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ST. JONES RIVER WATERSHED IMPLEMENTATION PLAN

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Prepared for:

State of Delaware
Department of Natural Resources and Environmental Control
Division of Water Resources
Watershed Assessment Section
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EXECUTIVE SUMMARY

The State of Delaware initiated a watershed study of the St. Jones River basin. This study was initiated to develop a plan to reduce pollutants in the St. Jones River Watershed (Watershed) to the Total Maximum Daily Loads (TMDLs) established by the State of Delaware Department of Natural Resources and Environmental Control (DNREC) in December 2006. The study was completed by the DNREC project team (DNREC, Duffield Associates, and CWP) and is comprised of three (3) steps. The "St. Jones River Watershed Baseline Assessment Technical Memorandum," by Duffield Associates, Inc. (Duffield Associates), dated October 2008, was completed as the first. The second step was an inventory of potential pollution control opportunities targeted at the identified impairments. Duffield Associates produced a memorandum detailing the natural or ecological pollution control approaches titled "St. Jones River Watershed Management Water Quality Technologies Opportunities," dated August 2008. The CWP staff produced a memorandum detailing upland pollution control approaches titled "St. Jones Upland Restoration Opportunities," dated August 5, 2008. This report, the Implementation Plan, is the final step. The Implementation Plan contains strategies and potential prioritization to achieve the pollution control goals using the opportunities identified.

The Implementation Plan details strategies which are broken into three (3) approaches: ranking; technology; and sub-watershed:

- Ranking strategy utilizes the scores of each identified pollution control opportunity site to prioritize project implementation;
- Technology strategy utilizes prioritization based on individual technologies reviewed; and
- Sub-watershed strategy focuses on an individual sub-watershed with the highest potential to reap implementation benefits.

Specific measures directed toward agriculture are not included in the strategies. DNREC is implementing agricultural best management practices through other initiatives.

It is recommended that the sub-watershed approach be the preferred implementation strategy. Further, because of possible future stressors, it is recommended that the Silver Lake sub-watershed be the highest priority sub-watershed. Descriptions of the five recommended highest WMWQ and five recommended highest upland restoration opportunities for Silver Lake sub-watershed are contained within Attachment A.

Although the sub-watershed strategy is the recommended priority approach, it is also recommended to implement other high priority opportunities in other sub-watersheds as funding becomes available and willing land owners are identified. It is also recommended that specific high priority sites for preservation in each of the sub-watersheds be identified within the recommended preservation corridors and subsequently evaluated for potential pollution prevention and preservation/conservation potential.

This plan, and the supporting documents the Baseline Assessment and the Pollution Control Opportunities, are intended for distribution to and for use by, stakeholders in the Watershed that will be preparing plans, reviewing proposed developments, and implementing pollution control projects. It is also intended to provide pollution control project ideas for any member of the

Watershed community. This plan does not contain all possible project ideas or all ongoing, current projects. It is recognized that new or different projects may be better suited for particular sites. This plan is intended to provide a preliminary framework with which to approach Watershed projects. A stakeholder meeting was held on December 16, 2008, and the comments received at that meeting have been addressed.

I. INTRODUCTION

A. BACKGROUND

The State of Delaware (State) initiated a watershed study of the St. Jones River basin (see Figure 1). This study was initiated to develop a plan to reduce pollutants in the St. Jones River Watershed (Watershed) to the Total Maximum Daily Loads (TMDLs) established by the State of Delaware, Department of Natural Resources and Environmental Control (DNREC) in December 2006. The study, also referred to as The Watershed Plan, is comprised of three (3) steps. The "St. Jones River Watershed Baseline Assessment Technical Memorandum," dated October 2008, also referred to as the Baseline Assessment, was completed as the first step and was prepared by Duffield Associates, Inc. (Duffield Associates). The Baseline Assessment consolidated information generated through a variety of available sources, complemented with additional evaluations to characterize the Watershed's current water quality status. A build out projection was also completed for the Baseline Assessment to determine potential future issues and impairments.

The second step was an inventory of potential pollution control opportunities targeted at the identified impairments. The St. Jones River tributary action team (TAT) developed a pollution control strategy with recommendations to help reduce pollutant loads to the TMDLs. Strategies to reduce pollutants included suggestions to improve open space, wastewater, stormwater, and agriculture management. Based on the Baseline Assessment and the recommendations from the TAT, the DNREC project team [(DNREC, Duffield Associates, and Center for Watershed Protection (CWP)] completed evaluations of various pollution control measures. Duffield Associates produced a memorandum detailing the natural or ecological pollution control approaches titled "St. Jones River Watershed Management Water Quality Technologies Opportunities," dated August 2008. The CWP staff produced a memorandum detailing upland pollution control approaches titled "St. Jones Upland Restoration Opportunities," dated August 5, 2008. These memoranda provided the data for the second report titled "St. Jones River Watershed Pollution Control Opportunities: Technical Memorandum," dated October 2008 by Duffield Associates which includes a synthesis of pollution control strategies evaluated by Duffield Associates and the CWP.

This report is the final step, the Implementation Plan for the Watershed based on the pollution control opportunities identified. The Implementation Plan presents the strategies and potential prioritization to achieve the pollution control goals using the opportunities identified. This plan is intended for distribution to and use by stakeholders in the Watershed that will be preparing plans, reviewing proposed developments, and implementing pollution control projects.

B. REPORT ORGANIZATION

This report contains a section (Section III) that provides and overview of the current and recommended regulatory and program practices of the various jurisdictions in the Watershed. The next sections (Sections IV, V, and VI) contain different strategies to implement the recommended pollution control opportunities. Costs, schedule, and a general monitoring plan are discussed in the final two sections (Sections VII and VIII).

INSERT FIGURE 1-LOCATION SKETCH (11X17)

C. BASELINE ASSESSMENT

The Watershed is located in Kent County, Delaware, with the Delaware Bay along its eastern border, the Choptank River Watershed of the Chesapeake Basin to its west, the Leipsic River and Little Creek Watersheds to the north and northeast, respectively, and the Murderkill Watershed to its south. Kent County is the middle of three (3) counties in Delaware, located within the Coastal Plain Physiographic province (see Figure 1). The Watershed is predominantly agricultural (38%) with almost 25% urban/residential (Table 1, Figure 2).

Duffield Associates prepared a sub-watershed boundary delineation map for the Watershed (Figure 3). Sub-watershed boundaries used in this report are consistent with the boundaries used for reporting in the St. Jones River basin by DNREC to date.

A Baseline Assessment was completed to characterize the Watershed and project future conditions. Several components were used to characterize the current and possible future status of the Watershed. A build out projection was completed to determine where potential land use change may further impair the watershed (Figure 4). A brief summary of components in the Baseline Assessment is listed below.

Databases

Results of the analysis of land use/geospatial data were considered for both the current condition and proposed built out condition within the Watershed. A series of maps were compiled including: Hydrography, Topography, Depth to Water, Groundwater Recharge Potential, Land Use 2002 and 2007, Protected Lands, and TMDL Impaired Streams.

Published studies

Several studies and reports were reviewed along with analysis for the proposed TMDLs to determine land use trends and pollution issues within the Watershed.

Field review

Field assessment forms were completed by volunteers and utilized to assign ranges for general visual stream reach impairment and compared to published data.

Program/Community regulation

Existing local regulations and ordinances were reviewed to identify existing local regulations and programs that should be used to support Watershed restoration and protection strategies, and, if necessary, to highlight gaps and weaknesses in the local ordinances and regulations.

Table 1 – St. Jones River Watershed Land Use Changes 1997 – 2007

ST. JONES RIVER WATERSHED STATISTICS		1997	2007	Change
LAND USE (Square Miles)	Agriculture	39.34 (44.66%)	33.68 (38.13%)	-5.66 (-6.53%)
	Barren/Open	1.21 (1.37%)	1.68 (1.9%)	0.47 (0.53%)
	Combined Urban	3.22 (3.66%)	3.59 (4.06%)	0.37 (0.41%)
	Commercial	2.8 (3.18%)	2.88 (3.26%)	0.08 (0.08%)
	Extraction	0.42 (0.48%)	0.52 (0.59%)	0.1 (0.11%)
	Forested Land	8.64 (9.81%)	7.43 (8.41%)	-1.21 (-1.4%)
	Industrial	0.84 (0.95%)	0.98 (1.11%)	0.14 (0.16%)
	Recreation	1.28 (1.45%)	1.62 (1.83%)	0.34 (0.38%)
	Residential	14.11 (16.02%)	18.82 (21.31%)	4.71 (5.29%)
	Transportation	1.21 (1.37%)	1.36 (1.54%)	0.15 (0.17%)
	Utilities	0.03 (0.03%)	0.11 (0.12%)	0.08 (0.09%)
	Wetlands/Water	1.92 (2.18%)	2.44 (2.76%)	0.52 (0.58%)

*Statistics derived from GIS analysis completed for the Baseline Assessment.

INSERT FIGURE 3 SUB-WATERSHED DELINEATION MAP (11x17)

INSERT FIGURE 4 PROJECTED BUILD-OUT MAP (11x17)

Published studies and reports reviewed included issues of land use change and nutrient loading from point and non-point sources. Both factors are important to the ground and surface water health of any watershed. In particular, urbanization in Kent County may increase nutrient loads through development of land (impervious cover) and individual septic system use. In addition, the report "St. Jones Watershed Proposed TMDLs" (DNREC, August 2006) was reviewed for point and non-point source pollution targets.

Section 303(d) of the Federal Clean Water Act (CWA) requires States to develop a list [303(d) List] of water bodies for which existing pollution control activities are not sufficient to attain applicable water quality standards and to develop Total Maximum Daily Loads (TMDLs) for pollutants of concern. A TMDL sets a limit on the amount of a pollutant that can be discharged into a water body such that water quality standards are met.

The State established TMDLs for the St. Jones River Watershed in December 2006. DNREC's target reduction for the existing pollutants in the Watershed, as a result of various load reduction analyses, is 40% non point source reduction of nitrogen and phosphorous (nutrients) and carbon (BOD), and 90% non-point source reduction of *enterococcus* (bacteria or pathogen). The non-point source load reductions will be coupled with point source reductions. The point sources identified in the Watershed are in the Silver Lake sub-watershed, Reichhold Chemicals and Dover Mckee Run Power Plant.

