscal pressure placed on communities throughout the Commonwealth by the USEPA and the PADEP to upgrade, repair, and replace aging CSO systems has often exceeded the financial abilities of many municipalities.

According to a 2010 report from The U.S. Conference of Mayors, local governments in the U.S. expended approximately $150 billion per year to address capital wastewater needs. Over the past 20 years, the operations and maintenance (O&M) portion of total local wastewater expenditures grew from 50 percent to 60 percent. This is an indication of the increasing O&M needs related to aging wastewater infrastructure and to



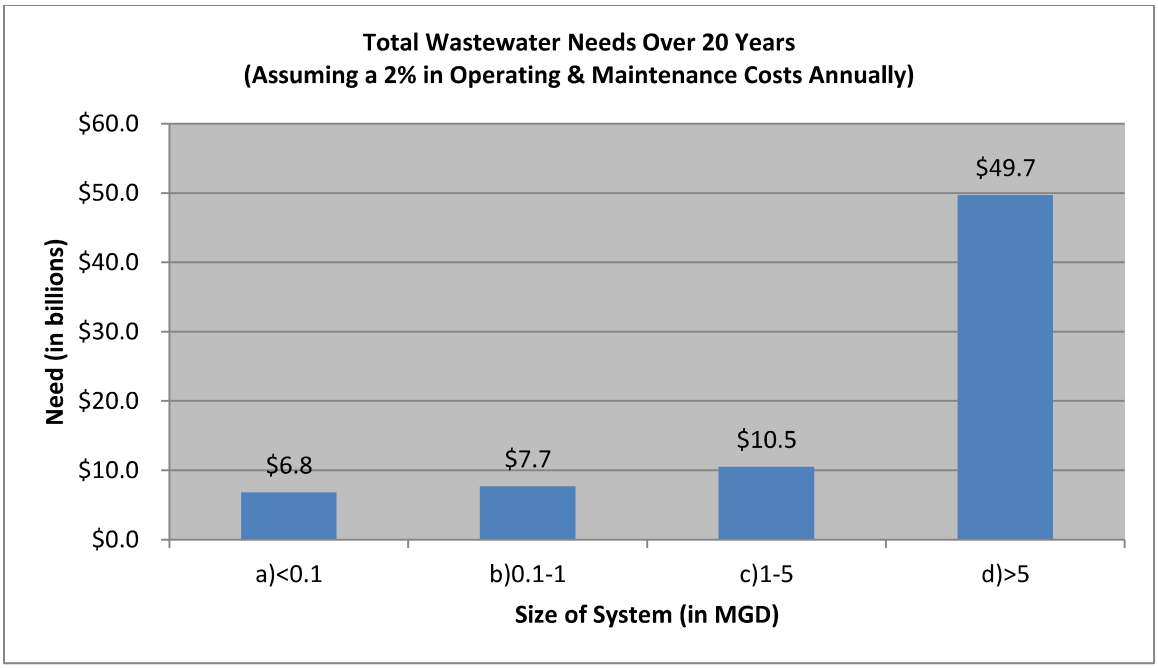
Local Government Spending on Public Wastewater Systems, 1956 – 2008, Constant Dollars (2008 = 100%)

Source: Trends in Local Government Expenditures on Public Water and Wastewater Services and Infrastructure: Past, Present and Future, The U.S. Conference of Mayors, 2010

increasing material and energy costs. Local capital expenditures have remained flat over the past 20 years. In general, capital renewal projects have not kept pace with the increasing need to rehabilitate or replace aging infrastructure.

According to the Commonwealth's *2008 Sustainable Infrastructure Task Force Report*, the capital investment for improvements to the state's 9,168 permitted wastewater systems is estimated to be $25 billion over the next 20 years (estimated in 2007 dollars). This estimate exceeds previous USEPA estimates which were last updated and released in 2008. The USEPA's 2012 Clean Watersheds Needs Survey is scheduled to be released in mid-2014 and will provide a more current estimate. With current operating costs and at current user rates, there is a total funding gap of $28.3 billion, assuming a modest 2% increase due to inflation. The figure below taken from the Sustainable Infrastructure Task Force Report indicated the total wastewater needs over the next 20 years based on the size of the system in Million Gallons per Day. It should be noted that the funding gap between projected water investment needs and current spending levels is dependent upon the growth of user rates. The gap largely disappears if Pennsylvania municipalities increase sewer rates at a rate of 2.5% over the rate of inflation.

