

*ELEMENT C: Management Measures
Necessary to Achieve Your Load Reductions,
Along with the Critical Areas for
which to Implement*



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Element C

- A Description of the nonpoint source management measures that will need to be implemented to achieve load reductions, and a description of the critical areas in which those measures will be needed to implement this plan.

What's it mean?

- The WPP must describe the management measures that are needed to achieve the load reduction goals in element B
- It must also describe any additional pollution prevention goals identified
- Identify critical areas in which those measures will be needed (can be done via map or description)
- Chapters 10 & 11 cover this element

Key Points in evaluating potential management measures

- Are the site features suitable for incorporating the practice?
- How effective is the practice at achieving the goals and loading targets?
- How much does it cost? (compare too)
- Is it acceptable to the stakeholders

Reference Documents for Measures

NRCS Handbook on Conservation Practices

[www.nrcs.usda.gov/technical/standards/nhcp.html]

http://efotg.nrcs.usda.gov/efotg_locator.aspx?map=TX

EPA Management Measures Documents

[www.epa.gov/owow/nps/pubs.html]

Texas Forest Service Handbook

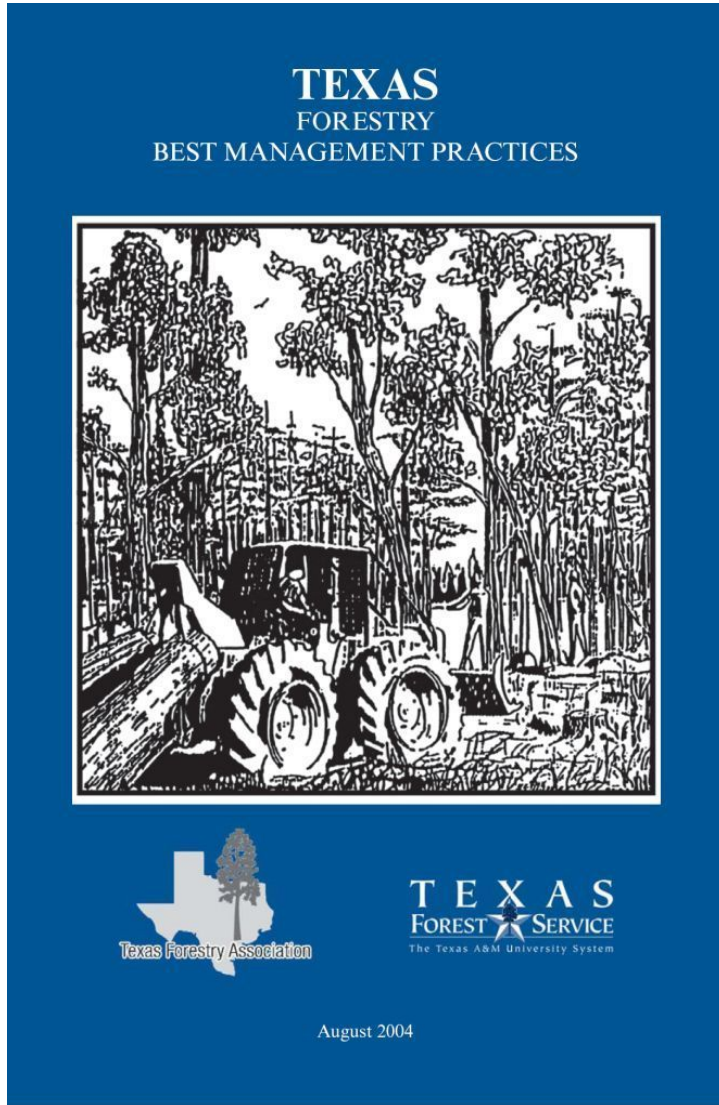
[<http://texasforestservicetamu.edu/main/article.aspx?id=74>]