The studies reviewed state that the current condition of the Watershed is of degraded quality. Water quality samples have shown that the impairments (parameters) listed in Table 2 affect approximately 35.6 miles of streams and 208 acres of ponds (Figure 5). These impairments are primarily caused by non point sources (DNREC, 2006). Silver Lake has been impaired by planktonic algae. Moores Lake has also been impaired by planktonic algae to a lesser degree than Silver Lake. Data has not been provided for Wyoming Lake. The segments included in Table 2 (1998, 2002, 2004 and 2006 Draft 303(d) Lists) were listed as impaired by pollutants. Impairments include dissolved oxygen (DO), nutrients, and bacteria.

Land use changes affect the amount of pollution entering watersheds. Land use changes in the St. Jones River Watershed have been trending toward more development (conversion) of agricultural and forested lands. While grasslands contribute the highest annual nutrient load for nitrogen, development contributes the second highest with septic systems third highest (Volk, Jennifer). Annual phosphorous loads are highest from septic systems while grassland is second and development fourth (agriculture supplies the third highest annual phosphorous load). The nutrient loads from development are from urban stormwater runoff. The runoff takes excess fertilizer into the waterbodies.

Table 2 – Miles of Impaired Waterbodies within St. Jones River Watershed under the EPA 303(d) Guidelines

Sub-watershed	Segment	Length/ Size (miles)	Impairments	Probable Source
St. Jones	Lower St. Jones	8.3	Bacteria, DO**, nutrients	NPS*
Tidbury Creek	Tidbury Branch	3.8	Bacteria, DO, nutrients	NPS
	Derby Pond	23.1	Bacteria, nutrients	NPS
Isaac Branch	Isaac Branch	9.1	Bacteria, DO, nutrients	NPS
	Moores Lake	27.1 ac	Bacteria, DO, nutrients	NPS
Silver Lake	Upper St. Jones	6.7	Bacteria, DO, nutrients	NPS
	Fork Branch	7.7	Bacteria, DO, nutrients	NPS
	Silver Lake	157.8 ac	Bacteria, nutrients	NPS

Adapted from DNREC report "St. Jones River Watershed Proposed TMDLs," dated August 2006.

*NPS-non-point source
**DO-low dissolved oxygen

INSERT FIGURE 5 EPA 303(D) TMDL IMPAIRED STREAMS

In areas of Kent County, ground and surface waters are generally directly connected. This connection allows nutrients from septic systems to reach surface waters through groundwater discharges. Cumulative impacts of onsite wastewater treatment and disposal systems (OWTDS) is a major concern in Delaware and presumably in Kent County as well (Gerner, Jay).

Reducing nitrogen and phosphorous concentrations from septic systems by connecting to municipal systems, or using performance based systems, was identified by DNREC as a desirable path to reduce nutrient loads in ground and surface waters. In addition, DNREC identified using BMPs in urban areas, such as wet and dry ponds, infiltration and constructed wetlands, to reduce nutrient loads from development (Greer, Randy).

To characterize the current condition of the Watershed four (4) elements were assessed including current reports, geospatial data, current regulations, and field review of the actual stream bodies. Based on the elements reviewed, identified conditions causing the impairments in the Watershed include:

1. Undersized culverts downstream from development;
2. Lack of Riparian Buffer area;
3. Point source discharge pollutant problems;
4. Older developments without stormwater quality best management practices;
5. Uncontrolled stormwater runoff - severe channel erosion;
6. Lack of infiltration basins;
7. Isolated wetland loss due to lack of regulations; and
8. Agricultural nutrient loading.

The impairments that have been described in the studies, reports and field work reviewed for the Watershed could be reduced through watershed management water quality (WMWQ) techniques and upland restoration projects within and around urban areas. Approaches to pollutant reduction include:

- Tree Planting, additional native landscaping;
- Stormwater pond maintenance or creation or bioretention;
- Impervious cover removal;
- On-site stormwater management (e.g., rain barrels, rain gardens, green rooftops);
- Creation/Restoration of Upland Buffers;
- Wetland/Floodplain Creation and/or Restoration;
- Stormwater Infiltration;
- Stream Channel Improvements;
- Preservation of Streams, Wetlands, Floodplains, and Buffers; and
- Flood Control.

The Baseline Assessment indicated various sources and types of water quality impairment. Table 3 shows a summary of the build out projections for the sub-watersheds shown in Figure 4. With land uses projected to continue to change (develop) especially in particular sub-watersheds, the Watershed could benefit from pollution control strategies including urban retrofit and the WMWQ technologies. Agricultural best management practices, a separate initiative by DNREC, would also benefit the Watershed. Local planning and regulatory agencies could benefit from assistance from DNREC and other stakeholders in developing local planning documents and programs (both regulatory and project implementation) directed toward pollution control.

D. POLLUTION CONTROL OPPORTUNITIES

Potential pollution control opportunities to improve or prevent water quality impairment within the St. Jones River Watershed were identified and evaluated for each of the major sub-watersheds and urban areas within the Watershed. Twenty-six (26) WMWQ technology opportunities and 132 upland opportunities (total of 158 opportunities) were identified, screened, scored, and prioritized. [For the WMWQ sites, parcels 12 and 13 are combined to one (1) site.] An additional five (5) potential corridors for preservation/land management opportunities were also identified (Figure 6). Details of the methods used and findings are included in the "Pollution Control Opportunities Technical Memorandum," dated October 2008.

The Baseline Assessment identified several practices that could reduce pollution in the Watershed. Sites were selected in the Watershed to evaluate the various practices. Upland target areas included opportunities such as retrofitting existing sites with revised best management practices (e.g., bioswales, bioretention) and select neighborhood and hotspot sites that could increase water quality protection by using different site or land management practices. The upland sites were ranked from high to low priority (Table 4). The WMWQ sites were evaluated for six (6) technologies, which focused on wetland/floodplain restoration and creation, buffers, infiltration, and preservation. The WMWQ sites were scored and then ranked by Watershed-wide, sub-watershed, technology, and site. Table 5 shows Watershed wide rankings for total WMWQ scores and individual WMWQ technology scores for each site evaluated.

The Baseline Assessment indicated that Silver Lake is projected to reach 20% impervious more quickly than the other sub-watersheds. Silver Lake is currently at 15.7 % impervious and future development would be in the lower portion of the sub-watershed associated with the City of Dover. This growth in urban land use will likely be accompanied by additional impervious cover and possible increase in pollutants entering the Watershed. In addition Silver Lake has the smallest amount of protected open space of the sub-watersheds. Silver Lake sub-watershed contains the highest number (122) of pollution control opportunities in the Watershed. Within the City of Dover, ninety (90) upland opportunities were explored and thirteen (13) opportunities were found in the areas outside of the City of Dover. Nineteen (19)

potential WMWQ sites were also evaluated. In addition, significant headwater preservation corridors for the Penrose and Fork Branch were identified as well.

Table 3 – Sub-Watershed Potential Future Land Use Statistics and Existing Protected Lands

	SUB-WATERSHED			
	St. Jones	**Tidbury Creek**	**Issac Branch**	**Silver Lake**
Current Impervious (acres)	1,616.9 (9.8%)	660.5 (10.4%)	922.4 (10.2%)	3,868.0(15.7%)
Designated Open Space (Protected Lands in acres)	5,236.2 (31.6%)	349 (5.5%)	1,144.5 (12.6%)	878.7 (3.6%)
Future Impervious Cover (acres)	3,874.3 (23.3%)	1,752.8 (27.6%)	1,987.7 (22.0%)	5,122.4 (20.8%)

*Statistics derived from the build out projection completed for the Baseline Assessment.

Table 4 – Recommended Upland Sites by Target Area, Rank and Sub-Watershed

Rank	Project ID	Sub-Watershed	Municipality	Name
High	R19c	Silver Lake	Dover	Dover High School
	R30a	Silver Lake	Dover	DE Agricultural Museum
	R48a	Silver Lake	Dover	Carroll's Corner Shop Cntr
	R31c	Silver Lake	Dover	Legislative Hall
	R41a	Silver Lake	Dover	Holy Cross
	R19e	Silver Lake	Dover	Dover High School
	R14c	Silver Lake	Dover	DE Tech & Comm College, Terry Campus
	R14d	Silver Lake	Dover	DE Tech & Comm College, Terry Campus
	R19b	Silver Lake	Dover	Dover High School
	R29c	Silver Lake	Dover	Fairview Elementary School
	R8a	Silver Lake	Dover	Super Fresh
	R34a	Silver Lake	Dover	Schutte Park
	R56A	St. Jones		Carlton and Frear Middle School
	N53	Silver Lake	Dover	Chatham Cove
	N56	Silver Lake	Dover	Silver Mill
	N49	Silver Lake	Dover	Capitol Green 1
	N78	Silver Lake		Rodney/ May/Cross/ Wedge
	N36	Silver Lake	Dover	Woodcrest
	N52	Silver Lake	Dover	Lake Club Apartments
	N77	Silver Lake	Dover	Woodbrook/Sherwood
	N38	Silver Lake	Dover	Fairview
	N55	Silver Lake	Dover	Overlook on Silver Lake
	N54	Silver Lake	Dover	East Lake Gardens
	N11	Silver Lake	Dover	Baltray
	N66	Silver Lake	none	Hunter's Pointe
	N131	Tidbury Creek	none	Brookfield
	N94	Isaac Branch	none	Shady Ln / Greenview/Blades
	N92	St. Jones	none	Pennwood 1

	H505	Silver Lake	Dover	State Police Station/Museum
	H510	Silver Lake	Dover	Public Works Yard (P2)
	H506	Silver Lake	Dover	City Public Works Yard
Med.	R13a	Silver Lake	Dover	Modern Maturity
	R26a	Silver Lake	Dover	Target
	R22a	Silver Lake	Dover	William Henry MS / Booker T Washington ES
	R8b	Silver Lake	Dover	Super Fresh
	R19a	Silver Lake	Dover	Dover High School
	R26b	Silver Lake	Dover	Target
	R106a	Silver Lake	??	Taco Bell
	R502a	Silver Lake	Dover	Wawa
	R23a	Silver Lake	Dover	Dover Central Middle School
	R29a	Silver Lake	Dover	Fairview Elementary School
	R48b	Silver Lake	Dover	Carrolls Corner Shop. Cntr
	R64c	Silver Lake	Dover	Blue Hen Corporate Center
	R201a	Silver Lake	Dover	Women's Health Center
	R530a	Silver Lake	Dover	Frear Federal Building
	R501a	Silver Lake	Dover	US Gas
	R64b	Silver Lake	Dover	Blue Hen Corporate Center
	R101a	Silver Lake	Dover	City Hall
	R13b	Silver Lake	Dover	Modern Maturity
	R25b	Silver Lake	Dover	Edgehill Shopping Center/State Library
	R41c	Silver Lake	Dover	Holy Cross
	R64a	Silver Lake	Dover	Blue Hen Corporate Center
	R108a	Silver Lake	Dover	La Tonalteca
	R505b	Silver Lake	Dover	State Police Museum
	R31b	Silver Lake	Dover	Legislative Hall
	R500a	Silver Lake	Dover	St Andrews Lutheran Church
Med	R25c	Silver Lake	Dover	Edgehill Shopping Center/State Library
	R105a	Silver Lake	Dover	Burger King
	R510a	Silver Lake	Dover	Harvest House
	R26c	Silver Lake	Dover	Target
	R505a	Silver Lake	Dover	State Police

