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List of Acronyms

ARC	Appalachian Regional Commission
BMP	Best management practices
CAST	Chesapeake Assessment Scenario Tool

CEA	Critical Environmental Areas
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DCAP	Delaware County Action Plan
DPW	Department of Public Works
EFC	Environmental Finance Center
EPA	Environmental Protection Agency
EQIP	Environmental Quality Incentives Program
ESM	Environmentally Sensitive Maintenance
FD	Fire Department
FEMA	Federal Emergency Management Agency
GIS	Geographic Information Systems
GWLF	Generalized Watershed Loading Function
H/H	Hydrologic and Hydraulic
HMPG	Hazard Mitigation Plan Grants
HUD	Housing and Urban Development
LIDAR	Light Detection and Ranging
MRLC	Multi-Resolution Land Characterization
MS4	Municipal Separate Storm Sewer System
NFWF	National Fish and Wildlife Foundation
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NYHP	New York Heritage Program
NYSDAM	New York State Department of Agriculture & Markets
NYSDEC	New York State Department of Environmental Conservation
NYSDEP	New York City Department of Environmental Protection
NYSDOS	New York State Department of State
NYSEFC	New York State Environmental Facilities Corporation
NYSHCR	New York State Homes and Community Renewal
NYSOCR	New York State Office of Community Renewal
NYSSWCC	New York State Soil and Water Conservation Committee
PCB	Polychlorinated biphenyls
SARE	Sustainable Agriculture Research and Education
SCA	Stream Corridor Assessment
SCIG	Sidney Center Improvement Group
SCNY	South Central New York
SED	Sediment
SEQR	State Environmental Quality Review Act
SPDES	State Pollutant Discharge Elimination System
SRBC	Susquehanna River Basin Commission
STERPDB	Southern Tier East Regional Planning Development Board
SWCD	Soil and Water Conservation District
SWM	Stormwater Management
TMDL	Total Maximum Daily Load

TN	Total nitrogen
TP	Total phosphorus
USACE	United States Army Corps of Engineers
USC	Upper Susquehanna Coalition
USDA	United States Department of Agriculture
USDA FSA	United States Department of Agriculture Farm Service Agency
USDA NRCS	United States Department of Agriculture Natural Resource Conservation Service
USDA RD	United States Department of Agriculture Rural Development
USLE	Universal Soil Loss Equation
VOC	Volatile organic compounds
WWTP	Wastewater treatment plants

1 Introduction

The Sidney Center Improvement Group (SCIG) is in the process of developing a watershed management plan for the Carr's Creek Watershed. Carr's Creek, located in Delaware County, New York, is a direct tributary to the Susquehanna River with a confluence located at the Town of Sidney.

The community of Sidney Center is located centrally in the watershed at the intersection of County Highways 23 and 35 (see Map 1). The northern border of the Town of Sidney, marked by the Susquehanna River, is the border of Otsego County, New York, and the west town line is the border of Chenango County, New York. According to the United States Census Bureau, the town has a total area of 50.7 square miles (131.2 km²), of which, 50.3 square miles (130.3 km²) of it is land and 0.4 square miles (1.0 km²; 0.76%) of it is water.

In 2006, a severe flooding event in Carr's Creek, and throughout Delaware County, prompted the completion of a Flood Recovery Plan, which called for the study and proper mitigation of Carr's Creek and its tributaries to protect the watershed's infrastructure and the community at large. SCIG received a grant from the National Fish and Wildlife Foundation to develop a watershed management plan for Carr's Creek.

This Watershed Management Plan builds upon the previously completed Watershed Characterization Report (KCI, 2012). The characterization describes the current watershed condition and sets priorities, based on condition and need, for preservation and restoration. The management plan documents the management strategies recommended including funding mechanisms, public participation practices, and implementation plans needed to reach the goals and objectives described below.

1.1 Goals and Objectives

The goals of the plan are to restore and sustain ecological function of Carr's Creek and its tributaries, to preserve and restore natural resources and working lands, and to reduce the risk of future severe flooding as experienced in 2006. Additional long-term goals include:

Re-establishment of environmental functions in the river;
Protection of important natural resources through conservation easements;
Elimination of fish barriers;
Livestock exclusion from streams;
Reduction of risk of severe flooding; and
Reducing bacterial contamination, excessive sedimentation, and high water temperatures that impact the trout fishery.

The project will contribute toward the 2011 Chesapeake Bay milestones for reduction of nitrogen and phosphorus and meet the Environmental Protection Agency (EPA) Watershed Plan Elements and guidelines based on Section 319 of the Clean Water Act.

1.2 Regulatory and Programmatic Environment

Regulations and ordinances that guide land use and protection of natural resources within the Carr's Creek watershed are promulgated primarily at the town, state, and federal levels, with a few exceptions; most notable, Section 239 of General Municipal Law, which provides for review of certain projects by the County Planning Board; and, the Susquehanna River Basin Compact, which provides approval

authority for the Susquehanna River Basin Commission for water withdrawals over a certain threshold. Local land use regulations create the framework for development according to each town's adopted Comprehensive Plan. Regulations under NYS Environmental Conservation Law and other relevant sections of the NYS Code protect public health and safety, water quality, and drinking water supplies through various compliance requirements.

The purpose of this review is to identify and evaluate the controls, policies, and programs in place to guide development to appropriate areas and conserve natural resources. Plans and regulations reviewed address land use planning and zoning, flood damage prevention, water quality protection, land conservation, aquatic buffers, erosion, and stormwater. Because the focus of the Carr's Creek Watershed Management Plan is water resources, the review concentrated on water quality and water quantity. This review followed a process developed by the Center for Watershed Protection entitled, *Assessing Your Watershed Protection Programs and Regulations*. The findings are summarized in Table . This evaluation will subsequently be used to recommend changes and/or additions to existing regulations.

Table - Review of Existing Land Use and Water Resource Regulations

Regulation and/or Program	Description	Mechanisms Supporting Water Resource Goals	Effectiveness in Addressing Water Resource Goals	Comments
Town of Sidney Comprehensive Action Plan	-develop new ideas, identify community needs, and establish goals and strategies to guide the pace and direction of future changes -action plan updated periodically as needed	-action plan does not currently support water resource management	-plan does not address water resource goals -no provision for integrating watershed management -plan does not address flood damage prevention	-plan adopted before 2006 and 2011 floods -plan indicates water/sewer as "future challenges"
Town of Sidney Highway Management Plan	-identify town road and natural disaster issues + budget needs -inventory/map roads + storm water structures -evaluate road/related structure condition -create map-books of highway infrastructure location	-identification of natural disaster issues (including flooding) -inventory/evaluation of road stream crossings and storm water structures	Road bridge /culvert replacement and re-sizing to accommodate increase stream flows	-proper bridge/culvert re-sizing requires stream flow modeling
Town of Sidney Zoning Ordinance	-zoning districts consist of Residential, Residential-Agricultural, Commercial-Manufacturing, each with varying use and lot size requirements	No provisions to support water resources (except in Flood Hazard zones appended by 1987 Flood Damage Prevention ordinance)	-no provision for review + approval of most projects by the Planning Board (Town has not approved a proposed zoning amendment with a Site Plan Review provision)	-Site Plan review authority has been an effective tool for addressing water resource issues in other municipalities in Delaware County. Approval of Site Plans triggers a review under the State Environmental Quality Review Act, which provides for mitigation of significant environmental (and other) impacts
Town of Sidney Subdivision Regulations	-Planning Board approval authority for subdividing land parcels. Meant to ensure that all parcels resulting from subdivision are suitable for development under all applicable land-use laws	-subdivision approval includes provisions for natural resource protection. Approval requires a review under the State Environmental Quality Review Act, which provides for mitigation of significant environmental (and other) impacts	-regulations do not specifically address water resource management	

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Regulation and/or Program	Description	Mechanisms Supporting Water Resource Goals	Effectiveness in Addressing Water Resource Goals	Comments
Town of Sidney Flood Damage Prevention Ordinance	-regulate development in designated floodplain as depicted on FEMA Flood Insurance Rate Maps (1% annual-chance floodplain, AKA 100-year floodplain)	-permit required by local Floodplain Administrator	-buildings/utilities must be elevated or flood-proofed, stored materials anchored, obstructions mitigated	Pre-FIRM (i.e. structures built before 1974) are grandfathered until they are "substantially" damaged (greater than 50% of assessed value) at which point they must come into compliance
Multi-Jurisdictional Hazard Mitigation Plan	-guides risk-reduction of County agencies and municipalities including flooding. After 2011-2012 update, Town of Sidney will adopt their own section ("Jurisdictional Annex") of the AHMP along with the update	-basis for developing flood mitigation projects	While water quality is not addressed directly in the AHMP, many mitigation projects have a substantial water quality benefit	Any flood mitigation activities in the Carr's Creek Watershed Plan must be coordinated with the AHMP and the Town of Sidney's municipal annex to the AHMP
Delaware County Action Plan for Economic Vitality and Water Quality	-enhances/protects County's economy and reduces contaminant loading in water bodies. Sets up a framework for collaboration between Delaware County agencies and important stakeholders	DCAP Core Group (composed of DelCo Departments of Watershed Affairs, Public Works, Planning, Emergency Services, and Economic Development, as well as the DelCo Soil and Water Conservation District and Cornell Cooperative Extension) meets every other week. The DCAP Core Group should be considered a resource for implementing the Carr's Creek Watershed Plan		
Susquehanna-Chemung Action Plan	-ecosystem approach to conserve and protect water resources	-broadly supportive of water resource management goals/strategies		

2 Watershed Characteristics

2.1 Watershed Delineation and Hydrography

Located in Delaware County New York, the Carr's Creek watershed drains directly into the Susquehanna River, which is the natural border between northern Delaware County and the southern edge of Otsego County (Map 1 and Map 2). The Carr's Creek watershed extends into three towns: Sidney, Franklin, and Masonville. The majority of the watershed is located in the town of Sidney, with the hamlet of Sidney Center located approximately in the center of the watershed. The headwaters of Carr's Creek originate near Merrickville, New York in the Town of Franklin and a small portion of the watershed also extends into the Town of Masonville along County Highway 27. In addition to Sidney Center and Merrickville, the hamlets of Franklin Depot and Youngs Station are also located in the Carr's Creek watershed.

The Carr's Creek watershed is approximately 19,009 acres in area (Table), and includes 54.5 miles of mapped stream channel. Named stream channels include the mainstem of Carr's Creek (41.9 miles) and Willow Brook (12.6 miles).

