

# Supplemental Guidance for Planning Contractors: Water Management Practice Cost Comparison



Georgia's  
State Water Plan

TECHNICAL PLANNING GUIDANCE

Georgia Environmental  
Protection Division

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# Supplemental Guidance for Regional Planning Contractors: Water Management Practice Cost Comparison

## Background

The Regional Water Planning Councils (Councils) are beginning to identify and select water management practices for their Regional Water Plans. The relative cost of water management practices will be an important consideration as the Councils compare different practices. This cost guidance was developed to provide a state-wide reference tool for the Planning Contractors to encourage consistency in relative costs throughout the state and support Council decision-making.

This Guidance presents unit costs for a representative list of anticipated water management practices. While the list of water management practices is not exhaustive, this Guidance includes instructions for developing unit costs for water management practices that are not specifically listed.

To facilitate the comparison of water management practices, most of the unit costs were developed in terms of cost per million gallon (\$/MG), cost per million gallon per day (\$/MGD), or cost per capita (\$/capita). The water management practices are grouped both by the type of water management practice but also by the unit of measurement. Table 1 shows the groups and the unit of measure as used in the unit cost tables. These groups consider how water management practices are likely to be compared. For example, water conservation program costs are likely to be compared to new water supply development; thus are presented in common units.

Table 1: Category of Water Management Practices with Unit of Measure

Category	Unit of Measure
Water Demand Management Practices (WD)	\$/MG
Water Supply Management Practices (WS)	\$/MG
Water Treatment Management Practices (WT)	\$/MGD
Wastewater Treatment and Return Management Practices (WW)	\$/MGD
Education Management Practices (E)	\$/capita
Ordinance and Policy Management Practices (OP)	\$/capita

The unit costs were developed based on actual project costs adjusted to 2010 dollars for a range of projects in Georgia, where the data was available. National cost guidelines were used where Georgia-specific costs were not available. The costs reflect the cost to implement the water management practice. Some water management practices, such as water conservation practices, may reduce

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energy costs for customers or reduce production costs. Cost savings are not included within the unit costs because that is considered a “benefit” and vary based on local conditions.

There are a few water management practices that cannot be expressed in terms of unit costs. The discrete costs for these water management practices are presented in a separate section of this Guidance. These water management practices include data collection and ecosystem restoration, which do not correlate with supply, demand, or population units.

Water management practice costs can be presented in a number of different fashions. This guidance presents costs in current dollars, or the cost to implement the water management practice in 2010. Other ways to present costs include “present worth”, which reflects the changes in cost over time due to inflation and other factors (i.e., a water treatment plant will be more expensive to construct in 2050 than in 2025). Water management practices are also often presented as a benefit-to-cost ratio which considers that some water management practices provide more “benefit” than others (i.e., the return flow benefit from converting one LAS site to centralized sewer is much greater than converting one septic system). The Planning Contractors may apply regional knowledge of timing and benefits associated with specific water management practices to these state-wide unit costs, as appropriate for their region.

The unit costs in this guidance are presented as a baseline range instead of as a discrete number because there is a wide range of costs for water management practices based on the intensity of implementation and regional considerations. To address differences in intensity of implementation, the unit cost tables include a description of program elements that would be considered in the low or high range of costs. These descriptions are intended to help the Planning Contractor select a unit cost based on the water management practice being considered by the Council. To address differences based on regional considerations the unit cost tables include recommendations for additional cost factors; such as operations and maintenance (O&M), environmental, and piping lengths. For example, the O&M costs for a wastewater treatment plant will depend on the type of treatment facility, age, and effluent quality. Similarly, environmental costs for a reservoir will vary based on the acres of wetlands and miles of stream impacted. These costs are not included in the ranges as they could misrepresent the typical range of unit costs for that practice. The Planning Contractor must add these costs, where appropriate, based on regional knowledge and best professional judgment. Several guidelines for calculating these additional cost factors are included in this Guidance in case regional information is not available.

The goal of this cost guidance is to provide a tool to Planning Contractors to facilitate the comparison of water management practices. The unit cost ranges that are provided in this Guidance may be used in combination with estimated benefits developed by the Planning Contractor to assess the benefit-cost ratio.