OTHERS

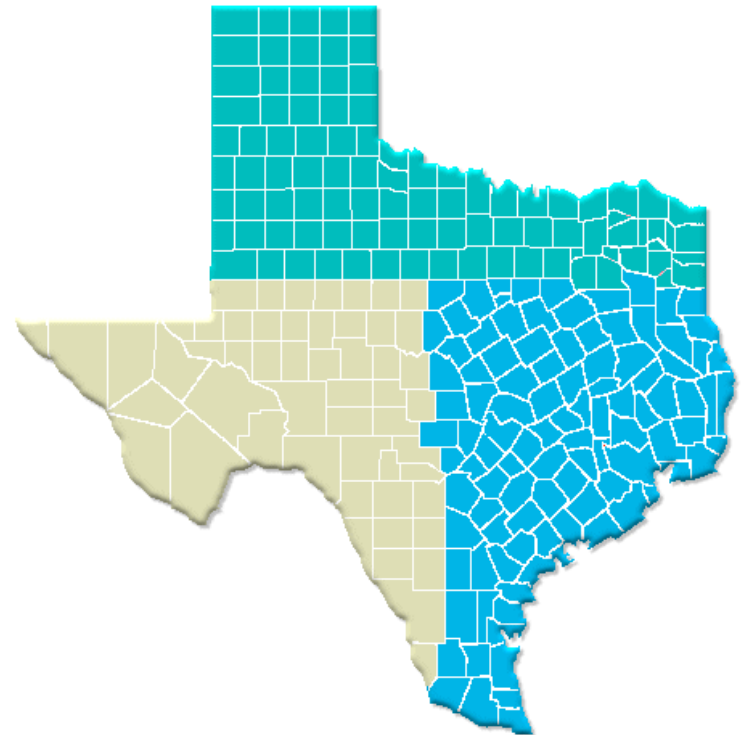
Urban Sources [www.bmpdatabase.org]

Center for Watershed Protection [www.cwp.org]

SAMPLES



USDA-NRCS, Texas Website



Types of Management Measures

Structural/Non-Structural Practices

- Agriculture
 - Structural:
 - Buffer strips, mulching, exclusion fencing, riprap, sediment basins, waste treatment lagoons, grassed waterways
 - Non-Structural:
 - Brush control, conservation tillage, nutrient management plans, rotation grazing, pesticide management, residue management

Types of Management Measures

Structural/Non-Structural Practices

- Forestry
 - Structural: culverts, cover crops, windrows, road dips
 - Non-Structural: education, erosion sediment control plans, fire management, better road layouts, preharvest planning

Types of Management Measures

Structural/Non-Structural Practices

- URBAN
 - Structural: bioretention cells, green roofs, stormwater ponds, sand filters, vegetated gabions,
 - Non-Structural: LID planning, pollution prevention plans, public education, ordinances, pet waste programs, erosion control plans.

Regulatory Tools as Management Measures

- State & Local Stormwater Ordinances
- State and Local Land Use Ordinances
- Regulate NPS, ex. CA requires NOI before irrigation return flow can be discharged
- NPDES Programs: CAFOs, POTWs

Steps to Select Management Practices

- Inventory existing management efforts
- Quantify effectiveness of current measures
- Identify new management opportunities
- Identify critical areas in watershed where additional measures are necessary

Steps to Select Management Practices

- Identify possible management practices
- Establish pollution reduction efficiencies
- Develop screening criteria
- Rank options and develop proposed management opportunities

Quantify Existing MM Efforts

- Urban Runoff
 - Are cities and counties covered under a NPDES Stormwater Permit?
- Agriculture/Silviculture
 - Are land owners operating under a WQMP?
 - Map operations that are contributing loads
- Wetlands
 - Have wetlands been i.d. for flood control and WQ ?
- Wastewater
 - Are there failing OSSS?
 - Are wastewater permits being followed?

Sample Existing Programs within a Watershed

Table 10-2. Existing Programs and Policies Identified in the Mill Creek Subwatershed Communities (continued)

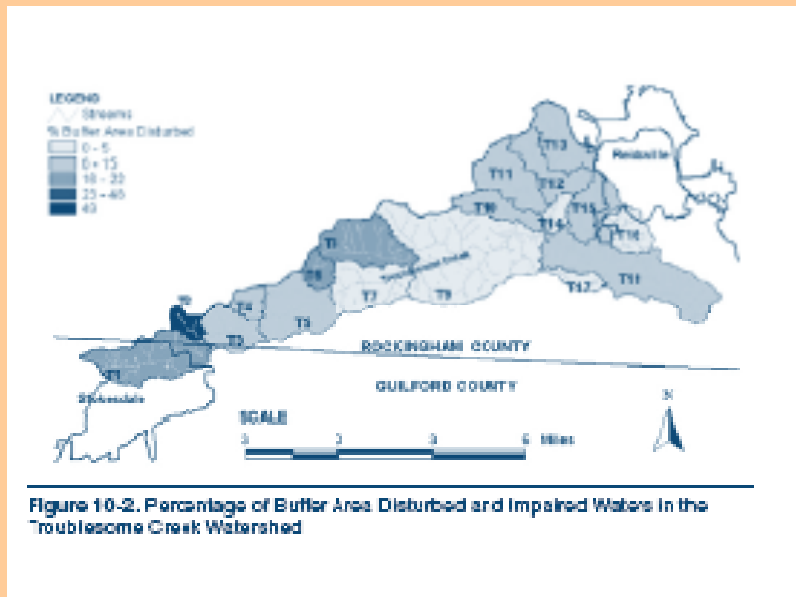
Stakeholder	Existing Program or Policy	Pollutant Addressed
Washburn County Road Commission	Leave buffers when grading gravel roads	Sediment
	Assess and manage erosion at stream crossings	
	Follow soil erosion and sediment control practices	
Village of Chelsea	Soil erosion and sediment controls and stormwater retention requirements on new developments	Sediment
	Stormwater calculations must account for roads in new development in addition to the other development	Hydrologic flow
	Large detention on wastewater treatment plant site	
	Stormwater collectors, proprietary treatment devices	
	Oil and grease separators installed; add outlet devices to existing development	Sediment, oil and grease
Daimler Chrysler Chelsea Proving Grounds	Leave buffers (of minimal width) along creek	Nutrients
	Switching products to no- or low-phosphorus alternatives	
	Ongoing monitoring of phosphorus levels in Letts Creek for NPDES permit	
	Pursuing alternative treatment chemical to reduce phosphorus	
	Soil erosion and sediment control permits and practices	Sediment
	Oil-grease separators installed	Oil and grease
	Devices in manholes checked monthly	