While the gap analysis discussed above provides a starting point for the magnitude of Pennsylvania's wastewater infrastructure funding issues, it does not adequately take into account the combined sewer problems of urbanized areas like Philadelphia and Pittsburgh nor the nutrient reduction requirements in the Chesapeake Bay watershed. While the data available represents a reasonable effort to quantify the funding gap,



Source: Governor's Sustainable Infrastructure Task Force Report, 2008

more detailed statewide data would further assist in more accurately quantifying the problem and projecting the impact of potential remedies.

Wastewater is primarily funded by fees collected from the citizens and businesses benefiting from the system. However, many Commonwealth wastewater systems charge rates below their costs, generating insufficient revenue to finance needed investment. For many households, sewage treatment remains relatively inexpensive, comprising less than one percent of household income.

The federal government has directly invested more than $85 billion in the construction of publicly owned sewage treatment works (POTWs) and their related facilities since passage of the Clean Water Act in 1972. Nevertheless, the physical condition of many of the state's wastewater treatment systems is poor, due to a lack of investment in plant, equipment, and other capital improvements over the years.

Federal funding under the Clean Water Act State Revolving Loan Fund (CWSRF) program has been decreasing for the past decade. The American Recovery and Reinvestment Act of 2009 (ARRA) provided a one-time inflow of funding during 2009 and 2010. In 2012, federal funding for Pennsylvania's CWSRF was $56.5 million, which decreased to $53.4 million in 2013.

At the state level, Pennsylvania created the Pennsylvania Infrastructure Investment Authority (PENNVEST) in 1988 to help communities finance infrastructure investments. The PENNVEST CWSRF program provides funding to projects throughout Pennsylvania for the construction and maintenance of wastewater treatment facilities,

stormwater management projects, non-point source pollution controls, and watershed and estuary management. This program offers low-interest loans with flexible terms to assist a variety of borrowers, including local governments, municipalities, and privately owned entities, and to establish partnerships to leverage other funding sources.

In 2010, the last year for which full reporting is available, PENNVEST had disbursed $204 million in ARRA funds to 110 projects. A total of 93 projects were provided with $437 million in financing (taking into account all funding sources). Of this total, $330 million were in the form of low-interest loans, while $107 million were in the form of grants. In November 2008, Pennsylvania voters approved a $400 million bond issue on water and wastewater infrastructure. This grant program is being administered by the Commonwealth Financing Authority.

The *2010 Needs Survey* conducted by USEPA indicates that Pennsylvania's wastewater infrastructure needs a total of $17.9 billion of investment. The term "need" is defined by EPA as "a project, with associated costs, that addresses a water quality or public health problem existing as of January 2008." The breakdown of the needs is over $1.3 billion for treatment, $1.9 billion for separate sewer wet weather issues, sewer rehabilitation and new sewers, and $8.7 billion for (CSO) correction.

In November 2008, the Governor's Sustainable Infrastructure Task Force released a more detailed gap analysis, which assessed the difference between current spending for wastewater infrastructure and total funding needs. The Task Force's Gap Analysis estimated that, over the next two decades, Pennsylvania will have a funding gap of over $28.3 billion for Capital Project Costs and for O&M, Replacement and Repair, and Debt Retirement. The Task Force made the following recommendations for more efficient water infrastructure management:

- Increase user rates incrementally over time;
- Increase funding in federal and state assistance; and
- Reduce costs through effective management, asset management, efficient operations, regionalization and rightsizing of systems, and maximization of innovative and nonstructural solutions

Increased federal subsidies for clean water needs would help finance required investment, but federal support cannot address the entire need. The costs of O&M are not eligible for federal funding and are the responsibility of local utilities. The wastewater system customers must plan for and invest in the systems they use every day.

The increased efficiencies are necessary for Pennsylvania agriculture industry to stay competitive in U.S. and foreign markets. Rather than invest in additional facilities to treat the water, policy changes have been made by PADEP to address the potential pollution these facilities may produce. Low interest loans have been made available to farmers to implement best management practices for manure handling and storage and land management to protect water sources. Additionally, Pennsylvania is a national leader in implementing a watershed-based TMDL nutrient (i.e., nitrogen and phosphorus, which

are common in farm runoff) discharge limit program in the Susquehanna River watershed in a multistate attempt to stop the drastic decline in the ecological health of the Chesapeake Bay. The capital cost for nutrient removal is estimated at $1.4 billion, and the increase in annual O&M costs for nutrient removal is $61 million per year.