Table - Watershed Drainage Area and Stream Miles

Towns	Drainage Area (Acres)	Stream Miles
Sidney	15,106.3	44.5
Franklin	3,638.9	10.0
Masonville	263.6	0.0
TOTAL	**19,008.9**	**54.5**

To assist in describing the Carr's Creek watershed in this study, the watershed has been subdivided into three subwatersheds (Map 1) with all three subwatersheds joining at the confluence at Sidney Center. The Willow Brook subwatershed drains north from the northern border of Masonville and Walton to the confluence with Carr's Creek. The Carr's Creek Upstream subwatershed drains from Merrickville to the confluence with Willow Brook. The Carr's Creek Downstream subwatershed drains from Sidney Center to the Susquehanna River.

2.2 Landscape

2.2.1 Climate

Climate influences soil formation and erosion processes, stream flow patterns, vegetation coverage and a significant part of the geomorphology of a watershed. Rainfall not only provides water to streams and vegetation, but the intensity, frequency and amount of rainfall can greatly influence watershed characteristics.

Delaware County is located in the Northeast climate region of the U.S. (Karl and Koss, 1984) and has a temperate climate with a mean monthly rainfall of 2.31-4.31 inches and a mean annual rainfall of 39.30

inches. Air temperature of the area ranges from an average low temperature of 22.2°F in January to an average high of 68.7°F in July (NOAA, 2011).

2.2.2 Ecoregion

There are 12 major ecozones and 40 minor ecozones throughout the state of New York. Delaware County is located in the Major Ecozone of Zone A: Appalachian Plateau and the Minor Ecozone of A03: Central Appalachians (NYSDEC, 1990). The Appalachian Plateau major ecozone accounts for approximately one-third of New York. The Central Appalachains minor ecozone comprises 18 percent of New York.

2.2.3 Physiography

The Carr's Creek watershed is situated at the foothills of the Catskill Mountains in the Southern New York section of the Appalachian Plateaus province in the Appalachian Highlands physiographic division (USGS, 2003). The Appalachian Plateau is the western part of the Appalachian mountains, extending from New York to Georgia and Alabama.

2.2.4 Topography

To document the presence of steep slopes and the influence of topography on the watershed, an evaluation of steep slopes was prepared. Slopes for this study were divided into the following four categories:

Gently to Strongly Sloping: <15%
Moderately Steep: 15%-25%
Steep: 25%-35%
Very Steep: >35%

The majority of slopes within the watershed are less than 15% (63 percent of the watershed; Map 3). Approximately one-fourth of the watershed (26 percent) falls in the 15%-25% slope category. The 25%-35% and >35% categories account for five percent and one percent of the watershed, respectively. The western and central parts of the watershed have the highest elevation, with the largest section of steep slopes extending east from Sidney Center to just north of Franklin Depot—25%-35% slopes with a small section of >35% slopes. The south eastern headwaters portion of the watershed is a more gradually sloping zone, particularly around the village of Merrickville.

The New York State Department of Environmental Conservation (NYSDEC) in Chapter 5 of the Stormwater Management Design Manual, recommends avoiding, if possible, the development on slopes with a grade of 15% or greater to limit soil loss, erosion, and excessive stormwater runoff and degradation of surface water (CWP, 2010). No development, regrading, or stripping of vegetation should be considered on slopes exceeding 25%.

2.2.5 Geology

The geologic formations underlying a watershed have a significant effect on the water resources. Geology is a major determinant of the type of topography and surface features, as discussed earlier. The chemical composition and minerals of the parent rock or unconsolidated sediments determines in large part the soil characteristics, including erodibility and infiltration rates.

As shown in Map 4, surficial geology of the watershed is dominated by the till material group (88 percent; NYSED, 2011)—in particular, glacial tills. Prevalent throughout the state of New York, glacial tills are deposits left by a continental glacier. Relatively impermeable, tills are variable in texture (clay, silt-clay, boulder clay) and are usually poorly sorted sediments. Potential land instability on steep slopes is also attributed to the till material group. Recent glacial deposits are prevalent along the majority of the floodplain of Carr's Creek mainstem.

Bedrock geology consists primarily of Lower Walton Formations of Upper Devonian shale and sandstone (Dicken et al., 2005). Bedrock outcrops are located running east to west along Dunshee Road and County Highway 35 and are also present along the northern border of the watershed. Kame deposits and outwash sand/gravel are also present but account for a negligible amount of the watershed.

2.2.6 Soils

Soil conditions are an important factor when evaluating water quantity and quality in streams and rivers. Soil type and moisture conditions greatly impact the amount and quality of runoff. In addition, the magnitude of the runoff is affected by the combination of soil type and slope. Soils also affect how land may be used and its potential for vegetation and habitat. Soils are an important consideration in targeting projects aimed at improving water quality or habitat.

As shown in Table and Map 5, the majority of soils (93.2 percent) are classified as hydrologic soil group C. These soils have relatively high runoff potential, meaning that water transmission, or infiltration, is somewhat restricted. Hydrologic soil groups B and D account for approximately five percent of the soils in the watershed (3.8 and 1.7 percent, respectively) and are generally found along streams valleys, particularly in the most downstream portions of the Carr's Creek mainsteam near Youngs Station. Soils in group B have moderately low runoff potential with unimpeded water transmission through the soil while D soils have a high runoff potential with restricted or very restricted water movement through the soil. Soil groups A and A/D account for approximately one percent of the soils in the watershed (0.6 and 0.4 percent, respectively). Soils in group A have the lowest runoff potential and water is transmitted freely through the soil.

Table - Hydrologic Soils Groups in Acres and Percent

	A	A/D	B	C	D	Water
Runoff Potential	Low	mixed	Moderatel y Low	Moderately High	High	na
Acres	111.70	80.34	730.39	17718.44	320.15	47.84
Percent	0.59	0.42	3.84	93.21	1.68	0.25

2.2.7 Erodibility

Soil erodibility is a measure of the soil's susceptibility to erosion. The Universal Soil Loss Equation (USLE) developed by the United States Department of Agriculture (USDA) Agricultural Research Service is a model used to describe soil erosion processes. In the USLE, erodibility is described quantitatively using

the K factor, which represents both the susceptibility of soil to erosion and its contribution to the rate of runoff. For example, clay soils have low K values because they are resistant to detachment. Coarse soils such as sand can also have low K values because even though they are easily detached, they are less susceptible to runoff. Silts have the highest K values because they detach easily and produce high rates of runoff (Institute of Water Research, 2002).

Subwatersheds with the largest percentage of highly erodible soils offer the greatest potential for addressing soil conservation with best management practices (BMPs) aimed at maintaining topsoil, such as riparian buffer forestation. Combining this indicator with other information, such as cropland, slope steepness and distance to streams would help to determine where to retire highly erodible land from farming, a type of BMP. Additionally, a high K value helps to identify areas where urban development near streams, such as road construction or utility placement may have particularly adverse watershed impacts.

Soil erodibility was divided into four categories:

No Data
Low Erodibility (K factor <0.24)
Medium Erodibility (K factor 0.24-0.32)
High Erodibility (K factor >0.32)

Map 6 presents the soil erodibility categories based on K factor for Carr's Creek watershed. The majority of the watershed consists of soils with medium erodibility (97 percent of the watershed) with approximately one percent low erodibility and one percent high erodibility (one percent of the watershed has no data and in most instances accounts for water).

Based on local observation, the majority of erosion within the Carr's Creek watershed during normal flows occurs from stream banks with little or no riparian vegetation and banks damaged by previous flood events. Severe erosion occurs during extreme storm events (i.e. 100+ year storms) when large quantities of sediment and rock are transported downstream and then deposited in the stream channel as energy dissipates.

2.2.8 Forest Cover

Among land cover types, forest cover provides the greatest protection for soil and water quality. Carr's Creek watershed is a heavily forested area with 11,712 acres of forest cover (deciduous, evergreen, and mixed forest); which comprises over half of the watershed (62 percent; Map 7).

In 2010, NYSDEC in cooperation with the USDA Forest Service, conducted a statewide aerial survey of tree health. According to the *2010 Forest Health Aerial Survey Report*, approximately 23.3 million acres were surveyed statewide with approximately 1.5 million acres of forest damage observed (NYSDEC(a), 2011). The majority of forest damage, including forest mortality, was caused by frost damage and biotic damage from the forest tent caterpillar (*Malacosoma disstria*). Damage from the forest tent caterpillar as well as severe frost damage was observed in Delaware County. However, minimal forest damage was observed in the vicinity of Carr's Creek watershed.

2.2.9 Wetlands

Section 404 of the Clean Water Act (USEPA, 1972) defines wetlands as the following:

Wetlands are "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soils. Wetlands generally include swamps, marshes, bogs, and similar areas."

Wetlands are environmentally sensitive habitats that play an integral part in supporting the water quality and water storage of a watershed. These reservoirs help to control flooding by retaining surface runoff and releasing steady flows of water downstream. Wetlands also support biological diversity, erosion control, and sediment retention.

Based on the National Wetland Inventory, there are 452 acres of wetland habitat throughout the watershed (USFWS, 2011) the majority of which are freshwater ponds (220 acres; Map 7). Freshwater forested/shrub and freshwater emergent wetlands cover 126 and 90 acres, respectively, with 17 acres of riverine wetlands.

2.3 Living Resources and Habitat

2.3.1 Sensitive Species

Much of the Carr's Creek and Willow Brook mainstems and tributary systems support Eastern brook trout (*Salvelinus fontinalis*) and Brown trout (*Salmo trutta*) both from stocked populations and spawning natural populations. Refer to section 2.4.1 below for details in the Use Designations related to trout resources. Carr's Creek is one of multiple streams, ponds, and reservoirs throughout Delaware County stocked annually with trout. A total of 420 Brown trout (*Salmo trutta*), 8-9 inches in length, were stocked in April 2011 in Carr's Creek (NYSDEC(b), 2011).

2.3.2 Rare, Threatened, and Endangered Species

The New York Heritage Program (NYHP) documents multiple rare plants and animals in Delaware County with a generalized distribution that may be within the vicinity of Carr's Creek watershed (NYSDEC, 2009).

2.3.2.1 Federal Endangered Species Act Listings

The dwarf wedgemussel (*Alasmidonta heterodon*) is a freshwater mussel that is listed as 'Endangered' under the Federal Endangered Species Act and by New York State. The dwarf wedgemussel was last documented in Delaware County in 2002. The northern monkshood (*Aconitum noveboracense*) is a flowering plant that is listed as 'Threatened' under the Federal Endangered Species Act and by New York State. The most recent year the northern monkshood was observed in Delaware County was in 1996.