Develop Screening Criteria for New Candidate Measures

- Location of management practice within critical area
- Estimated load reductions
- Legal and Regulatory Requirements
- Property Ownership & Site Access
- Added Benefits or Unintended Impacts
- Physical Factors
- Costs
- Social Acceptance

New Management Opportunities

- I.D. New MM
- I.D. Critical Areas
- I.D. Possible MMs
- I.D. Reduction Potential



SAMPLE I.D. EFFICINCIES of MANAGEMENT PRACTCES

AFO	Ag	Industry	Urban	Disturbed Areas	Stream Erosion	Management Practice	Load Reduction (H,M,L)
			☺	☺		Construction Site Mgt	L
	☺					Grazing	M
	☺	☺	☺	☺		Filter Strip	H
☺		☺	☺			Detention basin	M
	☺					Cover Crop	H
					☺	Gabions	H
			☺			Street Sweeping	L

Arroyo Colorado WPP

- Ag management measures' removal efficiency

Treatment System	Removal Efficiency (%)				
	BOD ₅	TSS	NH3-N	TN	TP
Irrigation Reuse Systems	96	90	80	80	87
Wetland Cell Systems	50	90	80	80	65
Polishing Pond Systems	15	80	40	33	51

Table 17. Estimated Annual Sediment, Total Nitrogen and Total Phosphorus Reductions Resulting from Implementation of the Agricultural Component of the ACW Protection Plan in Tons

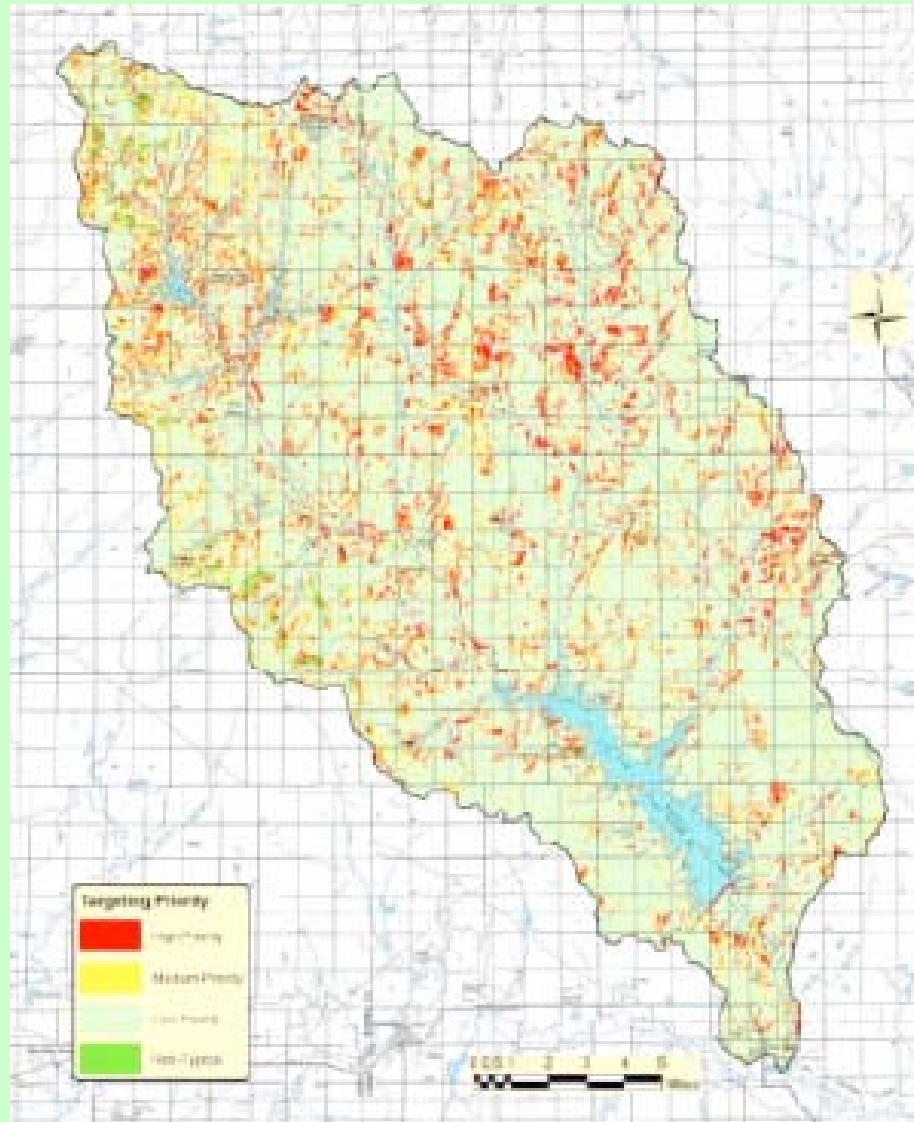
Constituent	Est. Reductions Per Treated Acres	Est. Annual Reductions From Treated Acres		
		50,000 acres	100,000 acres	150,000 acres
Sediment*	200 lbs/acre	50,000 tons	100,000 tons	150,000 tons
Total Nitrogen	0.567 lbs/acre	14.2 tons	28.4 tons	42.5 tons
Total Phosphorus	0.0947 lbs/acre	2.4 tons	4.7 tons	7.1 tons

