Cameron Engineering & Associates, LLP

"LEED Accredited Professionals"

Request for Proposal

Town of Brookhaven
Long Island

Planning for the Forge River Watershed

January 2009

A. EXECUTIVE SUMMARY

The Town of Brookhaven (Town) has issued a Request For Proposals (RFP) entitled "Planning for the Forge River Watershed". The Forge River is an important water body that flows through the Town communities of Mastic and Moriches, ultimately discharging into Moriches Bay. Over the years, the steady degradation of the Forge River due to inputs of manmade pollutants has resulted in a serious loss of water quality. Unable to attain water quality standards, the Forge River is now listed as an "impaired water body." The Forge River regularly experiences episodes of hypoxia, resulting in fish kills, noxious odors, and the loss of marine-related businesses, recreation and tourism.

While the Forge River has been the subject of many past and current studies that have previously studied or are currently investigating the causes and status of the river's degradation, there has not been a comprehensive approach to address the multitude of issues relating to the mitigation of water quality and ecological impacts. This RFP is a critical step in consolidating existing information and combining this wealth of historic and scientific knowledge into a workable plan for the river's restoration.

The Town has recognized the significance of restoring the health of the Forge River. The establishment of the Forge River Task Force was a pivotal event that formally acknowledged the concerns of the communities. A number of environmental organizations continue to advocate for the protection and restoration of the Forge River, while state and federal authorities and legislators have expressed strong concern and the need for financial assistance. Thus, a critical point has been reached in the momentum of community support, scientific inquiry and regulatory agency concern for the Forge River. The timing is perfect for the development of a comprehensive watershed management plan. Developed through stakeholder consensus, supported by community and validated by sound science, the plan would be implemented in a strategic and timely manner.

The Town is seeking a qualified and experienced firm to undertake the necessary steps as detailed in the RFP. The Cameron Engineering & Associates, LLP (CEA) in association with CH2M HILL comprises a Project Team that is capable and prepared to take on this challenging project. The Cameron Engineering Team combines a long-established local Long Island firm with one of the nation's largest and well known, respected and highly ranked environmental consulting firms. Assisting the Cameron Engineering Team will be Mr. Jeffrey S. Levinton, PhD of SUNY Stony Brook who will serve as Scientific Advisor on the project.

Why we believe we present the Town with the best opportunity to start the recovery of the Forge River is because of the Team's following strengths and expertise:

- Team is lead by individuals experienced in marine sciences, nutrient removal and receiving water issues.
- Experience in development of Total Maximum Daily Load and Waste Load Allocations.
- Extensive experience in sewage collection, sewage treatment, nutrient removal and SPDES permitting.
- First hand knowledge of State management plans for Long Island Sound and the South Shore Estuary.
- Local and national expertise in watershed analysis and stormwater treatment.
- Highly professional staff of certified planners skilled in public outreach, smart growth planning, visioning and consensus building.
- Award winning environmental projects on both local and nation levels.
- Excellent relationship with Local, State and Federal agencies including; SCDHS, NYSDEC, NYDOS, NYSEFC and ACOE.
- Successful completion of DOS sponsored projects involving coastal, marine and habitat restoration.
- Proven ability to assist clients in obtaining grant monies.
- Thorough knowledge of SEQRA and permitting processes.
- Proven track record on projects involving the reuse and disposal of dredge materials.
- Experience in analyzing growth and build out scenarios using local Town codes and ordinances.

- Results orientated approach to projects involving consensus building, development of cost effective solutions, finding funding and obtaining agency(ies) approval.

The diversity of the Cameron Team experience and depth of the resources will provide the Town with the confidence that the goals and objectives of the Forge River RFP will be met on a timely and complete basis. We believe that the Forge River project requires the attention and professional analysis that the Cameron Engineering Team will provide.

B. PROJECT UNDERSTANDING

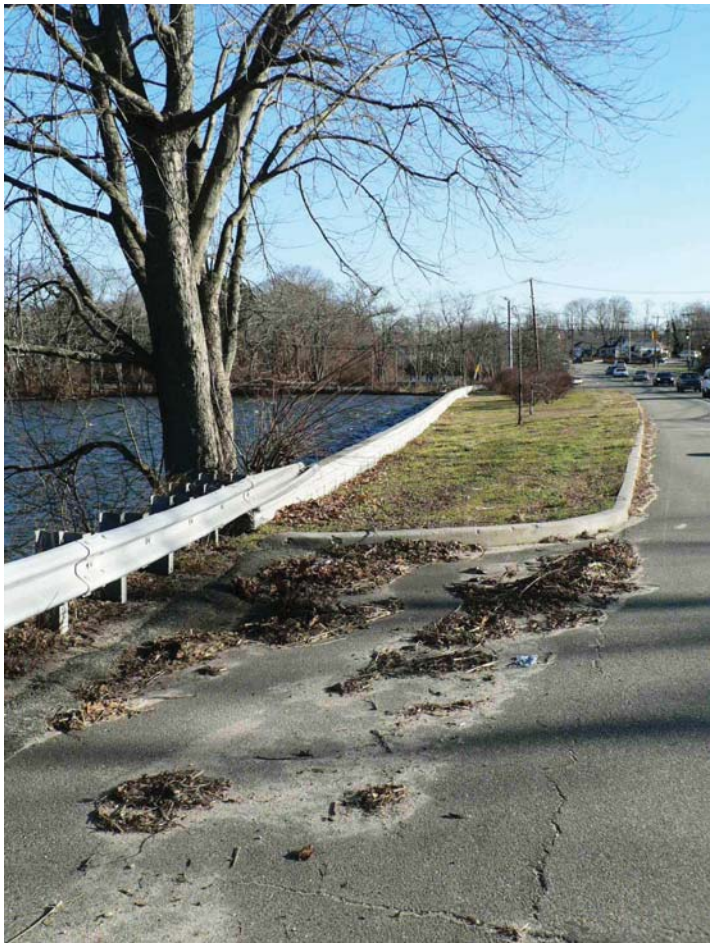
The Cameron Engineering Team has carefully reviewed the RFP and in addition to the information provided in this document, it conducted the following activities to further gain knowledge on the Forge River.

- Have spoken to scientists from SUNY Stony Brook University having worked on projects for the Forge River.
- Reviewed reports from the Suffolk County Department of Health Services pertaining to odors, fish kills, groundwater monitoring results and water quality data.
- Attended Suffolk County Sewer Task Force meetings where the potential sewering of the Mastic area was discussed.
- Discussed with State regulatory representatives relating to the removal and composting of duck manure from a major duck farm located on the upper reaches of the Forge River.
- Discussed with local Legislators on the importance and need for the sewering of the areas located within the Forge River watershed.
- Reviewed press releases and articles in local newspapers expressing the opinions and concerns of stakeholders located on the Forge River.
- Reviewed State water classifications, the South Shore Estuary Management Plan and current State water quality standards for the receiving waters of the Forge River.
- Visited the watershed area to observe field conditions.
- Reviewed census data and aerial photographs to better understand the concentration and location of housing units, commercial activities and open space within the watershed.

The Cameron Engineering Team has a good handle on the potential factors that have negatively impacted the health of the Forge River. It is know that there have been extensive efforts to collect data to better identify the relative proportion of the respect impact from groundwater, stormwater and sediments. It is known that differences of opinion amongst the various stakeholders as to what is causing the problems and what the solutions are exists.

This project will involve the assimilation and analysis of a large amount of data from over a dozen studies/ reports. Additionally, the need to analyze the existing conditions within the watershed is vital to further developing and quantifying the degree of the respective impacts on the Forge River both today and in future years. Equally important to the science side of the study is the community outreach and consensus building effort. The development of an effective plan will require buy-in from stakeholders as well as local and State governments. Funding will be needed to support many of the proposed remedial measures. The plan must clearly define attainable goals, associated costs and projected timeline for measurable improvements. If there were an easy solution at hand, it would have been put in place a long time ago. The Forge River has been undergoing a steady decline for more than twenty (20) years, it will take time to restore the health of this important ecosystem. A road map for its recovery is the deliverable of necessity.

The following sections detail the specific tasks that the Cameron Engineering Team propose to undertake in developing a comprehensive plan that could be implemented.



C. WORK PLAN AND TECHNICAL APPROACH

C.1.Community Outreach

Mastic and Shirley residents and their community organizations have played a prominent role in the efforts to restore the Forge River and its tributaries. Save the Forge River was established specifically to address the condition of the River and its tributaries and watershed. Environmental organizations such as Ducks Unlimited, Peconic Baykeeper, and others have contributed to the dialog. The Poospatuck Indian Nation borders the estuary. They have a strong interest in the health of the waters. The Waterways Homeowners Association, Mastic-Shirley Chamber of Commerce, Manor Park Civic Association, William Floyd Community Summit, and the Affiliated Brookhaven Civic Organization have all been involved in the efforts to address Forge River problems and consider the benefits of area sewering.

The NYS Department of State, Division of Coastal Resources published an important guidebook for the preparation of watershed plans in 2007, "Watershed Plans - Protecting and Restoring Water Quality." The authors stress the importance of community involvement in the process.

The Cameron Engineering Team has extensive public participation planning experience, having worked with communities in Nassau and Suffolk Counties in the development of a number of master plans. We recognize the critical importance that an informed public plays in the eventual implementation of any plan.

Watershed planning provides an opportunity for a community to reach out to its residents and businesses, building support for water quality improvements while planning for economic and community growth (NYSDOS).

Cameron Engineering has conducted numerous public participation planning workshops for parks master planning in the Towns of North Hempstead (Baywalk Park, Port Washington North), Oyster Bay (Western Waterfront, Hamlet of Oyster Bay), Babylon (Oak Beach Park, Oak Beach), Brookhaven (West Meadow Beach, Stony Brook). The workshops were always essential in seeking out stakeholder input, both positive and negative. In all cases, user groups, interest groups, community associations, environmental organizations, regulators, business interests, and others participated actively in the decision-making and design process. The resulting projects reflected the real needs and desires of the stakeholders, tempered by the realities of the site.

Our partner, CH2M Hill, has managed major watershed and waterbody planning initiatives around the country. CH2M HILL developed a watershed management plan for the 16-county Metropolitan North Georgia Water Planning District (MNGWPD). The plan included development of a water quality model, evaluation of watershed management alternatives and TMDL implementation strategies, and recommendations for long-term water quality monitoring. They conducted similar initiatives for the Tualatin River watershed, just west of the City of Portland, Oregon and the West Branch DuPage River in the Chicago metropolitan area, and major public outreach in New York that coordinated the efforts of over one hundred stakeholders.

C.1.1. Project Scoping Meeting

The Project Scoping Meeting would be held at the kick-off of the Project with the Town, the Watershed Advisory Committee (WAC), and the New York State Department of State (NYS DOS). If the proposed US Army Corps of Engineers (ACOE) Forge River Watershed Study has been initiated, then the ACOE would also be invited to participate to coordinate efforts and avoid duplication. The meeting would include a review of project requirements, site conditions, and roles and responsibilities. It would identify new information needs and next steps. Information that would assist in completion of the project would be transferred to the Cameron Engineering Team (Team). Key individuals, organizations, and entities to be involved in the Project would be identified. Project Scope items would be reviewed

and the makeup of the Technical Advisory Committee (TAC) to the WAC determined. A draft Project Schedule would be discussed that would include milestones, dates for the three (3) Public Workshops, and proposed advisory committee meeting dates. The Project Outreach plan would be reviewed with the Town. The Cameron Engineering Team would prepare and distribute a brief meeting summary indicating the agreements and understandings reached at the meeting.

C.1.2. Watershed Advisory Committee and Technical Advisory Committee

The Forge River Task Force, formed in 2005 by the Town of Brookhaven includes local lawmakers, state and local officials, environmentalists and advocacy group representatives. The Task Force was instrumental in developing a strategy to restore Forge River health. It worked with the NYS DEC to place the estuary on the State's Impaired Waters List, it oversaw the mapping of drainage infrastructure, and, along with citizen-based group Save the Forge River, played an advocacy role in securing federal funding for the river.

The Forge River Task Force meets monthly to consider Forge River environmental issues and to assist in the development of a comprehensive watershed management plan. The Task Force is chaired by the NYS DEC Regional Director and has oversight over watershed research activities including the SUNY Stony Brook sediment characterization, a stormwater remediation project along Montauk Highway, an illicit discharge reporting and response program, and, finally, the development of a watershed management plan. Best management practices and education/outreach materials are reviewed and recommended for implementation by the Forge River Task Force. In its 2007-2008 year, the Forge River Task Force provided oversight for a hydrographic study and the continuation of various studies including river sediments and a nitrogen budget study. It produced a non-point source guide brochure that was mailed to residents in the summer of 2008.

Forge River Task Force Members

DEC - Chair
SSER
SCDOH
SC Planning
SC DPW
SC Soil & Water Conservation Service
Suffolk County Legislator Kate Browning
Save the Forge River, Inc.
Peconic Baykeeper
Ducks Unlimited
Poospatuck Indian Nation
Waterways Homeowners Association
Mastic Fire Department
Brookhaven Environmental Protection & Planning

As a result of its continued advocacy efforts and success, the Forge River Task Force has been designated as the WAC for this project. The Cameron Engineering Team will work closely with the WAC throughout the study through in the development of the Community Outreach and Watershed Management Plans. The Team will keep the WAC up to date through scheduled meetings, project progress reports, e-mails and telephone contacts.

Our same level of commitment to coordination applies to the TAC who will oversee a number of aspects of this project, in particular, the review of scientific findings and methodologies. In addition to these scientific considerations, the TAC will provide feedback and ideas to the Team and the WAC with regard to the technical considerations of management strategies, ranking criteria, and approaches implementation. The TAC will make recommendations or provide advice on questions and issues that are raised during the course of the project.

C.1.3. Web-Based Actions

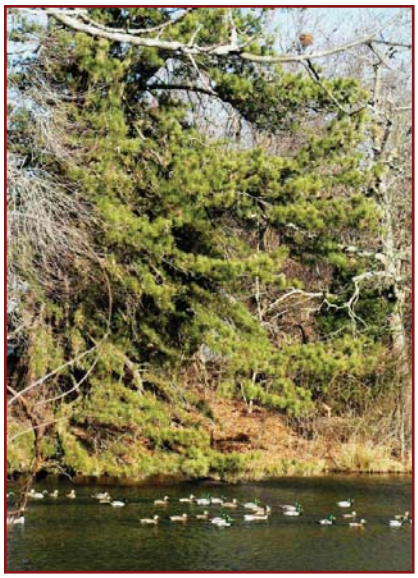
Use of the web can facilitate better communication between the Town, the Watershed and Technical Advisory Committees, and the Cameron Engineering Team. Project document sharing could be facilitated through the use of the Town's website, Cameron Engineering's website, a File Transfer Protocol (FTP) web site, third party web-based applications (e.g. Google Docs, Basecamp, others), or simply (but with less efficiency)

through email. With permission from the Town, the Cameron Engineering Team could establish a Project Blog that could serve as a useful forum for community commentary.

The Cameron Engineering Team would provide information for web pages for posting on the Town's interact server that would include educational material about watershed issues and information collected about the watershed. Drafts of the web pages would be submitted to the Town of Brookhaven and comments solicited from the Advisory Committees and the NYSDOS.

C.1.4. Public Workshops and Workshops

The Cameron Engineering Team would hold three (3) Public Workshops in cooperation with the WAC. The first workshop facilitated by the Cameron Engineering Team would be a Watershed Assessment. The purpose is to present all information gathered – summarized in text, tabular, map, and diagrammatic form – on the existing environmental, socioeconomic, and regulatory conditions that govern the Forge River watershed. The event would begin with a presentation of the findings that led to the Plan and the elements of the Plan itself. The presentation would include an overview of general watershed issues, the causes and effects of the recognized ecological impairments, the specific problems affecting this watershed, the role of government agencies in water quality protection, and the use of a TMDL to restore this aquatic system to acceptable water quality standards. After an initial PowerPoint presentation, attendees would be given an opportunity to break into smaller issue-focused groups where Project Team and Advisory Committee members would be available for discussion and recording of public sentiment and concerns. Boards would be set up to make it easy for attendees to record their opinions on particular issues. Feedback mailer forms would also be available along with take-home information that would include the Project Website and email addresses.



The Cameron Engineering Team would hold a second Public Workshop that will conducted as a community visioning session. At this event, a range of potential watershed management strategies that are under consideration will be presented. The visioning process will also include potential scenarios for the restoration and future use of the waterfront as well as future buildout scenarios for the watershed. After being informed of the potential costs, benefits, time frames and other implementation factors, participants will be asked to rank strategies. The feedback from this visioning workshop, such as community preferences and objections to specific strategies, will be recorded and used to inform the WAC's selection process for watershed management strategies.

The third Public Workshop would serve as a forum for the presentation by the Cameron Engineering Team of the Watershed Management Plan and the proposed elements of the TMDL to be developed at a subsequent phase. After an initial presentation by the Team, a number of stations would be established with presentation materials detailing the Plan. A member of the Team would be positioned at each station to engage in discussion with the public and record comments. Easels would be made available to record comments and forms made available to mail in commentary. In addition to providing information, this workshop seeks to maintain community involvement in the planning process and ensure support for the proposed watershed management strategies.
Project Workshops would be advertised in advance through the local paper, the library, and through mailings and email contact with all the stakeholder organizations. The advertising would request that potential Workshop attendees and other interested parties email their contact information to the Cameron Engineering Team if they would like to receive background information, read Project Advisory Committee minutes, and stay informed of future Project meetings and new postings. An email service, such as iContact, could be used to facilitate communication with all Project interested parties.

C.1.5. Project Meetings

In addition to the Project Scoping Meeting – that will serve as the kick-off meeting to the project – the Cameron Engineering Team anticipates a total of five (5) additional meetings, for a total of six project meetings.

The second meeting will be a "planning summit." At this time, the Team will lay out the framework and essential elements of the Community Outreach Plan to the WAC. The WAC will have the opportunity to modify the plan as necessary and select from a set of outreach techniques that they feel would be most appropriate for the Forge River communities. The essential components of the visioning process, a separate component within the entire outreach effort, will also be discussed and debated. The structure of the Watershed Management Plan – which follows the methodology presented in the NYSDOS Guidebook to Watershed Plans – will also presented, refined and finalized at this planning summit.

At the third project meeting, the Cameron Engineering Team will present the findings of the Draft Watershed Characterization Report to the Town, the WAC and the TAC. The Team anticipates that the release of the draft report will raise a number of questions that are best addressed in person. If time permits, the Team intends to present the key findings of the Draft Regulatory and Programmatic Environment Report. Both efforts, the preparation of the watershed characterization report and the regulatory and programmatic environment report, can proceed simultaneously in this project.

The fourth project meeting, conducted with the TAC, will consist of a presentation and discussion on the methodological approaches for the prioritization of storm-sewer-sheds and the ranking of watershed management strategies. Ranking methods, which typically employ weighting factors, are often a contentious matter within planning committees. A preliminary set of management strategies will also be presented and reviewed, and probably, expanded during this meeting.

The fifth meeting, held with the Town and the WAC, will comprise a "workshop" for ranking and selecting a set of watershed management strategies. The Cameron Engineering Team can, of course, develop a set of watershed management strategies based on cost-effectiveness, habitat improvement, etc. There are, however, other considerations, such as political realities and fiscal constraints, that would be best evaluated by the WAC. Furthermore, planning is ideally conducted through a process of consensus, even within a group of like-minded advocates.

The sixth and final project meeting will be held with the Town, the WAC and the TAC to deliver a presentation on the Draft Watershed Management Plan. By this time, the Team will have received written comments on the plan and be prepared to respond in person. In addition, the PowerPoint presentation to the group will also be delivered at the final public workshop. This meeting provides the Town and the advisory committees with the opportunity to comment on and improve the presentation. The completion of the plan marks the kick-off of the implementation phase of the project; this meeting will also focus on the next steps in this process.

C.1.6. Preparation of the Community Outreach Plan

The fundamental principles of a successful public outreach campaign can be simply summarized as follows:

- Communication. This basic component of community outreach ensures that the public, civic organizations, and community leaders are well informed of important events (e.g., public workshops) through a variety of popular media, and the Internet and by word-of-mouth through watershed stakeholders.
- Understanding. The community outreach program must explain why the protection and restoration of the Forge River is important and how the restoration of the Forge River's health is in the interest of everyone. 'Understanding' also applies to the process itself; it must be simply constructed and transparent to all.
- Involvement. To ensure success of the outreach campaign and, ultimately, the management strategies, the community must feel assured that they are participating in a signficant way toward the planning process. Public forums, where comments can be recorded and where focus groups can be established, and community visioning initiatives are examples of successful techniques for engaging the community.
- Follow-up. Once the community is involved, follow-up communication on project milestones and successes help maintain

continued public interest, involvement and support.

With these principles in mind, the Cameron Engineering Team will prepare a plan that will actively involve the community in the watershed planning process. The Community Outreach Plan will comprise a number of components such as the identification of key participants, the types of media used for communication, a schedule of important events and a body of information for public education as described below.

Key Participants. With recommendations from the WAC, the Team will compile a list of key participants, including concerned individuals, civic, business and environmental groups, schools and other institutions, to name a few. A number of organizations are already participants in the process thanks to the efforts of the Forge River Task Force. The community outreach effort offers the potential to broaden the constituency for the Forge River. The plan will also define the roles that participants could fill, for example, from simply providing written or verbal comments, participating in focus groups that address specific watershed issues and participating in the visioning session.

Selection of Appropriate Media. The Internet has become a primary source of information for the public, and the Town of Brookhaven web site is an ideal location from which to disseminate information on the project. Other media, suchs as newspaper, flyers including newspapers, newsletters, posted announcements, are still vital for informing the public about the project, especially meeting dates and locations for public workshops and visioning session. The plan will recommend a host of other media for effective communication about the plan. The Team recommends – if it could be arranged – a series of interviews with a local journalist and a representative of the WAC about the watershed planning initiative. Perhaps a group of film students from a local media school or college program may even be interested in making a documentary about the Forge River that could eventually be broadcast on local cable channels.

Compilation of Information. The Community Outreach Plan will provide a design for web pages that will be hosted by the Town of Brookhaven web site. The design would comprise a project "home page" with links to other pages that 1) define the vision for the Forge River Watershed, 2) portray the river's history and its current problems, 3) provide ongoing information on the Watershed Management Plan, and 4) show how every can become involved in the plan itself and in protecting the Forge River.

Schedule and Public Workshops. The structure, content and dates for the public workshops will are a primary component of the outreach plan. As discussed in Section C.1.4 above, the public workshops will consist of presentations, project updates and a visioning session. The schedule for these workshops will be coordinated with the completion of certain deliverables.

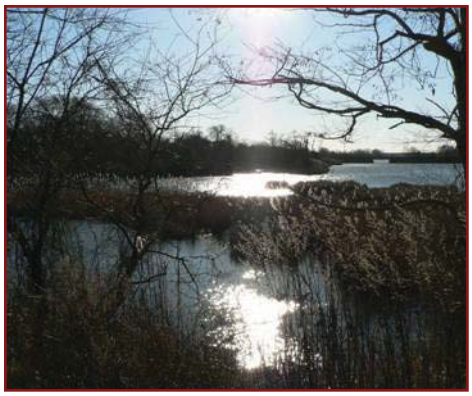
As described in Section C.1. above, the Community Outreach Plan will first be outlined in detail by the Cameron Engineering Team. The plan will then be discussed and further developed during a "planning summit." A draft version of the Community Outreach Plan will be prepared well in advance of the first public workshop in order to provide a sufficient review and comment period for the Town and the advisory committees.

C.2. Review of Existing Studies

Forge River water quality is poor and has been for many years. According to the NYS Department of Environmental Conservation (DEC), it is the result of "extremely dense, unsewered residential development in the river's ground watershed as well as the long history of multiple duck farms in the watershed." The DEC's Section 303d Impaired Waterbody List (see below) sites the sources of the pollution as "agriculture (duck farms), on-site septic systems, boat pollution, toxic/contaminated sediment, and urban/storm runoff." University researchers, Federal, State and County agencies, the Town of Brookhaven, and environmental organizations have been studying the Forge River for years.

The Cameron Engineering Team will secure all available academic, municipal, agency, and private documents relevant to the Forge River. Some of the studies are ongoing, such as the sediment studies by the School of Marine and Atmospheric Sciences (SOMAS) at SUNY Stony Brook and a detailed watershed study by the Army Corps of Engineers. Sampling by the Suffolk County Department of Health Services, the Riverkeeper, the US Geological Survey, and others is on-going. The Team would incorporate findings from these entities as they became available.

The Cameron Engineering Team includes scientists and engineers with academic backgrounds in the marine sciences and environmental engineering. Our Scientific Advisor is Dr. Jeffrey Levinton, a marine ecologist from SUNY Stony Brook's Department of Ecology and Evolution, who will provide scientific oversight, will review the Team's work product, and will act as a liaison to the SUNY Stony Brook School of Marine and Atmospheric Sciences (SOMAS).