## Cost Guidance Overview

The unit cost tables for common water management practices are located in Appendix A. These tables include a range of costs for each water management practice, a note section with descriptions of low

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end and high end costs within that range, and checkmarks for additional cost factors. Table 2 provides a more detailed summary of the content of the unit cost tables. The Planning Contractor will select a unit cost for a specific water management practice based on the interests of the Council in terms of the intensity of the practice.

Table 2: Description of Columns in the Unit Cost Tables

Column Name	Description
<b>Water Management Practice</b>	Name of the water management practice
<b>Description</b>	Text description of the water management practice
<b>Unit</b>	The unit of measure that the basis for the cost range (\$/MG, \$/MGD, or \$/capita)
<b>Cost Range</b>	Identifies the anticipated range of costs for that particular management practice in the units presented
<b>Additional Cost Considerations</b>	Indicates additional cost considerations that may influence the selection of a unit cost within the range. Most of these additional cost considerations are related to the region and how they intend to implement the water management practice.
<b>Specific Notes</b>	The specific notes include the descriptions of programs that were the basis for the low range and high range of costs. Other notes on the basis for the costs or what are included and not included are located in this section as well.

The additional cost considerations include a number of categories of common cost elements that may impact the unit cost for a given Council. The categories and a description of these additional cost considerations are presented in Table 3. The intent is for Planning Contractors to adjust or add costs to the unit costs based on the applicability of these additional considerations. For most of the categories, Table 3 provides a general method for estimating costs where site/regional information is unavailable.

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Table 3: Description of Categories for Additional Cost Considerations

Category	Description
<b>O&amp;M</b>	Some water management practices may have long-term operations and maintenance (O&M) costs, such as treatment plants. Typical planning level O&M costs can range from 10% - 25% of the overall cost.
<b>Environment</b>	Some water management practices may have significant environmental costs depending on placement. For example, the presence of wetlands or endangered aquatic species may impact project costs. (See Table 5 for comparable costs)
<b>Permitting</b>	Permitting costs are very site specific. Typical planning level permitting costs can range from 5 – 20% of the overall cost.
<b>Community Age</b>	The age of the community and infrastructure will impact the cost of specific alternatives. For example, the replacement of older plumbing fixtures will cost more in older communities with more fixtures to replace than in newer, efficient communities. The cost of asset management for water and wastewater systems will also be more expensive in areas with older infrastructure. Community age will impact where in the range of unit costs a region falls.
<b>Pipelines/Public Infrastructure</b>	Pipeline costs will vary widely depending on the length and size of the main. Appendix B provides information on the cost of pipelines based on the diameter that can be applied based on the specific project. These pipeline costs are the major cost element for some practices such as system interconnections.
<b>Other</b>	There are other considerations outlined in the Specific Notes column.

## Using this Cost Guidance

For any water management practice, the Planning Contractor will evaluate the range of unit costs. Figure 1 shows the range for a specific water management practice of about \$250 - \$3,000/MG. The Planning Contractor will select a unit cost or a narrower range of unit costs based on the type of program selected and the descriptions in the Notes column. The age of the community is also a factor in selecting a unit cost for this practice. Two examples of how the unit cost tables are used to select a unit cost are shown in Figure 2.

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Figure 1: Example Cost Range from the Unit Cost Tables

Unit	Cost Range										PC Cost Considerations					Specific Notes		
	\$0 - \$100	\$100 - \$200	\$200 - \$300	\$300 - \$400	\$400-\$500	\$500 - \$750	\$750 - \$1,000	\$1,000 - \$2,000	\$2,000 - \$3,000	\$3,000 - \$4,000	\$4,000 - \$5,000	O&M	Environmental	Permitting	Community Age		Piping/ Public Infrastructure	Other
\$/MG																		Low Range: Includes residential water audits. High Range: Includes rebate programs, government efficiency programs, and programs targeting high water users. Note: The effectiveness depends on the current level of efficiency.