2.3.2.2 New York State Listings

In addition to the dwarf wedge mussel and northern monkshood listed in section 2.3.2.1, Table presents rare or state-listed animals and plants, significant natural communities and other significant habitats, which NYHP databases indicate occur, or may occur, within Carr's Creek watershed or in the immediate vicinity of the watershed.

Table - Rare species within Carr's Creek watershed

Common name	Scientific name	Type	Group	NY Legal Status	NYS Rank

Hellbender	*Cryptobranchus alleganiensis*	Animal	Amphibians	Special concern	Imperiled
Bald eagle	*Haliaeetus leucocephalus*	Animal	Birds	Threatened	Imperiled
Yellow lampmussel	*Lampsilis cariosa*	Animal	Mussels	Unlisted	Vulnerable
Green floater	*Lasmigona subviridis*	Animal	Mussels	Threatened	Critically imperiled

2.4 Water Quality

2.4.1 Use Designations

NYSDEC has established water quality classifications of surface waters and groundwater throughout the state which are described in 6 NYCRR Chapter X – Division of Water §701. Carr's Creek and Willow Brook are both sub-tributaries in the Susquehanna River drainage basin. Use designations of Carr's Creek and Willow Brook sub-tributaries are listed and described in Table 5.

Two portions of Carr's Creek mainstem are classified as trout waters: the first section extends from Merrickville to Sidney Center, the second section runs from Dunshee Road to 0.4 miles south of Quarry Road. One sub-tributary of Carr's Creek, located in Franklin Depot along Stillson Road, is also considered trout waters. The remaining portions of Carr's Creek mainstem and all other sub-tributaries to Carr's Creek are classified as Class C fresh surface waters.

The majority of Willow Brook stream reaches are classified as Class C fresh surface waters. One portion of Willow Brook, which extends between Budine Road and Pine Swamp Road, is classified as trout waters. One sub-tributary of Willow Brook, located north of the boundary of Masonville, is classified as Class AA fresh surface waters, which holds the same standards as Class C surface waters with the addition of water supply for drinking, culinary or food processing purposes.

DEC is currently updating the use classifications regarding trout, and based on communication with DEC it is expected that most all segments of Carr's Creek and Willow Brook will be listed as TS, trout spawning waters.

Table - Use Designations of Carr's Creek sub-tributaries

Regulation	Class	Definition
§701.5	Class AA fresh surface waters	(a) The best usages of Class AA waters are: a source of water supply for drinking, culinary or food processing purposes; primary and secondary contact recreation; and fishing. The waters shall be suitable for fish, shellfish, and wildlife propagation and survival. (b) This classification may be given to those waters that, if subjected to approved disinfection treatment, with additional treatment if necessary to remove naturally present impurities, meet or will meet New York State Department of Health drinking water standards and are or will be considered safe and satisfactory for drinking water purposes.

§701.8	Class C fresh surface waters	The best usage of Class C waters is fishing. These waters shall be suitable for fish, shellfish, and wildlife propagation and survival. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes.
§701.25	Trout waters (T)	The symbol (T), appearing in an entry in the "standards" column in the classification tables of Parts 800 through 941 of this Title, means that the classified waters in that specific Item are trout waters. Any water quality standard, guidance value, or thermal criterion that specifically refers to trout or trout waters applies.
§701.25	Trout waters (TS)	The symbol (TS), appearing in an entry in the "standards" column in the classification tables of Parts 800 through 941 of this Title, means that the classified waters in that specific Item are trout spawning waters. Any water quality standard, guidance value, or thermal criterion that specifically refers to trout, trout spawning, trout waters, or trout spawning waters applies.

2.4.2 303(d) Impairments

Under the Federal Clean Water Act, the state of New York is required to assess and report on the quality of waters throughout the state. Where designated uses are not fully supported, Section 303(d) requires states to list these water bodies as impaired waters. States are then required to develop a Total Maximum Daily Load (TMDL) for the listed impaired waters. The Final NYS 2010 Section 303(d) List was approved by the USEPA (U.S. Environmental Protection Agency) on June 29, 2010.

While two segments in the Susquehanna Drainage Basin were listed on the 2010 303(d) List, Carr's Creek, Willow Brook, and all of their sub-tributaries to the Carr's Creek watershed were not included and therefore currently meet their designated uses (NYSDEC, 2010).

2.4.3 NPDES and SPDES Permittees

The Federal Clean Water Act prohibits the discharge of pollutants through a point source into a "water of the United States" without the requirement of a NPDES permit (National Pollutant Discharge Elimination System; USEPA, 2002). In addition to NPDES permitting, New York State has also initiated a state program, approved by USEPA, known as the State Pollutant Discharge Elimination System (SPDES). The SPDES program is broader in scope than that required by the Clean Water Act because it controls wastewater and stormwater discharges of point sources to groundwaters as well as surface waters.

Currently, there are no NPDES or SPDES permittees within the Carr's Creek watershed.

2.4.4 Superfund Sites

The federal government established the Superfund program to clean up the nation's abandoned and uncontrolled hazardous waste sites.

The Sidney Landfill is a listed Superfund site (EPA ID#: NYD980507677) located approximately 2.5 miles southeast of Sidney Center in the southern portion of the Carr's Creek watershed within the Willow Brook subwatershed. Added to the National Priorities List in 1989, Sidney Landfill covers 74 acres along the eastern side of Richardson Hill Road and is characterized by steep hills with farmlands and wooded areas. The landfill consists of approximately 20 acres and from 1964 through 1972 accepted municipal and commercial waste including waste oils. The groundwater contained volatile organic compounds (VOCs), including solvents and polychlorinated biphenyls (PCBs).

At this time, physical cleanup activities have been completed with site maintenance and monitoring occurring on a quarterly basis. Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Section 121(c), EPA must conduct five-year reviews of the site. The most recent EPA review occurred in June 2009, which concluded that the implemented remedy is protecting public health and the environment.

An additional Superfund site, Richardson Hill Road Landfill (EPA ID#: NYD980507735) is located approximately 0.5 miles southwest of the Sidney Landfill yet just outside of the Carr's Creek watershed boundary.

2.4.5 Wastewater Treatment Plants

Of the two wastewater treatment plants (WWTP) located in Delaware County—Walton and Delhi; neither are located in the Carr's Creek watershed.

2.4.6 Septic Systems

The majority of development within Carr's Creek watershed is on private septic systems with a very small percentage on common/public systems (<1 percent).

2.5 Flooding

Flooding has been a reoccurring problem for towns and villages throughout the Carr's Creek watershed and in Delaware County. Table presents a summary of the major floods that have occurred in the sub-basin which includes the Town and Village of Sidney over the past 15 years. Map 8 depicts the 100-year floodplain (provided by Delaware County) extent throughout the Carr's Creek watershed.

Table - Summary of floods

Beginning Date	Ending Date	Type of Flood	Type of Event	Location	Estimated damages
1/19/1996	1/20/1996	Flash Flood	Snowmelt, heavy rain	Countywide	$9.3 million
1/6/1998	1/12/1998	Flood	Snowmelt, heavy rain	Sidney/western Delaware County	$410 thousand
7/8/1998	7/8/1998	Flash Flood	Thunderstorm	Sidney Center	$650 thousand
2/27/2000	2/29/2000	Flood	Snowmelt	Sidney/western Delaware County	$50 thousand
3/26/2002	3/28/2002	Flash Flood	No information	Western Delaware County	Not reported
9/18/2004	9/18/2004	Flash Flood	Hurricane Ivan	Countywide	$12 million
4/2/2005	4/5/2005	Flood	No information	Countywide	$150 thousand
6/27/2006	6/28/2006	Flash Flood	Stalled frontal system	Countywide	$ 250 million
5/20/2011	5/20/2011	Flash flood	Heavy Rain	Countywide	No data

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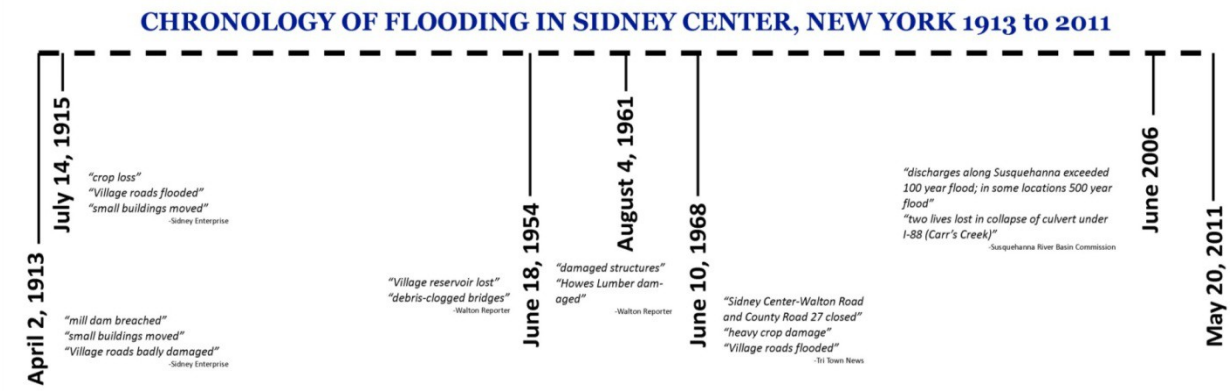
9/7/2011	9/8/2011	Flood	Tropical Storm Lee	Countywide	No data

Source: DCPD, 2006; NCDC, 2012 with additions by KCI

In addition to these events, Figure 1 below details a chronology of flooding events in Sidney Center from 1913 to 2011.

Figure - Flooding Events 1913 to 2011



2.5.1 June 2006 Flooding

In response to the June 2006 flooding event, Delaware County Planning Department prepared a *Post Flood Recovery and Reconstruction Plan* for the Town of Sidney, which details the actions necessary to redevelop areas that were most harmed by the flooding and the necessary steps to ensure that all redevelopment projects are prioritized in order of necessity and that all projects are done in accordance to local, regional, state, and federal laws and plans (DCPD, 2006).

The plan also addresses the actions that are necessary for the Town to limit the exposure of future flooding. For example, repairing damaged infrastructure and cleaning out streams to accommodate future storms and spring runoff and developing municipal plans and land use controls to ensure safety of lives and property during a flood event.

2.5.2 Other Significant Events

Starting September 7, 2011, heavy rain from the remnants of Tropical Storm Lee flooded the Susquehanna River valley and Carr's Creek watershed.

On September 13, 2011, the Federal Emergency Management Agency (FEMA) officially declared Sidney a federal disaster area as a result of Tropical Storm Lee (Sidney Chamber of Commerce, 2011). For one week, residents were under a Boil Water Advisory and were urged to stay out of the water as several propane and oil leaks were reported.