C.2.1. US Army Corps of Engineers

The US Army Corps of Engineers (ACOE) is engaged in an in-depth effort to understand the problems of the Forge River. The effort addresses potential causes for the fish kills, algae blooms and odors in the river. A summary of the proposed study noted that duck farms, stormwater runoff, and contaminants from septic systems are likely degrading the river's ecosystem. The $100,000 Reconnaissance Study, expected to be released in 2009, will decide whether there is a 'Federal interest' in saving the river. The Coastal Section of the New York District is conducting the study. If it determines that a 'Federal interest' exists, then Federal funding could be made available.

"The river it littered with dead fish. The water, a mix of fresh and salt, is a murky gray color, everything is dying, and it smells like a cesspool."
Save The Forge River President Ron Lupski, blaming septic tank overflows for much of the river's pollution.
Press of Manorville (April 11, 2008)

C.2.2. US Fish and Wildlife Service

The US Fish and Wildlife Service (USFWS) reports that the Forge River is an important spawning ground for striped bass (http://training.fws.gov/library/pubs5/web_link/text/mb_form.htm). The agency includes the Forge River and the associated tidal creeks and marshes that feed into the 'Moriches Bay Habitat Complex.' The USFWS identified Moriches Bay and its tributary estuaries as a regionally-significant habitat for fish and shellfish, migrating and wintering waterfowl, colonial nesting waterbirds, beach-nesting birds, migratory shorebirds, raptors, and rare plants. They cite 105 species of special emphasis in the Moriches Bay complex, including 42 species of fish and 41 species of birds, some of which are federally- and state-listed species. The Team will summarize USFWS information as it pertains to the natural resources of the Forge River complex. Where available, data for these sensitive habitats will be incorporated into our Geographic Information System (GIS) as part of the overall inventory of watershed resources and conditions.

C.2.3. NYS Department of Environmental Conservation

The Clean Water Act requires New York State (NYS) to periodically assess and report on the quality of its waters. Section 303(d) of the Act also requires NYS to identify 'Impaired Waters,' defined as those "where specific designated uses are not fully supported." For these Impaired Waters, the state "must consider the development of a Total Maximum Daily Load (TMDL) or other strategy to reduce the input of the specific pollutant(s) restricting waterbody uses, in order to restore and protect such uses."

In 2006, the DEC classified the Forge River and the other tidal tributaries to West Moriches Bay as an Impaired Waterbody with an 'Individual Waterbody Impairment Requiring a TMDL.' It is a waterbody with a verified impairment that the DEC expects will be addressed by a pollutant-

specific TMDL, in this case, nitrogen. The 303d listing includes the Upper Forge River, which is the "tributary of primary concern." The Lower Forge River and Cove is included in the Shellfishing Waters portion of the 303d list due primarily to pathogens. The DEC Impaired Segment report details the problem as follows:

Aquatic life support and recreational use (fishing, boating) in these tidal trib[utaries]s to West Moriches Bay - particularly the Upper Forge River - are impaired by excessive nutrients (nitrogen), low dissolved oxygen and elevated pathogens. These contaminants are attributed to very dense development in the watershed, as well as contributions from sediments resulting from past/historic impacts from duck farms.

The DEC has also applied year-round shellfishing restrictions to most of the tributaries of Western Moriches Bay due to stormwater-borne pathogens and urban runoff and waste products from recreational boating and marinas. The DEC has an on-going water-quality sampling program that supports its shellfishing regulations. The Cameron Engineering Team will request data from the agency that may be useful to this study.

C.2.4. Suffolk County Department of Health Services

The Suffolk County Department of Health Services (SCDHS) has collected a large amount of water quality data for the Forge River, its tributaries, and the groundwater and stormwater discharging into the estuary. The program, initiated by its Office of Ecology in 2005, sampled 20 sites monthly from the fresh water reaches north of Sunrise Highway to the mouth of the Forge River where it enters Moriches Bay. Data collected from 960 stations, from June 2005 through September 2008, included measurements of salinity, temperature, dissolved oxygen, secchi depth, coliform bacteria, ammonia, nitrite+nitrate, total and dissolved nitrogen, total and dissolved phosphorus, suspended solids, phytoplankton, and chlorophyll-a.

The Office of Ecology found extremely low dissolved oxygen and speculated that "the eutrophic conditions are [caused by] multiple nutrient sources including, duck farms, vegetable farms, residential on-site septic systems, fertilized lawns, and STP discharge, all contributing nitrogen to the upper reaches of the river." The data showed these nitrogen sources coming from groundwater underflow and stormwater runoff. Research by SUNY Stony Brook is focused on the nitrogen contribution from sediments (see below).

Suffolk County has extensive groundwater monitoring data and a computer model of its groundwater. The County's Comprehensive Groundwater Management Plan program is operated in cooperation with the Suffolk County Water Authority and the NYS Department of Health. The Suffolk County Department of Health Services is preparing a Comprehensive Groundwater Management Plan that includes sub-regional plans such as the 'Mastic Shirley pilot study.' The study recognizes the interaction of groundwater protection through sewering with future development. Suffolk County recognizes that properly planned development can stimulate 'smart growth' and preserve open space, rather than promote sprawl. A Comprehensive Water Resources Management Plan would encourage growth in areas that are already developed by building sewage collection and treatment systems there. A modern wastewater collection and treatment system that replaces aging on-site septic systems can dramatically improve groundwater quality by reducing nitrogen input. As part of a Groundwater Management Plan, the County would examine future and existing development and highlight potential areas for sewering such as the hamlets of Mastic and Shirley.

The Cameron Engineering Team would review the County data and integrate the results and implications into the Watershed Characterization report.

C.2.5. Hydrological Studies

The US Geological Survey operates the National Water Information System (NWIS). The NWIS (frequently in cooperation with the Suffolk County Water Authority) collects many types of groundwater data, including "comprehensive information for site characteristics, well-construction

details, time-series data for gage height, streamflow, ground-water level, precipitation, and physical and chemical properties of water." The agency also collects peak flows, chemical analyses for discrete samples of water, sediment, and biological media. The adjacent box shows water quality parameters that are collected by the agency. The Team would collect all data available from the USGS pertinent to the Forge River watershed.

Water Quality Parameters

Dissolved oxygen, water, unfiltered, %saturation (1 site)
Dissolved oxygen, water, unfiltered, mg/L (7 sites)
Specific conductance, water, unfiltered, µS/cm at 25 ° C (12 sites)
Suspended sediment concentration, mg/L (6 sites)
Suspended sediment discharge, tons/d (5 sites)
Temperature, water, °C (14 sites)
Temperatures, water, °F (1 site)
Turbidity, water, monochrome near infra-red LED light, 780-900 nm, detection angle 90+/-2.5 degrees FNU (2 sites)
Turbidity, water, unfiltered, NTU (3 sites)
pH, water, unfiltered, field, standard unites (8 sites)

The Suffolk County Water Authority (SCWA) also collects groundwater data through its extensive network of monitoring wells. Several of the Authority's water 'Distribution Areas' are located in the Forge River watershed and includes portions of Distribution Areas 18 and 20 in the Mastic-Shirley areas north and south of Sunrise Highway (see Figure 1 below). Cameron Engineering has an established relationship with the SCWA and would reach out to their office to request pertinent groundwater data.

The Cameroon Engineering Team will also review a report on calculations of freshwater flows into the Forge River that was prepared by the School of Marine and Atmospheric Sciences, SUNY Stony Brook. The results of this study, along with water quality data from various sources, may be used to construct and validate a simplified model of pollutant loading for the watershed. As discussed in Section C.3.8, such a model would be much simpler than a formal TMDL model, but sophisticated enough for the purposes of watershed characterization.

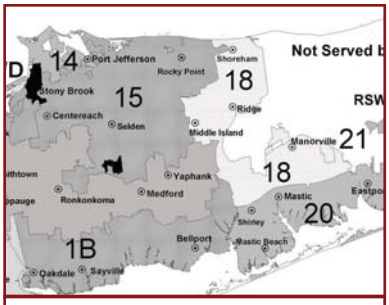


Figure 1: SCWA Distribution Areas

C.2.6. *Sampling by the Peconic Baykeeper*

The Peconic Baykeeper began their efforts on behalf of the Forge River in 2005. They and their volunteers sampled estuary water in the second half of 2005. The Peconic Baykeeper and citizen activists were instrumental in the decision by the DEC to classify the Forge River and its tributaries as "Impaired Waters" in April 2006. The Team would work with the Peconic Baykeeper organization through the Forge River Task Force.

C.2.7. *SUNY Stony Brook and Stony Brook Southampton*

A Sediment Characterization study is being conducted by SUNY Stony Brook's Marine and Atmospheric Sciences (SOMAS). The SOMAS researchers are examining sediment physical properties and contaminants, and will measure benthic nutrient flux and sediment oxygen demand. Their focus on contaminant and toxicological contributions of the river sediments will be the critical third component in the development of a nitrogen balance for the river, the other two (2) elements being groundwater and stormwater. Their efforts include thermal imaging in groundwater discharge areas, additional groundwater monitoring wells, and possibly use of tracers to measure cesspool/septic system contributions to the river.

Researchers at the Stony Brook Southampton Coastal and Estuarine Research Program (SCERP) are examining the dynamics of nutrient cycling and primary production as they relate to Forge River hypoxia. The SCERP program is collecting information about phytoplankton biomass, diversity, and productivity, as well as nutrient concentrations. They specifically focused on the role of sea lettuce (Ulva lactuca) in nutrient cycling and hypoxia. Ulva blooms (in addition to phytoplankton) are typical of eutrophic estuaries, where high nitrogen concentrations stimulates the bloom, summer temperatures and nutrient depletion ends the bloom, and the plants' death and decay contribute to low oxygen and recycling of nitrogen. The SCERP experimental work

demonstrated this phenomenon and suggested that the seasonal decline in Ulva supplies "regenerated nutrients to pelagic algal blooms and may directly and indirectly promote hypoxia in the Forge River."

The Cameron Engineering Team of scientists and environmental engineers would review completed and on-going SUNY Stony Brook research as it will be critical to a complete understanding of nitrogen cycling in the estuary. Understanding the fate of all the nitrogen inputs to the Forge River estuary will be required for the development of a TMDL.

C.2.8. Cornell University Cooperative Extension of Suffolk County

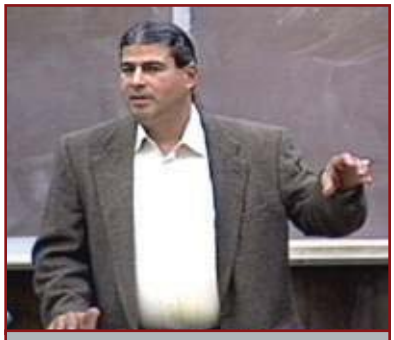
The Cameron Engineering Team has worked with the Cornell Cooperative Extension Marine Program on a number of projects. The Marine Program has been actively in the Forge River estuary collecting groundwater flow data in cooperation with SUNY Stony Brook researchers. The Team would reach out to Cornell program staff to request previously collected data and to understand the view from the water.

C.3. Waterbody and Watershed Characterization

The preparation of an effective Watershed Management Plan and the development of a TMDL depend on the availability of comprehensive information. A clear and thorough characterization of the watershed and its waterbodies is required in order to identify threats, select management strategies and predict the outcome of the recommended management strategies. It is also an important component of the public outreach effort. Involved citizens will make reasonable choices when presented with all the pertinent information, alternatives, and their implications. The Cameron Engineering Team will compile and evaluate a wide array of data to accurately characterize the environmental, cultural, socioeconomic, and ecological conditions of the watershed and estuary.

C.3.1. Geographic Setting

Situated in the southeastern portion of the Town of Brookhaven, the Forge River Watershed encompasses the hamlets of Mastic and Moriches, and the Poospatuck Indian Nation. Parts of Manorville, Shirley and Center Moriches also comprise the outermost portions of the watershed. Prepared with our Geographic Information System (GIS), Figure 2 provides a preliminary boundary for the Forge River watershed. This delineation is based on a digital elevation model available from the United State Geological Survey (USGS). According to this preliminary boundary delineation, the entire watershed is approximately 10,000 acres in area. However, most of the surface runoff to the Forge River and its attendant pollutants are contributed by the portion of the Watershed – about 5,000 acres – south of Sunrise Highway (State Highway 27). A more refined and precise boundary of the watershed and its subwatersheds would be developed with our GIS according to the methodology provided in C.3.2. below.



"Our livelihood depends on the health of this river." *(Harry Wallace, chief of the Unkechaug Indian tribe from the NY Times 02/25/08).*

Our GIS will play an integral role in many aspects of this study. This includes the organization and analyses of various geographic, or spatial, data about the watershed. Spatial data are, simply, data that describe characteristics of a particular location. Examples of spatial data include the concentration of nitrogen at a specific river location, the number of septic systems in given neighborhood, or the type of soil at a particular site. Thematic maps, produced with our GIS, will show characteristics vary from place to place across the watershed (e.g., water quality, land use, and demographics). Moreover, spatial data can vary not only by location, but over time successive time periods,

comprising spatio-temporal data; these data will be especially useful for understanding and portraying the seasonal variations in a number of environmental indicators. As an interactive tool, GIS provides a visual and analytical medium for comprehending the challenges and opportunities within the watershed. All of the spatial data compiled and geographically encoded for the purposes of this study will be stored within a central geographic database, thus making it available for future planning and TMDL model development.

C.3.2. Delineation of the Watershed and Subwatersheds

Watershed and storm-sewer-shed boundaries will provide a framework for characterizing the Forge River Watershed. Land use, impervious surfaces, locations of point-source pollution, pollutant loads from runoff, ecological information and a host of other data will all be identified and summarized according to subwatershed boundaries. Build-out modeling for future growth and the selection and prioritization of management strategies will also be conducted according to storm-sewer-shed boundaries.

The Cameron Engineering Team will employ readily available drainage plans, CAD drawings, GIS data layers and surveys to accurately delineate the watershed. An understanding of the drainage infrastructure within the watershed, in particular, will be essential to the watershed delineation. The existing network of drainage infrastructure defines storm-sewer-sheds which effectively constitute subwatersheds of the greater Forge River watershed, especially for the urbanized areas. Each storm-sewer-shed will represent the drainage area associated with a major outfall to the Forge River. In the undeveloped and low-density portions of the watershed, where drainage infrastructure is

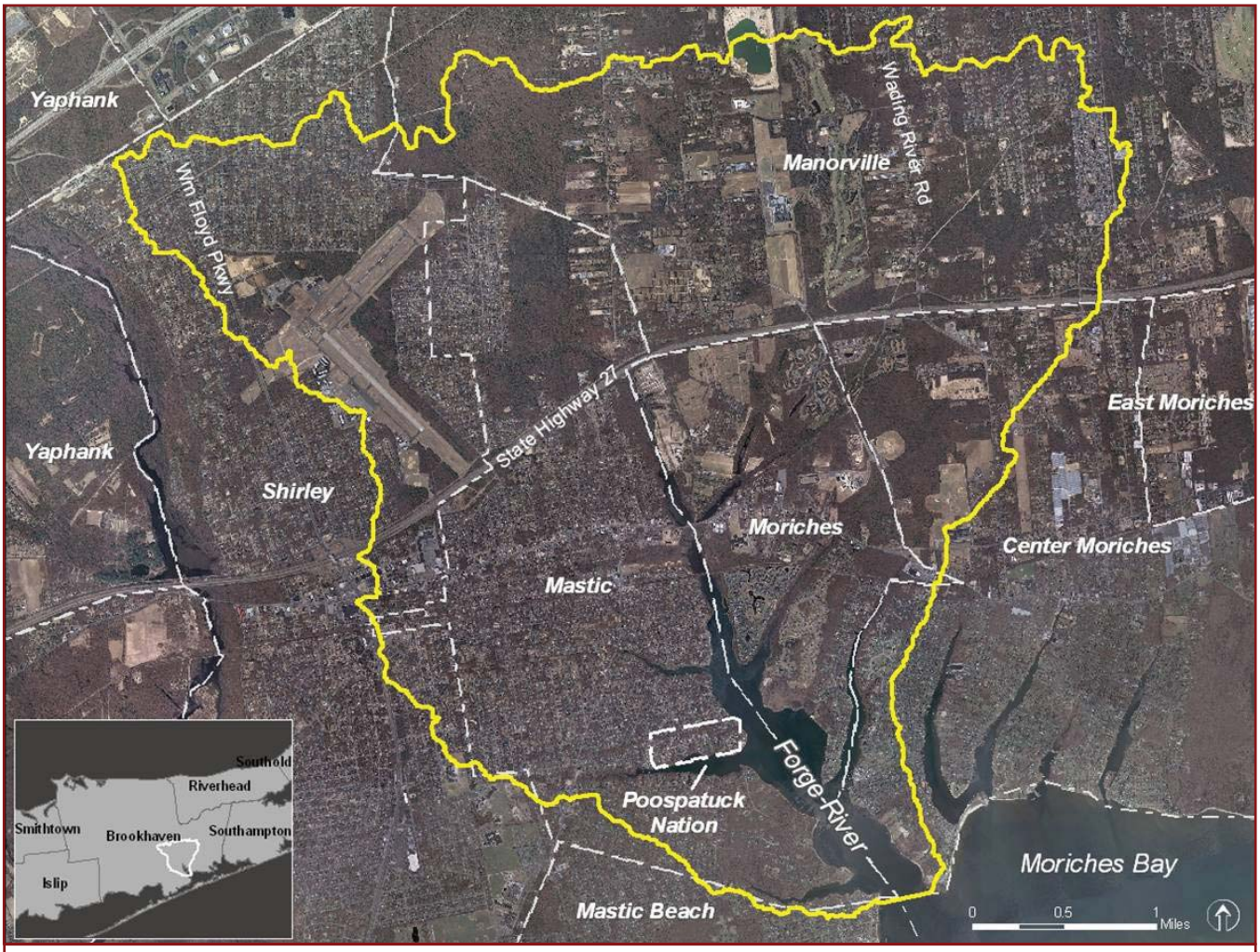


Figure 2. Watershed Boundary of the Forge River
(preliminary delineation from USGS Digital Elevation Model)

limited or absent, topographic data (e.g., digital elevation models) will be used to delineate subwatershed boundaries. However, with the exception of farmland, it is understood that runoff from the vacant and lesser developed portions of a watershed typically contribute much less runoff volume and contaminants. The storm-sewer-shed boundaries will be modeled in our Geographic Information System (GIS) and appropriately labeled according to local geography (e.g., Upper Mastic, Poospatuck Creek North, West Mill Pond, etc.). The subwatershed boundaries will comprise the sub-basin framework for the development of RFP for a TMDL model.

C.3.3. Water Quality Classifications and Impairments

The fresh and marine water reaches of the Forge River, its tributaries, and Moriches Bay are classified for a variety of designated recreational and aquatic life uses. The Forge River impairments listed in the DEC's 303(d) list are based on observations and data compared to the water quality standards assigned to protect the designated uses. Much information has been gathered on aquatic life impairments in the Forge River. Documentation of these impairments will be fully compiled to identify not only that they occur, but also when, where, and under what meteorological, tidal, pollutant discharge, sediment flux, and other forcing functions they occur to fully understand the impairments and identify their causes. All available historical and current information and monitoring data must be used to fully review and characterize conditions in the Forge River as compared to the water quality standards. Therefore the classifications and the applicable water quality standards protecting the designated uses will be firmly established.

New York State water quality standards can be found in 6 NYCRR Parts 700-704. The fresh water reaches of the Forge River are designated as Class C waters. Marine waters are designated as Class SA in Moriches Bay and the lower Forge River, transitioning to Class SC in the upper river and its

Figure 3. Water Quality Classifications of the Forge River

tributaries (Figure 3). The water quality standards applicable to the Forge River, its tributaries and Moriches Bay are taken from 6 NYCRR as follows:

701.8 Class C fresh surface waters. The best usage of Class C waters is fishing. The 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.

701.10 Class SA Saline Surface Waters. The best usages of Class SA waters are shellfishing for market purposes, primary and secondary contact recreation and fishing. These waters shall be suitable for fish propagation and survival.

701.12 Class SC Saline Surface Waters. The best usage of Class SC waters is fishing. These waters shall be suitable for fish propagation and survival. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use of these purposes.

Nutrients have been identified as the source of aquatic life impairments in the Forge River. There are only narrative nutrient standards in 6 NYCRR the limit phosphorus and nitrogen concentrations to "none in any amounts that will result in growths of algae, weeds and slimes that will impair the waters for their best usages."

The dissolved oxygen (DO) water quality standard applicable to non-trout Class C waters is a daily average not-less-than 5.0 mg/L and never-less-than 4.0 mg/L. Class SA, SB, and SC waters formerly had a never-less-than concentration of 5.0 mg/L at any time. But in February 2008, the DEC amended 6 NYCRR Parts 700-704, including a revised marine dissolved oxygen standard in part 703. The amendment changed the DO standard applicable to SA, SB, and SC waters from a never-less-than 5.0 mg/L standard to a chronic and acute standard that considers the time-variable nature of marine systems and aquatic life needs for propagation, growth and survival in New York State waters. The new chronic DO standard applicable to Class SA, SB and SC ambient waters are a daily average of 4.8 mg/L, with allowable excursions to not less than 3.0 mg/L for certain periods of time. The acute standard is a never-less-than 3.0 mg/L at any time. The standards can be found at 6 NYCRR 703.3, and were based on guidance developed by EPA in 2000 (EPA, 2000) and illustrated in Figure 4.

The Cameron Engineering Team will document all of this information to comprehensively characterize the Forge River impairments and recognize the waterbody classifications, their designated uses, and the applicable water quality standards. The designated uses and standards will be used as target goals for eliminating the impairments and restoring recreational and aquatic life uses in the Forge River.

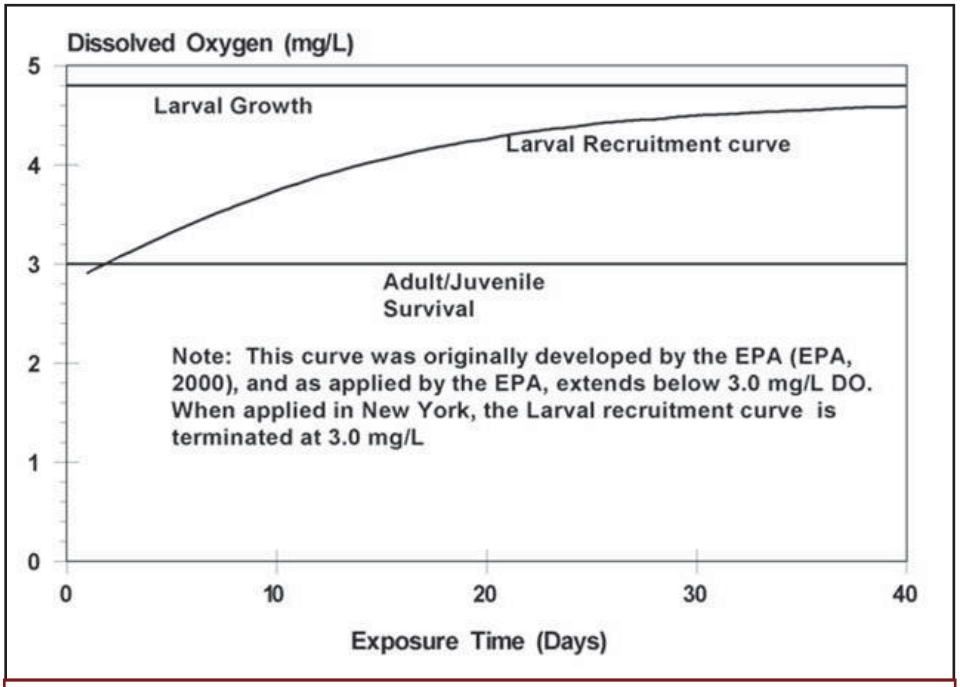


Figure 4. Marine Dissolved Oxygen Exposure-Duration Curve (Source: DEC, November 4, 2008 TOG 1.1.6)

REFERENCE:
US EPA, 2000. *Ambient Aquatic Life Water Quality Criteria for Dissolved Oxygen (Saltwater)*: Cape Cod to Cape Hatteras. EPA-822-R-00-012, November 2000.

NY DEC, 2008. *Interpretation Guidance for Marine Dissolved Oxygen (DO) Standard, New York State Department of Environmental Conservation, Division of Water,* Bureau of Water Assessment and Management, Technical and Operational Guidance *Series* (1.1.6),

November 4, 2008.

C.3.4. Land Use and Land Cover

Land use is an important driver of water quality in a watershed. Agricultural and urban land uses both release significant amounts of nitrogen and sediment to water bodies via precipitation runoff. Water bodies are typically impacted by grease, oil and metals from urbanized areas and coliform bacteria from farm operations, especially those involving livestock. In general, natural areas such as forests and grasslands contribute significantly less contaminants to their receiving waters than urban, agricultural and other uses.

Land use varies significantly across the Forge River watershed, comprised primarily of residential, commercial and transportation uses. A significant amount of land remains open (typically forested) or undeveloped, mostly in the Manorville and eastern Moriches portions of the watershed. In general, though, residential uses occupy a majority of the watershed. Medium-density residential uses – comprising ¼-acre lots on average – dominate the Mastic and Shirley areas to the west of the Forge River, as shown in Figure 5 below. Meanwhile, low-to-moderate-density residential uses are distributed along the east side of the river. With the exception of a handful of small treatment plants, all residences in the watershed are unsewered, thus relying on septic systems. Commercial land uses are located mostly along highway and downtown corridors. Agricultural uses, which are minimal in terms of area, are located in one of the most vulnerable portions of the watershed – the headwaters of the Forge River. In particular, an active duck farm is located just above West Mill Pond which overflows into the Forge River.