Figure 2: Example Cost Calculations

*Example 1:*

*Practice: Stormwater Public Education and Outreach (E-1)*  
*Intensity: Several print media elements, workshops, and no mass media elements*  
*Cost Range: \$0.10 - \$2.30/ capita*  
*Additional considerations: None*  
*Estimated Unit Cost: \$1.00/capita*  
*Total Cost: population \* \$1.00/capita*

*Example 2:*

*Practice: Decommission On-site Sewage Management Systems (OSSMS) (WW-7)*  
*Intensity: Pump and remove OSSMSs*  
*Cost Range: \$0.10 - \$1.00/ capita*  
*Additional considerations: Need additional 5 MGD of WWTP expansion, 10 miles of 24-inch diameter pipe*  
*Estimated Unit Cost: \$1.00/capita*  
*Total Cost: population decommissioned \* \$1.00/capita + 5 mgd \* \$7.5M + 10 miles \* \$3.4M*

**Additional Unit Costs**

Some of the water management practices that may be considered by the regional water planning councils do not translate well into the three categories of unit costs. These costs are presented in this section.

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The State Water Plan states that the Regional Plans should include “proposals for addressing data and information needs” (SWP, page 38). These costs are unique and these practices are less likely to be compared against other water management practices. As it is anticipated that these measures will be considered by the Councils, the costs are provided in Table 4.

Table 4: Costs for Monitoring and Data Collection Management Practices

Water Management Practice	Description	Costs
<b>Agricultural Well Metering</b>	Installation of meters on agricultural wells to collect information on water usage as part of the ongoing NRCS program.	\$600 - \$2,500 per well \$200 annual maintenance
<b>Water Quality Monitoring (grab sample)</b>	Monitoring chemical water quality annually for fecal coliform bacteria and traditional stormwater parameters (no metals) using grab sample collection.	\$4,000 - \$8,000 per site
<b>Water Quantity Monitoring (gage station)</b>	Monitoring real-time flow and level through a USGS gage station.	\$30,000 - \$60,000 new site installation \$15,000 annual maintenance
<b>Water Quality Monitoring (habitat and benthos)</b>	Monitoring biological water quality annually looking at habitat and macroinvertebrate populations.	\$5,000 - \$20,000 per site

Similarly, costs for ecosystem restoration and pollutant trading are not presented in the unit cost tables. Costs for these water management practices are market-driven, so the costs vary with supply and demand within the region. The costs presented here are based on a snapshot in time and therefore were not included in the unit cost tables.

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Table 5: Ecosystem Restoration and Pollutant Trading Management Practices

Water Management Practice	Description	Costs
<b>Ecosystem Restoration</b>	Ecosystem restoration includes identifying areas with water quality or habitat degradation and constructing projects to restore the environmental function that was lost. Common ecosystem restoration techniques include stream and wetland restoration. The costs are based on the cost to purchase credits from a restoration bank.	Wetlands Credits \$5,000 - \$9,000/ credit  Stream Credits \$40 - \$100/ credit
<b>Pollutant Trading</b>	Water-quality trading is a market-based approach that can complement water-quality regulation. A water-quality trading market allows the facilities to buy pollutant-reduction credits from other facilities in the same watershed, or from non-point sources such as agriculture. Since non-point source pollutant reductions are frequently less expensive than treatment-plant upgrades, trading programs can cost-effectively improve water quality.	Phosphorus Credits \$1.08 - \$23.37/ pound removed  Nitrogen Credits \$0.45 - \$4.72/ pound removed

## Developing Additional Cost Estimates

The unit costs included in this Guidance were developed based on literature values. The majority of the unit costs are based on implementation of these water management practices in communities in Georgia. Other national and state literature sources were used where appropriate. The descriptions associated with a specific unit cost provide information on what the water management practice includes, which was the basis for the cost range.

The steps to develop unit cost ranges for new water management practices not included in the unit cost tables include:

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1. Select the unit of measure for the cost based on what practices will be compared to the selected water management practice.
2. Perform a literature search to identify two or three sources of costs for similar water management practices. Local budgets and/or CIPs are good sources for this cost data. Georgia costs should be used where available.
3. Adjust the costs based on year. If the comparable projects are several years old, they may need to be adjusted to reflect 2010 costs.
4. Determine the unit cost by dividing the project cost by the unit. For example, the unit cost of a wastewater treatment plant is the cost of the plant divided by the size of the plant in MGD. Since the unit cost for treatment facilities often decreases with size; costs should be collected for a range of facility sizes, if possible.
5. Compare the calculated unit cost against any comparable water management practices in the unit cost tables provided in this Guidance. Use best professional judgment to determine whether the unit costs are appropriate or if any of the costs from the literature search are outliers. Adjust the unit costs as necessary.