2.6 Demographics and Population

As of the census of 2000, there were 6,109 people, 2,565 households, and 1,641 families residing in the Town of Sidney. Communities and locations in the Town include: East Sidney, Franklin Depot, Sidney – The Village of Sidney, Sidney Center, South Unadilla, and Youngs Station.

The population density was 121.5 people per square mile (46.9/km²). There were 2,987 housing units at an average density of 59.4 per square mile (22.9/km²). The racial makeup of the town was 96.35% White, 0.85% Black or African American, 0.33% Native American, 0.77% Asian, 0.03% Pacific Islander,

0.39% from other races, and 1.28% from two or more races. Hispanic or Latino of any race were 1.44% of the population.

There were 2,565 households out of which 29.6% had children under the age of 18 living with them, 47.7% were married couples living together, 11.7% had a female householder with no husband present, and 36.0% were non-families. 30.3% of all households were made up of individuals and 16.1% had someone living alone who was 65 years of age or older. The average household size was 2.35 and the average family size was 2.90.

In the town, the population was spread out with 25.4% under the age of 18, 6.5% from 18 to 24, 25.3% from 25 to 44, 23.9% from 45 to 64, and 18.9% who were 65 years of age or older. The median age was 40 years. For every 100 females there were 90.8 males. For every 100 females age 18 and over, there were 87.0 males.

The median income for a household in the town was $30,078, and the median income for a family was $35,351. Males had a median income of $28,168 versus $25,014 for females. The per capita income for the town was $16,335. About 11.1% of families and 14.3% of the population were below the poverty line, including 19.9% of those under age 18 and 10.3% of those age 65 or over.

2.7 Land Use

The type and density of various land uses can have a dramatic effect on water quality and stream habitat. Forested areas slow stormwater flow and allow water to gradually seep into soils and drain into streams. Vegetation and soils bind nutrients and pollutants found within stormwater—improving water quality as it infiltrates the ground. Developed areas, with a high percentage of impervious surfaces (buildings, paved roads, parking lots, etc.), do not slow stormwater flow—increasing the amount of pollutants entering streams. Increased stormflow can negatively affect stream habitat by increasing bank erosion and decreasing instream and riparian habitat. Agricultural land, if managed incorrectly, can also increase nutrients and bacteria in streams.

Land use/land cover data was analyzed using the National Landcover Database for the United States (2001) available through the Multi-Resolution Land Characterization (MRLC) Consortium (Homer et al., 2004).

2.7.1 Existing Land Use and Land Cover

The majority of the 19,009 acre drainage area of the Carr's Creek Watershed is forested land (66 percent), mainly consisting of deciduous forest (Map 9; Table and Table). Close to a third of the watershed is agricultural land (30 percent), the majority consisting of pasture/hay. Developed land accounts for less than one percent of the watershed.

Table - 2001 Land Use for Carr's Creek watershed.

Land Use Description	Acres	Percentage
Forest/Brush	12498.7	65.8
Agriculture	5732.3	30.2

Barren Land	695.8	3.7
Developed Land	82.7	0.4
Total land area	19008.9	100.0

Table - 2001 Land Cover for Carr's Creek watershed listed from largest to smallest.

Land Cover Class	Acres	Percentage
Deciduous Forest	9278.1	48.8
Pasture/Hay	5016.5	26.4
Mixed Forest	1674.0	8.8
Evergreen Forest	759.7	4.0
Cultivated Crops	715.8	3.8
Developed, Open Space	636.9	3.4
Grassland/ Herbaceous	340.5	1.8
Woody Wetlands	251.8	1.3
Shrub/ Scrub	186.1	0.9
Developed, Low Intensity	73.9	0.4
Open water	58.9	0.3
Emergent Herbaceous Wetlands	8.7	0.1
Developed, Medium Intensity	5.6	0.03
Developed, High Intensity	2.7	0.01
Total land area	19008.9	100.0

2.7.2 Imperviousness

As mentioned in Section 2.7, impervious surfaces concentrate stormwater runoff, accelerating flow rates and directing stormwater to the receiving stream. This accelerated, concentrated runoff can cause

stream erosion and habitat degradation. Runoff from impervious surfaces picks up and washes off pollutants and is usually more polluted than runoff generated from pervious areas. In general, undeveloped watersheds with small amounts of impervious cover are more likely to have better water quality in local streams than urbanized watersheds with greater amounts of impervious cover. Impervious cover is a primary factor when determining pollutant characteristics and loadings in stormwater runoff.

The degree of imperviousness in a watershed also affects aquatic life. There is a strong relationship between watershed impervious cover and the decline of a suite of stream indicators. As imperviousness increases the potential stream quality decreases with most research suggesting that stream quality begins to decline at or around 10 percent imperviousness (Schueler, 1994; CWP, 2003). However, there is considerable variability in the response of stream indicators to impervious cover observed from 5 to 20 percent imperviousness due to historical effects, watershed management, riparian width and vegetative protection, co-occurrence of stressors, and natural biological variation. Because of this variability, one cannot conclude that streams draining low impervious cover will automatically have good habitat conditions and a high quality aquatic life.

As shown in Table , a very small percentage (2.6 percent) of Carr's Creek watershed consists of impervious surfaces.

Table - Impervious Area in Carr's Creek watershed

Impervious Acres	Impervious Percent
497.0	2.6

2.7.3 Zoning

2.7.3.1 Town of Franklin

Two zoning districts in the town of Franklin are present within Carr's Creek watershed: Rural III and Rural V. Out of a total of 152 parcels located within the Carr's Creek watershed, 64 percent are zoned as Rural III. The remaining 36 percent of parcels are zoned as Rural V.

As written in the Town of Franklin Zoning Law, the Rural III district allows for lower density development of residential, agriculture and limited commercial establishments. The Rural III district encompasses all lands within 500 feet of the center line of a town road, with direct frontage on the right-of-way. The Rural V district permits only low density residential development with limited commercial uses and includes all lands not within 500 feet of an existing town. Permitted uses for both rural zones include: one, one- or two-family dwelling per lot; one mobile home per lot; agricultural practices; forestry management; and, wildlife management. Table lists density, height, area, and yard requirements for Rural III and Rural V zoning districts.

Table - Town of Franklin Zoning Requirements

Requirements	Rural III	Rural V
Minimum lot area	3 acres	5 acres
Minimum frontage	300 feet	350 feet
Maximum height	35 feet	35 feet
Front setback	75 feet from road center line	75 feet from road center line
Side/rear setback	25 feet	30 feet
Maximum lot coverage	20%	15%
Maximum lot depth to width ratio	4:1	4:1

2.7.3.2 Town of Sidney

The Town of Sidney is divided into four classes of districts: Residential, Residential-Agricultural, Commercial, and Manufacturing. The majority of the parcels located within the Carr's Creek watershed are zoned as Residential-Agricultural (78 percent). The remaining 22 percent is split between Residential (18 percent) and Commercial (4 percent).

As stated in the Town of Sidney Zoning Ordinance, permitted uses for the Residential district include single family dwellings, public buildings or recreational areas (e.g. churches, schools, libraries, playgrounds) not operated for financial gain. Land or buildings used by the Town of Sidney for administrative purposes, water supply, sewerage facilities, fire, or police stations is also permitted within the Residential district. Residential-Agricultural permitted uses include those regulated under the Residential district in addition to agricultural facilities including floricultural, horticultural, and forest farming; animal hospitals, riding stables, and private wildlife reservations; cemeteries; and, mobile home parks. Permitted uses for the Commercial district include any permitted use in the Residential district (except mobile home parks) in addition to, but not limited to, the following: retail stores; service shops; restaurants; hotels, banks, and offices; commercial recreation facilities; public garages and auto repair shops.

2.8 Protected Areas

2.8.1 Conservation Areas

NYS DEC and local agencies may designate specific geographic areas within their boundaries as "Critical Environmental Areas" (CEAs; NYSDEC(c), 2011). Critical Environmental Areas must have an exceptional or unique character with respect to one or more of the following:

A benefit or threat to human health;

A natural setting (e.g. fish and wildlife habitat, forest and vegetation, open space and areas of important aesthetic or scenic quality);
Agricultural, social, cultural, historic, archaeological, recreational, or educational values; or,
An inherent ecological, geological or hydrological sensitivity to change that may be adversely affected by any change.

While there are no CEAs within the Carr's Creek watershed, Carr's Creek is a stocked and naturally reproducing trout stream that is protected by the NYDEC. A Protection of Waters Permit is required for disturbing the bed or banks of a stream with a classification of C(T) or higher, which includes all of Carr's Creek and Willow Brook, whether the disturbance is temporary or permanent. Further, the NYDEC's Protection of Waters Regulatory Program by way of Title 5 of Article 15 of the Environmental Conservation Law seeks to preserve and protect the states lakes, rivers, streams and ponds. Through this program the DEC requires that projects that disturb or will discharge to a regulated waterbody, including commercial, industrial or multi-residential development projects go through an environmental clearance process, including satisfying the requirements of the State Environmental Quality Review Act (SEQR) to receive the proper environmental permits.

There are also no state forests, forest preserves, state parks, special use areas, or wildlife management areas in the Carr's Creek watershed. Pine Hill State Forest is the closest conservation area to the vicinity of Carr's Creek and is located approximately 1 mile to the west of the watershed's boundaries.

2.8.2 Buffer Protection

Stream corridor buffers are not currently protected through specific local or state regulation. There are, however, state and federal regulations related to forest impacts and timber harvesting that can apply to stream corridor buffers in certain situations. Depending on the project, the U.S. Army Corps of Engineers may require a permit for impacts at stream crossings and the NY DEC requires a permit for impacts to stream crossings for certain classifications of streams and wetlands. Further, NY DEC requires minimum residual stand densities for timber harvesting in wetlands, and protects State Wild, Scenic or Recreational Rivers with a 150 buffer from forest management roads. Carr's Creek and Willow Brook do not have this designation.

Delaware County, in partnership with the Delaware County Soil and Water Conservation Program, the New York City Department of Environmental Protection (DEP), and the U.S. Army Corps of Engineers are creating Stream Corridor Management Plans for the East Branch and West Branch of the Delaware River. The plans are voluntary programs to address issues related to stream stability, property protection, flooding, aesthetics, recreation and ecology. The plans offer information for landowners on the benefits and management of riparian buffers and recommends buffer widths for various scenarios including 25 feet wide for mid-sized streams in residential settings and 35-180 feet in agricultural lands (DCSWCD, 2006).