Figure 5. Dense concentration of unsewered housing. Within Mastic alone, over 4,000 homes with septic systems, are within one mile of the Forge River.

The Cameron Engineering Team will prepare a detailed land use map that is based on a GIS parcel data layer provided by the Town of Brookhaven. Having worked with these data before, we understand that the parcel data layer contains a data field, or attribute, that defines the land use of each parcel. In this data set, land uses are classified into almost eighty (80) different land use types. The objective of this effort will be to appropriately reclassify these land uses – by aggregation – into a smaller, more manageable classification system for the purposes of watershed analysis. The land use layer will be thoroughly checked for accuracy and updated based upon the Year 2007 aerial photography. Vacant land, based on records available from the Town of Brookhaven, will also be classified according to public or private ownership.

Land cover data are also important for watershed analysis. In particular, watershed analysis is primarily concerned with the amount of pervious versus impervious cover within a given subwatershed. The Cameron Engineering Team will utilize remote-sensed image analysis techniques to extract impervious surfaces from color-infrared aerial photography. Because of the significant difference between spectral signatures from natural and man-made surfaces, it is relatively easy to separate out impervious from pervious surfaces. Impervious surfaces will be summarized according to each subwatershed.

Other types of land cover, such as forests, wetlands, riparian habitat, grasslands, and bare lands, will be mapped through a combination of existing land cover data (available from the New York State Department of State and the National Oceanic and Atmospheric Administration) and a classification of Year 2007 Landsat remote-sensed satellite imagery. All land cover and land use classes will be summarized by area for each subwatershed.

C.3.5. Inventory of Flora, Fauna, and Key Habitats

The Cameron Engineering Team will review available State and local natural resources information for the Forge River watershed. The Team will request natural resource data and maps from the Town, Suffolk County's Office of Ecology, SUNY Stony Brook, the South Shore Estuary Reserve, the New York Natural Heritage Program, the US Fish and Wildlife Service, South Shore Audubon Society, and other agencies and organizations. We will conduct a visual survey of the accessible portions of the Forge River estuary, the East and West Mill Ponds, and perimeter areas to assess overall plant and animal resources. Observations will be made of each of the tributary estuaries from the water. A reconnaissance will be performed of the areas surrounding both Mill Ponds to confirm the locations and observe the conditions of reported wetlands and other sensitive areas as well as other reported wetlands and ecologically sensitive areas in the watershed.

Ecological community information will be incorporated into the Project GIS along with the NYS DEC's tidal and freshwater wetland maps and information from other agencies. Freshwater wetlands appear to have been mapped recently (see photo). Ecological community types will be according to "Draft Ecological Communities of New York State (Edinger et al. 2002), an update of "Ecological Communities of New York State by Reschke (1990). Toward the development of the ecological inventory, the Cameron Engineering Team will utilize GIS data resources developed by the Division of Coastal Resources under the South Shore Estuary Program. Useful for comprehensive planning, these data sets provide tidal wetland boundaries, extents of benthic habitats and high-resolution aerial photography.

Team ecologists, with oversight from Dr. Levinton of SUNY Stony Brook, will focus primarily on aquatic and riparian habitats, particularly those impacted by hypoxia and those that warrant special protection or restoration. We will discuss the potential impacts on these areas of

no action as well as potential restoration and protection options and the impacts of a TMDL. Team biologists and GIS specialists will include descriptions and maps that identify water quality classifications for all segments of the waterbody, impairments and threats to water quality and living resources, and key water and habitat resources warranting special protection or restoration. The project deliverable will include an inventory of the available living resources data with a focus on fish and macroinvertebrates. The Team will establish an ecologically-based target for dissolved oxygen (DO) concentrations and the maximum pollutant loading of nitrogen that the estuary could accommodate without falling below the target DO.

C.3.6. Demographics and Economics

Based on a preliminary watershed delineation and according to the US Census, there were approximately 28,700 persons residing within the Forge River Watershed in Year 2000. In terms of racial composition, whites comprised the majority, or 88.1 percent, of the total population. Black residents accounted for 4.7 percent and Native Americans for 1.0 percent of the total; asians and all other races comprised 6.2 percent of the total population. These residents occupied approximately 9,400 of the total 9,800 housing units in the watershed. Given the imposition of building moratoria during this decade, it is likely that the population has not grown significantly from Year 2000 to present. However, with the eventual lifting of the current building moratorium within the watershed, significant residential and commercial development could to occur over a twenty-year (20) period.

The Cameron Engineering Team will utilize US Census geographic boundaries and data to characterize demographic and socioeconomic conditions within the watershed for historic, current and future conditions. Both demographic data (from the decennial censuses) and economic data (from the 5-year economic censuses) will be summarized within our GIS according to subwatersheds. Census block and block group boundaries will not necessarily follow subwatershed boundaries; therefore, population, housing and other variables will be apportioned from Census geographies to subwatersheds, as appropriate, based upon area. Year 2005-2007 estimates, where available at the village or town level, will be also be summarized by subwatershed for specific socioeconomic variables. Projections of future population levels for 10- and 20-year horizons will be based upon potential buildout scenarios discussed in Section C.3.7 below.

US Economic Census data will be especially useful for calculating the economic impacts of degradation to the estuary. For example, the Cameron Engineering Team will employ economic data in concert with environmental economics principles to calculate the losses to the fishing industry, impacts to home value, and loss of tourism revenues. Environmental economics can be an important component of watershed analyses. For example, by placing a value on environmental assets and/or calculating environmental costs and benefits, An optimal strategy may be selected from a set of management strategies on the basis of the value of environmental assets to society or the environmental costs and benefits of different management strategies.

C.3.7. Zoning and Potential Buildout

Future development in the watershed may induce new impacts to the Forge River estuary. To estimate future impacts, the Cameron Engineering Team will prepare two (2) potential build-out scenarios for the watershed. Scenario I will represent future growth associated with a minimal investment in sewer infrastructure and Scenario II will simulate growth induced by a much more expansive installation of sewer infrastructure. The minimal sewer investment scenario would induce only a partial buildout, one slowed by restrictive environmental regulations given the limited availability of sewer infrastructure. The more expansive sewer investment scenario can approach full buildout of the watershed area, with development proceeding more rapidly and extensively in many sewered areas across the watershed. As is necessary to support the buildout scenarios, the Cameron Engineering Team will review master plan documents and zoning ordinances to determine as-of-right buildout potential; this review will also contribute to our characterization of the watershed. Potential changes in existing zoning, i.e., "upzoning", could be incorporated into the buildout model as a response to sewering, especially for downtown areas.

Either Scenario I or II is possible given the wide range of political decisions and financial conditions in the coming years. However, the buildout scenarios will establish a range of potential impacts to the Forge River estuary for consideration by the WAC and TAC. This exercise may ultimately demonstrate that a more intensive use of undeveloped land in the watershed – provided by extensive sewer infrastructure – induces less impacts to the estuary than a less intensive, but minimally sewered scenario. The impacts will be summarized according to subwatershed areas.

C.3.8. Estimate of Runoff Volume and Pollutant Loading

EPA's March 2008 Handbook for Developing Watershed Plans to Restore and Protect Our Waters discusses how pollutants can be delivered to waterbodies from various point and non-point sources. Identifying and characterizing sources will be critical to the successful development and implementation of a Forge River watershed management plan and control of pollutant loadings to receiving waters. The Cameron Engineering Team will characterize and quantify watershed pollutant sources to provide information on the relative magnitude and influence of each source and its impact on instream water quality conditions. Watershed-specific sources are typically identified and characterized through a combination of generation, collection, and evaluation of GIS data, instream data, existing wastewater, stormwater, and other SPDES permits, and local information. Point- and non-point pollutant sources will be identified and characterized to identify not only to estimate the volumes of pollutant runoff and discharges, but under what conditions they occur. Existing and readily available watershed modeling tools will be evaluated to identify the correct tool to estimate non-point source runoff into the Forge River and its tributaries. Available tools highlighted in the DOS Watershed Plans Guidebook include spreadsheet models, the Source Loading and Assessment Management Model (SLAMM), the Stormwater Management Model (SWMM), the Hydrologic Simulation Program-Fortran (HSPF), P8, DR3M-QUAL, and the HMS/HEC-RAS hydrologic modeling system. The DOS Nonpoint Pollution Runoff Potential Model highlighted in the DOS Watershed Plans Guidebook may also be used. It is a GIS-based model that factors in land cover, elevation, soils, and distance to surface waters and graphically depicts the relative risk of pollution to nearby surface waters and may be used to evaluate pollutant loading.

These tools can be linked to watershed characterizations performed with GIS to simplify the modeling and evaluation process and allow for streamlining future updates as new data and information becomes available during the project and in the future. The selected tool or tools will be applied to the watershed delineation and characterization to identify and quantify the pollutant sources for average and critical conditions that most likely cause receiving water impairments. This will be useful for a variety of purposes including establishing a nutrient balance and identifying the components of loads and wasteloads that will be used later for TMDL allocations.

REFERENCE:

US EPA, 2008. *Handbook for Developing Watershed Plans to Restore and Protect Our Waters, Office of Water, Nonpoint Source Control* Branch, Washington, DC 20460, EPA 841-B-08-002, March 2008

"It's the worst case of anoxia I have seen."
(Larry Swanson, oceanographer, SUNY Stony Brook, NY Times 2-25-08).

C.3.9. Dissolved Oxygen, Nitrogen Concentrations, and Hypoxia

In spring, an overgrowth of seaweed chokes the water. In summer, blue crabs, eels and juvenile flounder — all bottom fish — rise to the surface, eventually suffocating in oxygen-depleted waters. These impairments are typically caused by over-enrichment of receiving waters by nutrients causing eutrophication and other water quality conditions that result in hypoxic (very low) or anoxic (complete depletion) of ambient dissolved oxygen. These conditions may be occurring seasonally and/or driven by meteorological or

other forcing functions. Therefore, it is critical to draw from the data and information compiled and developed in the previous tasks to characterize nutrient and ambient dissolved oxygen conditions in the Forge River to fully understand the dynamics of the system and combinations of conditions that lead to the very noticeable impairments.

The Cameron Engineering Team's experience coupled with watershed management planning tools and guides will be used to focus an analysis on nutrient concentrations from pollutant sources and resultant receiving water concentrations. Typically, phosphorous is the limiting nutrient in fresh water systems and nitrogen is the limiting nutrient in marine waters. The US EPA's Protocol for Developing Nutrient TMDLs (EPA, 1999) will be used as a primary guide for identifying the nutrient and other conditions that are causing impairments in the fresh and marine water reaches of the Forge River.

Dissolved oxygen data will be reviewed and compared to the water quality standards for the Class C, SC and SA waters of the Forge River and Moriches Bay. A comprehensive characterization will require not only performing simple statistics to determine if dissolve oxygen concentrations have been observed below the average daily and never-less-than standards, but also a more detailed analysis will be needed to characterize the duration and frequency of low dissolved oxygen conditions for comparison to the new marine dissolved oxygen standards. The analysis will also yield comparisons of observed ambient nutrient and dissolved oxygen concentrations to the forcing function to establish cause and effect relationships that will be used in the TMDL analysis.

REFERENCE:
US EPA, 1999. *Protocol for Developing Nutrient TMDLs, Office of Water,* EPA 841-B-99-007, November 1999.

C.3.10. Identification of Threats to Watershed

A comprehensive inventory of existing and potential threats to the Forge River watershed and estuary will be compiled by the Cameron Engineering Team. These threats will include, but not be limited to, the following:

- Unsewered residences and other uses that utilize on-site septic systems
- Point sources of pollution (e.g., discharges from car washes and sewage treatment plants)
- Contaminated sediment within the river bed
- Non-point source pollution (i.e., across a range of land uses)
- Unstable and eroded shorelines
- "Hotspots" (e.g., brownfields, car repair shops, and gas stations.)
- Material storage areas (e.g., public works maintenance and storage yards, garden centers and "big box" stores that store fertilizers and chemicals improperly), and
- High-nutrient producing land uses (e.g., duck farms, heavily fertilized turf, nurseries, etc.)

The Cameron Engineering Team will compile this list of threats from a variety of sources, primarily from published reports and spatial databases developed by State, Federal and local agencies, academic institutions and advocacy groups. Additional, but previously unrecognized, threats may be revealed during meetings with the WAC and TAC and by citizens during public workshops. The Cameron Engineering Team will incorporate this inventory of threats into the Project GIS and the Watershed Characterization Report. Furthermore, the locations of the various threats will be compared with locations of the watershed's most critical assets, such as benthic habitats, sensitive shorelines, and other critical landscape traits. The mapping of threats together with critical assets will provide important information for prioritizing and ranking subwatersheds and management strategies. For each identified threat, the Cameron Engineering team will consider its severity (i.e., low, moderate, high) with regard to human health, ecological damage, and economic impacts. The team will also evaluate the likelihood that ecosystem damage is reversible or repairable. The threats, along with these human, ecological and economic considerations will be compiled and summarized by subwatershed.

It is important to recognize that identified threats extend beyond the physical, i.e., natural resource, aspects of the Forge River watershed and estuary. Social (e.g., quality of life and recreation) and economic elements (e.g., fishing and tourism) of the watershed are also threatened by the degradation of the watershed and estuary. The threats to the watershed will be discussed and evaluated in the Watershed Characterization Report in terms of their ecological, socioeconomic,

cultural, and environmental impacts.

C.3.11. Identification of Data Gaps

A gap analysis will then be performed to identify what data or information is missing, if any, that is required to perform a comprehensive TMDL analysis. The analysis will yield whether or not further data collection efforts are necessary to develop a comprehensive watershed and waterbody characterization sufficient to support the watershed management plan. The gap analysis will include a matrix that links the data gaps to corresponding project drivers, goals, constraints, or opportunities. This will be used to direct future field investigations to be targeted at the most important informational needs needed to support planning and TMDL development efforts.

The objectives of this task depend on the previous tasks that included acquiring available data relevant to the TMDL development, determining the data sets best suited for the TMDL development, understanding the state of the watershed and its elements, and assessing all potential sources of the causes of impairments. This task will enable the Cameron Engineering Team to assess the quality of the data, including the identification of gaps in the data record, and to correct any erroneous or missing data before advancing to the TMDL analysis itself. In addition to quality and spatial resolution of data, enable the Cameron Engineering Team will consider the time period during which the data were collected in determining suitable data sets for the TMDL analysis.

C.3.12. Preparation of Draft and Final Watershed Characterization Reports

The Cameron Engineering Team will prepare a characterization report that is based upon an extensive library of previous studies, data collections, computer models, mapping initiatives and ecological inventories. Other analyses, such as the nitrogen mass balance and development buildout models, will be prepared by the Team. Important studies by the Army Corps of Engineers and local universities are still ongoing; results of these studies will be incorporated into the characterization report as they become available. It is apparent that the Forge River is one of the most studied estuaries in Long Island. Our challenge will be to summarize and condense this significant body of information, evidence and knowledge into one cohesive characterization report, comprising all of the assessments and analyses proposed in Sections B.3.2 through B.3.11 above. The characterization report will be organized into two main parts: one which comprehensively depicts the characteristics of the upland areas, summarized according to storm-sewer-shed boundaries; the other part will provide a detailed assessment of the natural resources, such as water quality, aquatic and terrestrial habitat conditions, and targets for indicators of ecological health. Map, tables and other graphic tools will be used extensively to portray the conditions and findings. Appendices will be included as necessary to support methodological approaches and conclusions.

A Draft Watershed Characterization Report will be submitted to the Town for initial review and comments; the draft report will then be formally submitted to the advisory committees and the NYSDOS. Given the significance of this report and its ramifications for subsequent phases of the study, the Cameron Engineering Team recommends meeting with the advisory committees to make a formal presentation and respond to comments in person. Following the review by the advisory committees and the NYSDOS and after addressing comments within the report, a Final Forge River Watershed Characterization Report will be submitted to the Town.

C.3.13. Prioritization and Ranking of Storm-Sewer Sheds

One of the main purposes for collecting and analyzing data on watershed characteristics is to evaluate and rank the storm-sewer-sheds according to their degree of threat to the water quality and habitat. The highest ranked storm-sewer-sheds will be the focus of watershed management strategies during the final phases of this study, especially non-point source pollution management. Throughout this proposal we have emphasized that environmental indicators and upland characteristics would be summarized by storm-sewer-sheds. Since much of the Forge River watershed data are spatial in nature, storm-sewer-sheds data summaries will be easily prepared using our Project GIS. Ultimately, spatial and non-spatial data for each watershed will be organized in a tabular format for further review and comparative analysis.

The Cameron Engineering Team, with guidance from the TAC in the development of a methodology, will develop a weighted ranking approach for prioritizing the storm-sewer-sheds. Since nitrogen loading has been cited as a primary factor in the degradation of the estuary, it will be assigned the heaviest weighting factor, followed closely by ecological considerations and contaminants other than nitrogen. There is some redundancy in the list of ranking evaluation factors provided in the RFP. For example, redundant factors (e.g., stormwater outfall density and % impervious cover) will be grouped into appropriate categories and represented by a primary group factor. Evaluation values (e.g., integers 1 through 5) for different threats will be applied to category weighting factors; the product of the evaluation values and weighting factors will be summed across each storm-sewer-shed to create the priority ranking value. The higher the priority ranking value, the greater will be the level of impairment and thus, the higher impetus for implementing non-point source management strategies.

A draft report of our storm-sewer-shed ranking process and summary of prioritized storm-sewer-sheds will be prepared and submitted to the Town. and copies distributed to the Town, WAC, TAC and NYSDOS. Comments will be solicited from the WAC, TAC and NYSDOS and a Final Report on the Prioritzation of Storm-sewer-sheds.

C.4. Regulatory and Programmatic Environment

C.4.1. Evaluation of Government Roles

The government has an important role in shaping the future of the Forge River watershed through its regulatory authority, its role in supporting research, planning and design, and its capacity to fund remedial activities and new infrastructure. The Cameron Engineering Team would evaluate the various roles of government agencies in the management, regulatory oversight, and funding of the recommendations of the watershed Management Plan.

One of the most important means of reducing nitrogen inputs to the Forge River is by sewering the upgradient communities. On April 7, 2008, County Legislators Horsley and Browning announced their intent to "explore a public-private partnership for a sewage treatment plant serving the Montauk Highway Business District, the Neighborhood Road Business District, the Mastic Road Business District, and, most importantly, the Forge River and its estuaries." The legislators envision an initial sewage treatment plant developed with private funding to treat wastewater associated with a proposed senior development community, and 53,000 square feet of retail. They suggested, "10-acres could be set aside for the creation of a private sewage treatment plant with at least 70,000 gallons of treatment capacity, or more." That private plant would ultimately be taken over by Suffolk County. The legislators proposed that a Forge River Sewer District would incorporate the area from the William Floyd Parkway from Montauk Highway south to the Neighborhood Road Business District, and east to the Forge River, and would include the communities along the tributaries to the Forge River estuary. The legislators stressed the potential economic impact to the community from construction, new and expanded business activity, and increased sales tax revenue.

> *The need for sewers in the Tri-Hamlet area is an absolute necessity if we are to see economic growth for our downtown business districts. It is imperative that we pursue every opportunity to advance the creation of a sewage treatment plant, including efforts to install dry sewer lines at the time of the reconstruction on Montauk Highway in anticipation of this much needed sewer district.* (Bth Wahl, President, William Floyd Community Summit)

The federal government has expressed an interest in the project according to Congressman Bishop who said, "As a member of the House Transportation and Infrastructure Committee, I have been working to increase federal funding for Long Island's sewage infrastructure. It is vital that local and federal efforts combine to expand and improve our infrastructure. The study of feasibility of a new sewage district will provide valuable information about how best to serve local sewage needs."

The Cameron Engineering Team will provide a full discussion on the legal and procedural issues regarding the formation of a sewer district. Provisions of Article 5-A of New York State County Law will be explained and details of its application to forming a district within the Forge

River Study Area will be provided. A comparison of County or Town formation will be provided. The various procedural requirements will be detailed. It is anticipated that public interest will be high. The various procedural steps associated with district formation will go hand in hand with the estimation of the costs of sewering. The Cameron Engineering Team will provide a preliminary cost estimate for sewering options to assess the expense side of a potential district formation.

"Our business community cannot continue to 'just survive,' that is why we must start this path towards a sewer district. In the end, it is the only change for our businesses and downtowns to actually thrive."
(Mark Smothergill, President, Chamber of Commerce Mastic-Shilrey)

C.4.2. Analysis of Programs and Practices Affecting the Watershed

The Team would summarize local laws, ordinances, programs, and practices that affect point and nonpoint source pollution management and watershed ecology in the Forge River watershed and will assess their adequacy and utility. We would utilize the Nonpoint Assessment Tool developed by the New York State Department of State (DOS) for the Town of Brookhaven to summarize the governmental programs, policies, and practices affecting the Forge River watershed and their strengths, weaknesses, and gaps. The Assessment Tool would identify gaps in local programs, policies, and practices. The DOS charts compare the existing practices of the Town with the practices as described in the Model Program. The charts also assess the degree to which the Town implements the Model Program practices. The Tool recognizes that some of the practices may be implemented through the Town's environmental quality review.

The Team would also refer to the Town of Brookhaven's 2008 Stormwater Management Plan. The Plan is a requirement of the NYS DEC and summarizes the Town's ongoing efforts to mitigate surface runoff in environmentally sensitive areas throughout the town. Cameron Engineering has been assisting the Town with its Stormwater Management Plan.
The analysis would identify in tabular form the changes or amendments to local laws, practices, and programs that could better protect and restore the Forge River watershed and its natural resources.

C.4.3. SEQRA

The Cameron Engineering Team would outline the requirements of the State Environmental Quality Review Act (SEQRA) as it pertains to the implementation of a Watershed Management Plan and the actions that would be required to implement a TMDL for nitrogen. The "adoption by any agency of a comprehensive resource management plan" is considered a Type I Action by SEQRA.

The Team would prepare a Full Environmental Assessment Form (EAF) for the Watershed Management Plan as required for all Type I actions. The Team would complete Part I of the EAF and would identify all involved agencies for the Town. After all agencies are informed and a Lead Agency has been selected, the Team would assist with the completion of Parts II and III and the Determination of Significance. An Environmental Impact Statement would be required if the Lead Agency determines that there would be significant adverse impact as a result of the adoption of the Watershed Management Plan. Preparation of an EIS would not be included as part of this project.

Even if the Watershed Management Plan receives a Negative Determination from the Lead Agency, some of the actions that might be contemplated as long-term solutions would be classified as Type I actions, such as sewering or large-scale dredging. An Environmental Impact Statement (EIS) would be required before either of those actions could proceed.

C.4.4. Draft/Final Report

The Cameron Engineering Team will compile a report from available NYS DOS information along with additional information that describes the roles and evaluates the effectiveness of Federal, State, County, Town, and local government agencies and non-governmental groups in the management of point and non-point source pollution in the Forge River watershed.

A special focus of the report will be on the three (3) critical roles of government: (1) establishment of a sewer district (a Town or County role), (2) the completion of a nitrogen TMDL for the watershed (a State role through the NYS DEC,

and (3) dredging of portions of the Forge River estuary (a Federal role through the ACOE if their Forge River Watershed Study demonstrates a federal 'interest' in the watershed). The Draft and Final Regulatory and Programmatic Environment Reports would be submitted to the Town of Brookhaven, and comments solicited from the Advisory Committee and the NYSDOS.

C.5. Initiate TMDL

The Town of Brookhaven desires to establish a preliminary total pollutant load limit that will guide the development of a TMDL to eliminate the impairments and protect designated uses. The pollutant load limit is typically developed via a detailed TMDL analysis using modeling tools that won't be available at this stage of the watershed management planning process. Characterizations of loadings, water quality, and impairment conditions can be used to preliminarily calculate a nutrient mass balance, identify a preliminary nutrient target protective of the designated uses, and back-calculate a preliminary overall pollutant load limit. This will be accomplished by reviewing approved state and federal TMDLs for similar hydrologic, hydraulic, and ecological systems, and initiating the TMDL analysis. Recommendations will then be made on how to proceed with the TMDL analysis, and draft an RFP for a Forge River Nitrogen TMDL.

C.5.1. Review TMDLs

The Cameron Engineering Team has the experience and the knowledge to know what needs to be done in developing and implementing a TMDL. CH2M HILL has provided extensive water quality services, including TMDL implementation and NPDES permitting strategy for the municipal wastewater community, stormwater communities, and a broad range of industries (e.g., oil and gas, chemicals, mining, manufacturing, food and beverage, paper and forest product, and power utilities) across the country. CH2M HILL staff has provided technical support on ambient water quality and TMDL development and implementation for the regulated community or regulatory agencies in over 45 states. This breadth and depth of knowledge will enable our team to quickly identify approved TMDLs in the State of New York, within EPA Region 2, and across the country that mirror or closely resemble the characteristics of the Forge River.