The Planning Contractors should communicate the results of this analysis with EPD staff. EPD may share the additional analysis with other Planning Contractors, as appropriate.

### APPENDIX A: Unit Cost Tables

#	Water Management Practice	Description	Unit	Cost Range											PC Cost Considerations					Specific Notes	
				\$0 - \$1,000	\$1,000 - \$2,000	\$2,000 - \$3,000	\$3,000 - \$5,000	\$5,000-\$10,000	\$10,000 - \$50,000	\$50,000 - \$100,000	\$100,000 - \$200,000	\$200,000 - \$300,000	\$300,000 - \$400,000	\$400,000 - \$500,000	O&M	Environmental	Permitting	Community Age	Piping/ Public Infrastructure		Other
<b>Water Demand Management Practices</b>																					
WD-1	Municipal (Domestic & Commercial) Water Conservation & Efficiency	Programs to conserve water and reduce water loss for residential and commercial water users.	\$/MG	[Bar chart showing cost range from \$1,000 to \$5,000]														✓	✓	Low Range: Includes residential water audits. High Range: Includes rebate programs, government efficiency programs, and programs targeting high water users. Other: The effectiveness depends on the current level of efficiency.	
WD-2	Industrial Water Conservation & Efficiency	Programs to conserve water and reduce water loss for industrial water users.	\$/MG	[Bar chart showing cost range from \$1,000 to \$2,000]											✓		✓		✓	Low Range: Includes facility inspections and water use audits. High Range: Includes facility upgrades, such as cooling tower efficiency improvements or replacement of older equipment. Other: The effectiveness depends on the current level of efficiency and number/type of industries.	
WD-3	Agricultural Water Conservation & Efficiency	Programs to conserve water and reduce water loss for agricultural water users.	\$/MG	[Bar chart showing cost range from \$1,000 to \$5,000]											✓				✓	Low Range: Sod based rotation with conservation tillage. High Range: Includes replacement of irrigation equipment to Variable Rate Irrigation to lower water use. Other: The effectiveness depends on current water use rate and size of irrigated acres.	
WD-4	Reduce Non-Revenue Water (Water System Asset Management)	Routine activities by water providers to identify and reduce non-revenue water, which includes water loss (leaks), unbilled-authorized uses (fire fighting, line flushing), and apparent losses (metering/data handling errors).	\$/MG	[Bar chart showing cost range from \$1,000 to \$2,000]														✓	✓	✓	Low Range: Includes reactive response to leaks and customer complaints, completing a self-audit annually. High Range: Includes proactive leak detection, meter calibration, and programmatic water line replacement. Other: The costs are related to the age of the pipes in the system, pipe material, and maintenance history.
WD-5	Conservation-Oriented Rate Structures	Implement or modify rate structures to provide inclining block rates (such as a three-tiered program) that charge customers more per unit for higher use.	\$/MG	[Bar chart showing cost range from \$0 to \$1,000]																✓	Low Range: Includes rate analysis and minor adjustments to billing system. High Range: Includes rate study with replacement of billing system to accommodate tiers. Other: Cost range depends on the quality of the billing systems in the region.
WD-6	Landscape Conservation Measures	Implement programs to reduce or eliminate potable water use for the maintenance of landscaping.	\$/MG	[Bar chart showing cost range from \$1,000 to \$2,000]														✓		Low Range: Installation of irrigation rain sensor shut-off valves. High Range: Replacement of landscaping (over time) with low water usage, native landscaping.	
WD-7	Golf Course Water Conservation & Efficiency	Implement programs to reduce water consumption at golf courses in Georgia.	\$/MG	[Bar chart showing cost range from \$1,000 to \$5,000]																	Low Range: Includes training for golf course superintendents & workers. High Range: Includes training and water use assessments with leak detection & repair, as needed.
<b>Water Supply Management Practices</b>																					
WS-1	New Surface Water Storage Reservoirs	Construct a new surface water supply reservoir. Costs do not include land acquisition, permitting, conveyance or treatment.	\$/MG	[Bar chart showing cost range from \$50,000 to \$100,000]											✓	✓		✓	✓	Low Range: Quarries or other sites that do not require dams. High Range: Larger dams Other: Cost dependent on land value and construction materials. Piping costs not included.	
WS-2	Increase Existing Surface Water Storage Reservoirs	Increase the height of existing surface water reservoirs to provide additional water supply.	\$/MG	[Bar chart showing cost range from \$10,000 to \$50,000]											✓	✓		✓		Low Range: Minor adjustments to the existing dam structure. High Range: Major renovations to the existing dam structure.	
WS-3	New Groundwater Sources	Locate and develop new groundwater wells for water supplies. Costs do not include land acquisition, wellhead protection, or treatment.	\$/MG	[Bar chart showing cost range from \$1,000 to \$5,000]											✓	✓	✓	✓	✓	Other: Dependent on well depth, soil conditions, piping distance and number of pump stations.	
WS-4	Aquifer Storage and Recovery	Develop a program to recharge a groundwater aquifer to withdraw later to supplements supply during seasons of water shortage or drought.	\$/MG	[Bar chart showing cost range from \$10,000 to \$50,000]											✓	✓	✓	✓	✓	Other: Dependent on well depth, soil conditions, piping distance and number of pump stations.	
WS-5	Interbasin Transfers	Transfers can supply water to areas of need. These may not have adverse impact on the donor basin and will only be considered following consumptive use assessments.	\$/MG												✓	✓	✓		✓	Other: The cost for interbasin transfers is associated with the piping. Therefore, there is no unit cost.	
WS-6	System Interconnections for Water Supply	Interconnection of water supply systems between counties or even cities can provide a back up supply during a natural disaster or provide for routine sale of water.	\$/MG												✓				✓	Other: The cost for water system interconnections is associated with the piping. Therefore, there is no unit cost.	
NOTES:																					