PADEP's Office of Water Management (OWM) plans, directs, and coordinates departmental programs associated with the management and protection of the Commonwealth's vast water resources. Since 2009, budget cuts and furloughs at PADEP have resulted in cutbacks to the Wastewater Operator Certification program and reductions in staffing in the Bureau of Point and Non-Point Source Management Sections of PADEP. The latter has reduced staffing in areas where an increase in staffing was already needed.

POLICY OPTIONS

If Pennsylvania fails to meet the investment needs of the next 20 years, it risks reversing the investment in public health and the environment over the past three decades.

Many national drinking water regulations have included opportunities for states to reduce costs by tailoring requirements to the conditions actually experienced by their drinking and wastewater systems, and approaching all three parts of the water triad (wastewater, drinking water, and stormwater) in an integrated watershed-based approach. States can only make use of this flexibility if they have adequate staff and administrative support to make the case-by-case determinations necessary to grant variances and exceptions available under USEPA’s rules. Funding shortfalls in state budgets are magnified at the local level by rigid one-size-fits-all prescriptions that often result in inefficient expenditures of capital when more affordable or new innovative and efficient technologies could have been used.

In many cases the approach toward public infrastructure is to build it and operate it with minimal maintenance until it wears out. Wastewater systems need to conduct a full accounting of the costs to manage their assets both for current operations and future investments needs. By appropriately managing its assets, an agency may be able to reduce overall investment needs.

Regulators, engineers, and wastewater operators tend to be conservative when it comes to adopting new technologies. Methods to clean and repair old pipes that provide low-cost alternatives to replacement of collection mains and sewers are already available. New pipe materials can reduce groundwater infiltration into sewers, and new-high efficiency fixtures can reduce water demand. These new technologies must be supported by full-scale demonstrations to gain acceptance by the clean water industry.

The case for increased federal investment to assist Pennsylvania and the other states is compelling. Needs are large and unprecedented; in many locations, local sources

cannot be expected to meet this challenge alone and, because waters are shared across local and state boundaries, the benefits of federal help will be enjoyed by the entire nation. Clean and safe water is no less a national priority than an adequate system of interstate highways. Many other highly important infrastructure programs enjoy sustainable, long-term sources of federal backing, often through the use of dedicated trust funds; under current policy, water and wastewater infrastructure unfortunately do not.

RECOMMENDATIONS

The four Pennsylvania Sections of the American Society of Civil Engineers believe the Commonwealth of Pennsylvania should develop a guaranteed source of federal-state-local shared investment and support watershed-based policies for the construction and repair of wastewater, drinking water and stormwater facilities. If funding needs are not met, the state risks reversing the public health, environmental and economic gains that have been made over the past four decades.

We support the following actions for wastewater infrastructure investment:

- Balance economic development and environmental protection endorsed in the Commonwealth's *Keystone Principles for Growth, Investment & Resource Conservation* and promote public education on the importance of infrastructure and its funding needs.

- Support the establishment of an evolving statewide environmental infrastructure needs inventory to be administered by the state's metropolitan planning organizations. This inventory would serve as a mechanism to differentiate between expenditures for current consumption and long-term investment, and would reduce major inefficiencies in the planning, design, and construction process for long-term investments. An infrastructure needs inventory would help to increase public awareness of the problems and needs facing the state's physical infrastructure, and would help the State legislature to focus on programs devoted to long-term growth and productivity. We recommend including a 5-year projection of future needs on the current permit renewals process in order to properly generate an accurate infrastructure needs inventory utilizing existing permitting processes.

- Develop mechanisms to fund critical water infrastructure. With the decreasing federal funding for the State Revolving Loan Fund (SRF) program, Pennsylvania should leverage the available federal funds that remain, using them as collateral for the issuance of State bonds, effectively doubling the amount of funds available for infrastructure investments.

- Provide funding to communities affected by the Chesapeake Bay Strategy requirements.

- Obtain sustainable funding for the Sewage Facilities Planning Grant Program (Act 537) and Pennsylvania Municipalities Planning Code (Act of 1968, P.L. 805, No. 247).

- Promote energy conservation, renewable energy, and environmental sustainability initiatives to close the funding gap by promoting better asset management techniques for reducing long-term costs and improving performance, promoting water efficiency, which reduces water consumption and the volume of wastewater to be treated; advocating full-cost pricing of water treatment; and supporting reduction of non-point source pollution of water sources.

- Support programs addressing water resource restoration projects and AMD cleanup. Pursue fair funding through the Federal Abandoned Mine Lands Program for Pennsylvania.