*Adjusted for comparison to HSPF-generated loading estimates (e.g., SWAT estimate x .1)

BMP Options, Associated Efficiencies, Land Usage

BMP Option	TSS Removal Efficiency (%)	TP Removal Efficiency (%)	TN Removal Efficiency (%)	Maximum Land Usage (%)
<i>Urban Land</i>				75
Detention Ponds	65	50	30	20
Retention Ponds	80	50	30	0
Riparian Buffers	50	20	20	10
Treatment Ponds (Wetlands)	80	40	30	10
Vegetated Swales/Strips	80	25	40	10
Infiltration Basins	80	80	80	25
<i>Agricultural Land</i>				40
Grass Planting	48	19	19	5
Grading/Grassed Waterways/Filter Strips	50	20	20	25
Grade Stabilization Structures/Wet Pond	53	21	21	10
<i>Range Land</i>				50
Grass Planting	48	19	19	25

Fort Cobb - priority areas for sediment management based on SWAT modeling



FT COBB, OK. WPP

SWAT ANALYSIS FOR

SUBWATERSHEDS

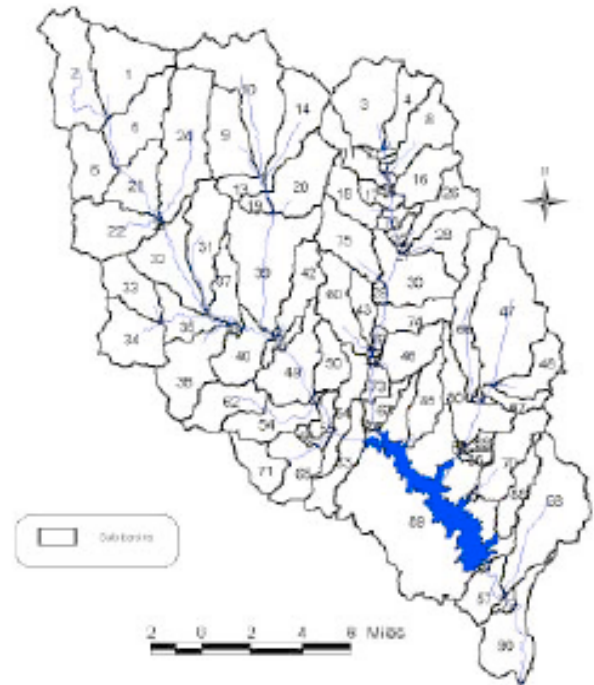


Table 2. SWAT Estimated Subbasin Loading.