				Museum
	R31a	Silver Lake	Dover	Legislative Hall
	R48c	Silver Lake	Dover	Carrolls Corner Shopping Center
	R41b	Silver Lake	Dover	Holy Cross
	R16c	Silver Lake	Dover	McKee Business Park
	R102a	Silver Lake	Dover	Merrill Lynch
	R42a	Silver Lake	Dover	South Dover Elementary School
	R43a	Silver Lake	Dover	Bay Court Plaza
	R50a	Tidbury Creek	Camden	Nellie Hughes Stokes Elementary School
	R54a	Isaac Branch	Wyoming	Caesar Rodney High School
	R39a	Isaac Branch	None	Rodney Village Shopping Center
	R58a	Isaac Branch	Wyoming	WB Simpson Elementary
	N1	Silver Lake	Dover	Mill Creek
	N50	Silver Lake	Dover	Capitol Green 2
	N51	Silver Lake	Dover	Edgehill/Dover Heights
	N86	Isaac Branch	Wyoming	Chaplecroft
	N89	Isaac Branch	Wyoming	Wyoming Mills
	N114	Silver Lake	none	Capitol Park
	N139	St. Jones	none	Old Mill Acres
	N104	Isaac Branch	none	Kent Acres
	N173	Silver Lake	none	Quails Nest
	N4	Silver Lake	Dover	Maple Dale Retreat
	N178	Isaac Branch	none	Rockland Hills
	N202	Silver Lake	None	Meadow Ridge
	N3	Silver Lake	Dover	The Meadows
	N60	Silver Lake	none	Carlisle Village
	N84a	Isaac Branch	Wyoming	Railroad Ave 1
	N47	Silver Lake	Dover	Elm Terrace & State St
	N87	Isaac Branch	Wyoming	Pharsalia
Med	N134	St. Jones	none	Stonegate
	N175	Isaac Branch	None	Village of Wild Quail
	N176	Isaac Branch	None	Wild Quail
	N48	Silver Lake	Dover	Kent Ave

	N132	Tidbury Creek	none	Royal Grant
	N39	Silver Lake	Dover	Division St & Governors
	N145	St. Jones	None	Pleasant Hill
	N146	St. Jones	None	Eagle Meadows
	N63	Silver Lake	None	Foxhall
	H501	Silver Lake	Dover	US Gas
	H504	Silver Lake	none	Cheswold Recycle Center
	H302	Isaac Branch	none	Rodney Village Shopping Center
	H502	Silver Lake	Dover	Wawa
Low	R14a	Silver Lake	Dover	DE Tech & Comm College, Terry Campus
	R107a	Silver Lake	Dover	Del Taco
	R4a	Silver Lake	Dover	Kmart
	R10a	Silver Lake	Dover	Golden Corral
	R20a	Silver Lake	Dover	Proctor & Gamble North Building
	R27a	Silver Lake	Dover	Dover Mart
	R14b	Silver Lake	Dover	DE Tech & Comm College, Terry Campus
	R21a	Silver Lake	Dover	Proctor & Gamble South Building
	R19d	Silver Lake	Dover	Dover High School
	R200a	Silver Lake	none	A & H Uniform
	R501b	Silver Lake	Dover	US Gas
	N2	Silver Lake	Dover	Maple Glen Dr
	N84b	Isaac Branch	Wyoming	Railroad Ave 2
	N163	St. Jones	None	Point Landing/Riverside
	N21	Silver Lake	none	Zurkow Lots
	N129	Tidbury Creek	None	Wynn Wood
	N120	St. Jones	None	Windswept
	N69	Silver Lake	None	Rt 8 & Sharon Hill Rd
	N93	St. Jones	None	Grand Oaks
Low	N402	St. Jones	None	Pennwood 2
	N121	St. Jones	None	Burwood
	N123	Tidbury Creek	Camden	Barclay Farms
	H301	Silver Lake	Dover	Gas Station/U-Haul
	H303	Silver Lake	Dover	Car Zone
	H503	Silver Lake	none	Poors Energy Service

	H507	Silver Lake	Dover	Jiffy Lube
	H508	Silver Lake	Dover	Edgehill Shopping Center
	H500	Silver Lake	Dover	Auto Zone
	H509	Silver Lake	Dover	Self Wash/Wax

*Property owners have not been contacted as part of the preparation of this report.

Sub-Watershed Key
St. Jones
Tidbury Creek
Isaac Branch
Silver Lake

INSERT (excel) TABLE 5 WATERSHED WIDE TOTAL WMWQ SCORES RANKED HIGHEST TO LOWEST

INSERT FIGURE 6 POTENTIAL CORRIDORS FOR PRESERVATION OPPORTUNIITES (11X17)

St. Jones sub-watershed does not contain urban centers, therefore has limited upland opportunities (11) and limited, although potentially beneficial, WMWQ technology sites (3). The highest initial priority for this sub-watershed appears to be the potential preservation opportunities within the corridors identified.

Tidbury Creek and Isaac Branch sub-watersheds are also projected for significant growth. Although Tidbury Creek and Isaac Branch sub-watersheds may experience significant growth, limited WMWQ sites were found (1 and 3 sites respectively) and limited upland sites were found in and around the Cities of Camden (2) and Wyoming (7). There are no high ranking WMWQ sites in the headwaters where significant gains could be accomplished. Continued efforts for preservation and high priority (high return) urban retrofits are recommended for these sub-watersheds, in and around, the Cities of Camden/Wyoming.

II. WATERSHED PLAN GOALS AND RECOMMENDATIONS

A. ST. JONES RIVER WATERSHED PLAN GOALS

The purpose of the Watershed Plan is to identify pollutant sources and outline methods to reduce pollutant loads to the established TMDLs. The Watershed Plan will ultimately provide the State of Delaware with a prioritized list of pollution control opportunities within the Watershed. The opportunities presented are based on an extensive screening process specific to the Watershed.

In order to create a functional and defensible list of pollution control opportunities, the following objectives were identified for the Watershed Plan:

- Identify appropriate technologies that are accepted approaches used to improve water quality;
- Develop scoring criteria to be used to evaluate selected sites relative to the identified technologies;
- Develop scoring values that are properly weighted to measure the value and feasibility of the sites;
- Obtain sufficient desktop information to allow each site to be evaluated;
- Perform a site reconnaissance for each site to gain additional site-specific insight and verify desktop assumptions; and
- Present the findings in a useable format allowing the end user to quickly identify appropriate pollution control sites when funding is available.

Existing data was used as the primary source for characterizing the sub-watersheds (i.e., land use data). Additional data collection focused on identifying areas of impairments (i.e., field reconnaissance) and potential pollution control. Potential

types of restoration, enhancement, retrofit, and preservation opportunities have been identified in the following major categories for the Watershed:

- Stream/Riparian Buffers/Floodplains;
- Wetlands;
- Agricultural Best Management Practices;
- Urban Stormwater Retrofits;
- Urban Sub-watershed Site Reconnaissance; and
- Conservation Easements or Acquisitions.

A goal of the Watershed Plan is to identify and prioritize potential restoration, preservation, or improvement projects within the respective Watershed for implementation by DNREC and others. A goal of the Implementation Plan is to provide a framework for approaching pollution control on a watershed basis as well as sub-watershed basis, a technology basis, and jurisdictional basis. In addition, projects that may be eligible for 319(b) funds will be identified for DNREC's use in submitting grant applications.

B. IMPLEMENTATION RECOMMENDATIONS

Improvements to the Watershed will be dependent on participation from a myriad of stakeholders/users, funding from a variety of sources with different mandates, and level of improvements anticipated versus the feasibility and cost of implementation. To accommodate these varied considerations, recommendations for implementation are presented in the following general categories:

- Watershed wide
- Sub-watershed
- Technology
- Jurisdiction

In presenting the strategy in this format, decision makers can identify priorities for the identified opportunities on several bases and levels, and present the strategy to various users/funding agents tailored to those specific objectives.

In general for the Watershed, based on the types and locations of impairments, the communicated pollutant reduction goals, and types and locations of opportunities identified, strategies for pollution control are presented according to these general categories.

III. CURRENT AND RECOMMENDED WATERSHED MANAGEMENT PRACTICES

As part of the Baseline Assessment, the CWP produced a memorandum titled "Local Regulatory and Program Audit of Jurisdictions in the St. Jones Watershed," dated June 20, 2008 (CWP audit memorandum). The audit was performed for two (2) jurisdictions in the Watershed: Kent County and the City of Dover. The audit is intended to (1) identify existing local regulations and programs that should be used to support watershed restoration and protection strategies, and (2) to highlight gaps and weaknesses in the local ordinances and regulations with respect to pollution control prevention. The jurisdictions of Camden, Wyoming, Bowers Beach and Magnolia were not included in this assessment simply due to budgetary limitations; however, many of the recommendations for the evaluated municipalities will likely be similar to the regulations for the municipalities which were not evaluated.

The findings and recommendations provided in the CWP audit memorandum are intended to serve as guidance for the Watershed planning team, interested stakeholders, and local jurisdictions throughout the Watershed planning process. This evaluation did not cover the full suite of potential program options and alternatives available to the jurisdictions, rather it recommends which existing tools should be further utilized and suggests possible remedies for existing gaps in the programs and regulations.

The comprehensive plans and zoning ordinances reviewed were up to date for the entities of Kent County and City of Dover. In general, plans and regulations should offer more protection for wetlands, contiguous and large forest stands, 100-year floodplain and farms. Codes should be updated to promote cluster development, require open space, buffers on streams (intermittent and ephemeral), protect isolated freshwater wetlands, and promote native vegetation. In addition, conservation/protection work should be done with the Silver Lake Commission and a county wide greenway that connects forests and corridors should be continued.

Table 6 lists the summary of audit findings.