2.9 Stormwater

2.9.1 Stream Crossings/Culverts

Stream crossings are critical components of local infrastructure both in terms of transportation connectivity and their potential impact on the stream system. Impacts can include presenting a barrier to aquatic organism passage, particularly fish, and crossings can also be locations where stream bank and stream bed erosion can occur due to the placement of bridge footers and culvert bottoms. Stream

crossing flooding and the need to keep transportation corridors open during emergency events is a particularly important challenge in the Carr's Creek Watershed.

Many stream crossings occur throughout the watershed. Map 11 displays the locations of the County and Town bridge structures in addition to culvert crossings which are distinguished between driveway pipes and cross pipes. Based on the analysis of data provided by Delaware County Department of Public Works there are 17 County bridges, six town bridges, and 438 culvert crossings in the Carr's Creek Watershed. Of the culvert crossings, a majority are small crossings of 2 feet in diameter or smaller; however, 22 culverts are greater than 4 feet in diameter.

2.9.2 Storm Drains

The Carr's Creek watershed is a disconnected system without storm drains and curb and gutter use. Open swales and roadside ditches are used to direct runoff.

2.9.3 Stormwater Management

The need for extensive structural stormwater management facilities related to water quality treatment for roadways and parking lots is low in the Carr's Creek watershed due to the small amount of impervious surface (2.6 percent) in the watershed. In addition, the watershed and Delaware County are not covered under a State Pollutant Discharge Elimination System (SPDES) Municipal Separate Storm Sewer System (MS4) permit. Specific information on the type and location of stormwater management facilities was not available for this report; however, it is assumed to be of minor significance.

3 Current Condition Assessment

3.1 Stream Assessment

In 2008, trained citizens conducted stream corridor assessments throughout the Carr's Creek watershed by walking segments of Carr's Creek and Willow Brook (Map SC1). The assessment focused on erosion sites, cows in streams, trash dumping, fish barriers, and any other occurrences that would be detrimental to overall stream health. Table , Figure 1, and Maps SC1 through SC5 present the results from the 2008 Stream Corridor Assessment in Carr's Creek watershed.

Channel alteration was observed at 14 sites with the type of material used for the alterations ranging from earth channel to concrete, rip-rap, and steel bridge abutments and the length of channel alterations ranging from 50 feet to 300 feet (Map SC2).

Multiple erosion sites (55 sites) were observed throughout the assessed portions of Carr's Creek and Willow Brook (Map SC3) with the most erosion sites occurring along Carr's Creek adjacent to County Highway 23 near Dunshee Road and adjacent to Franklin Depot Road near Franklin Depot. Eroded bank length ranged from 30 feet to as much as 500 feet to 0.25 miles (1,320 feet) with exposed bank heights ranging from 1 foot to 40 feet. The majority of erosion sites were located on meanders with pasture/crop fields, lawn, shrubs, or small trees within the riparian buffer. Mature trees within the riparian buffer zone help with erosion control as the root systems within the soil add stability to a stream bank.

Table - Summary of Sites found in Carr's Creek Watershed during 2008 Stream Corridor Assessment

Channel Alteration	Erosion Sites	Exposed Pipes	Fish Barriers	Inadequate Buffers	Pipe Outfalls	Stream Crossing	Trash Dumping	Unusual Conditions
14	55	6	5	5	4	7	2	11

Figure - Stream Corridor Assessment Results

As shown in Map SC4, few exposed pipes (6) and pipe outfalls (4) were observed throughout the Carr's Creek watershed. Seven stream crossings were found primarily along the main tributary of Carr's Creek and generally consisted of informal vehicle crossings, county bridges, and in one instance, a bridge for cattle crossing. All stream crossings were considered to be causing minimal to no impact to the stream.

Map SC5 presents Stream Corridor Assessment data for fish barriers, inadequate buffer, and unusual conditions found in Carr's Creek watershed. Five fish barriers were recorded; all sites were located along the downstream portion of Carr's Creek. Observed fish barriers included fallen trees in stream, beaver dams, dry channels, and boulder blockages. Due to the prominent agricultural land use found along Carr's Creek and Willow Brook (27 percent pasture/hay, Table , Section 2.7.1), inadequate buffers were observed throughout the watershed.

Two trash dumping sites were observed along County Highway 23 near Franklin Depot—one site consisting of tree trunks and a metal roof, while the other site consisted of a washed out informal

bridge. Eleven unusual conditions were observed throughout the watershed ranging from debris dams to excessive algae/unusual water color and clarity in a pond downstream of East Sidney Lake.

3.1.1 Valley Type

The Carr's Creek watershed can be classified as Valley Type VIII. Valley Type VIII is characterized as "wide, gentle valley slope with well-developed flood plain adjacent to river and/or glacial terraces" (Rosgen, 2007).

3.1.2 Habitat

Detailed information on stream habitat is not presently available for Carr's Creek and Willow Brook. Stream habitat for macroinvertebrate and fish populations consists of a combination of riffles, pools, glides and eddies with instream woody debris. A complexity of flows, depths, velocities and habitats is preferable with shaded and stable reaches. Based on visual observation and the understanding that the system supports trout populations the status of the habitat quality in Carr's Creek is generally in good condition. Segments of erosion, inadequate riparian buffer, and instream sediment deposition are present; however, good water quality conditions and a prevalence of desirable gravel and cobble substrate provide available cover for macroinvertebrates and spawning areas for trout.

3.1.3 Riparian Buffer

Streamside vegetation observed during the Stream Corridor Assessment consisted of willows, sycamores, and sedges with the occasional presence of invasive species such as Japanese knotweed (*Polygonum cuspidatum*) and multiflora rose (*Rose multiflora*) also observed. Riparian buffer width varies throughout the watershed depending on local land use—with excellent buffers in forested areas and depreciated buffers for streams adjacent to roadways (e.g. through Sidney Center). Vegetative protection is also variable throughout the watershed, ranging from stable root systems of mature trees to mowed lawns or pasture grasses.

3.2 Pollutant Load Modeling

Pollutant load modeling is a type of water quality modeling that is used to estimate the amount of a pollutant entering a particular water body. In itself, the modeling is not sufficient to determine if there will be water quality problems because there are physical, chemical and biological processes in the downstream receiving waters that can change the effects of the loads by reducing or compounding them. Estimating pollutant loading, however, is a less complex modeling task than estimating receiving water quality. The model used for this study is uncalibrated, meaning that there were no onsite samples of runoff or dry weather pollutant loads to be used to adjust the input parameters. The results, however, are still a useful guide to watershed management, if used to indicate the relative effects of different types of pollutant sources or management measures.

The Generalized Watershed Loading Function (GWLF) model was used to estimate pollutant loads. The model includes loads from rural (forest and agricultural) runoff, urban runoff, point sources, septic systems, and groundwater. Pollutants modeled included total nitrogen (TN) and total phosphorus (TP). The model provides procedures to estimate improvements from changes in land use or other practices.

The charts below summarize the results. Fifty percent of the nitrogen loads were from rural sources, and 26 percent was from septic systems, both working and failed. Twenty percent of the load is from uncontrollable sources: groundwater, open water, and forest/wetland.

Figure - Nitrogen and Phosphorus Sources

The majority of the phosphorus load was estimated to be from rural sources. These sources, plus septic systems, accounted for 90 percent of the total. Eight percent of the load was from uncontrollable sources, including groundwater and forest/wetland.

Table 12 below breaks down the runoff loads from each type of land use in more detail:

Table – Pollutant Sources

Source	Area (ac)	Runoff (in)	TN (lb/yr)	TP (lb/yr)
URBAN SOURCES				
Developed/Low	74.13	1.09	44.10	0.00
Developed/Med	4.94	1.38	0.00	0.00
Developed/Hi	2.47	7.48	22.05	0.00
Roadway R/W	637.52	2.66	1,190.70	154.35
RURAL SOURCES				
Row Crops	716.59	2.66	6,085.80	4,101.30
Grassland	341.00	0.76	242.55	110.25
Pasture/Hay	5,016.13	0.93	4,079.25	1,278.90
FOREST/WETLAND				
Deciduous Forest	9,278.61	0.80	463.05	242.55
Evergreen Forest	758.60	0.66	44.10	22.05
Mixed Forest	1,672.87	0.80	88.20	44.10
Shrub/Scrub	185.33	0.53	220.50	176.40
Woody Wetlands	252.04	1.32	22.05	0.00
Herbaceous Wetlands	9.88	1.50	0.00	0.00
OPEN WATER	59.30	32.58	88.20	0.00

3.3 Flooding

3.3.1 H/H Modeling

SCIG requested that KCI Technologies Inc. prepare a Hydrologic and Hydraulic (H/H) analysis for the Carr's Creek Watershed in support of watershed management efforts (KCI, 2012). The objective of this study is to estimate the volume and peak discharges corresponding to design storms with 1-, 2-, 5-, 10-, 25-, 50-, and 100-year return periods for eight subwatersheds including the main stem of Carr's Creek, Willow Brook Tributary and two unnamed tributaries of Willow Brook. These discharges are used to model the reaches and five crossings to estimate the hydraulic response of the system for each design storm including water surface elevation, velocity, and shear stress. The results are being used in the current watershed planning studies and the model can provide a means to investigate the impact of various management scenarios in the future.

The model utilizes land cover, soils, topography, stream channel information, and stream crossing data to estimate peak flows and channel response in terms of stream discharge, water surface elevations, and potential for road crossing overtopping. The modeling effort included extensive calibration and validation against regional gage data and the June 2006 flooding event. Initial model inputs were enhanced with the inclusion of newly available LIDAR (Light Detection and Ranging) data that increased the accuracy of general topographic data and stream channel geometry and dimensions in particular.

A total of five crossings were modeled in HEC-RAS. They were selected based on the potential for flooding impact on community or populated areas, and potential need for replacement. Three crossings were on Carr's Creek (one culvert – CC02 under Franklin Depot Road West from Powers Road

intersection and two bridges – CC09 under Franklin Road West of Wheat Hill Road intersection and CC11 under Route 23 East from Franklin Road intersection) and two bridges were on Willow Brook (WB7 under Route 27 West from Route 23 intersection and WB9 under Route 35 between Finch Avenue and Route 23). Geometry dimensions describing the crossings were derived from data and photos provided by project partners.

Table 13 summarizes the frequency and depth of overtopping. Appendix A provides the 100-yr water surface elevation profiles. Model results show that the most frequently overtopped crossing was CC02, a small culvert under Franklin Depot Road. The other structures overtopped less frequently, at either the 10-, 25-, or 50-year event. All the structures overtopped for the 100-year event. In every case, the model indicates that flooding is caused by structure capacity rather than by back water from flooding effects downstream.