A portfolio of case studies and best practices will be prepared based on research involving Internet queries, literature search, and direct experience amongst the project team, regulators, and other experts in the industry. Case studies will be compiled from similar watersheds, with a focus on documenting successful examples of and lessons learned from planning and engineering that encompass similar goals to Forge River stakeholders. We will be able to efficiently build on the prior efforts, saving time and resources for other aspects of the project, and providing the scientific and engineering basis for initiating a detailed TMDL analysis.

C.5.2. TMDL Initiation

TMDLs are the sum of the individual waste load allocations (WLAs) for point sources, load allocations (LAs) for both non-point sources and natural background, and a margin of safety (MOS). This definition is denoted by the TMDL equation:

$$TMDL = \Sigma\ WLAs + \Sigma\ LAs + MOS$$

For nutrients, TMDLs are expressed in terms of mass loadings on a daily basis, in accordance with 40 CFR 130.2(I). Section 303(d) of the Clean Water Act (CWA) requires TMDLs to include "a margin of safety," which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality." There are two methods for incorporating the margin of safety in EPA's 1991 Guidance for Water Quality-Based Decisions: The TMDL Process (EPA, 1991):

- Implicitly incorporate the margin of safety using conservative model assumptions to develop allocations, or
- Explicitly specify a portion of the total TMDL as the margin of safety; use the remainder for allocations.

The characterizations of pollutant loadings and receiving water quality can be used to preliminarily calculate a nutrient mass balance. Characterizations of the impairments and comparisons made to water quality standards will be used to identify a preliminary nutrient target protective of the designated uses. The nutrient target will most likely be for nitrogen in the marine waters. A preliminary total pollutant load limit will then be back-calculated using the TMDL equation above that may require the use of either

a spreadsheet tool or simplified receiving water models such as the BASINS system.

REFERENCES:
US EPA, 1991. *Guidance for Water Quality-Based Decisions: The TMDL Process,* Office of Water, Assessment and Watershed Protection Division, Washington, DC, 20460, EPA 440/4-91-001, April 1991.

C.5.3. Draft RFP for TMDL

The Cameron Engineering Team will assist the project partners and the technical advisory group to prepare a draft RFP for a Forge River nitrogen TMDL. EPA's guidance recommends that the following TMDL analysis components be completed concurrently or iteratively depending on site-specific conditions for TMDL development (EPA, 1999):

- Problem identification
- Identification of water quality indicators and targets
- Source assessment
- Linkage between water quality targets and sources
- Allocations
- Follow-up monitoring and evaluation
- Assembling the TMDL

Several of the steps will have been completed during the execution of this project. Therefore, the draft RFP will be developed to address the remaining components. We recognize the importance of selecting a suitable analysis approach and the right modeling tools, depending on the cause, location, pollution sources, and other characteristics of the impairments and available watershed management strategies. Because of the various land use conditions with variable non-point and groundwater sources, in combination with estuarine conditions in the downstream boundary, the TMDL analysis will most likely require analysis of time-variable conditions driven by wet weather and seasonal conditions. The development of a modeling strategy should be included as the RFP that allows often-complex watershed processes to be simulated and their impacts assessed. Based on our experience, the key to a successful modeling approach is to "begin with the end in mind." To maximize the benefits of modeling, the RFP should require the recommendation of an approach with a clear modeling strategy, defining the modeling objectives, approach, and justifications. This strategy directly contributes to completing the TMDL development in a timely manner and to successfully defend the TMDLs and future permitting actions.

C.6. Management Strategies and Plan

The selection of a set of cost-effective, readily implemented management strategies for protecting and restoring the Forge River is the main goal of this study. It will be the culminating step in a planning process which relies upon the detailed characterization of the estuary and its watershed, prioritization of the major threats – by storm-sewer-sheds – to the Forge River, and an assessment of the regulatory and programmatic setting for a watershed management program. The selection process will be based upon the primary considerations of feasibility, cost-effectiveness and ease of implementation. The advisory committees will participate heavily in the identification and selection of watershed management strategies.

C.6.1. Establish List of Potential Management Strategies

The Cameron Engineering Team, with oversight and input from the TAC, will develop a comprehensive set, or 'Long List', of watershed management strategies for the Forge River. Each management strategy will be described in detail and organized by into two sets of management strategies, that is, one for restoration and the other for protection. The Long List of strategies will address the specific threats imposed by – and opportunities presented within – each of the storm-sewer-sheds and the impaired ecological and water quality conditions extant in the Forge River. A primary focus of the management strategies is toward the high-priority storm-sewer-sheds that were identified in a previous phase of the study. However, the Team will also include management strategies for the lower-priority storm-sewer-sheds as there may be easily implemented, low-cost (or even no-cost) approaches for addressing their threats to the Forge River.

The Long List will include popularly considered strategies such as sewering, dredging of contaminated sediments, non-point source pollution reduction, stormwater best management practices (BMPs) and and a host of many other potentially effective strategies. For each of the potential management strategies of the Long List, the Team will evaluate their cost-effectiveness, political concerns, funding constraints, and time

frame (i.e., short- or long-term implementation) and consider relevant environmental factors; information will be provided to the WAC for its selection of watershed management strategies. The process for selecting an optimal set of management strategies, or 'Short List", is described in the Section C.6.2. below.

C.6.2. Selection of Optimal Management Strategies

The final selection of watershed management strategies will follow from a comparative analysis and ranking procedure, ultimately producing a 'Short List' of watershed protection and restoration strategies. Each management strategy will be evaluated according to a set of criteria. These criteria broadly include, but are not limited to, adherence to goals/objectives, cost-effectiveness, political concerns, funding constraints, time frame for implementation, and regulatory and technological hurdles. Each management strategy will be assigned an evaluation value according to the criteria. The scores, presented in a matrix format, will determine the ranking of the strategies; the highest scores typically comprise the Short List.

With the guidance and input of the TAC, the Cameron Engineering Team will establish the ranking methodology and prepare an initial management strategy evaluation matrix. However, given the critical importance of this definitive phase of the study, the Team strongly recommends that the WAC complete the evaluation matrix, independently of the Team's results. This evaluation can be performed in a group setting or, individually, by each member of the WAC. In the latter instance, the Cameron Engineering Team can provide blank evaluation matrices to the WAC members – along with detailed information on the strategies and the evaluation criteria – and allow them to complete the evaluation at their leisure. The Cameron Engineering Team will compile the evaluations, organize strategies according to rank and present the findings to the WAC. Under either approach to the ranking, the final selection of management strategies will be the responsibility of the WAC. The WAC may decide to re-rank the management strategies following group discussion and consensus.

C.6.3. Draft/Final Watershed Management Plan

The Cameron Engineering Team will integrate all previous reports, consisting of the watershed characterization, storm-sewer-shed prioritization, regulatory and programmatic environment, and selected management strategies reports, into a Draft Watershed Management Plan, Executive Summary. This integration will be complemented by a final report section – the implementation strategy.

The report will specify the key elements necessary to enable the successful implementation of each one of the selected management strategies. First, the goal and the specific objective(s) to be realized for a given management strategy and its location(s) will be stated. Cost estimates, projected and/or amortized over the life of the strategy, i.e., including long-term maintenance, if any, will be prepared. A list of potential funding sources, along with requirements and limitations, will be compiled. An implementation schedule will be forecast for each strategy; this is especially important to the Town, given its stated goal of early implementation of restoration strategies. Finally, a management strategy must have a champion, i.e., an individual or entity who will follow the strategy through its own project development process, removing hurdles along the way and securing the necessary funding.

The Draft Forge River Watershed Management Plan will submitted for review to the Town and solicit comments from the WAC, the TAC and the NYSDOS. The final version of the plan will be formatted for the appropriate project web page and ten (10) paper copies will be printed and delivered to the Town.

D. PROJECT ADMINISTRATION

D.1 Project Meetings - Town

Due to the size and range of the project scope, it will be necessary to develop and follow a schedule (see Section D for details). There are numerous stakeholders including civic, business, technical and public organizations that have important roles and interest in the project. Periodic project meetings will be scheduled with the Town. These meetings will be specific to the Team's activities in undertaking and completing the various tasks as identified in this proposal. Meeting minutes will be prepared for all scheduled meetings and will be distributed to Team members, the Town and other designated stakeholders. At the Town's discretion, these meeting minutes can be posted on the web site if deemed appropriate.

D.2 Team Meetings

The Team will be conducting its own internal meetings on a weekly basis with the Project Manager and Task Managers reviewing and discussing project progress, problems encountered, informational needs, upcoming milestones, preparation for public meetings and the like. As necessary, updates from these meetings may be forwarded to the Town to serve as progress report. At a minimum, monthly progress reports will be presented to the Town. The Town at its discretion could post these progress reports on its web site.

D.2 Mandatory Meetings

The RFP and this Proposal identify required meetings that will be scheduled throughout the project. This include the following:

- Project Kick-off – Scoping Meeting, to review scope with Town and key stakeholders (WAC)
- Public Workshops – three (3) meetings, dissemination of information on project and draft deliverables
- Presentation Meetings – five (5) meetings to Town, stakeholders, regulatory agencies on findings and recommendations from the study

Due to the limited budget for all project tasks, it will be necessary to maintain adherence to the number of scheduled meetings. However, due to the importance of the project and the number of stakeholders, it is recognized that additional meetings and workshops may ultimately be added to the scope. This may result in a lengthening of the project schedule and an increase in project cost.

D.3 Deliverables

Per the RFP, the following work products are required to be delivered to the Town:

- Watershed Characterization Reports (Draft and Final)
- Prioritization of Sub-watersheds (Draft and Final)
- Regulatory and Programmatic Environmental Reports (Draft and Final)
- Request For Proposals for a Forge River Nitrogen TMDL (Draft and Final)
- Various informational pages for posting to Town web site
- Periodic project status and meeting minutes

These deliverables will be provided both in hard copy and in electronic format. Posting of these documents on the Town's web site will be at the discretion of the Town.

E. PROJECT SCHEDULE

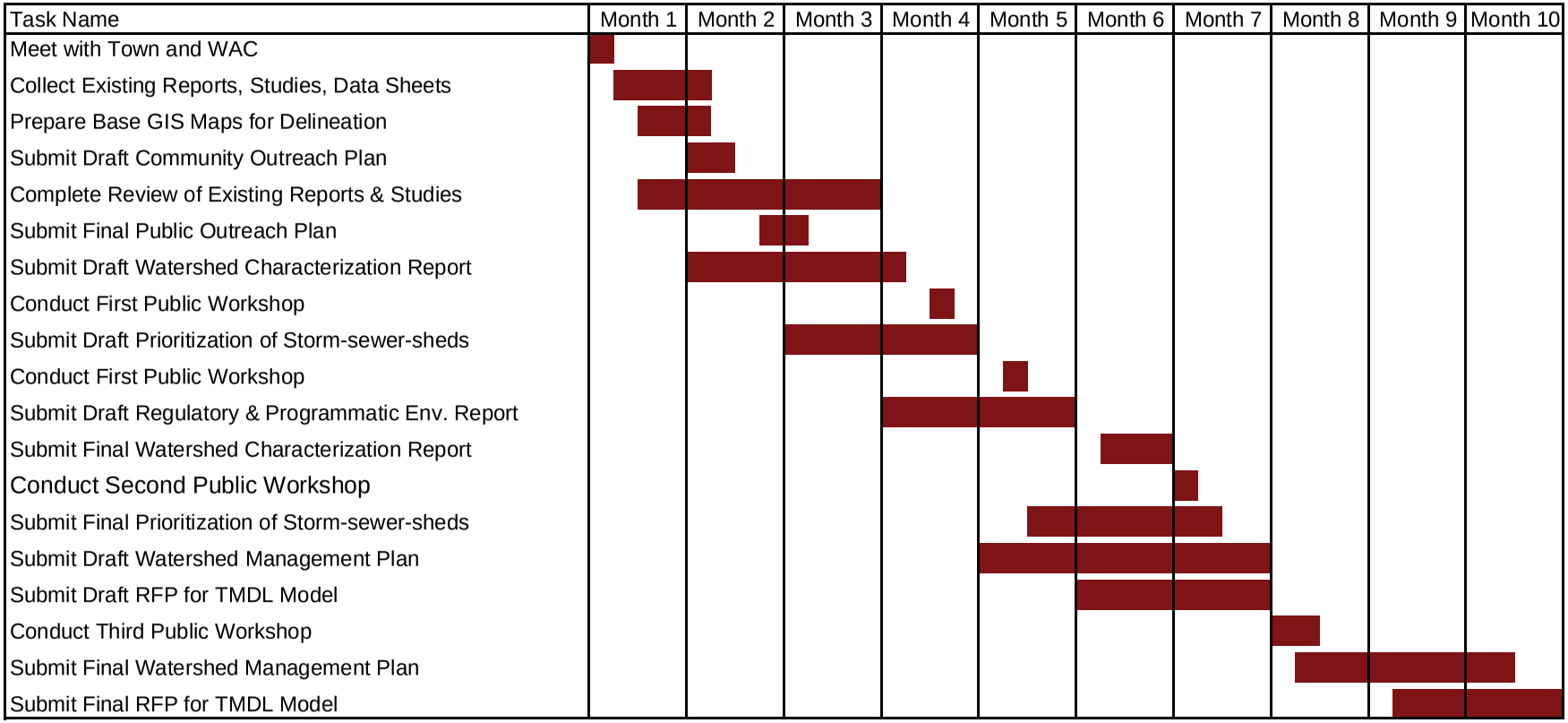
The project is anticipated to be completed within an eleven (11) month period of time. The RFP notes that the contract term is January 1, 2009 to December 31, 2009. As the Proposals have not been reviewed (submittal date of 1/10/09) at the time of this writing, the timeline for completion will require the award of the project by the Town within a month of its receipt. The eleven (11) months is approximately 300 calendar days. Key milestone dates (time required for task to be completed) from receiving the Notice to Proceed or other form of written authorization is as follows for key project deliverables:

• Meet with Town and WAC	5 days
• Collect existing reports, studies, data sets	30 days
• Prepare base GIS maps for watershed delineation	30 days
• Submit Draft Outreach Program Plan	45 days
• Complete review of existing reports, studies	50 days
• Complete review of existing reports, studies	60 days
• Submit Final Public Outreach Plan	90 days
• Submit Draft Watershed Characterization Report	100 days
• Submit Draft Prioritization of Storm-sewer sheds	120 days
• Conduct First Public Workshop	130 days
• Submit Draft Regulatory and Programmatic Report	140 days
• Submit Final Watershed Characterization Report	150 days
• Conduct Second Public Workshop	175 days
• Submit Final Prioritization of Storm-sewer sheds	200 days
• Submit Draft Watershed Management Plan	210 days
• Submit Draft RFP for TMDL	210 days
• Conduct Third Public Workshop	250 days
• Submit Final Watershed Management Plan	300 days
• Submit Final RFP for TMDL	300 days

Figure 6 Provides a graphical representation of the Project Schedule

This schedule is aggressive as review and revision periods for the bulk of the submittals ranges from 45 to 90 days. With multiple agency review, these review periods could be exceeded if comments and responses go through several iterations.

Figure 6


Task Name
Month 1
Month 2
Month 3
Month 4
Month 5
Month 6
Month 7
Month 8
Month 9
Month 10
Meet with Town and WAC
Collect Existing Reports, Studies, Data Sheets
Prepare Base GIS Maps for Delineation
Submit Draft Community Outreach Plan
Complete Review of Existing Reports & Studies
Submit Final Public Outreach Plan
Submit Draft Watershed Characterization Report
Conduct First Public Workshop
Submit Draft Prioritization of Storm-sewer-sheds
Conduct First Public Workshop
Submit Draft Regulatory & Programmatic Env. Report
Submit Final Watershed Characterization Report
Conduct Second Public Workshop
Submit Final Prioritization of Storm-sewer-sheds
Submit Draft Watershed Management Plan
Submit Draft RFP for TMDL Model
Conduct Third Public Workshop
Submit Final Watershed Management Plan
Submit Final RFP for TMDL Model

E. TEAM QUALIFICATIONS AND EXPERIENCE

E.1. Why the Cameron Engineering Team

E.1.1. Experience Overview

Cameron Engineering & Associates (CEA) in association with CH2M HILL provide a Project Team to the Town of Brookhaven with the combined strengths of a local and an international firm with:

- Extensive wastewater experience throughout the nation and on Long Island including Glen Cove BNR, Belgrave BNR, Great Neck Sewer District BNR, Greater Atlantic Beach Water Reclamation District, Village of Lawrence, Village of Cedarhurst, Village of Greenport BNR, Town of East Hampton, Nassau County DPW and Suffolk County DPW.
- Local and national expertise in Biological Nutrient Reduction design.
- Completed Feasibility Studies for the sewering of Village of Southampton, Downtown Smithtown and Downtown Kings Park.
- Local and national expertise in development of Stormwater Management Programs and Pollution Prevention Plans.
- Local and national expertise in watershed management plans, TMDLs, and waterbody restorations, including sediment reuse and disposal.
- First hand knowledge and experience in DEC Management Plans for South Shore Estuary, Long Island Sound and Peconic Bay Estuary.
- Have assisted clients on Long Island in receiving over $25 Million for environmental projects.
- Highly professional staff including certified planners skilled in community outreach, visioning, smart growth planning and SEQRA process.
- Technical staff in excess of 100 within 40 minutes of Town offices.
- Recognized success in award winning projects for environmental and wastewater treatment projects.

Joining the Project Team as a Technical Advisor is Mr. Jeffrey S. Levinton, PhD., Distinguished Professor in the Department of Ecology and Evolution with the Stony Brook University. Mr. Levinton has first hand experience with the various studies performed to date on the Forge River. He will be assisting on Community Outreach and Water Quality Issues.

We Offer a Local Team with Local and National Experience

The Project Team has excellent first hand experience in working with Long Island communities including the Town of Brookhaven. CEA has and is working in all of the Towns on Long Island (except Shelter Island) providing municipal engineering services such as planning, wastewater and stormwater treatment, infrastructure (roads, drainage) improvements, SEQRA, permitting, regulatory interface, waterbody restorations, parks, and environmental related projects. We have an excellent relationship with the State and County regulatory agencies. Additionally, as described in subsequent sections, the team features CH2M HILL, an internationally and nationally recognized firm. They currently have over 2000 staff in the northeastern United States including over 350 in the Metropolitan New York area. Their client base includes NYC Department of Environmental Protection, Westchester County, Various Sewage and Water Authorities in Northern New Jersey and the Great Neck Sewer District on Long Island where a $65 Million BNR Upgrade is currently being designed. The local knowledge and national expertise provides for a unique blend of talented resources.

E.2. Cameron Engineering & Associates, LLP

CEA was formed in 1985. The firm is entering its twenty-fifth year of providing services to Long Island communities. CEA has grown to a staff level of over seventy (70) individuals including professional engineers, certified planners, landscape architects, degreed scientists and construction management professionals. Twenty-three (23) of these individuals are certified in Leadership in Energy and Environmental Design (LEED) an accreditation provided by the U.S. Green Building Council.

Many CEA projects been recognized by professional organizations (ACEC) as well as regulatory agencies (NYSDEC) for excellence in design and operations of environmental facilities. CEA prides itself on working closely with clients and their staff to develop economically sound solutions for challenging problems. Intimate knowledge of current codes and regulations as well as good relationships with local and state regulators has always been a hallmark of CEA. We have worked on wastewater projects to meet TMDL and Waste Load Allocations in Long Island Sound (Nitrogen reduction and Total Residual Chlorine) as well as on projects for meeting Water Based Quality Effluent Limitations (WQBEL) in the South Shore Estuary for ammonia and Total Residual Chlorine. CEA has designed the largest BNR facility in Nassau County as well as the largest ultraviolet light system on Long Island (20 MGD capacity). We have been responsible for introducing new technologies for nitrogen reduction using Integrated Fixed Film Activated Sludge (IFAS) as a cost effective (capital and O&M costs) alternative to Sequence Batch Reactors (SBRs).

CEA is currently working with the Town of Brookhaven in developing its stormwater management plan including development of codes and ordinances along with a step by step procedure for determining need for and completion of a Stormwater Management Pollution Prevention Plan (SWPPP). SWPPPs can be very useful for identifying and mitigating pollutants transfer during storm events into sensitive water bodies such as the Forge River.

Projects of interest having similar components to the Forge River RFP that CEA has been involved in include but are not limited to the following:

Public Outreach
- Bay Walk Park, Village of Port Washington North
- Gyrodyne, 324 acre property in Stony Brook
- West Meadow Beach, Town of Brookhaven
- Gordon Heights, Town of Brookhaven
- Oyster Bay Western Waterfront, Town of Oyster Bay
- Baxter Pond Restoration, Town of North Hempstead
- Omni Transfer Station, Village of Westbury

Stormwater Management and Water Quality Improvement
- Village of Cedarhurst Annual Stormwater Reports
- Roslyn Pond Restoration, Town of North Hempstead
- Mill Pond Restoration, Town of North Hempstead
- Mill Dam Pond Restoration, Town of Huntington
- Scudder's Pond Evaluation, Town of North Hempstead
- Mill Pond Restoration, Village of Lloyd Harbor
- Massapequa Preserve, Nassau County
- Roosevelt Pond Restoration, Nassau County
- Massapequa Canals, Nassau County

Watershed Analysis
- Valley Stream Brook Watershed Analysis, Nassau County
- Restoration of the Massapequa Preserve, Nassau County
- Glen Cove Creek North-South Side, City of Glen Cove
- Scudder's Pond, Town of North Hempstead
- Valley Stream Brook Restoration, Village of Valley Stream

Treatment Plants Upgrades for TMDL or WQBEL
- Glen Cove BNR, City of Glen Cove
- Belgrave BNR, Belgrave Water Pollution Control District
- Lawrence WPCP, Village of Lawrence
- Greater Atlantic Beach Water Reclamation District

Sewer Feasibility Studies
- Village of Southampton
- Downtown Smithtown/Kings Park, Suffolk County
- Calverton Naval Defense Plant – Private entity
- Riverhead Resorts – Private entity

GIS Mapping
- Water Distribution, Village of Farmingdale
- Sewer Collection System, Brightwaters and West Islip, Suffolk County

E.3. CH2M Hill

CH2M HILL is a global project delivery firm that employs more than 25,000 people serving clients from regional offices around the world. An employee-owned firm, CH2M HILL was founded

in 1946 and its recognized for its innovative approach to wastewater treatment, and has both created and cultivated new technologies since its inception. We have consistently been ranked by Engineering News-Record as one of the top water quality companies in the United States. In 2007, CH2M HILL was ranked first in wastewater treatment design.

Our broad employee ownership policy means that we have motivated employees who hold themselves accountable for the quality of products and the professional integrity required for project success. Our staff is known for its technical expertise, for commitment to quality and client service, and for working with clients to develop creative, cost-conscious solutions to unique issues.

CH2M HILL believes that responsiveness is best achieved through an organization populated with highly diversified technical professionals but operating together as a program. CH2M HILL staff exhibit the knowledge gained from a myriad of projects on every continent, rigorous attention to detail, and an ability to create non-routine projects that are also models for the industry. Solutions are crafted with sustainability – always mindful of government regulations, environmental concerns, maintenance requirements, and public perceptions. CH2M HILL's excellence in delivering complex projects is widely recognized within the industry.

While we represent a large and growing company, our staff addresses the small details that make a difference in project delivery. These actions include providing the right local staff, maintaining frequent personal contact with clients, and exercising control of each project through trained and certified project managers with proven delivery skills.

Our commitment to excellence is evidenced by our repeat customers that make up more than 75 percent of the firm's business – a testament to the quality of CH2M HILL's work as well as client satisfaction.

E.4. Local Resources

CH2M HILL employs a staff of nearly 2,000 in the northeastern United States. Our presence in the New York Metropolitan area has grown, and we now have nearly 350 employees working in offices in New York City and Parsippany, Somerset, and Hoboken, New Jersey. Our staff includes experts in the areas of water/wastewater treatment; environmental engineering and compliance; pipeline, design/build; geology/hydrogeology; environmental science; chemical engineering; process engineering; construction and remediation; operations and maintenance; ports and transit engineering; coastal and marine engineering; environmental health and safety; telecommunications system design; and security. Our staff represents a high degree of cultural, gender, and age diversity, and most are involved in professional societies and external charitable events. In addition to our New York Metropolitan area resources, we have 500 additional staff relatively close by in Boston, Massachusetts; Philadelphia, Pennsylvania; and Chantilly, Virginia.

We provide the following services for our private and public sector clients: watershed management, water quality modeling, treatment design; regulatory compliance assistance; water resources investigation, engineering design, and construction; site management and redevelopment; regulatory strategies; engineering, environmental, and safety management; air quality management; marine engineering; transportation planning and permitting, conceptual design; facility operations and management; and security vulnerability assessments.
Some of our past and existing metropolitan area clients include the following:

- New York City DEP
- Westchester County
- United Water
- Great Neck
- North Hudson Sewage Authority
- Newark Department of Water and Sewer Utilities
- Northwest Bergen County UA
- Passaic Valley Sewerage Commissioners
- Passaic Valley Water Commission

Due to our experience in watershed analysis, pollutant load assessments, stormwater management, waste load allocation modeling and first hand experience with New York State Section 303(d) Listing Methodology, we will be responsible for those tasks pertaining to projection of pollutant loads, preliminary nitrogen mass balance for the Forge River and development of a Request For Proposals for the development of a TMDL (future task- not in project scope) for the Forge River.