A. WATERSHED PROTECTION PRACTICES

The CWP audit memorandum lists recommendations for the Watershed planning process. In general, Watershed planning or Watershed boundaries should be taken into consideration in the comprehensive planning of the individual jurisdictions. Additionally, there is necessity of consistent protection, definition and requirements for aquatic buffers. Build out projections for Silver Lake, St. Jones and Isaac Branch show that they are the sub-watersheds that may experience high amount of future development. St. Jones has the highest amount of protected open space and lowest current impervious cover. As such, the planning for these sub-watersheds should focus on the recommended protections (critical areas, buffers, floodplain, open space, wetlands) and encourage conservation practices (green infrastructure, green building, on site stormwater management) and prioritize retrofits for business and neighborhoods identified in the Pollution Control Strategies.

B. MUNICIPAL PRACTICES AND PROGRAMS

1. TOWNS OF CAMDEN AND WYOMING

The Towns of Camden and Wyoming were not individually audited for the supporting regulations and ordinances. It has been assumed that the recommendations listed for the City of Dover and Kent County will apply to the Towns of Camden and Wyoming.

Table 6 – Summary of Audit Findings for Kent County and the City of Dover

Category	Overall Findings	Recommendations
Land Use Planning	• Comprehensive plans are in place and are regularly updated. • Some natural resource protections exist. • Silver Lake is a "Designated Watershed."	• Incorporate the watershed plan and recommendations from the draft plans. • Ensure that wetlands, contiguous forest stands, 100-year floodplain, and farms are fully protected from development. • Work with Silver Lake Commission to ensure additional protection in this watershed.
Land Conservation	• Kent County Conservancy (KCC) manages easements for the jurisdictions. • St. Jones Greenway Commission works to enhance natural resources and educate the public.	• Work with KCC to increase conservation easements. • Continue working with the Commission to develop a county-wide greenway system that connects all jurisdictions and provides continuous forest/greenway corridors.
Aquatic Buffers	• Aquatic buffer protection varies and does not always include wetlands. • Native vegetation in the buffer is currently encouraged. • The term "buffer" is sometimes used interchangeably with "setback."	• Adopt standard buffer regulations that include intermittent and ephemeral streams and all wetlands. Increase this buffer in the Silver Lake watershed and around sensitive, isolated freshwater wetlands. • Require native vegetation and demarcation, signs and physical barriers on development site to prevent encroachment. • Define aquatic buffer to ensure it is not seen as simply a setback.
Site Design	• Where cluster developments are allowed, they require additional steps/permits. • Dover did not complete a Code and Ordinance Worksheet (COW).	• Cluster development should be a by-right form of development. • Complete the COW and update codes to reflect better site design practices (Dover).
Sediment Control and Stormwater Management	• Delaware state sediment and stormwater regulations are being updated. • On-lot flagging of limits of disturbance (LOD) is not required.	• Adopt or refer to these updated regulations, when approved. • Ensure limited disturbance and protection of on-site natural resources by requiring demarcation and flagging of the LOD.
Non-Stormwater Discharges	• Discharges into a watercourse of industrial wastes, sewage, or other harmful substances are generally prohibited.	• Define and limit allowable discharges. • Assume legal authority and detail the enforcement measures and penalties in ordinances that address non-stormwater discharges.
Watershed Stewardship	• St. Jones Tributary Action Team completed a Pollution Control Strategy in 2007. • Pollution prevention plans for businesses, additional street sweeping, and public education are needed.	• Work with local stakeholders to craft pollution prevention plans for municipal, industrial, and commercial facilities. • Increase street sweeping efforts, particularly during the spring and fall. • Work with DNREC to publish its educational brochures on local jurisdiction websites.

2. CITY OF DOVER

The City of Dover was audited by the CWP and detailed recommendations can be found in the CWP audit memorandum. However, notable recommendations are:

- Recognize that Silver Lake sub-watershed has the highest current impervious cover, lowest amount of protected open space and one of the highest potential future growths in the Watershed according to build out projections. These trends could substantially impact the water quality if proper planning and regulation is not in place;
- Target infill and redevelopment areas for stormwater management;
- Target pollution control measures around Silver Lake;
- Clearly define and possibly expand aquatic buffer requirements; and
- Adopt local conservation practices to protect natural resources such as wetlands, aquatic buffers, and forested lands.

3. KENT COUNTY

Kent County was audited by the CWP and detailed recommendations can be found in the CWP audit memorandum. However, notable recommendations are:

- Integrate watershed, impaired waters, and green infrastructure maps into the natural resources section of the Comprehensive plan update;
- Clearly define and possibly expand aquatic buffer requirements;
- Consider streamlined review and permitting for green build projects;
- Provide specific management recommendations for the Kent Conservation District related to vegetative maintenance;
- Encourage on-site stormwater treatment;
- Require pollution prevention plans for hotspot areas (found in the Pollution Control Opportunities); and
- Continue to encourage alternative septic systems that remove a greater percentage of pollutants.

C. CONSERVATION/PRESERVATION PRACTICES

Preservation and management is among one of the oldest, simplest, often most used water pollution control technologies. Based on the Baseline Assessment, the Silver Lake and Tidbury Creek sub-watersheds have a relatively low amount of preservation and related land management efforts relative to other sub-watersheds. Much of this can be explained by the type of land ownership and the amount of urban and suburban land use within the Watershed.

This report evaluated specific parcels for preservation. In addition, this report identified proposed preservation corridors, which are blocks of parcels along streams that appear to have greater value and benefits for preservation than other areas within the Watershed. The corridors were identified with a focus on expanding/extending existing land masses of currently preserved and/or managed lands, and preserving large areas that have a significant need for preservation that has little preservation currently in place. The intent of delineating a corridor was to identify locations to focus potential preservation opportunities, as well as other pollution control opportunities. Appropriate sites need to be identified within the corridors.

Of the 26 sites evaluated, the site scores varied greatly for the preservation of streams, wetlands, floodplains, and buffers opportunities. Four (4) sites were identified to have the greatest opportunities. These sites were: Site 12/13 within the Silver Lake sub-watershed; Sites 21 and 23 within the Isaac Branch sub-watershed; and Site 27 within the St. Jones sub-watershed. No optimal preservation sites were identified within the Tidbury Creek sub-watershed.

Potential preservation corridors were identified in each sub-watershed; four (4) of the five (5) preservation corridors were located within rural areas at or near headwaters of the sub-watersheds (Figure 6). One preservation corridor was located in the St. Jones sub-watershed and was associated with a small headwater drainage that is in close proximity to preserved tidal waters (Corridor No. 5).

D. UPLAND RESTORATION PRACTICES

Silver Lake sub-subwatershed has one of the highest potential projected future urban growth (Table 3). In addition, it has the most urbanized areas in the four sub-watersheds. Silver Lake contains the most opportunities for water quality improvements. As such, strategies for these sub-watersheds should focus on existing sites that do not have pollution control measures installed (i.e., neighborhoods that do not have management ponds) in addition to ensuring proposed neighborhoods and urban development areas meet criteria for reducing pollution. The potential upland restoration opportunities have been ranked by High/Medium/Low potential/benefit and it is recommended to refer to this prioritization for these technologies and within these sub-watersheds (Table 4).

E. WATERSHED MANAGEMENT WATER QUALITY PRACTICES

WMWQ technology opportunities were identified in all of the sub-watersheds. The sub-watershed of St. Jones does not contain urban centers. Therefore pollution control opportunities which appear most beneficial appear to be the WMWQ technology sites which are outside of urban centers. Implementation of the WMWQ opportunities (several high priority sites) in conjunction with upland restoration opportunities could cumulatively provide greater benefits for the Silver Lake, Tidbury Creek, and Isaac Branch sub-watersheds. Priority ranking for these WMWQ

opportunities is also provided and recommended to be utilized in the pollution control strategy for these sub-watersheds (Table 5).

F. POLLUTION PREVENTION AND SOURCE CONTROL EDUCATION

Education is an important component in the Watershed Plan. Current activities such as the Nutrient Management Act have been beneficial in educating the Agricultural community to the watershed benefits of nutrient management. In the urbanized areas, efforts directed to existing land users on the benefits of retrofits and site management/maintenance activities would be beneficial for the Watershed. Additional education concerning the preservation and conservation easement aspects of the benefits for this Watershed could help landowners with the decision of preserving land and working with the agencies that provide funding avenues. It would appear that the initial efforts of the TAT, DNREC and other stakeholders regarding pollution prevention and source control could be built upon as part of the Implementation Strategy. Strategies identified in this plan could help to refine and refocus those outreach activities and approaches.

IV. SUBWATERSHED MANAGEMENT STRATEGIES

This section details management strategies and implementation priorities for each sub-watershed. Restoration opportunities include different technologies that were evaluated in the Pollution Control Opportunities. Sub-watershed management maps are included, which show locations of restoration opportunities and priority projects. For detailed discussion of methods of selection evaluation and prioritization refer to the Pollution Control Opportunities Technical Memorandum.

The following subsections (subsections are based on sub-watershed unit) are divided into five parts:

Overall Characterization - Summary of current and future land use characteristics. Refer to the Baseline Assessment for more information.

Existing Sub-watershed Conditions - 303(d) listed water bodies and results of field assessments.

Potential Targeted Opportunities - A summary of broad types of approaches or technologies that could benefit the sub-watershed based on the impairments and types of land uses identified in the Baseline Assessment.

Pollution Control Opportunities - A summary of individual restoration opportunities identified and a description of implementation priorities. Projects are ranked as high, medium or low or scored based on stream conditions, ability to link with other projects, and overall feasibility (although it should be noted that actual implementation may not strictly adhere to this ranking).

Strategy Summary – An overview of the implementation strategy for the sub-watershed.

A. ST. JONES

Sub-watershed Characterization

The St. Jones sub-watershed is approximately 25.9 mi^2 (16,576 acres) and contains the lower portion of the St. Jones River. The southeastern portion of this sub-watershed is in the Lower St. Jones River Reserve (the Reserve). This sub-watershed has the largest percentage of protected lands 5,236 acres with the River Reserve totaling approximately 3,750 acres of the protected lands. The sub-watershed land use is dominated by agriculture (33%), followed by wetlands (25.5%), and residential lands (17.4%). The impervious cover in the sub-watershed is approximately 9.8% with a possible future impervious cover of 23%. Between 2002 and 2007 agricultural lands decreased by 4% and residential lands increased by 2.1%. Wetland slightly decreased by 0.7% as did forested land by 0.1%. Table 7 highlights the potential future impervious cover change that could adversely affect the sub-watershed.