In the management planning phase of the project, two additional crossings were modeled, the Crossing under Route 35 between Anderson Avenue and Center Street, and the culvert from Finch Avenue to the mainstem of Willow Brook which are in sequence. For these crossings, the model indicates that flooding, at the 100-yr stage is potentially being caused by downstream backwater effects rather than crossing capacity.

Table - Road Crossing Overtopping

Crossing	Storm Return Period (frequency)	Overtop depth (upstream)	Overtop depth (downstream)	Water Surface Elevation (upstream)	Water Surface Elevation (downstream)	Road Elevation
CC02	1	0.33	0.28	1,613.33	1,613.28	1,613.00
	2	0.60	0.46	1,613.60	1,613.46	
	5	1.22	0.93	1,614.22	1,613.93	
	10	1.54	1.15	1,614.54	1,614.15	
	25	1.80	1.36	1,614.80	1,614.36	
	50	2.02	1.58	1,615.02	1,614.58	
	100	3.15	2.54	1,616.15	1,615.54	
CC09	10	0.73	0.69	1,324.73	1,324.69	1,324.00
	25	0.91	0.81	1,324.91	1,324.81	
	50	1.09	0.93	1,325.09	1,324.93	
	100	1.57	1.43	1,325.57	1,325.43	
CC11	100	1.42	1.26	1,290.42	1,290.26	1,289.00
WB7	50	1.30	0.59	1,363.80	1,363.09	1,362.50
	100	1.83	0.89	1,364.33	1,363.39	
WB9	25	1.59		1,294.79		1,293.20
	50	1.68	0.73	1,294.88	1,293.93	
	100	2.37	1.10	1,295.57	1,294.30	

4 Summary of Problems

Through a compilation of mapping data, monitoring and assessment results, and H/H and pollutant load modeling, KCI developed a summary of the resource issues and problems facing the watershed. To begin, parts of the stream network are in very good condition, as evidenced by the designation of sections of the watershed as Use Class C with trout spawning areas. Trout are very intolerant to pollution, habitat degradation, and to increases in water temperature, so they are a good indicator that long-term conditions are good. Likewise, during the macroinvertebrate bioassessment, stoneflies, mayflies, caddisflies, and blackflies were all identified, among others. The stoneflies and mayflies are generally sensitive to water quality degradation and are therefore good indicators of an overall good condition.

Other areas of the streams and watershed showed evidence of problems, however, including the following:

4.1 Streambank Erosion

During the stream assessment, 55 sites were flagged with active erosion, for a total of 1.26 miles of stream. Stream erosion can be a significant source of sediment and nutrient loads, particularly phosphorus. This excess sediment changes the flow and habitat characteristics and can smother the gravel and cobble bottoms that are important in the life cycle of sensitive macroinvertebrates.

4.2 Reduced or Absent Riparian Buffer

Five sites were noted during the stream assessment with inadequate buffer. Forested stream buffers are desirable for a number of reasons. They provide shade for the streambed, which helps keep water temperature from increasing. Higher temperature reduces dissolved oxygen, which in turn, affects sensitive species. Leaves, woody debris, and detritus from the buffer also provide habitat and a food source for species on the bottom of the food chain, leading to improved biodiversity. Finally, root systems from buffer vegetation help anchor soil on stream banks, reducing or preventing erosion.

4.3 Flooding

Reports of flooding in Sidney Center date back 100 years, with one of the most severe instances occurring recently in June 2006. Flooding issues include overtopping of road crossings. This was noted during the 2006 flood. The H/H modeling showed that there is the potential for frequent overtopping of the modeled road crossings. Three of the five modeled bridges and culverts overtopped for the 25-year storm.

Upstream watershed characteristics contribute to the potential for flooding. Two features in particular cause a high rate of runoff. The first is the underlying geology of glacial till, and the soils derived from it. The majority of soils in the watershed have low infiltration rates and high runoff potential; that is, a large percentage of the rainfall runs off instead of soaking into the soil. The second feature is the topography. A substantial portion of the watershed consists of steep slopes. Along with this, there are few locations where runoff is ponded or stored before it flows to ditches or tributaries to the stream network.

Development in the floodplain has also contributed to flooding. Several structures in Sidney Center have been built within the floodplain of both Willow Brook and Carr's Creek and are vulnerable to flooding during a substantial storm event.

4.4 Water Quality

While overall there were no significant impairments identified, there are two sources of pollutants that could contribute to poor water quality: septic system discharges and agricultural runoff. Septic systems, even those in good working order, export nitrates from the leach field to groundwater which eventually makes its way into stream baseflow. In areas with a high enough density of septic systems, this can contribute to poor stream quality. Failed septic systems are a source of pathogens, which can be a health issue in significant concentrations.

Agricultural runoff is a source of soil washed off from fields, which contains nitrogen and phosphorus, along with sediment. Because of the amount of area in agriculture within the watershed boundaries, this was the single largest potential source identified with the pollutant load modeling.

4.5 Summary

Many of these water quality issues interact with one another, so that an issue which might not be significant on its own may be a factor in causing other, more serious degradation. Figure illustrates this process.

Figure - Watershed Issues Summary

By themselves, soils and slopes may not be a problem in a watershed; however, coupled with land use changes such as deforestration or urbanization, they can lead to higher runoff rates. High flows, with poor buffers, may be a cause of streambank erosion and habitat impairment. High runoff rates alone in an urbanized area may not be a problem, but if they occur in areas with floodplain development or road crossings that were designed for lower flows, they can lead to flooding problems.

4.6 Emerging Issues

In recent years, the exploration and removal of natural gas from deep reserves in low permeability Marcellus Shale rock formations has been made possible due to drilling techniques such as horizontal drilling and high-volume hydraulic fracturing. This process, also known as hydrofracking, has been quite controversial and its use has been evolving to varying degrees in several states with Marcellus Shale reserves such as Maryland, West Virginia, Ohio, Pennsylvania, and New York. New York State's policies on hydraulic fracturing continue to evolve quickly and are therefore not documented here. Visit the Department of Environmental Conservation website for more details (www.dec.ny.gov). While the pros and cons of this type of gas extraction continue to be debated, this plan seeks only to recognize the potential impacts to the Carr's Creek watershed from hydraulic fracturing and the related infrastructure.

Table – Hydraulic Fracturing Gas Extraction Potential Impacts

Component	Primary Impacts	Secondary Impacts
Drilling pad site development	Forest, land clearing, loss of habitat	Erosion, sedimentation, increased runoff, stream and groundwater

		impacts, dust/air quality impacts
Road development (paved and unpaved)	Forest, land clearing, increase in roadway runoff and pollutants	Erosion, sedimentation, stream and groundwater impacts, dust/air quality impacts
Pipeline/transmission line development	Forest, land clearing, loss of habitat	Impacts at stream crossings
Increase in heavy truck traffic	Noise, air pollution	Damage to local roads and bridges, traffic impacts
Water utilization (if acquired from streams)	Reduced baseflow and low flow discharge	Potential aquatic habitat degradation
Water utilization (if acquired from groundwater)	Reduction in local groundwater supply	
Inadequate disposal and treatment of fracking and backflow waters	Contamination of surface and groundwater	Impacts to biota, surface water quality, and groundwater quality, drinking water
Well casing failure or accidental spills of fracking and backflow waters	Potential contamination	Impacts to biota, surface water quality, and groundwater quality, drinking water

5 Conservation and Restoration Priorities

The completed watershed management plan will provide recommended management actions to restore, protect, and manage the watershed. Such actions, i.e. best management practices (BMP's) or resource protection are most effective when strategically located at sites that will have a substantial influence on natural habitat, water quality, and stream flows. In October 2011, the Sidney Center Improvement Group sponsored a Watershed Priorities workshop to develop criteria for selecting prospective restoration and protection areas. Guided by Michael Strager, Ph.D. of West Virginia University, the prioritization process combined the experienced views of resource professionals with the knowledge of local residents and stakeholders. Following the workshop, maps were prepared delineating these priority areas which will be integrated into the watershed management plan.

The conservation and restoration priorities delineated on the maps represent a landscape-level analysis for achieving the key watershed management goals of reducing flood risk, protecting natural stream corridors, improving stream and riparian habitats, and sustaining natural stream flows. These maps will guide the selection of sites best suited for implementing specific actions recommended in the watershed plan. Site-specific characteristics will also be considered on a project-by-project basis as appropriate. Areas delineated for resource protection consisted of working lands (farm and timber lands), wildlife habitat, wetlands, water quality, and forests. Important restoration needs include flood reduction measures, stream bank stabilization, inadequate bridges and culverts, and riparian buffers.

The developed maps are included at the end of this report and are organized as such:

Land Conservation Priorities

- Wildlife Habitat
- Working Lands
- Wetland Resources

Water Quality
Forest Resources
Combined/Overall Land Conservation

Resource Restoration Priorities

Riparian Stream Buffer
Stream Bank Erosion
Instream Debris
Stormwater Controls
Combined/Overall Resource Restoration

6 Management Plan

This management plan identifies the recommended strategies that, when implemented, will accomplish the goals and objectives of the watershed planning process.

6.1 Goals and Objectives

A set of goals and objectives were developed to provide a framework for the management strategies that follow. The final goals and objectives were developed as a combination of three sources; first, the initial goals and objectives identified by the SCIG during the NFWF grant application process before the initiation of the watershed characterization and plan (Section 1.1); second, the Watershed Priorities Workshop which was a collaborative effort among local and regional resource professionals and stakeholders developing an outline of the watershed issues and the priorities for preservation and restoration (Section 5); lastly, the results of the characterization itself and the primary watershed stressors (Section 4) were included in the development of the final Goals and Objectives.

Goal 1: Restore and sustain ecological function to Carr's Creek and its tributaries

- Objective 1A: Re-establish environmental functions in the river

Goal 2: Improve water quality to reduce impacts to the trout fishery

- Objective 2A: Reduce bacterial contamination
- Objective 2B: Reduce excessive sedimentation
- Objective 2C: Reduce or prevent high water temperatures

Goal 3: Preserve and restore natural resources and working lands

- Objective 3A: Preserve high priority natural resources, including wildlife habitat, wetlands, and forests
- Objective 3B: Restore high priority natural resources
- Objective 3C: Preserve working lands

Goal 4: Reduce the risk of future severe flooding

- Objective 4A: Reduce risk to structures
- Objective 4B: Reduce risk to road crossings

Goal 5: Contribute toward the Chesapeake Bay milestones for nutrient loads

- Objective 5A: Reduce nitrogen and phosphorus loads

6.2 Management Strategies

The management strategies listed in the matrix included in Appendix B were developed to correspond with the goals and objectives described above. Due to the nature of watershed issues, many strategies could be appropriately placed under several categories of objectives; however, to be concise the strategies were placed in the category deemed most appropriate. While many of the management strategies are broad and applicable to the entire Carr's Creek and Willow Brook watershed, the overriding theme is that the efforts will be targeted whenever possible in the highest priority restoration

and protection areas. The priority areas for several strategies have already been developed and are included as maps in this plan.