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#	Water Management Practice	Description	Unit	Cost Range (\$M)											PC Cost Considerations					Specific Notes		
				\$0 M - \$1 M	\$1 M - \$2 M	\$2 M - \$3 M	\$3 M - \$4 M	\$4 M - \$5 M	\$5 M - \$6 M	\$6 M - \$7 M	\$7 M - \$8 M	\$8 M - \$9 M	\$9 M - \$10 M	\$10 M - \$11 M	O&M	Environmental	Permitting	Community Age	Piping/ Public Infrastructure		Other	
<b>Water Treatment Management Practices</b>																						
WT-1	Water Treatment Plant (New) <sup>1</sup>	Treatment of surface water or a combination of surface and groundwater making it a viable water supply source.	\$/MGD															✓	✓	✓	✓	Low Range: Includes basic treatment components with manual control and minimal monitoring. High Range: Includes basic treatment components with advanced controls & monitoring.
WT-2	Water Treatment Plant Expansion <sup>1</sup>	Upgrade existing facilities to replace antiquated equipment, increase capacity, or improve level of treatment.	\$/MGD															✓	✓	✓	✓	Low Range: Includes upgrade of existing systems with minimal modification or replacement of existing process components. High Range: Includes upgrade of existing systems with replacement of existing systems and modification / addition of treatment components.
WT-3	Desalination <sup>1</sup>	Desalination removes the salt from ocean water making it a viable water supply source.	\$/MGD															✓	✓	✓	✓	Low Range: Includes basic treatment components with manual control and minimal monitoring. High Range: Includes basic treatment components with advanced controls & monitoring. Other: Dependent on water quality, pre-treatment, post-treatment and size of system.
<b>Wastewater Treatment &amp; Return Management Practices</b>																						
WW-1	Land Application System (LAS) <sup>1</sup>	Construct new land application systems. Costs do not include permitting or land acquisition.	\$/MGD															✓	✓	✓	✓	Low Range: Includes basic land application system. High Range: Includes land application system with underdrain system.
WW-2	Constructed Treatment Wetlands <sup>1</sup>	Treatment wetlands can provide wastewater treatment and also promote water reuse, wildlife habitat and public use benefits.	\$/MGD															✓	✓	✓	✓	Low Range: Cost for constructed treatment wetlands with moderate earthwork. High Range: Constructed treatment wetlands with extensive earthwork.
WW-3	WWTP (Secondary Treatment) <sup>1</sup>	Construct new wastewater treatment facility with secondary treatment levels.	\$/MGD															✓	✓	✓	✓	Low Range: Includes basic treatment components with manual control and minimal monitoring. High Range: Includes basic treatment components with advanced controls & monitoring. Other: Costs do not include permitting, land purchase, or collection system piping / pumping costs.
WW-4	WWTP (Tertiary Treatment) <sup>1</sup>	Construct new advanced wastewater treatment facility with tertiary treatment.	\$/MGD															✓	✓	✓	✓	Low Range: Includes basic treatment components with manual control and minimal monitoring. High Range: Includes basic treatment components with advanced controls & monitoring. Other: Costs do not include permitting, land purchase, or collection system piping / pumping costs.
WW-5	WWTP upgrade <sup>1</sup>	Upgrade existing facilities to replace antiquated equipment, increase capacity, or improve level of treatment.	\$/MGD															✓	✓	✓	✓	Low Range: Includes upgrade of existing systems with minimal modification or replacement of existing process components. High Range: Includes upgrade of existing systems with replacement of existing systems and modification / addition of treatment components.
WW-6	Wastewater Collection System Asset Management Program	Reducing sanitary sewer overflows (SSOs) through a wastewater asset management program or a collections systems operations and management (CMOM) program.	\$/MGD																	✓	✓	Costs will depend on miles of pipe, condition of system at start of program, and frequency of inspections and maintenance. Costs presented are for the volume of I/I removed from the system.
WW-7	WWTP decommissioning <sup>2</sup>	The unit cost to decommission an existing WWTP. This unit cost will likely be in combination with a new WWTP or treatment system.	\$/MGD																	✓	✓	Low Range: Includes abandoning treatment facilities in place. High Range: Includes complete removal /demolition of structures.
WW-8	Increase water returns by decreasing use of OSSMSs <sup>2</sup>	Decommission OSSMSs and connect to the centralized treatment system. This only includes the cost to decommission the OSSMS. Need to add cost for additional treatment capacity (if needed) and the cost for the estimated length of pipe to connect.	\$/MGD																✓	✓	✓	Low Range: Adopt rules to require new development to connect to sanitary sewer. High Range: Extend sanitary sewer to connect OSSMSs to the centralized system. Other: Does not include cost for new WWTP or pumping /piping systems.
WW-9	Increase water returns by decreasing use of LASs <sup>2</sup>	Convert existing LAS sites to conventional treatment/discharge. This only includes the cost to decommission the LAS. Need to add cost for additional treatment capacity (if needed) and the cost for the estimated length of pipe to connect.	\$/MGD																✓	✓	✓	Low Range: Adopt rules to require new development to connect to sanitary sewer. High Range: Extend sanitary sewer to connect OSSMSs to the centralized system. Other: Does not include cost for new WWTP or pumping / piping systems.
Notes:																						
1. Treatment plant costs typically have a decreasing unit cost as the size of the facility increases.																						
2. Decommissioning costs only reflect the cost of removal from service. The cost for treatment and piping modifications must be added, as appropriate.																						