Table 7 – St. Jones Sub-Watershed Potential Future Land Use Statistics and Existing Protected Land

St. Jones	
Current Impervious	1,616.9 acres (9.8%)
Designated Open Space (Protected Lands)	5,236.2 acres (31.6%)
Future Impervious Cover	3,874.3 acres (23.3%)

Summary of Existing Conditions

Table 2 contains the reaches included on the 303(d) impaired list. The sub-watershed benefits form the Reserve in the south; however, development in the upper portion has impaired the quality of the lower St. Jones River. Eight miles of the lower St. Jones is listed for bacteria, DO, and nutrients. The two (2) streams in the St. Jones sub-watershed, the Lower St. Jones and Cypress Branch that were completed during the field assessments scored as marginal overall. (For detail of field assessments see Baseline Assessment.)

Potential Targeted Opportunities

The St. Jones sub-watershed could benefit from:

- Additional preservation/restoration in the western area of the sub-watershed;
- Retrofits in the urbanized sections; and
- Water quality prevention (agricultural best management practices and other watershed management technologies) in the upper portion of the sub-watershed.

Summary of Pollution Control Opportunities

The St. Jones is primarily comprised of tidally influenced areas and protected lands. Ten upland target areas, primarily neighborhoods, were identified in this sub-watershed. High priority rankings were given to (R56a) John S Carlton and Allen Frear Middle Schools (stormwater retrofit) and (N92) Pennwood 1 neighborhood (Table 8). There are three (3) potential sites for which WMWQ technologies were evaluated. The highest scores for WMWQ technologies were for wetland/floodplain creation or restoration and infiltration. Site 32 (Cypress Glenn) also scored third highest in the Watershed for preservation of streams wetlands and buffers (Table 9). As noted in Figure 8, one (1) potential preservation corridor is located at the downstream end of the sub-watershed.

Table 8 – Recommended Upland Sites by Target Area and Rank within the St. Jones Sub-watershed Retrofit

Retrofit					
Rank	ID	Sub-watershed	Municipality	Name	Description
High	R56a	St. Jones	none	John S Carlton & Allen Frear Middle Schools	Convert rock-lined channel to bioswale

	Neighborhood								
Rank	**ID**	**Sub-Watershed**	**Municipality**	**Name**	Onsite Retrofit	Better Yard Mgmt	Common Space Mgmt	Pond Retrofit	Parking Lot Retrofit
High	N92	St. Jones	none	Pennwood 1	X				
Med.	N139	St. Jones	none	Old Mill Acres	X		X		
	N134	St. Jones	none	Stonegate	X	X		X	
	N145	St. Jones	None	Pleasant Hill	X	X		X	
	N146	St. Jones	None	Eagle Meadows	X		X		
Med.	N163	St. Jones	None	Point Landing/Riverside	X		X		
	N120	St. Jones	None	Windswept					
	N93	St. Jones	None	Grand Oaks	X	X			
	N402	St. Jones	None	Pennwood 2	X				
	N121	St. Jones	None	Burwood	X				

*Property owners have not been contacted as part of the preparation of this report.

INSERT FIGURE 7 ST. JONES SUB-WATERSHED POLLUTION CONTORL OPPORTUNITIES (11X17)

INSERT (excel) TABLE 9 -TOTAL WMWQ TECHNOLOGY SCORES FOR ST. JONES SUB-WATERSHED

INSERT FIGURE 8 –ST. JONES SUB-WATERSHED POTENTIAL CORRIDORS FOR PRESERVATION OPPORTUNITIES (11X17)

B. TIDBURY CREEK

Sub-watershed Characterization

Tidbury Creek is the smallest sub-watershed with 9.92 mi^2 (6,348 acres). This sub watershed has a high percentage of residential land (26.5%) and impervious cover 10%. This sub-watershed has the largest percentage of urban/commercial/residential area, approximately 36%. A very small portion of the sub-watershed is protected lands 349 acres or 5.5%. The sub-watershed land use is dominated by agriculture (43.4%), followed by residential (26.5%), forest (8.2%), and wetlands (7.3%). The possible future impervious cover of 27.6% is very high for a small sub-watershed. Between 2002 and 2007 agricultural lands decreased by 11.9% and residential lands increased by 6.8%. Wetland slightly increased by 0.2% forested lands slightly decreased by 0.6%. Table 10 highlights the potential future impervious cover change that could adversely affect the sub-watershed.

Table 10 – Tidbury Creek Sub-Watershed Potential Future Land Use Statistics and Existing Protected Land

Tidbury Creek	
Current Impervious	660.5 acres (10.4%)
Designated Open Space (Protected Lands)	349 acres (5.5%)
Future Impervious Cover	1,752.8 acres (27.6%)

Summary of Existing Conditions

Tidbury Branch and Derby Pond are the only 303(d) listed water bodies in the sub-watershed (Table 2). The impairments include bacteria and nutrients for the Derby Pond and bacteria, nutrients, and low dissolved oxygen for Tidbury Branch.

Tidbury, Red House, and Newell Branches were surveyed during the field assessments. The lowest overall score of the Watershed was from Tidbury Branch (Team 8). Tidbury Branch (Team 9) and Newell Branch both scored sub-optimally overall. Red House had the highest overall score in the entire St. Jones River Watershed. (For detail of field assessments see Baseline Assessment.)

Potential Targeted Opportunities

The Tidbury Creek sub-watershed could benefit from:

- Additional preservation/restoration in the eastern portion;
- Retrofits in the urbanized sections;
- Agricultural best management practices; and
- Water quality prevention (other watershed management technologies) in the upper portion of the sub-watershed.

Summary of Pollution Control Opportunities

Within the Tidbury Creek sub-watershed, three (3) upland opportunities were identified and only one (1) potential WMWQ technology opportunity site was identified (Table 11 and 12, Figure 9). The most suitable WMWQ opportunity for site 26 is infiltration, followed by creation/restoration of upland buffers; wetland/floodplain creation and/or restoration. The upland site of high rank is N31 Brookfield neighborhood; the upland sites of medium rank are R50a Nellie Hughs Stokes Elementary School and N132 Royal Grant neighborhood. One (1) potential corridor for preservation was noted within the headwaters of the Watershed (Figure 10).

Table 11 – Recommended Upland Sites by Target Area and Rank within the Tidbury Creek Sub-watershed

	Neighborhood								
Rank	**ID**	**Sub-Watershed**	**Municipality**	**Name**	Onsite Retrofit	Better Yard Mgmt	Common Space Mgmt	Pond Retrofit	Parking Lot Retrofit
High	N131	Tidbury Creek	none	Brookfield	X	X	X		
Med.	N132	Tidbury Creek	none	Royal Grant	X	X			
Low	N129	Tidbury Creek	None	Wynn Wood					

*Property owners have not been contacted as part of the preparation of this report.

INSERT FIGURE 9 Tidbury Creek SUB-WATERSHED POLLUTION CONTORL OPPORTUNITIES (11X17)

INSERT (excel) TABLE 12 -TOTAL WMWQ TECHNOLOGY SCORES FOR Tidbury Creek SUB-WATERSHED

INSERT FIGURE 10 –Tidbury Creek SUB-WATERSHED POTENTIAL CORRIDORS FOR PRESERVATION OPPORTUNITIES (11X17)

C. ISAAC BRANCH

Sub-watershed Characterization

Isaac Branch sub-watershed is the second smallest sub-watershed with 14.14 mi^2 (9,049 acres). This sub-watershed has a high percentage of residential land (22%) and impervious cover 10%. A modest sized portion of the sub-watershed is protected lands at 1,144.5 acres or 12.6%. The sub-watershed land use is dominated by agriculture (52.8%), followed by residential (22.2%), forest (7.5%), and wetlands (6.3%). The possible future impervious cover of 22% is very high for a small sub-watershed. Between 2002 and 2007 agricultural lands decreased by 3.8% and residential lands increased by 2.8%. Wetland slightly increased by 0.2% forested lands slightly decreased by 0.4%. Table 13 highlights the potential future impervious cover change that could adversely affect the sub-watershed.

Table 13 – Isaac Branch Sub-Watershed Potential Future Land Use Statistics and Existing Protected Land

Isaac Branch	
Current Impervious	922.4 acres (10.2%)
Designated Open Space (Protected Lands)	1,144.5 acres (12.6%)
Future Impervious Cover	1,987.7 acres (22.0%)

Summary of Existing Conditions

Nine miles of Isaac Branch and Moores Lakes are listed as impaired on the 303(d) list (see Table 2). The impairments include bacteria, nutrients, and low dissolved oxygen from non point sources.

Isaac and Almshouse Branches were surveyed during the field assessments. The scores were in the lower suboptimal range overall. (For detail of field assessments see Baseline Assessment.)

Potential Targeted Opportunities

The Isaac Branch sub-watershed could benefit from:

- Additional preservation in the central portion of the sub-watershed;

- Retrofits in the urbanized sections;
- Agricultural best management practices; and
- Water quality prevention (other watershed management technologies) in the upper portion of the sub-watershed.

Summary of Pollution Control Opportunities

Within the Isaac Branch sub-watershed, three (3) potential WMWQ technology opportunity sites and seven (7) upland target areas were identified (Tables 14 and 15, Figure 11). Site 23 had one of the highest WMWQ scores in the Watershed for preservation of streams wetlands and buffers. The three (3) WMWQ sites all scored high for infiltration and site 23 scored high for creation/restoration of upland buffers. The one (1) upland site of high rank is N94, Shady Lane neighborhood. There were several neighborhood sites with medium rank and one (1) hotspot of medium rank H302, Rodney Village Shopping Center. One (1) significant potential corridor for preservation was noted comprising the majority of the Watershed (Figure 12).

Table 14 – Recommended Upland Sites by Target Area and Rank within the Isaac Branch Sub-watershed

Retrofits					
Rank	**Project ID**	**Sub-Watershed**	**Municipality**	**Name**	**Description**
Med.	R39a	Isaac Branch	None	Rodney Village Shopping Center	Construct bioretention area to treat parking lot

Neighborhood									
Rank	**ID**	**Sub-Watershed**	**Municipality**	**Name**	Onsite Retrofit	Better Yard Mgmt	Common Space Mgmt	Pond Retrofit	Parking Lot Retrofit
High	N94	Isaac Branch	none	Shady Ln / Greenview/ Blades					
Med.	N104	Isaac Branch	none	Kent Acres	X	X			
	N178	Isaac Branch	none	Rockland Hills	X	X	X	X	
	N175	Isaac Branch	None	Village of Wild Quail	X	X			
	N176	Isaac Branch	None	Wild Quail	X	X			

Hotspots											
Rank	**ID**	**Sub-Watershed**	**Municipality**	**Name**	**Hotspot Status**	**Vehicle Operations**	**Outdoor Materials**	**Waste Management**	**Physical Plant**	**Turf / Landscaping**	**Stormwater Infrastructure**
Med.	H302	Isaac Branch	none	Rodney Village Shopping Center	Potential		X	X			X

*Property owners have not been contacted as part of the preparation of this report.