The strategies were developed by KCI with input from project partners and stakeholders. An Agency Workshop was held on September 27, 2012 to initiate development of the strategies and to begin the identification of the responsible parties. Agencies and organizations represented at the workshop included KCI Technologies, Inc. Sidney Center Improvement Group, National Park Service, Town of Sidney Highway Department, Delaware County Planning, Southern Tier East Regional Planning Development Board, Delaware County Economic Development, New York State Department of Environmental Conservation, Environmental Finance Center at Syracuse University, and the general public.

The following sections describe the major components of each strategy:

6.3 Benefits

A description of benefits is included for each strategy. Depending on the type of strategy, the existence and specificity of current condition data related to that strategy, and confidence in the estimates for potential implementation, the benefits are either qualitative in nature or more quantitative. Qualitative benefits include items such as improving fish spawning habitat, preservation of forested land, or improving safe conveyance of flood waters. For management strategies where more is understood and better forecasts of implementation can be made, the quantitative estimates focus on the strategy's impact on water quality (pollutant load reduction) or the effect on runoff and flooding. Descriptions of the development of quantitative benefits are included here.

6.3.1 Pollutant Load Reductions

To understand the impact that each strategy would have on water quality, a pollutant loading analysis was conducted to estimate reductions in nutrients and sediment. A full description of the methods and results is presented in Appendix C – Pollutant Loading Estimates. Water quality benefits from the proposed management strategies were estimated using the GWLF model prepared for the characterization study and a spreadsheet analysis using pollutant removal rates approved by the Chesapeake Bay Program. Improvements in water quality come from five types of activities: changes in land use, reduction of runoff pollutants at the source, treatment of runoff, improvements to septic systems, and projects to stabilize streams and reduce erosion.

Modeled load reductions were developed as follows:

Land Use - Four of the strategies could be modeled by a change in land use: Riparian Reforestation, Non-Riparian Reforestation, Restore Forest Upstream of Anderson Avenue, and Retire Marginal Cropland. The approach for all of these was to identify an existing land use, usually Pasture/Hay, that would be converted to forest. The input to the model was revised to reduce the acreage of the existing land use in increase the acreage of forest. Because runoff from forest has better water quality, the amount of pollutants is decreased.

Source Reduction - Seven of the strategies are designed to remove pollutants at the source, before they can be washed off by precipitation: Live Stock Exclusion, Barnyard Runoff Control, Loafing Lot Stabilization, Forest Harvesting Practices, Prescribed Grazing, Cover Crops, and Continuous No-Till. All of

these improvements were modeled by estimating the base load from existing conditions, and reducing them by a percentage attributable to the management strategy. Base loads were estimated by making assumptions of the type and area of land use that would be affected and using a loading rate (lb/ac/yr) derived from the GWLF modeling.

Treatment - Two strategies reduce loads in runoff. The first, Riparian Reforestation, adds filtration to the modeled reductions from land use change. Roadway Drainage Ditch retrofits provide filtration from roadway runoff. Both were modeled similarly to the source reduction strategies, by estimating the load to be treated from land use area and loading rates, then applying a reduction to this amount.

Septic Systems - Three strategies dealt with improvements in septic system loads: Water/Sewer in Sidney Center, Denitrification Upgrades, and Septic System Maintenance. Septic system loads and reductions were modeled in GWLF, which provides input options to indicate if systems are working, failed, or short circuiting. The underlying assumption throughout these scenarios is that the existing condition includes 655 septic systems, all of which are assumed to be short-circuiting, and therefore providing reduced nutrient removal. For the Water/Sewer alternative, the total number of septic systems was reduced from by 116 from 655 to 539. The scenario assumes that the number of septic systems in Sidney Center is 116 and all of these would be converted to sanitary sewer and that others in the watershed but outside of Sidney Center would remain on septic. The Denitrification Upgrade assumed that the 539 systems outside of Sidney Center would be restored to normal operation and retrofit to reduce nitrogen output by 50%. The 116 systems in Sidney Center would remain short-circuited but due to modeling limitations the 50% nitrogen reduction was also applied to these. The two scenarios (water/sewer and denitrification upgrades) are complementary strategies and the combination of the two produce the desired result. The Maintenance measure is an alternative strategy that aside from sewer and upgrades assumed all 655 systems would be changed from short-circuited to working normally.

Stream Erosion - One strategy, Stream Restoration, was designed to reduce sediment and nutrient pollution from failed stream banks. Base loads were estimated with a spreadsheet using methods developed by the NRCS, with variables including stream length, erosion severity, and bank height. Improvements were modeled assuming all eroded streams would be stabilized to the extent that no further erosion would occur and pollutant loads from this source would be reduced by 100 percent.

Appendix C presents details on the current condition model, the load reductions estimated for each management strategy and the total load reduction assuming full implementation of the modeled strategies for the Carr's Creek watershed as a whole. The overall watershed results are provided here in Table 15.

Table – Summary Total Load Reduction

SCENARIO	TN (lb)	TP (lb)	SED (lb)
Current Condition Loads	21,681.4	7,462.7	23,172,518
Reduction with Full Implementation	(6,654.7)	(2,863.9)	(4,884,374)
Future Load with Reductions	15,026.7	4,598.8	18,288,144.6
Percent Reduction	-31%	-38%	-21%

6.3.2 Flooding

KCI identified strategies that would impact runoff volumes and potentially effect the location and severity of flooding in the watershed. These strategies are included under 'Goal 4: Reduce the risk of future severe flooding,' and were broken into two categories involving risk to structures (buildings, private property) and risk to road crossings. In addition, the reforestation management strategy under 'Goal 3: preserve and restore natural resources and working lands' was the one other strategy that was determined to be a factor in controlling stormwater runoff. Of the strategies identified for flooding, it was determined that at this planning level, only two strategies could be readily modeled using the hydrologic and hydraulic model developed by KCI for the Carr's Creek Watershed (KCI, 2012). These included the reforestation strategy which assumed a 500 acre planting area based on the retirement of 10 percent of existing pasture land use, and the design concept to relocate the CR 35 tributary to Willow Brook to alleviate personal property flooding issues.

The results of these two scenarios are included in Appendix D. In summary, the conversion of retired pasture to forest scenario with the 500 acres distributed proportionately among the subwatersheds, produced only a minor impact on runoff volumes. In general the runoff, in this case represented by peak flows, was reduced by an average 1.2 percent, with values as high as 2.3 and 2.7 percent for individual tributaries. The 500 acre model input value was developed assuming 10 percent retirement of pasture land was deemed to be a reasonable area to plant in the near term. It is likely that additional reforestation, if it could be accomplished, would provide more substantial runoff reduction. Reforestation provides a number of other primary and secondary benefits such as habitat enhancement, pollutant removal, carbon sequestration, and aesthetic and recreational values – therefore reforestation, along with riparian buffer enhancements, are highly recommended strategies.

The relocation of the Willow Brook tributary that runs alongside Route 35 (Depot Street) and currently flows under Depot Street between Anderson Avenue and Center Street and then underground in a culvert from Finch Avenue to the Willow Brook mainstem was modeled for the impact on flooding related to existing stream crossings. The channel relocation caused an increase in water surface elevation for the 100-yr flood by 0.96 ft at the Depot Street mainstem crossing and for the properties currently affected by the Willow Brook mainstem crossing. Because the elevation at the current Depot Street crossing is substantially higher, flooding would not be expected at that location with the channel relocation.

6.4 Responsible Party

The responsible party ensures the success and completion of a given action and will vary depending on the management strategy. In many cases the strategy will be best accomplished as a collaborative effort among several organizations including state and local agencies, governments, and volunteer groups.

The SCIG should provide a central organizational hub and may consider establishing an implementation workgroup or committee represented by the necessary parties to provide support to the SCIG on implementing various components of the plan. SCIG and the supporting group would provide the overall planning, coordination, and implementation tracking. Further, they would provide a critical central communication link between the various involved groups.

The following parties are included in the management strategies matrix:

Delaware County Department of Health
Delaware County Planning
Delaware County Soil and Water Conservation District (SWCD)
Izaak Walton League
Nature Conservancy
New York State Department of Environmental Conservation (NY DEC)
Otsego Land Trust
Private land owners
Sidney Center Improvement Group (SCIG)
Town Code Enforcement
Town Highway Department
Town of Franklin
Town of Sidney
Trout Unlimited
Upper Susquehanna Coalition

6.5 Cost Estimates

To understand the financial implications of each strategy, a planning level cost estimate for proposed management strategies were developed. Similar to the benefits estimate, the strategies with more specificity were more quantifiable in terms of the cost. In some cases a cost per unit (treatment, linear feet, acre, etc.) could be derived; however, an estimate of either the current impact or the level of implementation was unknown so an estimate of the complete cost for that strategy is also unknown. In other cases, even a unit cost was unavailable due to high level of variability perceived in implementing the strategy. For some strategies it was determined that existing staff resources would likely provide the majority of the effort and therefore no additional cost above current staff and program resources were assumed. Volunteer involvement is indicated for those strategies where volunteers could be involved in a meaningful way and would offset costs to a minimal amount.

The cost estimates are based on a variety of sources. In some cases the estimate is based on KCI's experience implementing similar strategies and programs. Input was gathered from project partners when necessary and from existing planning guidance such as USEPA (2003) and USEPA (1993).

6.6 Funding Sources

Funding sources provided with the management strategies vary depending on the type of strategy, they include using current program resources, local and state government funding, and a variety of grants, cost share programs and private programs that focus on water quality and environmental restoration. Examples of the types of grant funding sources in the management strategies matrix are listed below.