E.5. Dr. Jeffrey S. Levinton, PhD

Mr. Levinton is joining the Project Team as a Technical Advisor. He is currently serving as Distinguished Professor at SUNY Stony Brook in the Department of Ecology and Evolution. He has over forty (40) years of experience in various fields of ecology and marine sciences. He will be serving as Technical Advisor to the Project Team providing expertise on analysis and findings of the various studies performed on the Forge River, participating in development of data gaps and necessary inputs to the watershed model and assisting in the public outreach meetings. He is a valued asset to the Project Team. His resume can be found after the "Key Personnel Section".

E.6. Related Project Experience

The Project Team has assembled descriptions of a few of the many projects that have similar components to the Forge River RFP. Personnel from both CEA and CH2M HILL that participated on these projects will be directly involved in the Forge River project.

Village of Cedarhurst
200 Cedarhurst Avenue
Cedarhurst, NY 11516

Cameron Engineering was engaged by the Village to evaluate needs at a 1 MGD wastewater treatment facility and its main pumping station. Evaluations lead to development of a Facility Plan/Engineering Report outlining short-term and long-term required improvements for the Village's facilities. Cameron Engineering developed Contract Documents for Phase I of the upgrade of the plant and pumping station. Improvements undertaken at the WPCP included a new influent screening station, new influent pumping station featuring dry pit submersibles, new controls, new primary and secondary digester covers and miscellaneous piping and valve replacements. The Cedarhurst Avenue Pump Station improvements included new dry pit submersible pumps, controls, valving, heating & ventilation and new natural gas standby generator. Force main improvements include cleaning, pigging and CCTV inspection of over 900 linear feet of cast iron piping. Cameron Engineering prepared the Facility Plan, design documents for all disciplines and conducted construction management.

New Project Features:
- New dry pit submersible pumps and grit removal
- Variable speed controls
- New grit and screenings

Cameron Engineering Services:
- Engineering Report
- Contract Documents
- Permitting
- Construction-related Services

Village of Lawrence
196 Central Avenue
Lawrence, NY 11559

The Village initiated the first phase of a multi-phase implementation plan for the upgrading of its 1.5 MGD secondary treatment wastewater facility. The first phase focused on the upgrade of its main pumping station and the upgrade of its influent station. This included the installation of new "Auger Monster" screening units, new dry pit submersible influent pumps, new grit chamber collector and grit dewatering units and new emergency standby generator. The new dry pit influent pumps are variable speed with control coming from a new bubbler system with backup ultrasonic controls. The pumps replaced 30 year old units located 25 feet below grade fitted with drive shafts and universal joints.

Project completed on time and within budget. The Engineering Report for Phase 2 that will include modifications for Biological Nutrient Removal and ultraviolet light disinfection has been completed. Bond Act grant of $1.16 Million has been received towards the Phase 2 project. It is anticipated that the design would be completed by end of 2006.

New Project Features:
- Dry pit submersible pumps
- Dual control for variable speed
- Upgraded influent station
- Maintenance of operations during construction

Cameron Engineering Services:
- Technical Design Report
- SEQRA and Permitting
- Contract Documents
- Bid Phase Services
- Construction Management

Nassau County Department of Public Works
1194 Prospect Avenue
Hicksville, NY 11590

The installation of sanitary sewers and increase in groundwater withdrawals for public water consumption lowered groundwater elevations in the 423-acre Massapequa Preserve. Streamflow was reduced and water levels lowered in the four ponds and two lakes. Designs were created to mitigate the effects of lowered groundwater by augmenting streamflow, making improvements to the streams and ponds, and better managing stormwater. A 1,100 gpm streamflow augmentation system was designed to bring groundwater to the upper portion of the stream channel. Stream bank stabilization designs included branch packing, live stakes, fascines, degradable geotextiles and native plantings. New berms in the ponds will separate stormwater from cooler baseflow. Drainage swales will divert stormwater from the ponds to the red maple swamp for stormwater treatment, recharge, irrigation, and swamp preservation. End-of-pipe treatment units will remove stormwater sediments and contaminants. The improvements will benefit the wetlands and stream channel of the Preserve, enhance passive recreational use, help restore native trout populations, and improve the quality of water discharged to the South Shore Estuary. Cameron Engineering prepared a successful Clean Air/ Clean Water Bond Act Grant for $1,300,000.

New Project Features:

- Coordination of impacts from Superfund site
- Streamflow augmentation
- Fisheries improvements
- Native plant materials
- Stream channel improvements

Town of North Hempstead
802 West Shore Road
Port Washington, NY 11050

Roslyn Pond Park is a system of three freshwater ponds in the historic Village of Roslyn. Nutrients, pathogens, and sediment deposition from stormwater runoff have impaired water quality and aquatic habitat in the ponds and receiving waters of Hempstead Harbor. Restoration plans were prepared to restore ecological function to the ponds and improve the quality of water discharged to the harbor. A steering committee of municipal, regulatory, and community representatives discussed the three conceptual designs prepared by Cameron Engineering. Final designs and specifications will include capture of stormwater sediments in underground swirl separators, pond deepening and regrading, introduction of a shallow perimeter marsh in the largest pond, upland waterfowl exclusion plantings, redirection of stream flow, restoration of stream banks with degradable geotextiles and plantings, and construction of a stormwater treatment wetland to capture stormwater contaminants prior to discharge to Roslyn Pond. All conceptual designs The Town received an Environmental Protection Fund Grant in 2004 for construction.

New Project Features:

- Sedimentation controls
- Pond deepening and regrading
- Pond perimeter marshes
- Bio-engineered bank stabilization
- Stormwater treatment wetland
- Pedestrian walkways and public access

Incorporated Village of Farmingdale
361 Main Street
Farmingdale, NY 11735

Cameron Engineering provided comprehensive GIS, programming and system implementation services to the Village of Farmingdale in its development of a Water Supply System GIS and Asset Management System. A GIS model of the entire Farmingdale water supply and distribution system, comprising all valves, hydrants, mains and service connections was created using ArcGIS. Water system components were located using a Trimble GeoXH GPS receiver, and system attributes such as sizes and materials of water mains and valves were extracted from existing plans and drawings. Cameron Engineering integrated the water system GIS into the Cartegraph Asset Management System. Work orders, inspections and customer requests are recorded, processed and tracked using the new asset management system. Future uses of the Cartegraph asset management system include capital planning for system improvements and financial reporting on value of assets.

New Project Features:

- Geodatabase model of the Farmingdale water system comprising over 750 main valves, 1,000 pipe segments, 220 hydrants, 400 backflow preventers, and 2,300 customer connections
- Automation of work orders, inspections, customer requests, and reporting

Cameron Engineering Services:

- GIS Database (Geodatabase) development
- Data Collection using GPS
- Asset Management System implementation
- SQL Express database creation
- GIS and GPS training

Village of Port Washington North
71 Old Shore Road
Port Washington, NY 11050

The local Waterfront Revitalization Program grant application by the firm made $165,000 available for site analysis, planning, public participation and engineering design for Bay Walk Park. The project Steering Committee of civic, environmental, and business representatives and local, state, and federal officials guided the open and inclusive public planning process. The Master Plan process integrated input from citizens, civic and environmental groups, municipal entities, regulatory agencies, and the larger community of potential park users throughout the Port Washington Peninsula. The approved park Master Plan includes the rehabilitation of two piers for fishing and boating, a shoreline walkway, seating, lighting, interpretive signage, a kayak launch, natural material play areas, and shade sails with seating and tables. The project will also involve the restoration and stabilization of 1,800 feet of shoreline with native coastal plantings and new bulkheading. The project will link several Villages plus Town and County-owned waterfront property.

New Project Features:

- Extensive community involvement
- Preservation of natural shoreline
- Active and passive components
- Intermunicipal cooperation

Cameron Engineering Services:

- Grant preparation
- Site analysis/assessment
- Public participation planning
- Master planning
- Site engineering

Town of Brookhaven
Planning, Environment, and Land Management
One Independence Hill
Farmingville, NY 11738

The Town of Brookhaven sponsored a visioning process to assist the Gordon Heights community to formalize its desires for the future. Residents wanted to create a clear sense of place, more housing choices that were affordable, access to neighboring commercial districts, and a multi-use community center for all residents. Cameron Engineering is developing a Land Use Plan for the two mixed-use neighborhood centers proposed by the community during the visioning process. We are assessing existing land use and zoning, infrastructure, environmental resources, demographics, economic conditions. The Land Use Plan will recommend new land uses for the two neighborhood centers, revised zoning, including a Planned Unit Development District and the required infrastructure to support the land uses. The Land Use Plan will be based on the community's vision and an economic analysis of the market potential for specific types of residential and commercial development. Cameron Engineering is also evaluating methods to reduce the concentration of sex offenders in the community and to reduce the tax burden imposed on the community by its Fire Department, which is supported primarily by residential taxes and only minimally by commercial taxes.

New Project Features:

- Extensive community involvement
- Steering Committee
- Community wide meetings
- Land use mapping utilizing GIS
- Use of Transfer of Development Rights
- Recommendations for new mixed-use developments

Gyrodyne Co. of America, Inc.
Flowerfield
St. James, New York

Prepared two Master Plan Concepts for redevelopment of a 326-acre parcel spanning two Towns. One Master Plan Concept was prepared under the Planned Development District zoning and incorporated housing, industrial, retail and recreational elements. The second Master Plan Concept included the development of a golf course community and championship 18 hole golf course, while maintaining existing industrial and commercial uses. The environmental impacts of both plans were analyzed.

Approved Design Standards (ADS) were prepared for use in negotiating leases with future occupants. The ADS cover all areas of lot development including site plan approval, approved uses, landscaping, refuse collection, signage, lighting, parking requirements, sewer use regulations, placement of utilities and HVAC equipment, and common area usage.

Following condemnation of 246 acres by New York State, prepared a Master Plan concept for redevelopment of the remaining acreage. The environmental impacts of the plan were analyzed. Critiqued Environmental Impact Statement and Phase I and Phase II Reports prepared by NYS for the condemnation. Prepared demolition estimates and asbestos removal estimates for existing buildings. Provided oversight of soil testing and soil management plan for metals associated with prior farming activities.

Town of Oyster Bay Department of Public Works
150 Miller Place
Syosset, New York 11791

Cameron Engineering developed a Master Plan for the waterfront area consisting of three Town-owned parcels and one State-owned parcel totaling approximately 16 acres on Oyster Bay Harbor. Cameron worked with a Steering Committee consisting of a dozen agencies, local business and civic groups and conducted a public outreach campaign to gather ideas for uses of the site. The Master Plan included a Community/ Environmental Education Center, a maritime history museum, ship restoration workshop, government offices, wetlands restoration and creation for stormwater treatment, baymen's access, public pier, path system, beach, and boat launch. Cameron prepared the Generic Environmental Impact Statement for the Master Plan and assisted the Town and the State in obtaining over $4.6 million in grant funding. Cameron participated in the development of the NYSDEC's Custodial Management Plan for the future operation of their portion of the site. Cameron performed design services and provided construction oversight for multiple phases of the project.

New Project Features:
- Community Outreach
- Consensus Building Process
- Environmentally Based

Cameron Engineering Services:
- Site Investigation
- Public Outreach
- Alternative Plans
- Land Use Plan
- Generic EIS
- Grant Applications
- Permitting
- Design
- Construction Observation

Town of Brookhaven
Farmingville, NY

The physical, environmental, and recreational opportunities and constraints were evaluated by Cameron Engineering for the one mile long West Meadow Beach. A Master Plan was prepared with extensive public participation that included protection of endangered species habitat, preservation and enhancement of native vegetation, and public access for passive recreation. The road was closed to regular vehicular use and opened to pedestrians, bicyclists and electric carts for those with special needs. A special area and two remaining cottages were designated for marine education programming and a nature trail designed to bring visitors to environmentally and scenically significant areas. Areas used by endangered species were protected from trail and other public access. Construction of improvements began in 2007.

New Project Features:
- Habitat Protection
- Habitat Restoration
- Public Access
- Protection of Key Species
- Environmental Education
- Use of Native Species
- Passive Recreation
- Universal Access

Cameron Engineering Services:
- Site Analysis
- Public Participation Planning
- Environmental Analysis
- Ecological Community Mapping
- Conceptual Use Plans
- Master Plan
- SEQRA

Belgrave Water Pollution
P.O. Box 408
Great Neck, NY 11022

The project includes the upgrade of the District's secondary treatment plant to achieve the NYSDEC requirements for nitrogen reduction by 2014 and Total Residual Chlorine (TRC) limitations. Improvements include new diesel emergency generator, influent screening station, parallel operation of primary clarifiers, installation of a new secondary clarifier, conversion of multimedia filters to dentrification filters, methanol addition, ultraviolet light and various site improvements including stormwater and drainage. Construction commenced in January 2006. Bond Act Grants totaling $4.1 million received by District from NYSDEC.

New Project Features:
- Reuse of existing tankage
- Conversion of multimedia filters to dentrification filters
- Paralleling of primary clarifiers
- Meet NYSDEC 2009 requirements for nitrogen reduction

Cameron Engineering Services:
- Evaluation of multimedia filter for conversion to denitrification
- Development of Engineering Report
- Development of Contract Documents
- Permitting
- SPDES Modification
- Bond Act grant

Town of Huntington Department of Maritime Services
100 Main Street
Huntington, NY 11743

Years of unattenuated stormwater flow has severely degraded the ecology and stormwater storage capacity of Mill Dam Pond. Pond sediments were sampled and recommendations were made to deepen and regrade the pond and restore habitat. Spillway modifications and self-regulating tide gates were proposed to reintroduce tidal flow and substantially increase stormwater storage in the pond. Conceptual design included stormwater sediment capture in a vegetated basin with an overflow to a 2-acre constructed stormwater treatment wetland. Deteriorated culverts will be replaced with an open stream channel from the new wetland to the restored pond. Walkways along the new wetland, stream channel and pond are incorporated for passive recreational use. A Clean Air/Clean Water Bond Act application was prepared which awarded the town $1.9 million.

New Project Features:
- Pond restoration
- Remediation and on-site re-use of dredged material
- Reduced area flooding
- Water quality improvements to the pond and receiving waters

Cameron Engineering Services:
- Watershed analysis
- Topographic Survey
- Pond sediment sampling and analysis
- Groundwater monitoring well installation
- Engineering design
- Construction cost estimates
- Grant applications

Nassau County Department of Public Works
1194 Prospect Avenue
Westbury, NY 11590-2723

Mill Pond Park has historically been used for model boating, walking, nature appreciation, ice-skating and ice hockey. However, the waste products from large populations of waterfowl have fouled the pond and the perimeter upland areas. Water quality and aquatic habitat have been impaired by stormwater-borne nutrients and pathogens. The pond has shallowed from years of stormwater sediment deposition. Sediments were sampled and found contaminated by typical stormwater constituents. Cameron Engineering designed water quality improvements that included the installation of an end-of-pipe stormwater treatment unit, retrofits to catch basins adjacent to the pond, and modification to a stormwater inlet to capture suspended solids. The spillway was modified to increase tidal flow and stormwater detention and make possible the reintroduction of tidal wetlands. The design incorporated waterfowl controls, invasive plant removal, and replacement of the stone wall around the pond perimeter. Additional improvements included upland landscaping, installation of park amenities and informational signage. The Town received a 2004 Environmental Protection Fund grant and a 2006 Long Island Sound Restoration Act Grant based on the engineering design to restore ecological function of the pond and improve the quality of water discharged to Manhasset Bay.

New Project Features:

- Pond Dredging
- Dredged Material Reuse
- Constructed Wetland
- Sedimentation Basin
- Spillway Modifications
- Vegetated Buffer

City of Glen Cove
9 Glen Street
Glen Cove, NY 11542

The Water Quality Improvement Plan focused on improving Glen Cove Creek water quality and reducing stormwater pollution. Glen Cove Creek and its contributing area were delineated to evaluate topography, existing drainage infrastructure, surface hydrology, floodplains, water table levels, tidal ranges, septic system density and locally significant habitats. Stormwater flows, runoff volumes and anticipated pollutant loads were determined. Water quality classifications were identified and impairments to water quality and living resources were characterized. Management strategies were identified to protect and restore Glen Cove Creek resources. Protection strategies included land use planning techniques, land conservation strategies, open space acquisition, sediment control measures, stormwater management practices, better site design and minimizing illicit discharges. Consolidation of the stormwater collection system would allow for more centralized and advanced treatment. An investigation of potential improvements to Mill Pond to increase capacity and treatment were reviewed. Treatment devices such as catch basin inserts and swirl separators were proposed along with non-stormwater discharge control measures. Stormwater Pollution Prevention Plans (SWPPP) were recommended for all waterfront properties. Increasing the number of on-site sewage disposal system connections to the treatment plant would protect groundwater quality and Glen Cove Creek.

Nassau County Department of Public Works
1194 Prospect Avenue
Westbury, NY 11590-2723

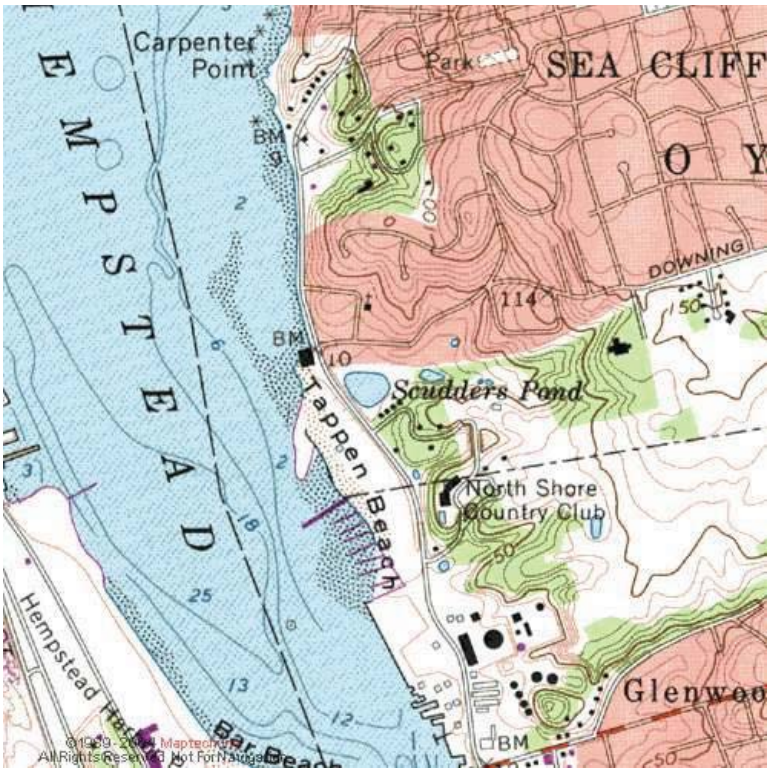
Cameron Engineering conducted a water quality study of the Massapequa and Grand Canals, tidally connected waterbodies that receive the overflow from the Massapequa Preserve. Coliform bacterial contamination in the canals forced the County Health Department to close Biltmore Beach at the outlet of the Grand Canal during the swimming season. The Massapequa Lake discharge was believed to be a significant source of the Coliform. The County wished to determine if closing the eastern discharge from Massapequa Lake could reduce breach closures at Biltmore Beach. Cameron Engineering prepared an assessment of total and fecal Coliform concentrations in fourteen locations including Massapequa Lake, the Canals, Massapequa Cove, and the adjacent Tackapusha Pond and Seaford Creek systems. Receiving water samples were taken during wet and dry weather and at the surface, two-foot depth, and bottom. Another round of samples was taken with the eastern Lake discharge closed. We determined that bacterial contamination was greatest in a layer of brackish water floating on the surface of the Canals. Bacterial contamination in the Grand Canal and by the Biltmore Beach Club was primarily due to stormwater inputs and waterfowl wastes. The Lake appeared to contribute only to a lesser extent. Cameron Engineering concluded that closing the eastern discharge of the Lake would not significantly impact the frequency of beach closures and could lead to an increase in bacterial contamination in the Grand Canal during dry weather. Water circulation and aeration techniques were recommended.

Hempstead Harbor Protection Committee
150 Miller Place
Syosset, NY 11791

Through grant funding from the New York State Department of State, the HHPC retained Cameron Engineering to conduct a feasibility study and prepare a schematic design to reduce non-point pollution to Scudder's Pond and improve water quality in the pond and the receiving waters of Hempstead Harbor. The project included a public outreach and education component as well as coordination between the HHPC, the Village of Sea Cliff, and the North Shore Country Club, owners of the pond.

New Project Features:

- Review of existing water quality data and prior reports, data, and maps.
- Calculation of existing and proposed pollutant loadings for the pond's subwatershed.
- Identification and description of stormwater conveyance system components.
- Identification of subwatershed land uses.
- Subwatershed reconnaissance and characterization of disturbances and causes.
- GIS mapping and conceptual plan development.



Cameron Engineering Services:

- New buffer area between golf course and existing wetland.
- New stormwater treatment wetlands.
- Elimination of direct stormwater discharges to ponds.
- Restored and stabilized stream channel.
- Swirl separator to intercept major stormwater inlet to stream and pond.
- Pond dredging, Phragmites removal and spillway improvements.
- Shoreline stabilization and waterfowl controls.

Village of Valley Stream
123 South Central Avenue
Valley Stream, NY 11580

Nassau County DPW
1 West Street
Mineola, NY 11501

Conducted a comprehensive hydrological and structural evaluation of the 4.3 square mile watershed. Sampled the pond and stream system to evaluate water quality and its relationship to stormwater inputs. Conducted sediment sampling program to recommend options for dredged material disposal and on-site reuse. Proposed techniques for ecological restoration and fisheries enhancement. Integrated visually appealing hydrological improvements into public use of park. Proposed new concepts for management of tidal flooding and intertidal wetlands. Recommended improvements to reduce flooding, improve water quality, expand and restore wetlands, and enhance the aesthetic appeal of the public spaces.

New Project Features:
- Emphasis on Recharge
- "Green" Engineering
- Dredged Material Reuse
- Aesthetic Appeal
- Habitat Restoration

Cameron Engineering Services:
- Survey and Site Investigation
- Drainage Analysis
- Watershed Modeling
- Agency Liaison
- Technical Review Committee
- Comprehensive Restoration Plan
- Pre-Permitting

Atlanta Regional Commission
40 Courtland Street NE
Atlanta GA 30303

CH2M HILL developed a watershed management plan for the 16-county Metropolitan North Georgia Water Planning District (MNGWPD). The District watershed management plan included development of a water quality model, evaluation of various watershed management alternatives and TMDL implementation strategies, and recommendations for long-term water quality monitoring.

As the Watershed Management consultant for the MNGWPD, CH2M HILL was responsible for developing an approach for local governments to improve water quality conditions within local jurisdictions. In this role, CH2M HILL developed approaches to streambank protection, pollutant load reduction, and stormwater management that were recommended to local jurisdictions to help meet water quality objectives and community needs. In this high-profile position CH2M HILL developed approaches for stormwater management that would help local governments meet requirements for compliance with the Phase I and II Municipal Separate Storm Sewer System (MS4) permit program, TMDL implementation, source water protection, and overall watershed management.
CH2M HILL coordinated the watershed protection work with similar tasks related to water supply and wastewater planning to ensure the compatibility of the program recommendations. These coordination efforts have continued to enable the CH2M HILL team to gain a thorough understanding of the key water supply, wastewater and watershed protection issues in the north Georgia area and the potential for meeting the overall water resources goals of the region.

Watershed Management Section, Planning Unit
1021 North Grand Ave. East, P.O. Box 19276
Springfield, Illinois

CH2M HILL conducted the TMDL study for the West Branch DuPage River for the Illinois Environmental Protection Agency (IEPA), which is located in the Chicago metropolitan area. The purpose of this study is to develop approvable and implementable TMDLs that will instill confidence in the stakeholders. To do this, CH2M HILL is following a proven approach that includes watershed characterization, modeling strategy development, modeling, TMDL development, and a final report for the U.S. EPA Region 5 to review and approve. The project involved:

- Conducting public informational outreach through meetings and hearings in the watershed and in Springfield to solicit input on the TMDL development process from interested stakeholders.
- Analyzing data from IEPA in-stream sampling, point-source discharger DMR reports, land use, meteorological data, and other data sources to identify point source and non-point source contributions to stream impairment.
- Developing a HSPF water quality model.
- Developing an implementation plan for chloride impairment.

Initial analysis focused upon nitrate, nitrogen, phosphorus, total suspended solids, total dissolved solids, copper, chloride, habitat impairments, and flow impairments. Data analysis and initial source screening were completed for all of these parameters. Final TMDL analysis was only completed for chloride while the remaining parameters were removed from the scope of the project. The final TMDL was approved by U.S. EPA Region 5.