INSERT FIGURE 11 Isaac Branch SUB-WATERSHED POLLUTION CONTORL OPPORTUNITIES (11X17)

INSERT (excel) TABLE 15 -TOTAL WMWQ TECHNOLOGY SCORES FOR Isaac Branch SUB-WATERSHED

INSERT FIGURE 12 –Isaac Branch SUB-WATERSHED POTENTIAL CORRIDORS FOR PRESERVATION OPPORTUNITIES (11X17)

D. SILVER LAKE

Sub-watershed Characterization

The Silver Lake sub-watershed is the largest in the St. Jones River Watershed at approximately 38.4 mi^2 (24,576 acres) and contains the upper portion of the St. Jones River. This sub-watershed has a large percentage of urban/commercial/residential area, approximately 31%, with the smallest portion of protected lands at just 878 acres or 3.7%. The sub-watershed land use is dominated by agriculture (34%), followed by residential (22.3%), and wetlands (13.1%). The impervious cover in the sub watershed is approximately 15.7% with a possible future impervious cover of 20.8%. Between 2002 and 2007 agricultural lands decreased by 3% and residential lands increased by 2.5%. Wetland slightly increased by 0.5% forested lands slightly decreased by 0.6%. Table 16 highlights the potential future impervious cover change that could adversely affect the sub-watershed.

Table 16 – Silver Lake Sub-Watershed Potential Future Land Use Statistics and Existing Protected Land

Silver Lake	
Current Impervious	3,868.0 acres (15.7%)
Designated Open Space (Protected Lands)	878.7 acres (3.6%)
Future Impervious Cover	5,122.4 acres (20.8%)

Summary of Existing Conditions

Table 2 lists 303(d) impaired water bodies in the Silver Lake sub-watershed. The Upper St. Jones and Fork Branch are impaired due bacteria, low dissolved oxygen and nutrients. Silver Lake contains elevated bacteria and nutrients due to non point sources.

Fork, Penrose, and Cahoon Branches were surveyed during the field assessments. The branches scored suboptimal to optimal ranges. However, Cahoon scored the lowest overall for the sub-watershed.

Potential Targeted Opportunities

The Silver Lake sub-watershed could benefit from:

- Additional preservation/restoration at the upper end of the sub-watershed;
- Retrofits in the urbanized sections of the City of Dover; and
- Water quality prevention (agricultural best management practices and other watershed management technologies) in the upper portion of the sub-watershed.

Summary of Pollution Control Opportunities

Silver Lake sub-watershed had the highest number of opportunities for both WMWQ technologies and upland opportunities. The top five (5) sites within the entire Watershed for WMWQ technology opportunities are within the Silver Lake sub-watershed (Table 5). In addition, there are 12 upland sites (retrofit, neighborhood, and hotspot) with a high rank (Table 4).

Within the Silver Lake sub-watershed, outside of the City of Dover, nineteen (19) potential WMWQ technology opportunities and twelve (12) upland opportunities were identified (Tables 17 and 18 and Figure13). Sites 12/13, 18, and 16 had the top three (3) total WMWQ scores Watershed-wide. This sub-watershed offers the greatest opportunities within the Watershed. Two (2) potential corridors for preservation [one (1) for Penrose Branch and one (1) for Fork/Cahoon Branch] were noted within the headwaters of the Watershed (Figure 14).

Table 17 – Recommended Upland Sites by Target Area and Rank within the Silver Lake Sub-watershed

Retrofits					
Rank	**Project ID**	**Sub-Watershed**	**Municipality**	**Name**	**Description**
Med.	R106a	Silver Lake		Taco Bell	Create bioretention in existing depression
Low	R200a	Silver Lake	none	A & H Uniform	Remove portion of parking lot to reduce IC

Neighborhood									
Rank	**ID**	**Sub-Watershed**	**Municipality**	**Name**	Onsite Retrofit	Better Yard Mgmt	Common Space Mgmt	Pond Retrofit	Parking Lot Retrofit
High	N78	Silver Lake		Rodney/ May/Cross/ Wedge	X	X			
	N66	Silver Lake	none	Hunter's Pointe	X	X			
Med.	N114	Silver Lake	none	Capitol Park	X				
	N173	Silver Lake	none	Quails Nest	X	X		X	
	N202	Silver Lake	None	Meadow Ridge	X	X		X	
	N60	Silver Lake	none	Carlisle Village	X	X	X		
	N63	Silver Lake	None	Foxhall	X	X			
Low	N21	Silver Lake	none	Zurkow Lots	X				
	N69	Silver Lake	None	Rt 8 & Sharon Hill Rd	X	X	X	X	

Hotspots											
Rank	**ID**	**Sub-Watershed**	**Municipality**	**Name**	**Hotspot Status**	**Vehicle Operations**	**Outdoor Materials**	**Waste Management**	**Physical Plant**	**Turf / Landscaping**	**Stormwater Infrastructure**
Med.	H504	Silver Lake	none	Cheswold Recycle Center	Not					X	
Low	H503	Silver Lake	none	Poors Energy Service	Potential		X				

*Property owners have not been contacted as part of the preparation of this report.

INSERT FIGURE 13 Silver Lake SUB-WATERSHED POLLUTION CONTORL OPPORTUNITIES (11X17)

INSERT (excel) TABLE 18 -TOTAL WMWQ TECHNOLOGY SCORES FOR Silver Lake SUB-WATERSHED

INSERT FIGURE 14 –Silver Lake SUB-WATERSHED POTENTIAL CORRIDORS FOR PRESERVATION OPPORTUNITIES (11X17)

V. MUNICIPAL STRATEGIES

The following section provides recommended strategies for each of the municipalities within the Watershed:

- Kent County
- City of Dover
- Town of Camden
- Town of Wyoming

For ease in coordinating with each municipality, information for each is included as a separate section that can easily be pulled out for discussion and distribution.

In general, each municipality can play a role in reducing and preventing pollution in the Watershed. Each municipality can specifically work with DNREC and other related stakeholders to review and amend comprehensive plans and local ordinances/regulations to support pollution prevention and reduce existing impairments. Each jurisdiction can also assist in educating residents and business owners in the Watershed using demonstrated successful approaches and networks within the jurisdiction. And finally, the jurisdictions can serve as local sponsors or cooperating technical partners in pollution control opportunity project implementation as part of the overall implementation strategy.

A. KENT COUNTY

The sites that are listed in Tables 8, 11, 14, and 17 and shown on Figures 7, 9, 11, and 13 are outside of the jurisdictions of Dover, Camden, and Wyoming therefore fall under the jurisdiction of Kent County. These sites are divided into the four sub-watersheds. These sites are found within each of the four sub-watersheds. Kent County can serve in the following ways to improve water quality in the Watershed:

- Work with stakeholders to implement the opportunities identified within the jurisdictional boundaries;
- Work to coordinate regional approaches with the stakeholders to implement strategies for:
  - Site acquisitions;
  - Project implementation;
  - Comprehensive planning considering the recommendations made; and
  - Coordination with the municipalities within the Watershed for optimizing resources and “holistic” solutions.

- Participate in outreach and education programs.

B. CITY OF DOVER

Ninety (90) upland opportunities were identified (Table 19). The target areas with opportunities identified in Dover include: retrofits (60), neighborhoods (19), and hotspots (11).

City of Dover can serve in the following ways to improve water quality in the Watershed:

- Work with stakeholders to implement the opportunities identified within the jurisdictional boundaries;
- Support components of regional approaches to be undertaken within the jurisdiction with the stakeholders to implement strategies for:
  - Site acquisitions;
  - Project implementation;
  - Comprehensive planning considering the recommendations made; and
  - Coordination with Sussex County within the Watershed for optimizing resources and "holistic" solutions.
- Participate in outreach and education programs.

Table 19 – Recommended Upland Sites by Target Area and Rank in the City of Dover

Retrofits					
Rank	**Project ID**	**Sub-Watershed**	**Municipality**	**Name**	**Description**
High	R19c	Silver Lake	Dover	Dover High School	Rain garden at existing curb cut near greenhouses
	R30a	Silver Lake	Dover	DE Agricultural Museum	Convert existing dry pond to bioretention
	R48a	Silver Lake	Dover	Carroll's Corner Shop Cntr	Convert existing dry pond to bioretention
	R31c	Silver Lake	Dover	Legislative Hall	Construct vegetated swale and bioretention at edge of parking lot
	R41a	Silver Lake	Dover	Holy Cross	Convert dry pond to bioretention
	R19e	Silver Lake	Dover	Dover High School	Rain garden at existing curb cut around yard inlet
	R14c	Silver Lake	Dover	DE Tech & Comm College, Terry Campus	Add native plantings and soil amendments to create rain garden
	R14d	Silver Lake	Dover	DE Tech & Comm College, Terry Campus	Add native plantings and soil amendments to create rain garden
	R19b	Silver Lake	Dover	Dover High School	Minimal parking lot excavation to direct water into proposed bioretention area.
	R29c	Silver Lake	Dover	Fairview Elementary School	Downspout disconnection throughout property
	R8a	Silver Lake	Dover	Super Fresh	Convert existing dry pond to a large, passive bioretention area
	R34a	Silver Lake	Dover	Schutte Park	Construct bioretention area to treat parking lot
Med.	R13a	Silver Lake	Dover	Modern Maturity	Convert dry pond to bioretention
	R26a	Silver Lake	Dover	Target	Create bioretention area in last row of parking stalls
	R22a	Silver Lake	Dover	William Henry MS / Booker T Washington ES	Rain gardens located at downspouts; tree planting
	R8b	Silver Lake	Dover	Super Fresh	Convert existing grass channel to dry swale
	R19a	Silver Lake	Dover	Dover High School	Disconnect downspouts to rain garden to treat rooftop runoff
	R26b	Silver Lake	Dover	Target	Create bioretention area in last row of parking stalls
	R106a	Silver Lake		Taco Bell	Create bioretention in existing depression
	R502a	Silver Lake	Dover	Wawa	Convert existing dry pond into bioretention