Agricultural cost share programs (WHIP)
American Rivers and NOAA Community-Based Restoration Program River grants
Federal Emergency Management Agency (FEMA) grants
Hazard Mitigation Plan (HMPG) grants
National Fish and Wildlife Foundation
New York State Department of Environmental Conservation "Trees for Tribs" Program

Susquehanna River Basin Commission (SRBC) grants
Trout Unlimited 1,000 Miles Campaign
U.S. Army Corps of Engineers grants
U.S. Department of Housing and Urban Development (HUD)
U.S. Fish and Wildlife Foundation grants
U.S. Fish and Wildlife Service National Fish Passage Program
USDA/NRCS Cost share programs - Wildlife Habitat Incentives Program

To initiate the funding component of plan implementation, SCIG sought the expertise of the Environmental Finance Centers (EFC) at Syracuse University and the University of Maryland. The EFC, together with SCIG, sponsored a Finance Workshop held in Sidney Center on October 22, 2012. The goal of the workshop was to identify applicable local, state, and federal funding mechanisms and programs specific to the Chesapeake Bay Watershed. Building on results of the workshop, the EFC prepared the following narrative strategy and a Funding Source Matrix found in Appendix E.

Financial Strategy Narrative
The Environmental Finance Center at Syracuse University and the Environmental Finance Center at the University of Maryland have prepared the Funding Source Matrix in Appendix E to provide a funding strategy for the Carr's Creek Watershed Management Plan. The matrix includes specific state, federal, local, regional, and private funding opportunities that either the Town of Sidney or SCIG can consider for watershed plan implementation. Additional partner entities include Delaware County and the Delaware County Soil and Water Conservation District who may also be able to apply for, or supply, funds and/or services in partnership with SCIG.

Where to Start:
While there are a number of ways that the actions in a watershed management plan may be prioritized, there are often immediate opportunities that can raise certain activities up the priority list. High priority short-term opportunities are those that are consistent with SCIG's current mission and core capacities and can be acted upon immediately, but cannot be expected to provide consistent income.

Wastewater Treatment – A local engineering firm has offered to develop an initial plan and feasibility study for an alternative wastewater treatment plant system for Sidney Center for $15,000. This plan could be funded by several programs included in the matrix, such as the NYS Environmental Facilities Corporation Engineering Planning Grant and the NYS Department of State Local Waterfront Revitalization Program.

Alleviating Flooding – The Delaware County Soil and Water Conservation district is preparing a plan to relieve flooding levels by reconnecting the creek (near Anderson Avenue) to the floodplain. This project will potentially lower stream levels during storm events and alleviate future flooding concerns. It is estimated that the full project will cost $1.2 million. Although full-project funding has not yet become available, there are several programs listed in this matrix, including the NYS Environmental Facilities Corporation Green Innovation Grants program, the Upper Susquehanna Coalition's Stream and Wetland Teams (of which Delaware County SWCD is a part), and potential NYS Department of State, USDA Rural Development programs. One potential concern will be the re-location of the County Highway Facility where the floodplain will be reconnected. USDA Rural Development Community Facilities funds could be

a particularly good fit for addressing this pressing need and should be sought to allow the construction of a new facility located outside of the floodplain.

Companion Funding – Effective and sufficient financing strategies typically require piecing together funds from a variety of sources to fully meet community needs. In addition to the aforementioned funding opportunities, it would be recommended that SCIG, upon completion of the watershed management plan, contact the Community Foundation of Southern Central New York to discuss opportunities for future funding. Community Foundation funds could be used for programs that require local cash matches. Community Foundation funds are unrestricted, meaning that they could be applied to any project deemed viable by the Community Foundation. It is also recommended that these funds could be considered to implement the watershed management plan, in whole or in part.

Emphasize Sidney Center's Chesapeake Bay Location – It is also advisable to seek additional funding from the National Fish and Wildlife Foundation. There are both large ($200,000 to $750,000) and small ($20,000 to $200,000) scale implementation grants available through the Chesapeake Bay Stewardship Program that would be appropriate for a number of the restoration and water quality improvement activities recommended in the watershed plan. Depending on SCIG's capacity, these could be applied for to complete projects as needed, or a family of projects could be grouped in pursuit of a larger grant. As the Foundation is intent on investing equitably throughout the Bay watershed and few headwaters communities have applied for grant funds, prospects could be quite favorable.

The fact that Sidney Center is in the Chesapeake Bay watershed should be highlighted in applications to the State as well. New York has nutrient reduction requirements as a result of the Chesapeake Bay TMDL and the actions taken in Sidney Center can help the State meet its load reductions.

Political Will – Regardless of the project under consideration or the funding to be pursued, it is recommended that SCIG begin to pursue funding, even if town-level political will is difficult to cultivate. Developing applications for fundable projects takes time, and that time will allow for the development of more favorable political leadership, or identification of an appropriate applicant, if SCIG cannot apply alone.

Should the Town of Sidney reach a point where they are fully supportive of implementation activities, there are additional NFWF programs that can help provide technical assistance to the local government. This can take a number of forms, including engineering, project design, environmental assessment and other activities, and much like the implementation grants mentioned earlier is offered at smaller scales ($40,000 maximum) and larger-scales ($150,000 maximum).

Next Steps:
Looking beyond what is immediately available, there are also a number of slightly longer-term opportunities to be considered.

Community Revitalization – Upon the completion of the feasibility study and conceptual plan for alternative wastewater systems in Sidney Center, as well as completion of the floodplain reconnection, it is recommended that an application be submitted to the Community Development Block Grant program administered through the NYS Department of Housing and Community Renewal. These funds can support the sustainable redevelopment of Sidney Center. This program provides financial assistance to develop viable communities by providing decent, affordable housing, and suitable living

environments, as well as expanding economic opportunities, principally for persons of low and moderate income. Coupled with Appalachian Regional Commission funding and NYS Local Waterfront Revitalization Program funding, these three programs can be leveraged to create meaningful, sustainable and lasting improvements to Sidney Center.

Open Space Funding from the Environmental Protection Fund at the NYS Department of Environmental Conservation could also be a good fit for certain revitalization activities. Projects to repair and improve commercial facades, improve public rights-of-way, sidewalks, green space, parks and streamside amenities can be supported through these programs and can enhance the quality of life to retain current residents and businesses and attract prospective new residents and businesses.

Taking the Long View:
Some opportunities will take longer to develop, and may require SCIG to increase its organizational capacity.

Leverage Partnerships and Conduct Outreach – In order to better safeguard Sidney Center from continued flooding in the mid- to long-term, it is advisable to work closely with Delaware County and the County SWCD to ensure that Carr's Creek and its tributaries upstream of Sidney Center are managed appropriately. While Sidney Center and SCIG have no real responsibility or authority over land use, Sidney Center is impacted by land use practices upstream. The SCIG may want to facilitate public education through workshops, information campaigns, or other similar outreach methods to encourage sustainable land use and stewardship upstream. Working with the County and SWCD to help landowners act responsibly will benefit Sidney Center by mitigating upstream issues to reduce downstream impacts. The Funding Matrix includes descriptions of many programs that can protect farmland, encourage wetland construction, restore stream banks and reconnection of floodplains, create easements, and erosion control practices – all opportunities that can be shared with upstream neighbors.

Help Residents Address Private Property Issues – To improve quality of life for Sidney Center residents, USDA Rural Development provides programs that support single-family home repair and self-help housing loans and grants that can address water management or damage on private properties. The USDA 504 home repair loan/grant can be used for repair, replacement, operations, and maintenance of septic systems, as well as for hook up to central sewer. These programs can help residents retain ownership as well as help Sidney Center retain its rural community character. The Appalachian Regional Commission, through its Basic Infrastructure Grants and Housing Infrastructure Grants, can also be approached to support these efforts.

Looking forward, the SCIG will need to consider exactly what it would like its role in the community to look like in the long-term. If the organization is interested in sustaining or expanding its role in the protection and restoration of Carr's Creek Watershed, there may be need to increase the capacity of the organization to support this work. This may require establishment of more formal administration, paid staff, and regularly scheduled education and outreach programming in addition to managing project work and the funding streams that support it. If this is the case, a sustainable financing stream for the organization will need to be identified. This may initially need to take the form of capacity development grants while a longer-term fundraising or local financing strategy is identified.

6.7 Public Participation / Education

Public participation and education is essential for the successful implementation of the Carr's Creek watershed management strategies. As discussed throughout the matrix, the public can be engaged in a variety of ways for multiple management strategies. For example, public outreach through SWCD meetings can build awareness and provide information on what is considered problematic in the watershed and how the public can report problematic areas (e.g. debris in streams, barriers at road crossings and culverts). In addition, public participation will be encouraged to assist in monitoring efforts (e.g. fish populations, macroinvertebrates, sensitive species, and invasive species), tree planting, and restoration maintenance.

Building partnerships with landowners is also critical, especially in the farming community, because the majority of management strategies involve land under private ownership. The success of many management strategies to improve water quality depend on landowner cooperation and participation in educational workshops and new programs (e.g. Forest Management Plans, Nutrient Management Plans, improved pasture management).

6.8 Schedule and Milestones

The schedules and milestones column for each management strategy shows an estimated timeline over which an action will be performed. In general the planning horizon is a 10-year period, therefore most strategies are planned to be accomplished in that timeframe. Each strategy was divided into sub-tasks and the time to complete each sub-task was recorded in the matrix based on the 10-year timeline. The largest or most complex strategies such as the installation of municipal water and sewer for Sidney Center may extend beyond the 10-year horizon.

The schedule and milestones can be used to track the future planning and implementation of the various strategies.

6.9 Evaluation Criteria

The evaluation criteria describe how the completion and success of the management strategy will be measured. These criteria generally refer back to the schedule and milestones and track implementation of the strategy but not necessarily the benefits. Example criteria include: acres planted, miles of stream protected, number of landowners participating in control programs, and number of conservation easements established.

6.10 Monitoring

Monitoring activities were developed for each objective and are listed following the strategies for each objective in the matrix. Similar to each management strategy, the following information is provided for each monitoring activity: responsible party, cost, funding mechanism, public participation/education, schedule/milestones, and evaluation criteria.

These proposed activities are designed to monitor the success of each objective and, collectively, the overall goal. While the evaluation criteria tracks implementation, monitoring, as it is described here, will evaluate the effectiveness of the strategy and whether or not the intended benefit of the activity is begin realized. For example, the elimination of fish passage barriers can be first evaluated based on the number of barriers identified and removed; however, to understand the strategy's effectiveness, the fish population must be monitored.

As mentioned in Section 6.7, monitoring activities serve as a good opportunity to engage and educate the public. When possible, existing monitoring programs carried out by agencies and groups such as the Izaak Walton League, NY DEC, and Trout Unlimited can be incorporated into monitoring programs.

The SCIG along with local education professionals have implemented several volunteer monitoring programs that can be used or expanded on in the future, these include water quality sampling, stream monitoring using benthic macroinvertebrate sampling, stream discharge gaging, and stream corridor assessments.

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