<u>Subbasin</u>	<u>ARFA</u> <u>(km²)</u>	<u>Surface</u> <u>Runoff</u> <u>(mm)</u>	<u>Baseflow</u> <u>(mm)</u>	<u>Total Water</u> <u>Yield (mm)</u>	<u>Sediment</u> <u>(mg/ha)</u>	<u>Organic</u> <u>Nitrogen</u> <u>(kg/ha)</u>	<u>Organic P</u> <u>(kg/ha)</u>	<u>Nitrate in surface</u> <u>runoff (kg/ha)</u>	<u>Soluble</u> <u>Mineral P</u> <u>(kg/ha)</u>	<u>Sediment</u> <u>bound mineral</u> <u>P (kg/ha)</u>	<u>Total P</u> <u>(kg/ha)</u>
<u>1</u>	<u>1.92E+01</u>	<u>27.198</u>	<u>21.307</u>	<u>51.494</u>	<u>3.02</u>	<u>4.895</u>	<u>0.603</u>	<u>0.106</u>	<u>0.009</u>	<u>0.452</u>	<u>1.064</u>
<u>2</u>	<u>2.12E+01</u>	<u>44.085</u>	<u>35.825</u>	<u>84.136</u>	<u>6.228</u>	<u>6.636</u>	<u>0.603</u>	<u>0.308</u>	<u>0.005</u>	<u>0.628</u>	<u>1.636</u>
<u>3</u>	<u>1.86E+01</u>	<u>45.708</u>	<u>41.17</u>	<u>91.644</u>	<u>4.087</u>	<u>7.324</u>	<u>0.917</u>	<u>0.139</u>	<u>0.015</u>	<u>0.589</u>	<u>1.521</u>
<u>4</u>	<u>8.41E+00</u>	<u>59.531</u>	<u>54.213</u>	<u>121.906</u>	<u>3.919</u>	<u>6.681</u>	<u>0.814</u>	<u>0.173</u>	<u>0.01</u>	<u>0.589</u>	<u>1.413</u>
<u>5</u>	<u>1.51E+01</u>	<u>59.522</u>	<u>35.941</u>	<u>105.415</u>	<u>1.371</u>	<u>9.323</u>	<u>1.123</u>	<u>0.21</u>	<u>0.119</u>	<u>0.951</u>	<u>2.193</u>
<u>6</u>	<u>1.15E+01</u>	<u>54.575</u>	<u>44.673</u>	<u>104.907</u>	<u>1.299</u>	<u>10.146</u>	<u>1.179</u>	<u>0.153</u>	<u>0.092</u>	<u>0.869</u>	<u>2.14</u>
<u>7</u>	<u>7.76E-01</u>	<u>64.588</u>	<u>93.128</u>	<u>175.716</u>	<u>4.213</u>	<u>3.414</u>	<u>0.427</u>	<u>0.221</u>	<u>0.006</u>	<u>0.538</u>	<u>0.971</u>