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#	Water Management Practice	Description	Unit	Cost Range											PC Cost Considerations						Specific Notes		
				\$0 - \$1	\$1 - \$2	\$2 - \$3	\$3 - \$4	\$4 - \$5	\$5 - \$6	\$6 - \$7	\$7 - \$8	\$8 - \$9	\$9 - \$10	\$10 - \$11	O&M	Environmental	Permitting	Community Age	Piping/ Public Infrastructure	Other			
<b>Education Management Practices</b>																							
E-1	Stormwater Public Education and Outreach	Develop and implement a stormwater education program.	\$/capita	[Bar chart: \$1-\$2]																			Low Range: Includes print educational materials. High Range: Includes print materials, workshops/classes, and mass media (television, billboards, etc.).
E-2	Water Conservation Education/Outreach Programs	Public education would be used to raise awareness of other conservation measures available to customers.	\$/capita	[Bar chart: \$1-\$2]																			Low Range: Includes print educational materials. High Range: Includes print materials, workshops/classes, and mass media (television, billboards, etc.).
<b>Ordinance &amp; Policy Management Practices</b>																							
OP-1	New Development Stormwater Management (such as the blue book)	Adopt an ordinance/policy that requires stormwater management standards for new development to reduce stormwater pollution. Costs do not include the increased cost for developments to comply with requirements.	\$/capita	[Bar chart: \$0-\$1]																			✓ Cost to develop ordinances or standards. Costs do not include additional staff needed to review stormwater plans or additional development costs.
OP-2	Source Water Supply Protection (reservoir buffers, lot size, septic setbacks, reservoir use restrictions, etc.)	Includes regulations and ordinances, such as prohibiting or restricting land uses that could release contaminants in critical source water areas.	\$/capita	[Bar chart: \$0-\$1]																			✓ Cost to develop ordinance to protect areas within the drinking water supply watershed. Costs do not include land acquisition, enforcement, or replacement of disturbed buffers.
OP-3	Groundwater Recharge Protection	Protecting groundwater quality by restricting landuses that generate, store or use pollutants in recharge areas.	\$/capita	[Bar chart: \$0-\$1]																			✓ Cost to develop ordinances or policies to protect groundwater recharge areas. Costs do not include land acquisition costs.
OP-5	Reduce Impervious Surfaces (LID, land conservation, transfer of development rights, etc.)	Develop a program to reduce impervious surfaces.	\$/capita	[Bar chart: \$0-\$1]																			✓ Cost to develop ordinances or policies to reduce impervious surfaces or plan areas for acquisition. Costs do not include land acquisition costs.
OP-6	Establish a Stormwater Utility to Increase Funding	Develop a stormwater user fee to provide stable funding for stormwater programs. The cost includes the cost to develop the utility and does not include the customer cost paid to the utility.	\$/capita	[Bar chart: \$3-\$4]																			✓ Cost to develop stormwater utility. Does not include the annual cost to homeowners. The cost per capita is higher for smaller communities than for larger populations.
OP-7	Protect Sensitive Land (stream buffers, floodplains, wetlands, steep slopes, etc.)	Develop a program to protect sensitive land.	\$/capita	[Bar chart: \$0-\$1]																			✓ Cost to develop develop a greenspace plan. Costs do not include land acquisition costs.
OP-8	Pollution Prevention Programs	Develop a program to identify and prevent stormwater pollution from commercial and industrial properties.	\$/capita	[Bar chart: \$2-\$3]																			✓ Low Range: Inspect outfalls every 5 to 10 years. High Range: Perform outfall inspections plus prioritize inspections of industries without NPDES industrial stormwater permits.
OP-9	Coordinated Environmental Planning	Intergovernmental coordination between comprehensive land use planning, stormwater management and wastewater (collections and septic) programs to enhance water quality protection.	\$/capita	[Bar chart: \$0-\$1]																			✓ Cost for planning and coordination.
OP-10	Maintenance for OSSMS (education, inspections, pumping, etc. for homeowners with OSSMSs)	Develop educational programs for homeowners with OSSMS's on proper use and maintenance	\$/capita	[Bar chart: \$0-\$1]																			✓ Low Range: septic system education (workshops or mailings). High Range: Adopt an ordinance requiring regular pumping of septic tanks; track and enforce maintenance along with education and training.
Notes:																							