Bruce Rawls, Director
Spokane County Utilities Division

The Washington Department of Ecology (Ecology) was in the process of a dissolved oxygen (DO) TMDL for the Spokane River and Long Lake Reservoir. Ecology had commissioned the application of the CE-QUAL¬W2 model to the river, which included several run-of-river reservoirs and Long Lake Reservoir, a deep, stratified reservoir subject to annual drawdown for power generation. This deep reservoir is located at the downstream-most reach of the overall 60-mile-long TMDL segment. The modeling work was leading Ecology to conclude that point sources would have to eliminate their discharges from the river in order to meet DO standards in the hypolimnion of the reservoir. The instantaneous DO criterion was being applied everywhere in the system at all times (i.e., no spatial or temporal averaging, and no allowance for stratification induced constraints in the deepest portion of the reservoir).

A consortium of dischargers on the river wanting to conduct a Use Attainability Analysis (UAA) retained CH2M HILL. The purpose of the UAA is to determine what the existing and attainable uses of the river and reservoir are, and to define DO criteria that would be protective of those uses. This was necessary because it appeared that the currently designated uses were not appropriate, and hence the associated DO criteria needed to be refined. The UAA focused on defining sub-categories of use specific to this system that are attainable, considering when and where those uses actually occur or could be attained. DO criteria that are protective of those uses were also derived based largely on a scientific review of the literature on DO requirements for various aquatic life uses that had been done in recent years by Ecology. These included both 30-day and instantaneous criteria. The definition of sub-categories of use specific to this system (e.g., applicable to separate uses for the lower and upper portions of the hypolimnion) allowed for delineation of DO criteria applicable to those location and time specific uses, rather than having to use a statewide DO criterion that was not applicable to these conditions. This approach is conceptually similar to the recent UAA and DO criteria development process for the Chesapeake Bay.

Although the TMDL is still underway, it is hoped that the final DO TMDL will be focused on attainable conditions and an outcome that does not force dischargers out of the river at extreme cost.

In response to a request by a confidential client in February 2008, CH2M HILL provided a technical review and developed a public comment letter to formally comment on the draft 2008 303(d) list developed by the New York State Department of Environmental Conservation (NYSDEC). In particular, CH2M HILL conducted a review on related information on Seneca River in upper New York State, which has been under extensive study over the past 15 years as part of Three Rivers system.

CH2M HILL concluded that based on extensive water quality modeling study and scientific literature, the major cause for the impairment due to oxygen depletion for the Seneca River is zebra mussels, which is pollution (i.e. an invasive species) not suitably addressed by a TMDL.

According to the New York State Section 303(d) Listing Methodology, standards attainment Category 4c says, "the impairment/threat is attributed to pollution (such as flow alteration, hydrologic modification, degraded habitat, exotic, invasive and/or non-native species, or other cause not associated with a contaminant), rather than a specific pollutant, and TMDL development is not appropriate." Therefore, CH2M HILL commented that a TMDL is not appropriate to address this impairment and that this waterbody/pollutant listing should be removed from the 2008 List (delisted) and placed in Category 4c indicating that a TMDL is not appropriate because the impairment is the result of pollution, rather than a pollutant that can be allocated through a TMDL. In September 2008, NYSDEC responded that the Department agreed with CH2M HILL's assessment that zebra mussels are the primary cause of the oxygen impairment in the Seneca River. NYSDEC also conceded that developing a TMDL for dissolved oxygen impacts due primarily to zebra mussels presents significant challenges, and that the listing of this waterbody in Part 1 of the List as "an Individual Waterbody Segment with Impairment Requiring a TMDL," is not entirely appropriate. However, rather than delisting the waterbody and placing it in Category 4c, NYSDEC has moved the listing to Part 3b of the Section 303(d) List as "a Waterbody for which TMDL Development May be Deferred (Requiring Verification of Cause/Pollutant)." NYSDEC further emphasized that development of a TMDL may be deferred, because NYSDEC is currently evaluating the possibility of just such a TMDL approach for this waterbody.

Clean Water Services
Phone # 503.681.3604

The Tualatin River, just west of the City of Portland, Oregon, is slated for multiple TMDLs because of water quality impairments while endangered species are also a concern. One water withdrawal facility and two water storage facilities are also present in the watershed. Clean Water Services (CWS) is the lead watershed management organization for Washington County, Oregon. As such, it is the steward of the Tualatin River watershed. CWS operates four wastewater treatment plants, and during the low-flow period, CWS effluent and CWS-controlled flow augmentation from local reservoirs constitutes as much as 66 percent of the daily flow. CWS also holds a NPDES permit for municipal stormwater.

Under an August 2001 TMDL for the Tualatin Subbasin, CWS has wasteload allocations (WLAs) for phosphorus, ammonia, and temperature. Instead of implementing the WLAs through four NPDES and one MS4 permit, CH2M HILL helped CWS in February of 2002 to launch an initiative to consolidate its permits into one Watershed Permit that would, among other things, establish a trading program for pollutant credits. Since then, CH2M HILL provided technical support to develop the permit, design the trading program, and provide for immediate implementation upon permit approval, including:

- Technical evaluation of original TMDL, including Oregon Department of Environmental Quality (ODEQ) and USGS assumptions.
- Drafting CWS's proposed watershed permit, including integrating and streamlining wastewater and stormwater provisions.
- Formally benchmarking EPA's Water Quality Trading Policy, Oregon Trading Guidance, EPA Region 10 Trading Guidance, and selected NPDES permits with trading provisions for model approaches and language.
- Drafting a "trading schedule" for the watershed permit that covers authority, trading area, tradable pollutants, trading baselines, credit eligibility and use, monitoring specific to trading, compliance and enforcement, public participation, and program reporting and evaluation.
- Performing technical analyses to establish trading ratios for DO pollutants (CBOD & NH4) and estimate the number of heat credits for various temperature reduction options.

An extensive stakeholder outreach program to develop broad public and regulatory agency support for the watershed plan complemented this technical work related to permit design. Watershed assessment activities were also conducted to identify prioritized actions that are consistent with the TMDL and with Endangered Species Act issues.

This watershed-based permitting project is one of EPA's featured case studies and is being used as a model program for EPA's Draft Watershed-Based NPDES Permitting Implementation Guidance, released in August 2003. CH2M HILL's relationships with EPA Headquarters staff and our national prominence in the realm of watershed permitting and water quality trading helped elevate CWS's position. In our role as a strong advocate for CWS, we were able to help bring EPA funding to the project and to gain support at the headquarters and regional level for the project to move forward.

In the first phase of this work, CH2M HILL provided CWS with Technical Support for Tualatin River TMDL Review and NPDES Support. CH2M HILL assisted in a thorough review of the Draft Tualatin Sub-basin TMDL and assisted CWS in preparation of comments for submittal to ODEQ. CH2M HILL reviewed the modeling and underlying assumptions for setting wasteload and load allocations for point and non-point sources. Modeling reviews were conducted for temperature (HeatSource model), DO (QUAL2E model), and bacteria and phosphorus (GIS-based models). In addition to reviewing the draft TMDLs, CH2M HILL modeled several scenarios and was able to demonstrate to DEQ that CWS activities in the sub-basin provided an overall thermal benefit on the Tualatin River. CH2M HILL conducted a workshop to present a summary of modeling reviews to CWS and DEQ staff. Overall, this effort resulted in the August 2001 TMDL including more provisions for trading, flexibility and adaptive management.

Most recently, CH2M HILL provided extensive technical and regulatory support to CWS for its reapplication for the watershed permit, which was submitted to DEQ in August 2008. CH2M HILL is currently supporting CWS in negotiating the conditions and revisions to be contained in the reissuance watershed permit. Several of the key issues that are being discussed with DEQ include modifying WLAs to allow for year-round discharge from two plants that currently discharge in winter, providing WLAs for those two plants to discharge via wetland treatment and polishing systems, modifying the phosphorus TMDL to provide alternative WLAs for the fall period for the two main plants, including additional trading mechanisms (e.g., between treatment plant and MS4 sources), and providing a mechanism for a "virtual outfall" process to allow treated effluent and augmentation water to be utilized in the tributary streams to improve water quality and habitat conditions there.

Clean Water Services
Phone # 503.681.3604

E.7. Project Organization, Management and Key Personnel

The Project Team believes that the success of the project is directly related to how it is organized, the management philosophy and the personnel assigned. From an organizational perspective, the Forge River project has three (3) key components. These include providing public outreach and disseminating information as it becomes available, determining relative proportion of causative factors impacting the Forge River and development of criteria for a future Total Maximum Daily Load (TMDL) for the River. With such a diversity of scope and range of required expertise, CEA has assembled a Project Team having the necessary expertise and resources to properly address the issues and provide the Town with the deliverables necessary to implement cost effective measures within the watershed.

With respect to project management, a senior Project Manager, will be assigned to the project. We are proposing to have Mark Wagner, CEP, Principal lead the Project Team. Mr. Wagner has over thirty (30) years of experience in the environmental field including planning, design, construction, regulatory and operational experience. He will be supported by Task Leaders, senior personnel that have proven experience in specific areas. Distribution of work to Task Leaders will lead to assignment of tasks to qualified staff without overburdening one leader. Also supporting Mr. Wagner will be Joseph R. Amato, Jr. P.E., Partner providing QA/QC, Mr. John D. Cameron, Jr., P.E., Managing Partner ensuring adequate allocation of resources and Mr. Jeffrey S. Levinton, PhD, Technical Advisor. The Organization Chart on the next page provides an illustration on our management philosophy with the distribution and assignment of key personnel to the tasks required for a successful project.

E.8. Key Personnel

E.8.1. Senior Management

The project requires the attention and skills of more than the Project Manager. As noted above, the Project Manager will be supported by several key personnel. These include but are not limited to the following:

John D. Cameron, Jr. P.E., Managing Partner – Project Director
Mr. Cameron is the founder of CEA and currently serves as Managing Partner. He has over 35 years of experience in the environmental field including work in both private industry, facility operations and in a governmental regulatory agency prior to starting CEA. He will serve as Project Director as will be responsible for ensuring adequate resources are allocated to the project.

Joseph R. Amato, Jr., P.E, LEED, Partner – Quality Assurance & Control and Technical Review
Mr. Amato has over thirty-three (33) years of experience in the environmental field including service in a federal regulatory agency prior to entering private consulting. As Partner, he is responsible for the day to day operations of CEA. His role on this project will providing technical review of the work product and ensuring that company QA/QC practices are followed throughout the project.

Mark Wagner, CEP, LEED, Principal – Project Manager
Mr. Wagner has thirty (30) years of experience in the environmental field including work in regulatory agency, contract O&M firm and municipal facility operations prior to joining CEA. He has been at CEA for the past 24 years and currently manages the environmental group including water, wastewater, stormwater, habitat restoration and regulatory agency interactions. His responsibility will be the for overall project operation including resources, budget, schedule and deliverables to the Town.

Mr. Jeffrey S. Levinton, PhD – Scientific Advisor
Mr. Levinton has over forty (40) years of experience in the environmental field including ecology and marine sciences. He has special expertise in marine benthic organisms and is quite familiar with the Forge River. He will report directly to the Project Manager and will interface with Task Managers on data interpretation,

existing conditions and community outreach activities.

E.8.2. Task Managers

Supporting the senior project management team will be seasoned and experienced staff serving as Task Managers. As a Task Manager, these individuals will be responsible for ensuring their group completes the necessary tasks identified in their respective scopes. Task Managers will report to the Project Manager on a regular basis to review progress, schedule, allocation of staff and budget.

Mr. David Berg, AICP, LEED – Mr. Berg has over thirty five (35) years of experience in the environmental field with special emphasis on the marine sciences. He will lead the Team's activities for characterization of the watershed, review of existing reports, identification of data gaps, interacting with other groups on waste loading and will also be involved in the public outreach program.

Ms. Janice Jijina, P.E., AICP, LEED – Ms. Jijina has over thirty (30) years experience in both municipal and private work. Particular specialties include planning, SEQRA and regulatory interface. She will lead the Team's activities on public outreach including leading of public meetings, dissemination of information, web site management, identifying SEQRA impacts and coordination with other involved regulatory agencies.

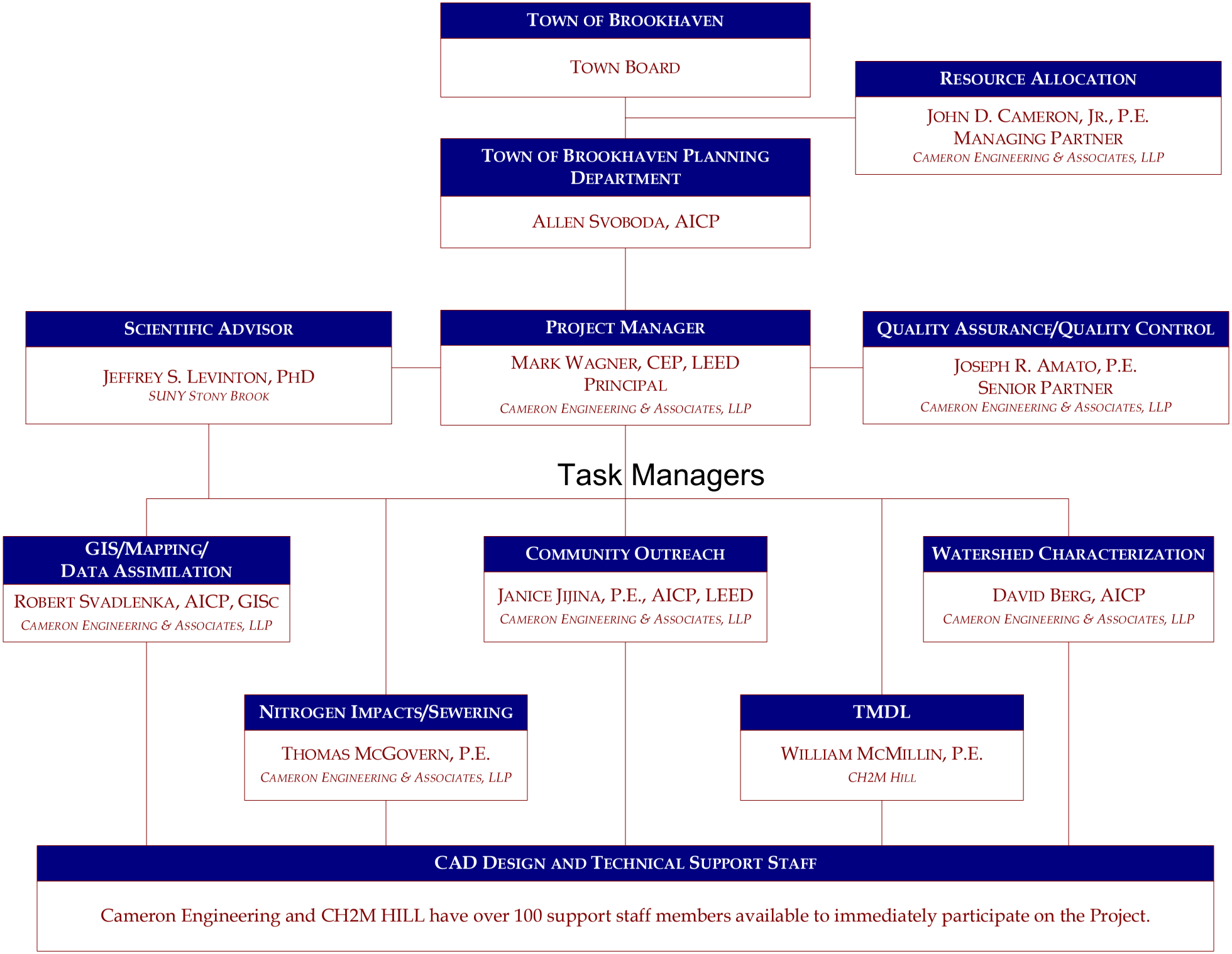
Robert Svadlenka, AICP, LEED, GISc – Mr. Svadlenka has over twenty-five (25) years of experience in municipal and private sector work with special emphasis on major planning projects utilizing GIS data bases. He will be responsible for the Team's activities on mapping, review of existing data bases, delineation of watershed boundaries, area demographics, assimilation of data points from previous studies and identifying data gaps that would need to be filled for completion of the TMDL (later phase).

Mr. Thomas McGovern, P.E., LEED – Mr. McGovern has over seventeen (17) years of experience in the environmental consulting field. Special emphasis has been on wastewater and stormwater treatment. He will lead the Team's efforts in identification of nitrogen sources, reviewing the infrastructure within the project site, reviewing data sets from previous and on-going studies, assisting on the development of waste load allocation and Total Mass Daily Load activities. Analysis of potential impacts of sewering including cost will be an assigned task.

Robert McMillin, Jr., P.E.(CH2M HILL) – Mr. McMillin has over twenty-two (22) years of experience in the environmental field. Special emphasis has been on watershed analysis, waste load allocations, modeling for TMDL, permitting and stakeholder interfacing. He will lead the Team's efforts in analysis nitrogen waste load within the watershed, dissolved oxygen concentration considerations and development of a Request For Proposals for the development of a TMDL (future phase). He will interface with other Task Leaders as well as Mr. Jeffrey S. Levinton, Scientific Advisor.

Organizational Chart and resumes of the senior management and task leaders are provided at the end of this section.

As would be expected, there will be many other professionals including engineers and scientists that will be working on the project. There are over 100 staff members available to support and assist on this project. Resources will allocated at the appropriate time throughout the project to ensure a complete and timely submittal of deliverables to the Town.


Town of Brookhaven
Town Board
Resource Allocation
John D. Cameron, Jr., P.E.
Managing Partner
Cameron Engineering & Associates, LLP
Town of Brookhaven Planning Department
Allen Svoboda, AICP
Scientific Advisor
Jeffrey S. Levinton, PhD
SUNY Stony Brook
Project Manager
Mark Wagner, CEP, LEED
Principal
Cameron Engineering & Associates, LLP
Quality Assurance/Quality Control
Joseph R. Amato, P.E.
Senior Partner
Cameron Engineering & Associates, LLP
Task Managers
GIS/Mapping/ Data Assimilation
Robert Svadlenka, AICP, GISc
Cameron Engineering & Associates, LLP
Community Outreach
Janice Jijina, P.E., AICP, LEED
Cameron Engineering & Associates, LLP
Watershed Characterization
David Berg, AICP
Cameron Engineering & Associates, LLP
Nitrogen Impacts/Sewering
Thomas McGovern, P.E.
Cameron Engineering & Associates, LLP
TMDL
William McMillin, P.E.
CH2M Hill
CAD Design and Technical Support Staff
Cameron Engineering and CH2M HILL have over 100 support staff members available to immediately participate on the Project.

EDUCATION:
Bachelor of Science
Oceanography
Florida Institute of Technology

LICENSE:
Licensed Operator Grade 4A
New York State Wastewater Treatment

CERTIFICATION:
LEED - Leadership in Energy and Environmental Design –U.S. Green Building Council Certification
Certified Environmental Professional (ABCEP)

AFFILIATIONS:
New York Water Environment Federation

- Chairman, Long Island Chapter: 2003
- Board of Directors, Long Island Chapter: 1997 – 2004
- Former Chair, NYWEA Plant Operations and Maintenance Committee

AWARDS:
NYWEA, State Chapter
Milton T. Hill Award
(2004)

Process Control Award
National Operations Challenge
(1997)

NYWEA, Long Island Chapter
Outstanding Operator Award
(1991)

NYWEA, Long Island Chapter
Chapter Achievement Award (1990)

Process Control Award
National Operations Challenge
(1989)

TOTAL YEARS EXPERIENCE: 31

YEARS WITH FIRM: 23

As Manager of Water and Wastewater Engineering, Mr. Wagner is extensively involved in the management and coordination of all projects involving wastewater treatment, residuals and biosolids management, operations and maintenance of municipal treatment facilities and solid waste treatment and management. Areas of responsibility include project design, providing operator training and technical assistance, systems troubleshooting, facility start-ups, regulatory interfacing, cost analysis project permitting, and treatability assessments. Mr. Wagner currently oversees the provision of operation and maintenance technical services to five (5) municipal wastewater treatment facilities. Services include troubleshooting, systems optimization, regulatory interface, permit modifications, consent order negotiation and sludge management.

Mr. Wagner is involved in design and permitting of residuals and biosolids management facilities. He secured the first two 6NYCRR Part 360 Permits for the composting of sewage biosolids for the Villages of Lawrence and Cedarhurst. He also was instrumental in designing and securing the first Part 360 Permit in New York for the composting of municipal solid waste. He continues to provide technical assistance to the largest private composting firm in New York State. He is well versed in regulatory and permitting requirements.

Mr. Wagner has extensive experience in the following treatment processes: Activated sludge (plug flow, step aeration, complete mix, extended aeration and pure oxygen); Trickling Filters (stone and plastic media); Rotating Biological Contactors, Intermittent Sand Filters, Biological Nitrification and Denitrification, Physical-Chemical Processes, Phosphorous Removal, Multi-media Filtration, Aerobic and Anaerobic Digestion, Solids Dewatering via beds, vacuum filters, belt filter presses and centrifuges; Solids Thickening via floatation thickeners, rotating drums and belt thickeners; Disinfection via chlorination, ozonation and ultraviolet light and Biosolids Composting.

Mr. Wagner has been involved in numerous facility start-ups throughout New York, New England and California. He is a Certified Grade 4A Wastewater Treatment Plant Operator (since 1978). He has been a Course Instructor for NYSDEC approved certification courses for over 28 years and has been involved first hand with the training of over 800 wastewater treatment operators. He has participated in the Operators Challenge on both the State and National Levels.

EDUCATION:
Master of Science
Marine Biology
University of Delaware

Bachelor of Science
Geology
University of Rochester

CERTIFICATION:
Member
American Institute of Certified Planners (AICP)

Accredited Professional
LEED – Leadership in Energy and Environmental Design - U.S. Green Building Council

AFFILIATIONS:
American Planning Association-Long Island Section Director

Congress for New Urbanism
Board Member

Vision Long Island
Board Member

TOTAL YEARS EXPERIENCE: 26

YEARS WITH FIRM: 10

As Senior Environmental Planner, Mr. Berg provides environmental oversight of many of the firm's projects. He coordinates the SEQRA process and has authored Environmental Assessments, Draft and Final Environmental Impact Statements, Phase I and Phase II Environmental Site Assessments. Mr. Berg has obtained permits from State and Federal agencies for projects adjacent to freshwater and tidal wetlands, for dams, and for clients seeking discharge permits. He is well versed in the requirements of the NYSDEC, NYSDOS, US Army Corps of Engineers, and other State and Federal agencies. Mr. Berg has conducted biological inventories and environmental sampling programs.

Mr. Berg prepared and helped facilitate numerous public participation planning events. He recently led one such event to develop a Master Plan for West Meadow Beach in Stony Brook. He helped plan and facilitate a public participation design process for the redevelopment of the 9-acre Oak Beach site for the Town of Babylon and Suffolk County and for the 4-acre BayWalk Park site in Port Washington North. Mr. Berg is a founding Board Member of Vision Long Island, Inc. (VLI), a regional planning organization that supports Smart Growth development, livable communities, and new urbanism. He is the Director of the Long Island Section of the NY Metro Chapter of the APA and was recently appointed to the board of the New York chapter of the Congress for New Urbanism.

Mr. Berg has written funding proposals for private and municipal research, design, and development projects. He prepared several successful grant applications totaling over $1M for the Village of Port Washington North for their BayWalk waterfront park. He authored a New York State Clean Water/Clean Air Bond Act grant application that resulted in $850,000 for tidal wetland restoration for the Town of Oyster Bay. A $1.3 million Bond Act grant application prepared by Mr. Berg for Nassau County was approved for streamflow augmentation, stormwater management, and pond restoration for the Massapequa Preserve. The Town of Huntington was awarded $1.9 million in Bond Act grant funding for a proposal prepared by Mr. Berg for the construction of stormwater control devices, a treatment wetland, and the restoration of Mill Dam Pond.

Mr. Berg drafted watershed plans for stormwater management, open space, and recreational activities including the 5.2 square mile Valley Stream Brook watershed and the 423-acre Massapequa Preserve. He has prepared coastal management plans, designed pond and stream improvements, and stormwater treatment wetlands. Mr. Berg is familiar with New York's Coastal Zone Management Plan and its Local Waterfront Revitalization Program (LWRP). As a founding member of the Town of Huntington Waterfront Revitalization Task Force, he helped formulate the LWRP and the new Waterfront Zoning Code and is helping the Town develop a plan to increase public access to and enjoyment of the historic waterfront.

Janice Jijina, P.E., AICP, LEED
Partner, Manager of PLanning & Environmental Engineering

EDUCATION:
Master of Science
Biological Oceanography
University of Washington

Bachelor of Science
Geology
State University of New York at Buffalo

LICENSE:
Professional Engineer: New York

CERTIFICATIONS:
Member
American Institute of Certified Planners (AICP)

Accredited Professional
LEED – Leadership in Energy and Environmental Design - U.S. Green Building Council

Certified Environmental Inspector
Environmental Assessment Association

AFFILIATIONS:
American Planning Association

NY Water Environment Association

Sigma Xi Scientific Research Society

Phi Beta Kappa

AWARDS:
NYWEA Environmental Science Award (2000)

NYWEA John Chester Brigham Award (1992)

NYWEA Chapter Achievement Awards (1987, 1989)

TOTAL YEARS EXPERIENCE: 28

YEARS WITH FIRM: 20

As the Manager of Planning and Environmental Engineering, Ms. Jijina maintains close contact with regulatory agencies and is responsible for the Firm's planning, environmental assessment and environmental permitting projects. Her responsibilities include preparation of planning studies including master plans and land development feasibility studies, preparation and review of environmental assessments and environmental impact statements, and coordination of the SEQR process. Ms. Jijina also manages various projects for the Firm in matters relating to environmental engineering reports, regulatory agency permitting and compliance in areas such as land use and zoning, environmental monitoring, solid waste management, sludge processing, water supply, groundwater protection, wetlands protection and restoration, resource recovery and wastewater treatment.