**TOTAL PHOSPHORUS
Hot Spots
SWAT ANALYSIS
FT COBB, OK. WPP**

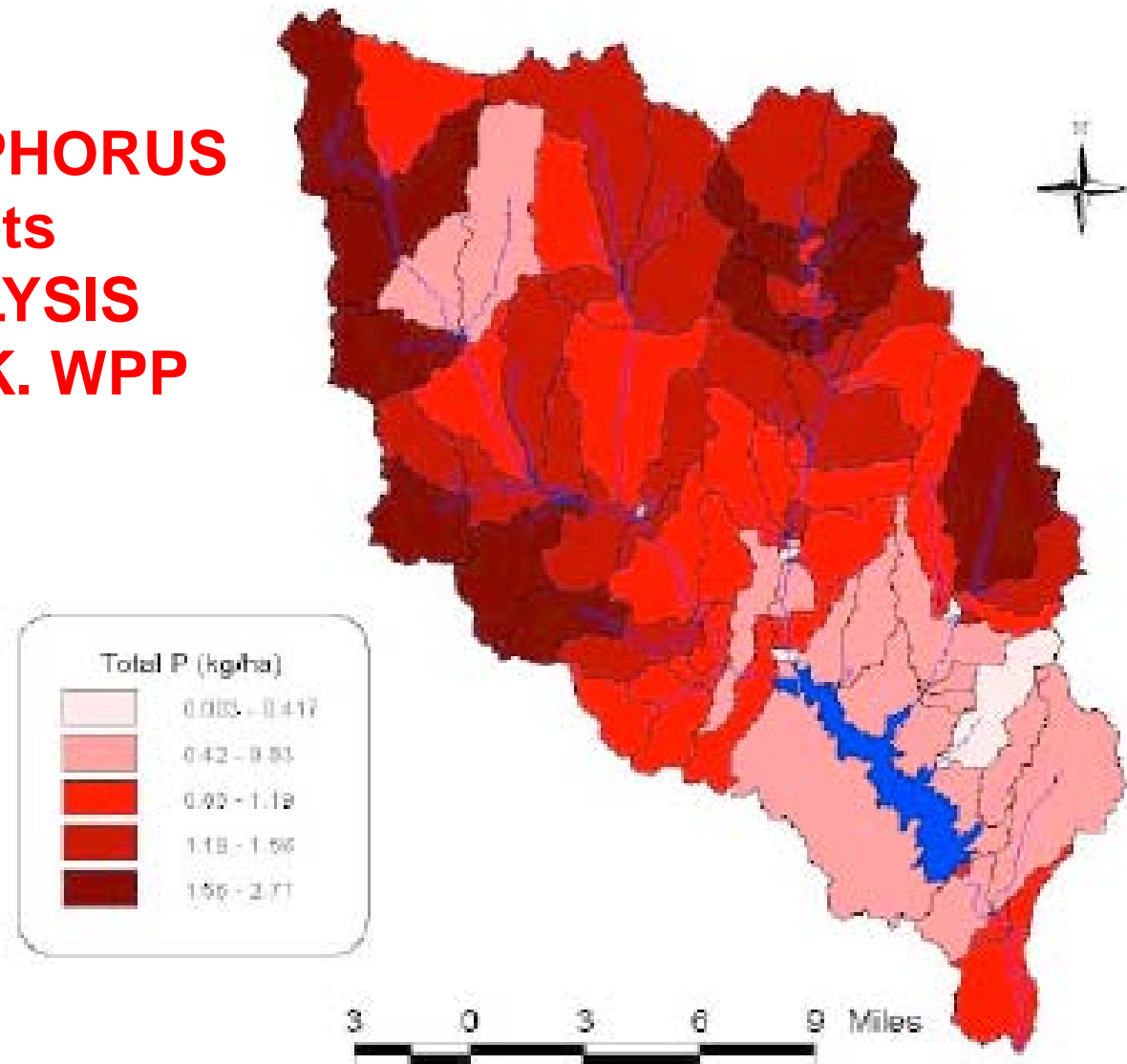
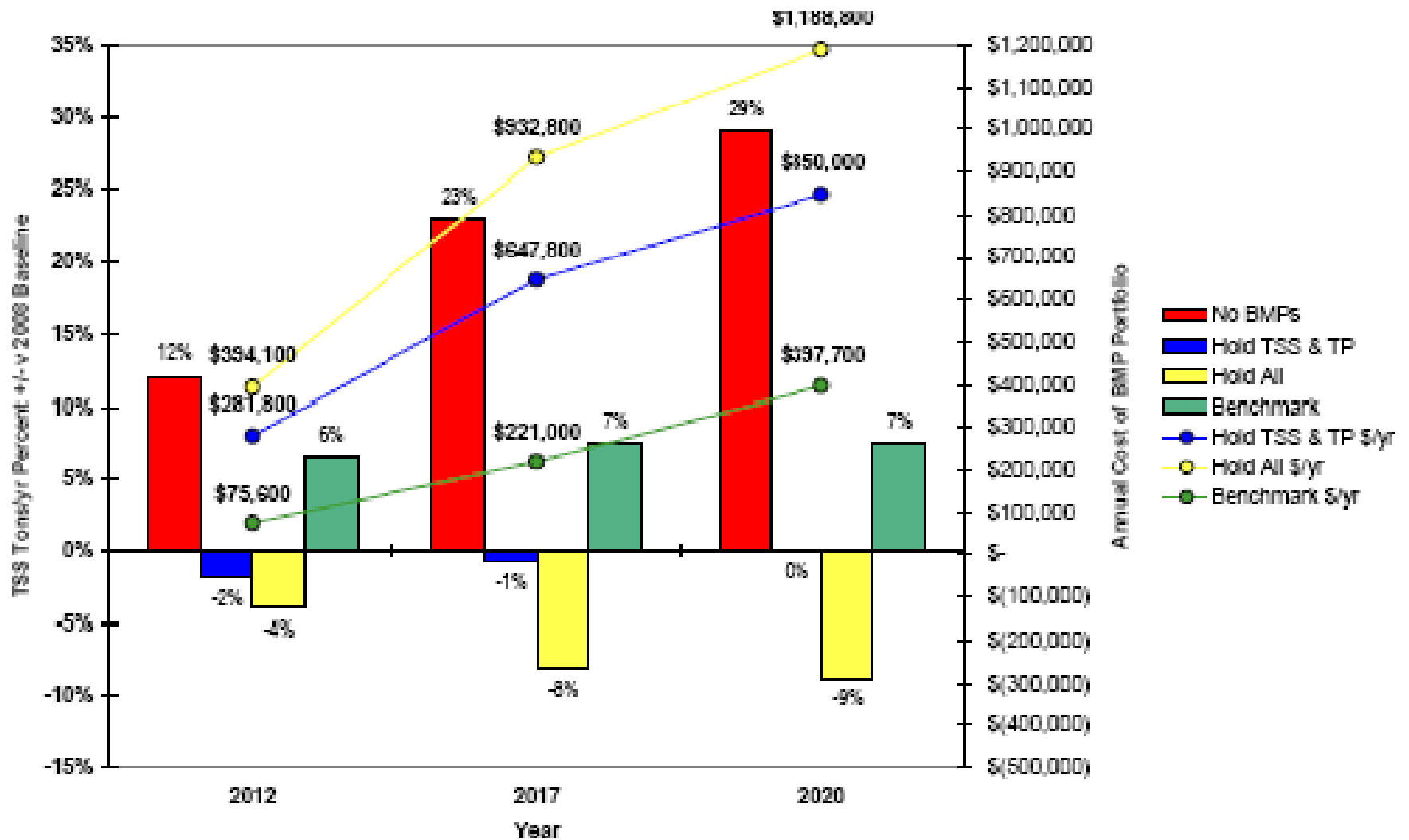