Retrofits					
Rank	**Project ID**	**Sub-Watershed**	**Municipality**	**Name**	**Description**
	R23a	Silver Lake	Dover	Dover Central Middle School	Disconnect downspouts to adjacent pervious areas, and where possible to rain gardens
	R29a	Silver Lake	Dover	Fairview Elementary School	Rain gardens around inlets in back of school and depressional area near sidewalk
	R48b	Silver Lake	Dover	Carrolls Corner Shop. Cntr	Create bioretention to treat parking lot
	R64c	Silver Lake	Dover	Blue Hen Corporate Center	Create shallow wetlands in perimeter areas
	R201a	Silver Lake	Dover	Women's Health Center	Create grass filter strip at inlets in parking aisles
	R530a	Silver Lake	Dover	Frear Federal Building	Create bioretention at existing depressed area around inlet
	R501a	Silver Lake	Dover	US Gas	Create bioretention at existing depression to treat runoff from gas station and adjacent retail area
	R64b	Silver Lake	Dover	Blue Hen Corporate Center	Create landscaped islands to act as filter strips
	R101a	Silver Lake	Dover	City Hall	Disconnect existing downspouts and direct runoff into planting beds
	R13b	Silver Lake	Dover	Modern Maturity	Convert wet pond to wetland
	R25b	Silver Lake	Dover	Edgehill Shopping Center/State Library	Construct bioretention area to treat parking lot runoff
	R41c	Silver Lake	Dover	Holy Cross	Create vegetated swale with check dams to a bioretention area
	R64a	Silver Lake	Dover	Blue Hen Corporate Center	Remove impervious cover in farthest unused parking lots
	R108a	Silver Lake	Dover	La Tonalteca	Provide linear bioretention in existing depression
	R505b	Silver Lake	Dover	State Police Museum	Convert existing swale in front of museum to large bioretention
	R31b	Silver Lake	Dover	Legislative Hall	Create rain garden and tree pits
	R500a	Silver Lake	Dover	St Andrews Lutheran Church	Convert existing dry pond to bioretention
	R25c	Silver Lake	Dover	Edgehill Shopping Center/State Library	Construct bioretention area to treat parking lot runoff
	R105a	Silver Lake	Dover	Burger King	Remove portion of parking lot to reduce site

Retrofits					
Rank	**Project ID**	**Sub-Watershed**	**Municipality**	**Name**	**Description**
					impervious cover
	R510a	Silver Lake	Dover	Harvest House	Disconnect downspouts to pervious areas
	R26c	Silver Lake	Dover	Target	Create bioretention area in parking lot
	R505a	Silver Lake	Dover	State Police Museum	Install linear bioswale at existing grass shallow channel
	R31a	Silver Lake	Dover	Legislative Hall	Convert existing dry pond to bioretention
	R48c	Silver Lake	Dover	Carrolls Corner Shopping Center	Sand filters to treat stormwater before discharging into closed pipe system
	R41b	Silver Lake	Dover	Holy Cross	Disconnect 3 downspouts to bioretention area
	R16c	Silver Lake	Dover	McKee Business Park	Provide step pool outfall in place of existing rip-rap inlet
	R102a	Silver Lake	Dover	Merrill Lynch	Disconnect existing downspouts and direct runoff into planting beds
	R42a	Silver Lake	Dover	South Dover Elementary School	Downspout disconnection to a bioretention area
	R43a	Silver Lake	Dover	Bay Court Plaza	Remove impervious cover in front parking area
Low	R14a	Silver Lake	Dover	DE Tech & Comm College, Terry Campus	Convert tax ditch to swale by constructing check dams and adding native vegetation
	R107a	Silver Lake	Dover	Del Taco	Create bioretention in existing depression
	R4a	Silver Lake	Dover	Kmart	Create bioretention cells as landscape islands, aligned with existing inlets
	R10a	Silver Lake	Dover	Golden Corral	Convert dry pond to wetland
	R20a	Silver Lake	Dover	Proctor & Gamble North Building	Retrofit existing rooftop with a green roof
	R27a	Silver Lake	Dover	Dover Mart	Impervious cover reduction
	R14b	Silver Lake	Dover	DE Tech & Comm College, Terry Campus	Construct infiltration practice/wetland in tax ditch
	R21a	Silver Lake	Dover	Proctor & Gamble South Building	Retrofit existing rooftop with a green roof
	R19d	Silver Lake	Dover	Dover High School	Grid pavers at bare soil / rutted parking area
	R501b	Silver Lake	Dover	US Gas	Install perimeter sand filter across front of site

	Neighborhood								
Rank	**ID**	**Sub-Watershed**	**Municipality**	**Name**	Onsite Retrofit	Better Yard Mgmt	Common Space Mgmt	Pond Retrofit	Parking Lot Retrofit
High	N53	Silver Lake	Dover	Chatham Cove	X		X		X
	N56	Silver Lake	Dover	Silver Mill	X			X	X
	N49	Silver Lake	Dover	Capitol Green 1	X				
	N36	Silver Lake	Dover	Woodcrest	X				
	N52	Silver Lake	Dover	Lake Club Apartments	X	X	X		X
	N77	Silver Lake	Dover	Woodbrook /Sherwood	X	X		X	
	N38	Silver Lake	Dover	Fairview					
	N55	Silver Lake	Dover	Overlook on Silver Lake	X	X			
	N54	Silver Lake	Dover	East Lake Gardens	X	X			
	N11	Silver Lake	Dover	Baltray	X	X			
Med.	N1	Silver Lake	Dover	Mill Creek	X	X	X		
	N50	Silver Lake	Dover	Capitol Green 2	X				
	N51	Silver Lake	Dover	Edgehill/Dover Heights	X				
	N4	Silver Lake	Dover	Maple Dale Retreat	X	X			
	N3	Silver Lake	Dover	The Meadows	X	X			
	N47	Silver Lake	Dover	Elm Terrace & State St	X				
	N48	Silver Lake	Dover	Kent Ave					
	N39	Silver Lake	Dover	Division St & Governors					
Low	N2	Silver Lake	Dover	Maple Glen Dr	X	X		X	

Hotspots											
Rank	**ID**	**Sub-Watershed**	**Municipality**	**Name**	**Hotspot Status**	**Vehicle Operations**	**Outdoor Materials**	**Waste Management**	**Physical Plant**	**Turf / Landscaping**	**Stormwater Infrastructure**
High	H505	Silver Lake	Dover	State Police Station/Museum	Potential	X					
	H510	Silver Lake	Dover	Public Works Yard (P2)	Potential		X				
	H506	Silver Lake	Dover	City Public Works Yard	Potential	X					X
Med.	H501	Silver Lake	Dover	US Gas	Severe	X	X	X	X		X
	H502	Silver Lake	Dover	Wawa	Potential					X	X
Low	H301	Silver Lake	Dover	Gas Station/U-Haul	Potential	X		X	X		
	H303	Silver Lake	Dover	Car Zone	Potential	X	X				X
	H507	Silver Lake	Dover	Jiffy Lube	Potential			X			
	H508	Silver Lake	Dover	Edgehill Shopping Center	Potential			X			
	H500	Silver Lake	Dover	Auto Zone	Not						
	H509	Silver Lake	Dover	Self Wash/Wax	Potential	X					

*Property owners have not been contacted as part of the preparation of this report.

C. TOWN OF CAMDEN

Within the Town of Camden, two (2) upland opportunities were identified (Figure 9, Table 20). The target areas identified in Camden include: retrofits (1) and neighborhoods (1).

Town of Camden can serve in the following ways to improve water quality in the Watershed:

- Work with stakeholders to implement the opportunities identified within the jurisdictional boundaries;
- Support components of regional approaches to be undertaken within the jurisdiction with the stakeholders to implement strategies for:
  - Site acquisitions;
  - Project implementation;
  - Comprehensive planning considering the recommendations made; and
  - Coordination with Kent County within the Watershed for optimizing resources and "holistic" solutions.
- Participate in outreach and education programs.

Table 20 – Recommended Upland Sites by Target Area and Rank in Town of Camden

Retrofits					
Rank	**Project ID**	**Sub-Watershed**	**Municipality**	**Name**	**Description**
Med.	R50a	Tidbury Creek	Camden	Nellie Hughes Stokes Elementary School	Create bioretention at existing landscaped area in parking lot

	Neighborhood								
Rank	**ID**	**Sub-Watershed**	**Municipality**	**Name**	Onsite Retrofit	Better Yard Mgmt	Common Space Mgmt	Pond Retrofit	Parking Lot Retrofit
Low	N123	Tidbury Creek	Camden	Barclay Farms		X			

*Property owners have not been contacted as part of the preparation of this report.

D. TOWN OF WYOMING

Within the Town of Wyoming, seven (7) upland opportunities were identified (Figure 11, Table 21). The target areas identified in Wyoming include: retrofits (2) and neighborhoods (5).

Town of Wyoming can serve in the following ways to improve water quality in the Watershed:

- Work with stakeholders to implement the opportunities identified within the jurisdictional boundaries;
- Support components of regional approaches to be undertaken within the jurisdiction with the stakeholders to implement strategies for:
  - Site acquisitions;
  - Project implementation;
  - Comprehensive planning considering the recommendations made; and
  - Coordination with Kent County within the Watershed for optimizing resources and "holistic" solutions.
- Participate in outreach and education programs.

Table 21 – Recommended Upland Sites by Target Area and Rank in the Town of Wyoming

Retrofits					
Rank	**Project ID**	**Sub-Watershed**	**Municipality**	**Name**	**Description**
Med.	R54a	Isaac Branch	Wyoming	Caesar Rodney High School	Create bioretention area at existing depressional area
	R58a	Isaac Branch	Wyoming	WB Simpson Elementary	Bioretention to treat parking lot

	Neighborhood								
Rank	**ID**	**Sub-Watershed**	**Municipality**	**Name**	Onsite Retrofit	Better Yard Mgmt	Common Space Mgmt	Pond Retrofit	Parking Lot Retrofit
	N86	Isaac Branch	Wyoming	Chaplecroft	X	X			
	N89	Isaac Branch	Wyoming	Wyoming Mills	X				
	N84a	Isaac Branch	Wyoming	Railroad Ave 1	X	X			
Med.	N87	Isaac Branch	Wyoming	Pharsalia	X			X	
Low	N84b	Isaac Branch	Wyoming	Railroad Ave 2	X	X			

*Property owners have not been contacted as part of the preparation of this report.

VI. IMPLEMENTATION STRATEGIES

A. OVERVIEW

The implementation strategies are broken into three approaches: ranking, technology, and sub-watershed.

- Ranking strategy utilizes the scores of each site to prioritize project implementation,
- Technology strategy utilizes prioritization based on individual technologies reviewed, and
- Sub-watershed strategy focuses on an individual sub-watershed with the highest potential to reap implementation benefits.