Ms. Jijina's managerial experience spans all areas of engineering as she routinely manages the Firm's largest planning, design and construction contracts including potential reuse of the Kings Park Psychiatric Center, the proposed $2 billion dollar Riverhead Resorts project in Calverton, the 500 acre industrial subdivision and redevelopment at Calverton, redevelopment of the Gyrodyne property in St. James, planning and SEQRA analysis for the Navy's transfer of the 105 acres at Bethpage to Nassau County, and many other residential, industrial, park and environmental projects. For these projects, Ms. Jijina provides oversight of the Firm's staff in all disciplines and of all subconsultants on the project. She develops the project schedule and is responsible for delivering these complex, multidiscipline projects on time and on budget.

In the Firm's capacity as a consultant to municipalities, Ms. Jijina has supervised the environmental review of several major industrial, commercial and residential development projects. For private clients, Ms. Jijina has supervised the preparation of environmental assessments and impact statements for major residential, commercial and industrial projects.

Ms. Jijina is responsible for securing regulatory permits from Federal, State and local government agencies. She has been in responsible charge of the permit application process for numerous solid waste management facilities, as well as air, tidal wetlands, freshwater wetlands and wild, scenic and recreational rivers act permits.

Ms. Jijina has extensive research experience encompassing preparation and administration of research grants, and the planning and implementation of many diverse laboratory and field research projects. Ms. Jijina has authored numerous publications on environmental topics.

EDUCATION:
Bachelor of Science (Cum Laude)
Civil Engineering
University of Hartford

Juris Doctorate
St. John's University

CERTIFICATION:
Accredited Professional
LEED – Leadership in Energy and Environmental Design - U.S. Green Building Council

AFFILIATIONS:
New York Water Environment Association

American Society of Civil Engineers

Tau Beta Pi

Sigma Xi

AWARD:
NYWEA, State Chapter
Charles Agar Memorial Award (2006)

TOTAL YEARS EXPERIENCE: 19

YEARS WITH FIRM: 2

As Director of Water and Wastewater Services, Mr. McGovern is intimately involved in each aspect of water projects including wastewater, potable water, stormwater and ecosystem restoration. By combining fundamental engineering principles with fresh, original and innovative technologies, Mr. McGovern has designed systems to treat a variety of waste streams including semiconductor waste, nocardia, high-strength dairy waste, extremely septic waste, cancer treatment waste, deicing fluids, exceedingly high ammonia waste, medical waste, senior living waste and water containing high levels of iron.

Mr. McGovern has been on the leading forefront of innovative technologies and has tailored creative solutions to meet particular project requirements. He designed a revolutionary nocardia collection and pumping system at the fifth largest wastewater treatment plant in the country. He managed the startup of one of Long Island's first north shore nitrogen removal facilities. He organized and managed one of the largest side by side dewatering pilot tests in the country. He completed the first contract documents to fiberglass wrap and concrete encase an extremely deteriorated and leaking 66-inch sludge pipe. He designed a sequencing batch reactor treatment plant for one of the heaviest ammonia loads in the country. He differentiated black water and gray water flows for a 1.4 mgd resort facility and designed a black water treatment system including vacuum sewers, SBR treatment and groundwater recharge. He designed a wastewater system to divert 2.0 mgd from Lawrence and 1.0 mgd from Cedarhurst to the Inwood pump station for ultimate treatment at Bay Park WPCP. He managed the demolition of a 95 ft diameter storage tank concrete dome for a 1 million gallon potable storage tank and replaced it with an aluminum panel cover. He started up and operated an SBR plant for a high strength dairy waste stream. After process upsets, Mr. McGovern identified key process parameters, instituted a sludge management plan and avoided toxic upsets to return a semi-conductor waste treatment plant to normal operations.

Mr. McGovern managed the plans and specifications for the Massapequa Preserve project which included stream flow augmentation, stormwater treatment units, dredging and various amenities. Mr. McGovern delineated contributing watersheds, evaluated hydrology, floodplains, significant habitats and identified management strategies to protect and restore Glen Cove Creek resources. Mr. McGovern has helped design the Mill Pond Improvements including stormwater treatment, dredging, plantings, retaining wall improvements and spillway improvements.

EDUCATION:
Bachelor of Science
Environmental Engineering
State University of New York
at Buffalo

CERTIFICATION:
LEED - Leadership in Energy and Environmental Design –U.S. Green Building Council Certification

AFFILIATION:
New York Water Environment Association

TOTAL YEARS EXPERIENCE: 7

YEARS WITH FIRM: 3

Ms. Cloud currently assists in the design of the Firm's projects within the areas of new wastewater treatment plants, the upgrading of existing treatment facilities, water systems design and stormwater management and treatment technologies. Her duties include project engineering analysis and calculations, conceptual design, preparation of plans and specifications and report writing. Her experience includes Sequence Batch Reactor and Denitrification Systems as well as water distribution system design and modelling for subdivisions. Ms. Cloud also conducts shop drawing review and attends meetings on the behalf of clients as part of the construction phase services.

Ms. Cloud also assists in hydrologic analysis and design; including pond restorations/improvements and drainage area analysis.

Ms. Cloud is also responsible for gravity wastewater collection system design; lower pressure sewer collection systems; pump station and force main design; and hydraulic analysis and design.

Ms. Cloud's current projects include:

Nassau County - Lawrence/Cedarhurst Consolidation: Preparation of gravity collection, pump station and force main Plans and Specifications for the sewage treatment plant consolidation plan within Nassau County.

Town of North Hempstead – Mill Pond: Construction phase services for stormwater and water quality improvements to Mill Pond. The project includes; pond dredging, tidal exchange rates, stormwater treatment devices and park restoration for this 5-acre pond located at the intersection of Shore Road and Mill Pond Road in historic Port Washington.

Nassau County – Stormwater Management Study for Sewage Treatment Plants. Proposing innovative treatment options to treat and reduce stormwater flow from leaving the site.

Suffolk County - Suffolk County Sewer District No. 6 Expansion Feasibility Study: Research/conceptual design layouts of traditional and alternative sewering within the study areas.

EDUCATION:
Masters of City and Regional Planning
Rutgers University

Bachelor of Science
Mechanical Engineering
Rutgers University

CERTIFICATION:
Member
American Institute of Certified Planners (AICP)

AFFILIATIONS:
American Planning Association

TOTAL YEARS EXPERIENCE: 20
GIS & Planning: 13 Years
Engineering: 7 Years

As GIS Manager, Mr. Svadlenka serves as the technical lead on GIS data and applications development projects and provides oversight for the integration of GIS with the firm's ongoing projects. He offers extensive experience in the development of spatial databases for municipal and county governments and regional planning entities including cadastral, transportation, environmental and demographic data. A key feature of his GIS skills and experience comprises applications of GIS to land use, travel demand, environmental models and 3D simulations. He has utilized GIS extensively in numerous planning initiatives, including alternatives analyses, growth management programs, community vision plans, and infrastructure needs assessments. He regularly uses GIS in public forums to illustrate important spatial features of proposals.

Prior to joining Cameron Engineering, Mr. Svadlenka participated in the planning and implementation of the Staten Island Bluebelt, a nationally acclaimed program of the New York City Department of Environmental Protection (NYCDEP) that utilizes existing and constructed wetlands to manage stormwater. Among his many duties at the NYCDEP, Mr. Svadlenka was in charge of mapping the Staten Island Bluebelt and planning future phases of the program. As a Project Manager for the Bluebelt Expansion, he conducted feasibility studies, coordinated environmental investigations, participated in system design, and interfaced with various agency and community representatives. In this role, he utilized GIS as a tool for coordinating the complex environmental, financial, and legal aspects of the program.

Mr. Svadlenka has employed GIS to a wide range of transportation projects, including alternatives analyses, master plans, congestion mitigation studies, and infrastructure needs assessments. He integrated GIS into these studies as a critical tool for modeling future travel demand and system ridership and for portraying the potential impacts of proposed plans and alternatives. Mr. Svadlenka has contributed to growth management initiatives, particularly in Hunterdon County, New Jersey where, as a member of the planning commission, he used GIS-based travel demand and land use models to demonstrate impacts from development. His models were used to educate local officials about the traffic impacts of various build-out scenarios. A corridor study that he conducted for the Interstate 78/State Highway 31 Corridor received a Recognition of Merit from the New Jersey Chapter of the American Planning Association.

Mr. Svadlenka has also provided GIS expertise and other technical guidance to a variety of firms and community groups regarding the use of spatial data for planning. Earlier in his career as an engineer, he participated in the design of the GPS Block II satellites which are now widely used for navigation and positioning. He is currently a PhD candidate at the Graduate Center of the City University of New York. His doctoral research utilizes GIS to understand the relationships among economic policy changes, land use, and environmental quality.

Present Position
Distinguished Professor
Department of Ecology and Evolution
Stony Brook University
Stony Brook, New York 11794
Tel. No. (631) 632-8602, 8601; fax (631) 632-7626
email: levinton@life.bio.sunysb.edu

Educational Experience
B.S., College of the City of New York, 1966 (Geology)
N.S.F. Paleoecology Summer Course, Woods Hole, 1967
M. Phil., Yale University, 1969 (Geology and Geophysics)
Ph.D., Yale University, 1971 (Geology and Geophysics)

Academic Honors
Ward Medal in Geology, College of the City of New York, 1966
Sterling Honorary Fellow, Yale University, 1969-1970
National Science Foundation Predoctoral Fellow, 1968-1970
John Simon Guggenheim Memorial Fellow, 1983-1984
President's Award (SUNY Stony Brook) for Excellence in Teaching, 1997
Chancellor's Award (SUNY) for Excellence in Teaching, 1997
Academy of Teacher-Scholars (Stony Brook), 1997-2000
Wiese Honorary Lecturer, University of South Alabama 1998
Sir Kirby Laing Honorary Fellow, University of Wales 1998
Fulbright Senior Scholar 1999
Fellow, American Association for the Advancement of Science 2000
Distinguished Professor, State University of New York 2004

Positions
Visiting Professor, University of Sydney, Australia, 4/99-9/99
Visiting Scholar, University of Washington, 9/90-6/91
Hudson River Fund Panel Chairperson, Hudson River Foundation, 2/86 6/90
Department Head, Department of Ecology and Evolution, S.U.N.Y. at Stony Brook, 9/84 8/90, 11/91-3/93
Visiting Investigator, Station Zoologique (Villefranche-Sur-Mer) and Laboratoire Arago (Banyuls Sur Mer), France, 1984
Visiting Professor, Department of Genetics and Kings College, University of Cambridge, 1983 (fall)
Visiting Professor, Uppsala University, Sweden, 1981 (fall)
Lecturer, Marine Ecology Course, Marine Biology Laboratory, Woods Hole, 1981, 1982, 1983 (summer)
Professor, Ecology and Evolution, State University of New York at Stony Brook, 1983 present
Research Associate, Duke University Marine Laboratory, 1978 (summer)
Visiting Professor, University of Aarhus, Denmark, 1976 1977
Associate Professor, Ecology and Evolution, State University of New York at Stony Brook, 1975 1983
Associate Professor, Paleoecology, State University of New York at Stony Brook, 1974 1975
Assistant Professor, Paleoecology, State University of New York at Stony Brook, 1971 1974
Instructor, Paleoecology, State University of New York at Stony Brook, 1970 1971
Guest Student Investigator, Woods Hole Oceanographic Institution, 1969
Graduate Research Trainee, Systematics Ecology Program, Marine Biological Laboratory, Woods Hole, 1969
Graduate Teaching Assistant, Yale University, 1967 1969

Editorial Boards, Journal Editorships, Committees
Distinguished Professor Committee Stony Brook University 2006 -

NYC2012 Olympic Team, Environmental Committee, October 2004
President's Faculty Advisory Council on the Future of Stony Brook University, 2004 - 2005
Faculty Advisor, Freshman College of Science and Society, SBU, 2003-2007
Member Advisory Board, Inst. For Cons. Tropical Environments, Stony Brook University
Member, Board of Directors, The River Project, New York City, 2002 -
Editorial Board, J. Marine Biological Association, U.K., 1999 -
Member, Friday Harbor Laboratories Development Advisory Committee, 1997-
Editorial Advisor, Global Change Biology, 1995 - 2007
Member of Book Review Advisors of Quarterly Review of Biology, 1994-
Editorial Advisor, Marine Ecology Progress Series, 1992 - 1999
Associate Editor, Ecological Applications, 1989 –1993
Associate Editor, Ecology, 1986 1989
Chairperson, Columbia Population Biology Seminar, 1978 l979
Member (past) of Editorial Board of Evolutionary Theory
Member of Editorial Board of Paleobiology, 1975 l978, l983 l986, 1986 1989
Managing Editor, American Naturalist, 1974 l977
Associate Editor, American Naturalist, 1978 1979
Member, Environmental Policy Committee of Connecticut, 1967 l968

Web Pages
Research: http://life.bio.sunysb.edu/marinebio/levinton.main.html
Marine Biology Web Page: http://life.bio.sunysb.edu/marinebio/mbweb.html
Marine Biology Explorations: http://life.bio.sunysb.edu/marinebio/explorations.html
Foundry Cove Web Page: http://life.bio.sunysb.edu/marinebio/foundryframe.html

Publications since 1997
(96) Ward, J.E., J.S. Levinton, S.E. Shumway, T. L. Cucci. 1997. Site of particle selection in a bivalve mollusk. Nature 390:131-132.
(97) Nilsson, P., J.Kurdziel, J.S. Levinton. 1997. Heterogeneous population growth, parental effects and genotype- environment interactions of a marine oligochaete. Marine Biology, 130: 181-191.
(98) Ward, J.E., J.S. Levinton, S.E. Shumway, T. Cucci. 1998. Particle sorting in bivalves: In vivo determination of the pallial organs of selection. Marine Biology 131: 283-292.
(99) Wallace, W.W., G.R. Lopez, J. S. Levinton. 1998. Cadmium resistance in an oligochaete and its effect on cadmium trophic transfer to an omnivorous shrimp. Marine Ecology Progress Series 72: 225-237.
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(101) Levinton, J.S., P. Klerks, D.E. Martinez, C. Montero, C. Sturmbauer, L. Suatoni,W. Wallace. 1999. Running the Gauntlet: Pollution, Evolution and Reclamation of an Estuarine Bay and its Significance in Understanding the Population Biology of Toxicology and Food Web Transfer. IN M. Whitfield, ed., Aquatic Life Cycles Strategies. Plymouth U.K., The Marine Biological Association.
(102) Baker, S., J.S. Levinton, J.E. Ward. 2000. Particle transport in the zebra mussel, Dreissena polymorpha (Pallas). Biol. Bull. 199:116-125.
(103) Nilsson, P., J. S. Levinton, J. Kurdziel. 2000. Migration of a marine oligochaete: induction of dispersal and microhabitat choice. Mar. Ecol. Prog. Ser. 207: 89-96.
(104) Levinton, J.S., J.E. Ward, S.E. Shumway, S. M. Baker. 2001. Feeding Processes of Bivalves: Connecting the Gut to the Ecosystem. Pp. 385-400. In Organism-sediment Interactions, ed. J. Y. Aller, S. A. Woodin, R. Aller, Belle W. Baruch Library in Marine Science no. 21. University of South Carolina Press, Columbia, SC 29208
USA.
(105) Marine Biology: Function, Biodiversity, Ecology, 2nd Edition. 2001. New York, Oxford University Press, 515 pp.
(106) Levinton, J. S. 2001. Extinctions, Rates of, In S. A. Levin, editor, Encyclopedia of Biodiversity, Academic Press.
(107) Levinton, J.S. 2001. Genetics, Paleontology, and Macroevolution. New York, Cambridge University Press, 617 pp..

(108) Levinton, J. S., J. E. Ward, S. E. Shumway. 2002. Feeding responses of oysters and mussels to chemical composition of fresh and aged kelp detrital particles. Marine Biology 141: 367-376.
(109) Wong, W.H., B. Twining, J.S. Levinton. 2003. The Benthic-Zooplankton loop: evidence for strong trophic interactions between dense bivalve populations and microzooplankton. Limnology and Oceanography, 48: 308-312.
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(132) Allen, B.A., D. DeLambert, J.S. Levinton. 2008. Connecting measures of fitness to reproductive performance of males of the fiddler crab Uca pugilator.

EDUCATION:
Masters of Public Administration, Executive Masters of Public Policy and Administration
Columbia University

M.S. Community and Regional Planning
The University of Texas–Austin

B.S. Petroleum and Natural Gas Engineering
Pennsylvania State University

Graduate Studies in Public Policy
The University of Texas–Austin

Project Management
University of Texas

Environmental Protection Agency
Water Quality Standards Academy

United States Geological Services
Water Quality Statistics/Hydrology Course

Colorado State University Water Quality Statistics and Monitoring Course

CERTIFICATIONS:
Member
American Institute of Certified Planners (AICP)

DISTINGUISHING QUALIFICATIONS:

- Ability to manage teams of technical and nontechnical professionals and support staff
- Develop and manage million dollar budgets
- Find common ground between divergent cultural and political interests
- Guide community and government representatives in resolving conflicts using consensus techniques
- Initiate and implement cooperative water-quality management programs

Ms. Reinmund-Martinez is a project consultant with CH2M HILL's Water Business Group in New York City. She comes to CH2M HILL with extensive public sector experience at the local, regional, and state levels and specifically has worked as a water quality planning specialist for the past 15 years. She managed a regional water quality management program which included the coordination of multi-agency water quality monitoring, assessment, and environmental outreach activities. Ms. Reinmund-Martinez has experience in developing multi-agency monitoring and assessment programs for rivers with several water quality problems. Ms. Reinmund-Martinez has developed and facilitated stakeholder involvement in numerous water quality programs including TMDL projects.

She has experience in working with local and state land use and water quality regulations and in negotiating settlements with various industries that ensured their long-term participation to protect water quality. She has conducted and facilitated numerous public meetings that resulted in agreements on land use development controversies citizens, non-governmental organizations, land-use developers, and other professionals. She has participated in the development of various state and federal water quality policies and regulations, and has successfully obtained U.S. Environmental Protection Agency funding to manage a toxic pollutant problem and to eliminate illegal dumping in urban watersheds. She voluntarily served on multi-disciplinary committee of professionals that developed land development policies and rules for a local government.

Representative Projects:

Project Consultant, Gilleland Creek TMDL Watershed Action Plan, Lower Colorado River Authority, Austin, Texas ; 2008 to present. Managing the development of a state mandated watershed action plan for the Lower Colorado River Authority. Responsibilities include working with private citizens, environmental organizations, and representatives from various state, local and federal agencies to develop a plan to improve water quality in the Gilleland Creek watershed.
Project Consultant, Water Quality Policy and Permit Reviews, Lower Colorado River Authority, Colorado River Basin, Texas, 2008 to present. Providing the Lower Colorado River Authority with advice on their position on state and federal policy and regulatory actions, which impact the water quality in the Colorado River basin.

EDUCATION:
M.S., Environmental Engineering
Clemson University

B.S., Industrial Engineering
University of Arizona

Mr. Albertin is a Project Scientist specializing in water quality modeling in CH2M HILL's Raleigh office. He has over ten years experience in the areas of watershed assessments, development of watershed and water quality models, and environmental database and water quality model integration. Mr. Albertin has led technical efforts to support state, regional, and national government agencies in a number of TMDL and watershed management studies. Mr. Albertin's recent projects have been largely focused on assessment of water quality in large urban areas. The projects, located in Louisville, KY, Milwaukee, WI, and Charlotte, NC, have included the development and integration of collection system and watershed models to predict long and short-term impacts of stormwater runoff on water quality conditions.

Select Project Experience:

Project Scientist; Levy County Nuclear Plant Environmental Report; January 2008 to present. Compiled information and developed documentation used to evaluate water supply impacts from the proposed operation of two new nuclear power plants in west-central Florida. Developed groundwater and surface water monitoring plans for pre-construction, construction, and operational phase of the project to establish baseline conditions track critical environmental characteristics.

Project Scientist; Harris Lake Water Quality Modeling; March 2008 to present. Developed a CE-QUAL-W2 model to predict the changes to Harris Lake water quality which could result due to the introduction of effluent from the proposed Western Wake Regional Water Reclamation Facility. Recent drought conditions in the state have led to increased interest in water reuse. Under consideration is the discharge of effluent from a new regional wastewater treatment facility to Harris Reservoir which is used as a cooling water supply for the Shearon Harris Nuclear Plant. Modeling efforts included development of a watershed model calibration to monitoring data, and evaluation of lake response to different effluent treatment levels.

Project Scientist; Harris Nuclear Plant Units 2 and 3 Environmental Report; July 2007 to December 2007. Compiled information and developed documentation used to evaluate water supply from the proposed operation of two new nuclear power plants in central North Carolina. Developed surface water quantity and quality models (GWLF, QUAL-2E, and BATHTUB) to evaluate impacts of operation on regional water supply, as well as, in-lake and in-stream water quality.

EDUCATION:
M.S., Environmental Engineering
Marquette University

B.S., Civil Engineering
Marquette University

REGISTRATIONS:
Professional Engineer: Wisconsin (25639)

CH2M HILL Certified Project Manager

DISTINGUISHING QUALIFICATIONS:

- Provided National Pollutant Discharge Elimination System (NPDES) permit assistance to dozens of municipal and industrial clients in 25 States throughout the U.S.
- Extensive experience in the Total Maximum Daily Load (TMDL) program, including work for watershed stakeholder groups, affected permittees, and state water quality agencies
- National expert on water quality standards, including UAAs, site-specific criteria, mixing zones and variances
- Water quality modeling, TMDL review, and NPDES permit development
- National expert in stormwater quality regulations

Mr. Dupuis is a principal technologist with CH2M HILL's Water Business Group in Boise, Idaho. He has more than 30 years of diverse experience in both public and private environmental engineering as a project engineer, principal investigator, and project manager. His areas of expertise include water quality monitoring and assessment, TMDLs, Use Attainability Analyses (UAAs), NPDES permit assistance, hydroelectric licensing, storm water management, hydrologic analysis, water resources management, computer modeling, and National Environmental Policy Act (NEPA) assessments. Mr. Dupuis obtained his knowledge of water programs while working for a private environmental research firm, for State water quality and water resources agencies in North Carolina, and for CH2M HILL providing technical and regulatory assistance services to private industry, government agencies, and municipalities.

Selected Project Experience:
NPDES / TMDL / UAA Experience
Mr. Dupuis assists CH2M HILL clients in complying with NPDES storm water regulations. He has conducted facility evaluations and prepared permit applications for a variety of industrial facilities in several states. These evaluations have included site drainage delineation, assessment of materials storage and handling practices, identification of illicit connections, development of storm event sampling protocols, and the preparation of Stormwater Pollution Prevention Plans. He managed a study for the Michigan Department of Transportation (DOT) related to stormwater quality, permitting, and management. He was Principal Investigator for a National Academy of Sciences project researching a process to assess the impacts of and determine mitigation strategies for storm water runoff from bridges. For the Federal Highway Administration (FHWA), Mr. Dupuis was Principal Investigator of a comprehensive nationwide study of the effects of highway storm water runoff on receiving waters. He planned and coordinated field monitoring and developed impact assessment methodologies; biological, sediment, and water column effects were quantified; and he developed a series of guidance manuals.

Mr. Dupuis has been heavily involved in the TMDL program for the last 5 years. TMDLs he has had extensive involvement in include the Lower Boise River, Tualatin River (OR), Spokane River, Johnson Creek (OR), Salt Creek (IL), West Branch DuPage River (IL), and East Branch DuPage River (IL).

In response to Clean Water Act water quality regulations, Mr. Dupuis has directed or provided senior review for numerous CH2M HILL client projects. The geographic scope of this work includes Alaska, California, Wisconsin, Michigan, Idaho, Florida, Alabama, Arkansas, Oklahoma, Virginia, Pennsylvania, Nebraska, New Jersey, North Carolina, Ohio, Oregon, Massachusetts, New Hampshire, Montana, Iowa, Missouri, Kansas, Colorado, Texas, Georgia, Maryland, Connecticut, Illinois, Indiana, Washington, Puerto Rico.