Table 11-2. Summary of Management Practice Simulation Techniques of the Selected Models

Model	Management Practice Evaluation Techniques	Water Quality Constituents
AnnAGNPS	<ul style="list-style-type: none"> • Sediment - RUSLE factors • Runoff curve number changes • Storage routing • Particle settling 	<ul style="list-style-type: none"> • Sediment • Nutrients • Organic carbon
STEPL	<ul style="list-style-type: none"> • Sediment - RUSLE factors • Runoff curve number changes • Simple percent reduction 	<ul style="list-style-type: none"> • Sediment • Nutrients
SWLF	<ul style="list-style-type: none"> • Sediment - USLE factors • Runoff curve number changes • User-specified removal rate 	<ul style="list-style-type: none"> • Sediment • Nutrients
HSPF	<ul style="list-style-type: none"> • HSPF infiltration and accumulation factors • HSPF erosion factors • Storage routing • Particle settling • First-order decay 	<ul style="list-style-type: none"> • Sediment • Nutrients
SWMM	<ul style="list-style-type: none"> • Infiltration • Second-order decay • Particle removal scale factor • Sediment - USLE (limited) 	<ul style="list-style-type: none"> • Sediment • User-defined pollutants
PL-DCM	<ul style="list-style-type: none"> • Infiltration - Green-Ampt method • Second-order decay • Particle removal scale factor 	<ul style="list-style-type: none"> • Sediment • User-defined pollutants
SWAT	<ul style="list-style-type: none"> • Sediment - MUSLE parameters • Infiltration - Curve number parameters • Storage routing • Particle settling • Flow routing • Redistribution of pollutants/nutrients in soil profile related to tillage and biological activities 	<ul style="list-style-type: none"> • Sediment • Nutrients • Pesticides

DENTON - HICKORY CREEK WPP COST/BENEFIT ANALYSIS FOR MANAGEMENT MEASURE IMPLEMENTATION



The Final Selections

- Develop Decision Criteria
 - Impacts to local government
 - Regulatory feasibility
 - Compatibility with other planning efforts
 - Political Support
- Summarize Results Present to Stakeholders
- Stakeholder Feedback
- Rank Preferences and make Final Selections