B. RANKING BASIS

One strategy to implementing the identified opportunities is to develop a ranking of each of the opportunities identified and work from highest ranked to lowest ranked. Opportunities can be ranked in several ways. There are two major types of opportunities identified for the Watershed (Upland and WMWQ). The upland sites have been ranked by a High/Medium/Low ranking while the WMWQ sites have been ranked based on a scoring matrix. These sites have been ranked by their overall score and sub-scores for each technology. The upland rankings are included in Table 4 and the WMWQ scores in Table 5.

This strategy to implementation prioritization has the benefit of providing lists for different entities that may implement projects. As an example, municipalities may be more interested in upland opportunities and DNREC, Sussex County and regional groups may be more interested in the WMWQ sites. This strategy does not provide the potential entity to implement the projects an understanding of how the site fits into more “holistic” or targeted approaches nor considers location within the Watershed.

C. TECHNOLOGY BASIS

Another strategy to implementing identified opportunities is to develop a ranking and prioritization for the sites identified for each technology. As an example, all wetland restoration/creation sites would be compared to each other and scored and ranked. With this strategy an entity interested in implementing that technology could select the highest ranked site for that technology. There may be sources of funding that target specific technologies and this ranking will help support/justify the selection of particular sites for funding.

This strategy has the benefit of identifying most likely successful sites for a particular technology. However, this strategy does not provide the potential entity with an understanding of how the site fits into more "holistic" or targeted approaches nor considers location within the Watershed.

D. SUB-WATERSHED BASIS

A preferred strategy for implementation would be to focus on strategies within sub-watersheds. Targeted multi-faceted improvements can have significant impact on water quality improvement. This strategy has the benefit of providing "holistic" approach to implementation and satisfies requirements for various funding sources.

The identified pollution control opportunities have been sorted and ranked within each sub-watershed and are included in Tables 7, 8, 11, 12, 14, 15, 17, and 18. Rankings of WMWQ opportunities are provided as well as rankings of upland restoration opportunities. A ranking between the two types was not performed.

As part of the sub-watershed basis strategy, a second level of prioritization is ranking/prioritizing the sub-watersheds for implementation. Based on the existing impairments, projected land use, and identified opportunities, the Silver Lake sub-watershed was identified as the best sub-watershed to initiate sub-watershed focused activities. The greatest gains in pollution control meeting the goals of the stakeholders appear to be possible for this sub-watershed.

E. RECOMMENDATIONS

Several strategies for implementation have been presented. Each has merits depending on specific goals and sources of funding.

Watershed implementation strategies can be based on a variety of approaches depending on sources of impairments, land uses, funding availability, schedules, regulatory mandates and local objectives/values. Given the varied users and uses of the Implementation Plan, several strategies that would appear to meet the objectives for the St. Jones River Watershed are recommended. In general, strategies are suggested based on watershed wide criteria, sub-watersheds, and technologies.

It is recommended that the sub-watershed approach be the preferred implementation strategy. Further, it is recommended that the Silver Lake Pond sub-watershed be the highest priority sub-watershed. Descriptions of the five recommended highest WMWQ and five recommended highest upland restoration opportunities are also attached as Attachment A. Attachment B includes a map of the entire St. Jones River Watershed with each of the opportunities identified. Highest priority opportunities are highlighted.

The Baseline Assessment indicated that Silver Lake has the greatest impervious cover, the least protected lands and the potential that urban growth could cover 20% of the Watershed in the future. This growth in urban land use will likely be accompanied by additional impervious cover and possible increase in pollutants entering the Watershed. The highest number (and greatest diversity in geographic location and type) of potential pollution control opportunities were identified for this sub-watershed. Significant preservation corridors for the two (2) main streams in the sub-watershed were also identified. Because of the future stressors this Watershed may experience, prioritization for implementing the identified opportunities for Silver Lake is recommended for consideration in the Implementation Strategy. The majority of upland and all of the WMWQ sites can be found on Attachment B. (Due to GIS scale, additional upland sites can be found in Figures 7, 9, 11, and 13.)

St. Jones sub-watershed does not contain urban centers. Additionally, this sub-watershed has limited although potentially beneficial WMWQ improvement projects. The highest initial priority for this sub-watershed appears to be the potential preservation opportunities within the corridors identified.

Tidbury Creek and Isaac Branch sub-watersheds are also projected for significant growth. Limited WMWQ sites were found in and around the Cities of Camden/Wyoming (downstream end of the sub-watersheds). There are no high ranking WMWQ sites in the headwaters where significant gains can be accomplished. Continued efforts for preservation and high priority (high return) urban retrofits are recommended for these sub-watersheds, in and around, the Cities of Camden/Wyoming.

Although the sub-watershed strategy is the recommended priority approach, it is also recommended to implement other high priority opportunities in other sub-watersheds as funding becomes available and willing land owners are identified. It is also recommended that specific high priority sites for preservation in each of the sub-watersheds be identified and subsequently evaluated for potential preservation/conservation opportunities.

VII. COSTS AND SCHEDULES

In developing a strategy and prioritization for implementing the plan within the Watershed, a projection of costs and schedule can be beneficial. For the Watershed, opportunities were identified in several categories (upland restoration, WMWQ, preservation/conservation, education/outreach, and comprehensive planning/regulations). In addition, the plan has been prepared to permit stakeholders to implement the strategy based on watershed wide, sub-watershed, technology, etc. bases. Given this approach to the plan, costs and schedules are difficult to prepare.

However, estimated planning level costs have been provided for the priority upland restoration sites and typical upland restoration technologies. These are detailed in the Pollution Control Opportunities Technical Memorandum. Costs for the WMWQ opportunities could not be generated since the amount of land available at a site, the diversity of approaches available on site and the amount of area needed in that location had not been determined. Similarly, costs for preservation efforts could not be projected since specific sites were not identified (only corridors), mechanisms for preservation (acquisition versus restriction/easement, etc.) have not been identified, and the range in land values within the Watershed.

VIII. ST. JONES RIVER WATERSHED MONITORING PLAN

Monitoring plans help determine the effectiveness of watershed projects which aim to improve TMDLs and water quality overall. As a result, it is important to institute tracking and monitoring systems to measure improvements in sub-watershed indicators over time. These systems include the internal tracking of the delivery of restoration projects in a sub-watershed, as well as monitoring of stream indicators at sentinel monitoring stations. Performance monitoring of individual restoration projects can be tracked to improve the design of future restoration practices. Information gathered from a tracking system is then used to revise or improve the restoration plan over a multi-year cycle.

The Watershed may experience significant change in land use if built out projections identified in the Baseline Assessment become reality. Monitoring plans for water quality improvement should take in to account the possibility of build out and the associated impacts. As a result, the following monitoring approaches are recommended:

A. PROJECT MONITORING (PERFORMANCE MONITORING)

Small scale (reach or smaller) project monitoring can be conducted to illustrate benefits of individual restoration efforts. Communities may want to invest in both in-stream and non-stream monitoring of individual restoration projects to assist in measuring project success. Such monitoring can be relatively simple (observing the success of a reforestation project or measuring public awareness through surveys) or extremely complex and expensive (measuring the pollutant reduction of a storm water retrofit or the biological response to a comprehensive stream restoration project). Restoration practices are often experimental or implemented as demonstration projects, which sometimes makes it difficult to show improvement in overall water quality or watershed indicators.

On an annual basis, information derived from the baseline and project monitoring should be complied into a report. This is something the TAT could possibly accomplish. The annual report should summarize current biological and physical conditions in the watershed; the number, type, and extent of projects taken; and the success to date of the plan in improving watershed conditions. Reporting on an annual basis will allow for mid-course corrections and adjustments to be made

based on the monitoring data.

Consider integrating this effort with DNREC's Delaware Environmental Navigator (DEN) system which allows users to explore the many types of information collected by DNREC such as permitted facilities, enforcement actions and environmental monitoring.

B. SENTINEL STATIONS

Sentinel monitoring stations are fixed, long-term monitoring stations which are established to measure trends in key indicators over many years. DNREC's Water Quality Monitoring stations (GAMN) contain the history of data necessary to detect trends in water quality that would be beneficial to determine project success in removing targeted pollutants. Figure 15 provides a map of existing monitoring stations with the Watershed. These are the stations which TMDL data was calibrated. It is understood that data is currently being taken from the sites indicated, and that at a future time, depending on funding, the remaining sites may be monitored again. Other stations shown that could be utilized for future monitoring are STORET, USGS, and NPDES stations. A list of existing GAMN stations can be found in Table 22.

If future funding allows, it is recommended to establish automated sampling at the GAMN station locations. This would allow for data continuity and ease of collection. In addition, if additional point sources are discovered or added, downstream sampling sites should be added.

C. ILLICIT DISCHARGE MONITORING

Illicit discharge detection and investigation are critical elements of watershed restoration and planning especially when there are obvious indicators of illicit discharges. Illicit discharges are often a significant source of pollution in a watershed that occurs repeatedly in association with specific polluting behaviors. The NPDES stations are areas where illicit discharges can be detected. Additionally, volunteer stream assessments which could be conducted yearly could identify potential illicit discharges.

D. PROJECT TRACKING

Create a routine spreadsheet or GIS system to track project data over time, such as project location, inspection, maintenance and performance. Project tracking data chronicles progress made in sub-watershed implementation, and can isolate management problems to improve the delivery of future restoration projects. Performance standards for each project can be projected, tallied and a running record of reductions in pollutants to demonstrate measurable improvements toward the goals can be accomplished.

E. REASSESSMENT OF WATERSHED STATUS

On a regular basis (every 5-7 years) the Watershed should be reassessed. The reassessment should include a general overview of land use practices and land disturbance, wetlands, and streams to determine the longer term effects of project implementation or Watershed changes. Streams should be monitored where project implementation has occurred for buffer and stream condition (possibly with the rapid bio-assessment or the CWP Unified Stream Assessment used in the Baseline Assessment). The reassessment should help refocus the Watershed Plan to keep the implementation and issues current with the existing issues in the future.

Insert Figure 15 – Existing Monitoring Locations

Insert Table 22 – GAMN Monitoring Info

IX. REFERENCES

Center for Watershed Protection. February 2005. *Manual 10. Urban Subwatershed Restoration Manual Series. Unified Stream Assessment: A User's Manual*. Version 2.0.

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ATTACHMENT A

RECOMMENDED SITE DESCRIPTIONS AND TARGET SUB-WATERSHED MAP (24x36) SILVER LAKE

ATTACHMENT B

UPLAND RETROFITS AND WATERSHED MANAGEMENT WATER QUALITY OPPORTUNITIES
(24x36-MAP)