## APPENDIX B: Pipeline Costs

Diameter	Cost/ lineal foot	Average Cost/ mile
10	\$175 - \$250	\$1,100,000
12	\$225 - \$300	\$1,400,000
18	\$375 - \$475	\$2,200,000
24	\$550 - \$650	\$3,200,000
30	\$725 - \$850	\$4,200,000
36	\$850 - \$975	\$4,800,000
42	\$1,000 - \$1,150	\$5,700,000
48	\$1,200 - \$1,350	\$6,700,000
60	\$1,600 - \$1,750	\$8,800,000
72	\$1,900 - \$2,100	\$10,600,000
84	\$2,300 - \$2,500	\$12,700,000
96	\$2,700 - \$2,900	\$14,800,000

**Adapted from Governor’s Water Contingency Planning Task Force. Appendix 1. 02/23/2010.**

Notes:

- All costs are in mid-2010 dollars
- ENR: Construction Cost Index (CCI) in October 2009 = 8,5961.31; Assumed CCI for mid 2010 = 8,770
- Cost per lineal foot =  $(CCI/653) * D^{1.085}$
- Built-in contingency factor of 1.5
- Accounts for distance calculated “as the crow flies” – factor of 1.2 for estimation of distances
- Includes contingency for easement acquisition

Pipeline O&M estimated at \$1,000 per mile per year for pipelines

## Works Cited

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