Possible Management Practices

Screening Criteria

Candidate Management Practices



Reject



Element C: NPS Management Measures

- Maryland – Corsica River Watershed

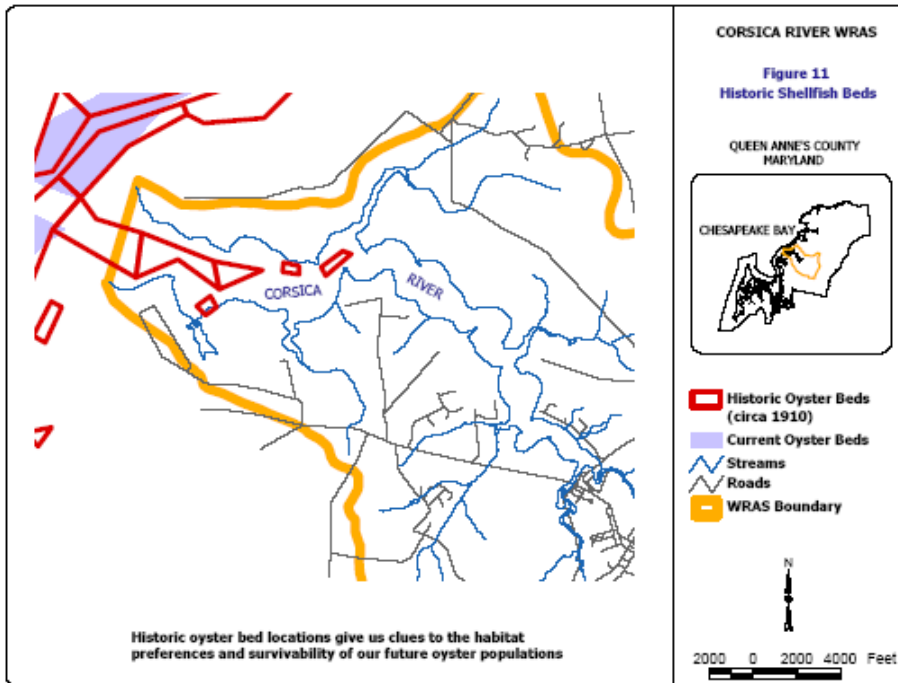
TABLE 5

<i>Summary of Implementation Project Costs and Reductions</i>			
Best Management Practice (BMP)	Goal	Cost	Nutrient Reduction/Lbs.
1. Nutrient Uptake	3,000 acres	\$90,000.00	21,000 N, 570 P
2. AG Nutrient and Sediment Reducing Buffers	100 acres	(\$170/ac + staff) \$67,000.00	9,188 N, 792 P
3. Whole Farm Nutrient Management and Horse Pasture Management	5 projects	(\$25,000.00/site) \$125,00.00	15,977 N, 1,944 P
4. Household Pollution Reduction	400 acres	\$3,696.00	634 N, 118P
5. Main Stem of the Corsica River: Water Quality Monitoring		\$345,434.00	
6. Submerged Aquatic Vegetation (SAV) Reestablishment		\$48,000.00	
7. Low Impact Development Technique in Ordinance Form		Ordinance \$37,000.00/Regional BMPs \$272,385.00	2,668 N, 236 P
8. Native Conservation Landscaping Demonstration Project		\$78,410.00	Est. 70% Reduction
9. Easements Incentive Program	1,710 acres	(\$2,437.00 ac.) \$4,167,270.00	
10. Creation of Non-Agricultural Wetlands		\$22,000.00	
11. Septic System Retrofits		\$141,000.00	28,905 N
12. EcoTeams		\$93,500.00	
13. Turbidity Reduction		(cost for first 10 ac.) \$145,000.00	
Total with All Programs, Complete		\$9,423,320.00	
Total without Easements (9) and Total Septic Conversion (11)		\$1,378,550.00	

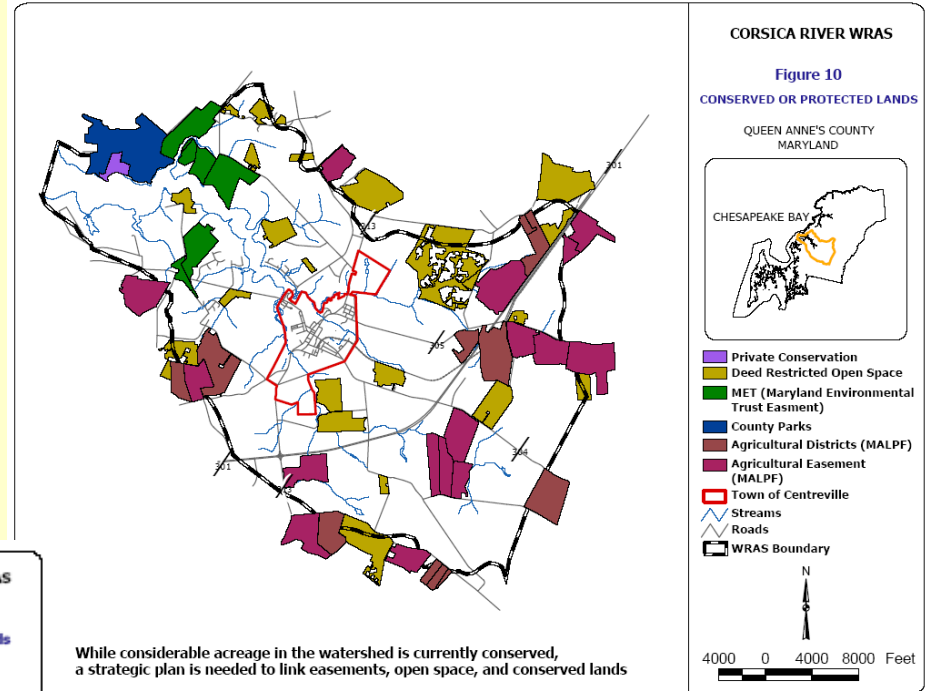
Vegetated Buffers

- 100 acres
- \$170/acre for 15 years
- 9,188.46 lbs/acre of N
- 792.40 lbs/acre of P

Oyster Bed Re-Population



Conservation Easements



Nutrient Management 50 Acres Volun. Demonstration • 5 Farmette Conversion Projects

- \$25,000 each
- 14% Nutrient Reduction

GRACIAS!