- Support innovative programs such as Growing Greener, Brownfield Redevelopment, and clean/green energy initiatives. Staff increases at the State level (PADEP) are required for evaluation/permitting of new technologies, as current staffing levels do not permit for enough manpower to effectively evaluate new technologies, including "Green" improvements.

- Support state-funded research at state-supported universities into wastewater, drinking water and stormwater treatment technology, which may reduce capital expenditures, as well as O&M costs, and create potential economic benefits through public-private partnerships licensing the new technologies.

- Support additional training for SEOs and installers.

- Encourage uniformity between the International Building Code and the Pennsylvania Department of Environmental Protection's Domestic Wastewater Facility Manual.

- Provide education to the general public to create awareness of the link between clean drinking water and suitable wastewater treatment facilities.

SOURCES

- "Transportation Leaders Introduce Bill to Create Jobs, Protect Water Quality" October 12, 2011. Available at http://democrats.transportation.house.gov/press-release/transportation-leaders-introduce-bill-create-jobs-protect-water-quality
- *An Examination of Failing Private Septic Systems in Pennsylvania*, Rick Day, Ph.D., Yuanhong Zhu, PhD., Stewart Bruce, and Amy Franklin, Pennsylvania State University, September 2008. Available at http://www.rural.palegislature.us/septic_systems2008.pdf

- Commonwealth of Pennsylvania *PA Infrastructure Investment Authority and PA Department of Environmental Protection Clean Water State Revolving Fund Intended Use Plan*. Available at http://files.dep.state.pa.us/Water/Drinking%20Water%20and%20Facility%20Regulation/DrinkingWaterPortalFiles/watersupply/municipalfinance/CW_%20IUP_%202013_%20Draft.pdf
- *Commonwealth's Keystone Principles for Growth, Investment & Resource Conservation (October 2005).* Available at http://www.phmc.state.pa.us/bhp/pkp.pdf
- *EPA Clean Watersheds Needs Survey*, 2008, Report to Congress. Available at http://water.epa.gov/scitech/datait/databases/cwns/upload/cwns2008rtc.pdf
- *Legislative Budget and Finance Committee, Chesapeake Bay Tributary Strategy Compliance Cost Study*, 2008. Available at http://lbfc.legis.state.pa.us/reports/2008/25.PDF
- *PA Department of Environmental Protection Pennsylvania Integrated Water Quality Monitoring and Assessment Report*, 2012. Available at http://www.portal.state.pa.us/portal/server.pt/community/water_quality_standards/10556/integrated_water_quality_report_-_2012/1127203
- *PA Department of Environmental Protection*, *Governor's Sustainable Infrastructure Task Force Report*, 2008. Available at http://www.elibrary.dep.state.pa.us/dsweb/Get/Document-71330/3800-BK-DEP4208.pdf
- *PENNVEST Annual Report 2010-2011*. Available at http://www.portal.state.pa.us/portal/server.pt/community/about_us/9320/publications/541430
- *Trends in Local Government Expenditures on Public Water and Wastewater Services and Infrastructure: Past, Present and Future*, The U.S. Conference of Mayors, 2010. Available at: http://www.usmayors.org/publications/201002-mwc-trends.pdf

ASCE POLICY STATEMENTS

- ASCE Policy Statement 243: Groundwater Management (PS 243)
- ASCE Policy Statement 299: Infrastructure Investment Policy (PS 299)
- ASCE Policy Statement 332: Wastewater and Greywater Reuse (PS 332)
- ASCE Policy Statement 362: Comprehensive Pollution Management (PS 362)
- ASCE Policy Statement 395: Control of Combined Sewer Discharges (PS 395)
- ASCE Policy Statement 403: Consultation on Environmental Regulations (PS 403)
- ASCE Policy Statement 418: Role of the Civil Engineer in Sustainable Development (PS 418)
- ASCE Policy Statement 420: Clean Water Act Reauthorization (PS 420)
- ASCE Policy Statement 422: Watershed Management (PS 422)
- ASCE Policy Statement 427: Regulatory Process for Infrastructure Development (PS 427)

- ASCE Policy Statement 429: Municipal Wastewater Biosolids (PS 429)
- ASCE Policy Statement 451: Life-Cycle Cost Analysis (PS 451)
- ASCE Policy Statement 453: Federal Capital Budgeting (PS 453)
- ASCE Policy Statement 480: Water Infrastructure and Facilities Construction Funding (PS 480)