Rico, and American Samoa. Examples of industrial clients include Atlantic Electric, Hoechst-Celanese, Ore-Ida, Heinz, StarKist, Mosinee Paper, James River, Boise Cascade, Potlatch, Pope and Talbot, Weyerhaeuser, Consolidated Papers, Midtec Papers, Kerwin Paper, Wisconsin Tissue, Tenneco Packaging, Michigan Sugar, and several confidential clients. Example of public sector clients include the Cities of Spokane, Washington; Montgomery, Alabama; Omaha, Kearney, Grand Island, and Hastings, Nebraska; Boise, Meridian, Idaho Falls, and Twin Falls, Idaho; international airports in Dayton, Anchorage, Pittsburgh, and Portland; Clean Water Services (Washington County), Oregon; Las Virgenes, California; Norman, Sapulpa, and Lawton, Oklahoma; Fayetteville, Arkansas; Idaho DEQ; Illinois EPA; and U.S. Navy bases in Hampton Roads. These projects focused on the development of compliance strategies and permit negotiations and included field studies, mixing zone and water quality modeling, and antidegradation/antibacksliding evaluations.

Various Mixing Zone Projects and Locations

Directed or provided senior review for TMDL, water quality, and effluent toxicity projects in more than 30 states and two territories. These projects focused on the development of compliance strategies and NPDES permit negotiations and included mixing zone analyses, field studies, water quality modeling, and anti-degradation/anti-backsliding evaluations. As a result of these many projects, he is a national expert in mixing zone assessment and modeling, well versed with the following EPA mixing zone models: CORMIX, Visual Plumes, UDKHDEN, PDS, and RDIFF/CDIFF. His expertise includes large and small rivers, lakes, reservoirs, and estuaries. Examples of receiving waters for which he has conducted mixing zone analyses include the Boise, Snake, Columbia, Tualatin, Wisconsin, Fox, Elizabeth, Mississippi, and Missouri Rivers; Lake Michigan; and Lake Superior.

EDUCATION:
M.E.E., Environmental Engineering,Manhattan College

B.C.E., Civil Engineering
Manhattan College

REGISTRATIONS:
Professional Engineer: New Jersey (#24GE04250700, 2000)

Mr. McMillin is a senior technologist with CH2M HILL's Water Business Group in Parsippany, NJ. He has a broad base of public and private sector experience in delivering evaluations, planning, design, and implementation of collection systems, wastewater treatment, water resources, and environmental management projects. He has conducted and managed projects and programs involving physical, biological, and water quality monitoring and assessment, facility planning for combined sewer overflows (CSO), stormwater and floatables pollution, effluent dilution, atmospheric deposition, remediation, restoration, total maximum daily loads (TMDL), use attainability analyses (UAA), stakeholder participation, permitting, funding, and navigating regulatory processes. He has conducted and managed design projects for collection systems and wastewater treatment. He is also specialized in managing and conducting mathematical modeling projects for watersheds, stormwater, sanitary and combined sewer systems, mixing zones, receiving waters, and sediment transport.

Mr. McMillin is experienced in the regulatory, planning, design and implementation aspects of wet weather flow management. He participated in authoring federal guidance documents for combined sewer overflow controls and professional publications on wet weather management and use attainability analyses. He has voluntarily assisted the State of New Jersey in developing its CSO policies and permits for long-term control planning, and has extensive experience in working with local and state agencies for conducting projects that address regulatory and permit compliance issues. He served on the EPA's Environment Technology Valuation (ETV) technology panel for Wet Weather Modeling.

Selected Project Experience
Technical Consultant on Water Quality and Total Maximum Daily Loads, Seminole County Yankee Lake Consumptive Use Permit Application, Sanford, FL; March 2008 to present. Consulting on hydrologic, hydraulic and water quality issues for an application to withdraw water from the middle basin of the St. Johns River in Florida. Responsibilities include reviewing and commenting on technical documents, directing hydrodynamic and water quality data analysis and modeling, evaluating effects on downstream TMDLs, evaluating withdrawal water quality, and providing expert witness in an administrative hearing.

Task Manager, Technical Consultant, and Deputy Program Manager for General Conveyance Services; North Hudson Sewerage Authority; Hudson County, NJ; April 2005 to present. Technical consulting and task management on wet weather, water quality, regulatory, design, state revolving funding, and regional planning issues to the Authority. Represents the Authority to the New Jersey Harbor Dischargers Group and liaisons to other regional planning efforts including Harbor Estuary Program TMDL efforts. Consults to the Authority concerning permitting issues such as for toxics,

nutrients, and long-term planning of combined sewer overflow controls. Also consults to the Authority on other issues such as capacity assurance, collection system hydraulics, and optimizing solids/floatables controls.

Quality Manager, Holly Pond Sedimentation Study and Improvement Design, Stamford, CT; August 2008 to present. As the quality manager, responsibilities include planning and reviewing all components of data compilation, field investigations, mathematical modeling, characterization, and alternative analyses for an engineering study of the Noroton River and Holly Pond for the Stamford Water Pollution Control Authority. Project goals are to develop watershed strategies for the Noroton River to control sediment entering Holly Pond while identifying and recommending sustainable sediment alternatives for removing sediment mounds in Holly Pond with beneficial uses.

Technical Consultant on Machado Lake TMDL, City of Los Angeles Watershed Protection Division, Los Angeles, CA; September 2007 to May 2008. Consulted on sampling, sediment flux calculations, modeling, and other water quality issues related to developing a TMDL for an urban freshwater lake in the City of Los Angeles.

Contributing Author; Use Attainability Analyses Guidance; National Association of Clean Water Agencies (NACWA) and the Water Environment Research Foundation (WERF); Washington, DC; March 2005 to September 2005. Contributing author of a guidance document being published by the NACWA (formerly the Association of Metropolitan Sewerage Agencies - AMSA) and WERF. The guidance is intended to be a practical Use Attainability Analysis (UAA) roadmap for stakeholders who are trying to determine whether a UAA is the right tool to ensure that beneficial uses to be protected are appropriate. Contributed experiences on applying the watershed approach, addressing wet weather issues in modified urban environments, mathematical modeling, and stakeholder involvement.

Project Manager, Use and Standards Attainment Project, New York City Department of Environmental Protection. This $15 million project provided the technical, scientific and economic bases to support regulatory processes needed to tailor water quality standards to the highest reasonably-attainable use and to allow water quality standards to be attained upon implementation of recommended projects for New York Harbor waters. Responsibilities included directing waterbody-watershed assessments, facility planning, use attainability analyses, physical, chemical and biological field investigations, data management, project and budget management, coordinating $5 million of subcontractor activities, coordinating peer reviews, directing public opinion surveys, and managing overall public outreach including managing a project internet web site and interacting with stakeholders, regulators, and citizen representatives. Personally directed long-term control planning for three CSO waterbodies and drafted a use attainability analysis for one of them.

EDUCATION:
Ph.D., Environmental Engineering (Water Resources)
Minor: Systems Engineering
University of Virginia

M.S., Environmental Engineering
Minor: Geotechnical Engineering
University of Saskatchewan
Saskatoon, Canada

B.S., Environmental Engineering
Minor: Sanitary Engineering
Tsinghua University
Beijing, China

REGISTRATIONS:
Professional Engineer: Virginia No. 041179

DISTINGUISHING QUALIFICATIONS:

- Serving the Industrial Water Resources Lead and subject matter expert in advancing the practice of industrial water supply and water quality throughout North America and abroad and continuously updates enterprise service offering to reflect these technology advances.
- Appointed by Interior Secretary as one of the 30 voting members for the Inter-agency Advisory Committee on Water Information (ACWI), a Presidential Advisory Committee (http://acwi.gov/); Serving the Steering Committee Member, Sustainable Water Resources Roundtable at ACWI. Extensive experience and publications on water sustainability and sustainable water management
- Serving the TMDL/NPDES/Water Quality subject matter expert in providing key technical services for industrial, municipal and federal clients. Provided multi-year TMDL-related support / project management for EPA HQ and states in all 10 EPA Regions under USEPA National Watershed Protection Program, which covers TMDL/ Watershed Management, Water Quality Modeling and Monitoring,

Dr. Zhang is a Principal Technologist in CH2M HILL's Chantilly, Virginia office and the Industrial Water Resources Lead within Industrial Systems Business Group. He serves the primary technical resource and subject matter expert in advancing the practice of Industrial Water Resources throughout North America and abroad and continuously updates enterprise service offering to reflect these technology advances. Dr. Zhang serves senior consultant / subject matter expert and provides key technical support on water resources and water quality/NPDES/TMDL projects for industrial and government clients.
As the industrial water resources lead, Dr. Zhang is responsible for developing comprehensive and global SOQs for Industrial Water Resources and Industrial Water Quality/ NPDES/TMDL, and associated collateral materials in key service areas. He gives presentations and covers business briefings on "Managing Global Water Risks in a Water-scarce World" and "Tools and Methodologies for Sustainable Water Management" for multi-national companies among various industries, including highlighting the Global Water Tool by World Business Council for Sustainable Development.

Selection Project Experience
Subject Matter Expert, TMDL/Water Quality/NPDES Services for Industrial, Municipal and Federal Clients. Dr. Zhang provided TMDL document review with a focus on pollutant source assessment and TMDL allocation for a global industrial company in Savannah River Dissolved Oxygen TMDL. Dr. Zhang made recommendation on TMDL implementation strategy and permitting approaches. In addition, Dr. Zhang performed technical review and regulatory support on water quality and TMDL issues for Anheuser-Busch in the Eastern U.S.

Dr. Zhang provided NPDES permitting support for a chemical company in Texas. He also performed technical support on mercury water quality issues in Great Lakes region for an alternative energy company in Michigan. Dr. Zhang provided technical support and guidance for watershed-based NPDES permitting and pretreatment permit for a GE facility in Massachusetts. In addition, Dr. Zhang provided technical support on stormwater permitting and water quality related services to Caraustar Industries, Inc. and BP in Mid-west Region.

Task Manager, TMDL Services for City of Los Angeles. Dr. Zhang led the efforts in conducting review of an urban Lake Nutrient TMDL modeling and related nutrient target development documents and providing recommendations for a monitoring plan to fill in data gaps in support of TMDL modeling and adaptive management. Dr. Zhang attended technical meeting by Los Angeles Regional Water Quality Control Board.

NPDES, Stormwater Management and Nonpoint Source Control

- Chair for AWRA Hydrology & Watershed Management Committee since 2002
- Co-Chair for WEFTEC Sustainable Water Resources Management track since its inception in 2005
- Adjunct Full Professor at China Institute of Water Resources and Hydropower Research and Beijing Jiaotong University
- Over 70 peer-reviewed publications, **including two papers at Water Encyclopedia by John Wiley & Sons and seven papers at Water Environment & Technology**

Subject Matter Expert, TMDL Services for City of Auburn, Alabama. Dr. Zhang provided technical review and comments for a Dissolved Oxygen and Nutrient TMDL modeling and nutrient target development in Alabama.

Subject Matter Expert, TMDL Support for Navy CLEAN Program. Dr, Zhang provide technical support for Navy CLEAN program on evaluation of regulatory impact of TMDL-listed waterbody on remediation action by Superfund program.

F. FEE PROPOSAL

It was noted in the RFP that the fee for the proposed scope of work should not exceed $200,000. We will conduct the work as detailed in the Proposal for the lump sum amount of $200,000 including costs for direct labor, overhead, administrative costs, expenses for travel and production of reports and other deliverables.

We have attached a spreadsheet providing tasks and projected level of work hours. The majority of senior staff and managers have been identified but due to the number of other staff to be involved, their work effort is lumped into "other engineers and scientists" category. The fee represents the work being conducted and concluded by 12/31/09 as stated in the Town's RFP.

Business Proposal Form A	Proposer Qualifications
Business Proposal Form B	Representations and Certifications of Proposer/Statement of Noncollusion Disclosure Statement
Business Proposal Form C	Reference Facility Description Suffolk County Department of Public Works Nassau County Department of Public Works Village of Southampton Town of North Hempstead Village of Greenport Greater Atlantic Beach Water Reclamation District City of Glen Cove Village of Lawrence Village of Cedarhurst Town of Hempstead

Supplemental Disclosure

Town of Brookhaven Board of Ethics Transactional Disclosure Form

Form of Affidavit Where Proposer is an Individual (Not Applicable)

Town of Brookhaven Employer, Contractor/Subconstractor Affidavit of Compliance with Repsect to the Hiring of Employees in Accordance with Federal Law

BUSINESS PROPOSAL FORM A

Proposer Qualifications

Describe the principal and any secondary nature of your current business:

Cameron Engineering provides multi-disciplined consulting engineering and planning services in a professional, timely and courteous manner to our municipal and private clients. Our experienced and qualified engineers, landscape architects, planners, and environmental scientists work together to solve difficult problems with well-designed, coordinated, cost effective solutions which consider environmental concerns, longevity and constructability.

State the length of time the firm has been in that business under your present name and identify all other names under which you have done business:

Cameron Engineering & Associates, LLP – 11 *years*

Cameron Engineering, P.C. - 13 *years*

List the names, addresses, and telephone numbers of Municipalities, counties, special districts or cities or nonprofit organizations which have utilized the firm's services (complete form C for each):

Village of Lawrence

Village of Cedarhurst

Village of Greenport

Town of Hempstead

Town of North Hempstead

Town of Huntington

Town of Oyster Bay

Town of East Hampton

Greater Atlantic Beach Water Reclamation District

City of Glen Cove

City of Long Beach

Nassau County

Suffolk County

Westchester County

BUSINESS PROPOSAL FORM B

Representations and Certifications of Proposer

STATEMENT OF NONCOLLUSION

All proposals and contracts awarded or accepted by a municipality must contain a statement of noncollusion. B y submission of this Proposal, the Proposer certifies that:

(a) This Proposal has been independently arrived at without collusion with any other Proposer or with any competitor or potential competitor.

(b) This Proposal has not been knowingly disclosed and will not be knowingly disclosed prior to the opening of Proposals for this project to any other proposer, competitor or potential competitor.

(c) No attempt has been or will be made to induce 'any other person, partnership or corporation to submit or not to submit a Proposal.

(d) The person signing this Proposal certifies that he has fully informed himself regarding the accuracy of the statements contained in this certification under the penalties of perjury, affirms the truth thereof of such penalties being applicable to the Proposer as well as to the person signing on its behalf;

(e) The attached hereto (if a corporation Proposer) is a certified copy of resolution authorizing the execution of this certificate by the signature of this Proposal in behalf of the Proposer. (***We are not a corporation.)***

Resolved that Mark Wagner (name of individual) be authorized to sign and submit the Proposal of Forge River Watershed and to certify as to noncollusion as the act and deed of such corporation/partnership and for any inaccuracies or misstatements in such certificates this corporate proposer shall be liable under. the penalties of perjury.

Mark Wagner, Principal

(Signature and Title)

Sworn to before me this

9th day of January ~~2008~~. 2009

ELIZABETH A. O'ROURKE
Notary Public, State of New York
No. 01OR5050403
Qualified in Queens County
Commission Expires October 10, 2009

BUSINESS PROPOSAL FORM B Disclosure Statement
PROPOSER MUST SIGN THIS FORM BEFORE A NOTARY PUBLIC

STATE OF NEW YORK)ss:
COUNTY OF NASSAU)

I, *Mark Wagner,* *Principal,*
(NAME) -(TITLE) Officer of Corp. or Partner or Principal

being duly sworn, deposes and swear under the penalties of perjury:

1. That is in connection with the above Proposal for the *Planning for the Forge River Watershed* that no other person will have any direct or indirect interest in this Proposal except: *Cameron Engineering & Associates, LLP*

(in case of corporations, all officers o f the corporation and stockholders owning more than 5% of the corporation stock must be listed. Use attached sheet if necessary.)

2. That *I am not* related to any (I am not) (none of-the officers or stockholders are)

officer or employee of the Town except _____

_____

3. There is not any state or local officer or employee or a member of a board of commissioners of a local public authority or any other public corporation within the Town, exclusive of a volunteer fireman or civil defense volunteer, interested in such application.

Mark Wagner Principal
(SIGNATURE AND TITLE)

Sworn to before me this
9th day of January, 2008 2009

ELIZABETH A. O'ROURKE
Notary Public, State of New York
No. 01OR5050403
Qualified in Queens County
Commission Expires October 10, 2009

BUSINESS PROPOSAL FORM C

Reference Facility Description

(Photocopy this Form for additional References as necessary)

1. Name: Cameron Engineering & Associates, LLP

2. Address: 100 Sunnyside Boulevard, Ste. 100
   Woodbury, New York 11797

3. Reference

   a. Name: Suffolk County Department of Public Works

   b. Address: 335 Yaphank Avenue, Yaphank, New York 11980

   c. Telephone No.: 631-852-4204

   d. Principal Contact

      (i) Name: Ben Wright

      (ii)Telephone No.:

4. Scope of Firm's Services (describe):
   Sewer Feasibility Study – Smithtown and Kings Point

5. Number of years services provided: 2

   Brief description of services provided: Planning, GIS, technical services assessing components for sewering at downtown Smithtown and Kings Park and upgrade Kings Park STP.

6. Project Cost: $245,000

BUSINESS PROPOSAL FORM C

Reference Facility Description

(Photocopy this Form for additional References as necessary)

1. Name: Cameron Engineering & Associates, LLP

2. Address: 100 Sunnyside Boulevard, Ste. 100
   Woodbury, New York 11797

3. Reference

   a. Name: Nassau County Department of Public Works

   b. Address: Prospect Avenue, Hicksville, New York

   c. Telephone No.: 516-571-6850

   d. Principal Contact

      (i) Name: Ken Arnold, P.E.

      (ii)Telephone No.:

4. Scope of Firm's Services (describe):
   Consolidation of Village sewage treatment plants, planning, Technical Design Report, Contract Documents, CCTV inspection, surveys, mapping

5. Number of years services provided: on-going

   Brief description of services provided:

6. Project Cost: $1,800,000 design fee; $18,000,000 capital cost

BUSINESS PROPOSAL FORM C

Reference Facility Description

(Photocopy this Form for additional References as necessary)

1. Name: Cameron Engineering & Associates, LLP

2. Address: 100 Sunnyside Boulevard, Ste. 100
   Woodbury, New York 11797

3. Reference

   a. Name: Village of Southampton

   b. Address: 23 Main Street, Southampton, New York 11968

   c. Telephone No.: 631-283-0247

   d. Principal Contact

      (i) Name: Mark Epley

      (ii)Telephone No.:

4. Scope of Firm's Services (describe):
   Provided Feasibility Study for sewering downtown business district with connection to Southampton Hospital STP. Provided costs for expansion/upgrade at Hospital.

5. Number of years services provided: 2

   Brief description of services provided: Outreach, planning, preliminary design, cost estimating

6. Project Cost: $50,000

BUSINESS PROPOSAL FORM C

Reference Facility Description

(Photocopy this Form for additional References as necessary)

1. Name: Cameron Engineering & Associates, LLP

2. Address: 100 Sunnyside Boulevard, Ste. 100
   Woodbury, New York 11797

3. Reference

   a. Name: Nassau County Department of Public Works

   b. Address: Prospect Avenue, Hicksville, New York

   c. Telephone No.: 516-571-6994

   d. Principal Contact

      (i) Name: Brian Schneider

      (ii)Telephone No.:

4. Scope of Firm's Services (describe):
   Valley Stream Brook Watershed Analysis; planning, characterization, mapping, calculations, sampling, modeling, development or recommendations, cost estimating, community outreach and interaction with State agencies.

5. Number of years services provided: 2

   Brief description of services provided: modeling, planning, sample program, public outreach, schematic design, multiple agency reports

6. Project Cost: $450,000

BUSINESS PROPOSAL FORM C

Reference Facility Description

(Photocopy this Form for additional References as necessary)

1. Name: Cameron Engineering & Associates, LLP

2. Address: 100 Sunnyside Boulevard, Ste. 100
   Woodbury, New York 11797

3. Reference

   a. Name: Town of North Hempstead

   b. Address: 220 Plandome Road, Manhasset, New York 11030

   c. Telephone No.: 516-869-6311

   d. Principal Contact

      (i) Name: Jill Guiney, P.E.

      (ii)Telephone No.:

4. Scope of Firm's Services (describe):
   Planning, technical reports, permitting, Bond Act assistance, coordination with Department of State, contract documents (plans and specifications) and construction management for major pond restoration (Mill Pond) to achieve water quality improvement.

5. Number of years services provided: 7

   Brief description of services provided: planning, multiple agency reports, Bond Act assistance, detailed design, public outreach

6. Project Cost: Construction Cost - $6,000,000
   Cameron Engineering fee - $400,000

BUSINESS PROPOSAL FORM C

Reference Facility Description

(Photocopy this Form for additional References as necessary)

1. Name: Cameron Engineering & Associates, LLP

2. Address: 100 Sunnyside Boulevard, Ste. 100
   Woodbury, New York 11797

3. Reference

   a. Name: Village of Greenport

   b. Address: Sixth Street, Greenport, New York

   c. Telephone No.: 631-477-1748

   d. Principal Contact

      (i) Name: David Nyce

      (ii)Telephone No.:

4. Scope of Firm's Services (describe):
   Planning, pilot testing, Engineering Report, Contract Documents for BNR upgrade of Village's WPCP. Bond Act assistance, financing assistance with NYSDEC, preparation of SPDES modification request.

5. Number of years services provided: 15

   Brief description of services provided:

6. Project Cost: Plant BNR Upgrade - $6,200,000
   Engineering Services - $400,000

BUSINESS PROPOSAL FORM C

Reference Facility Description

(Photocopy this Form for additional References as necessary)

1. Name: Cameron Engineering & Associates, LLP

2. Address: 100 Sunnyside Boulevard, Ste. 100
   Woodbury, New York 11797

3. Reference

   a. Name: Greater Atlantic Beach Water Reclamation District

   b. Address: 2150 Bay Boulevard, Atlantic Beach, New York

   c. Telephone No.: 516-239-6777

   d. Principal Contact

      (i) Name: William Kelly

      (ii)Telephone No.:

4. Scope of Firm's Services (describe):
   Upgrade of Water Pollution Control Plant, Chemical Bulk Storage, Engineering Reports, Pump Stations, regulatory interface, permitting, financing assistance, Bond Act assistance, construction oversight

5. Number of years services provided: 10

   Brief description of services provided: Phase I Upgrade at WPCP

6. Project Cost: $2,100,000

BUSINESS PROPOSAL FORM C

Reference Facility Description

(Photocopy this Form for additional References as necessary)

1. Name: Cameron Engineering & Associates, LLP

2. Address: 100 Sunnyside Boulevard, Ste. 100
   Woodbury, New York 11797

3. Reference

   a. Name: City of Glen Cove

   b. Address: 9 Glen Street, Glen Cove, New York 11542

   c. Telephone No.: 516-676-2004

   d. Principal Contact

      (i) Name: Ralph Suozzi

      (ii)Telephone No.:

4. Scope of Firm's Services (describe):
   Planning, permitting, design, Contract Documents and Construction Management services

5. Number of years services provided: 7-ongoing

   Brief description of services provided: Lead Firm on BNR upgrade of City's WPCP, and installation of ultraviolet light disinfection system

6. Project Cost: $4,500,000

BUSINESS PROPOSAL FORM C

Reference Facility Description

(Photocopy this Form for additional References as necessary)

1. Name: Cameron Engineering & Associates, LLP

2. Address: 100 Sunnyside Boulevard, Ste. 100
   Woodbury, New York 11797

3. Reference

   a. Name: Village of Lawrence

   b. Address: 196 Central Avenue, Lawrence, New York 11559

   c. Telephone No.: 516-239-4600

   d. Principal Contact

      (i) Name: Dan Herron

      (ii)Telephone No.:

4. Scope of Firm's Services (describe):
   Various - engineering design, operations and maintenance assistance, planning and infrastructure

5. Number of years services provided: 24

   Brief description of services provided: Municipal engineering, wastewater plant upgrades, technical design reports, wetlands, SEQRA, roadway infrastructure, permitting

6. Project Cost: varies – approximately $100,000/year

BUSINESS PROPOSAL FORM C

Reference Facility Description

(Photocopy this Form for additional References as necessary)

1. Name: Cameron Engineering & Associates, LLP

2. Address: 100 Sunnyside Boulevard, Ste. 100
   Woodbury, New York 11797

3. Reference

   a. Name: Village of Cedarhurst

   b. Address: 200 Cedarhurst Avenue, Cedarhurst, New York 11516

   c. Telephone No.: 516-295-5770

   d. Principal Contact

      (i) Name: Ronald Lanzilotta, P.E.

      (ii)Telephone No.:

4. Scope of Firm's Services (describe):
   Wastewater Treatment Plant upgrades, permitting, operations assistance, compliance reports - stormwater

5. Number of years services provided: 24

   Brief description of services provided:

6. Yearly Fee: $100,000

BUSINESS PROPOSAL FORM C

Reference Facility Description

(Photocopy this Form for additional References as necessary)

1. Name: Cameron Engineering & Associates, LLP

2. Address: 100 Sunnyside Boulevard, Ste. 100
   Woodbury, New York 11797

3. Reference

   a. Name: Town of Hempstead

   b. Address: One Washington Street, Hempstead, New York 11550

   c. Telephone No.: 516-489-5000

   d. Principal Contact

      (i) Name: John Rhinehart

      (ii)Telephone No.:

4. Scope of Firm's Services (describe):
   Various Water Distribution Projects, Point Lookout, Lido Beach.
   Replacement of deteriorated water distribution lines and valving including hydrant replacements and restoration of residential services.
   Maintenance of water service and construction observation.

5. Number of years services provided: 5

   Brief description of services provided:

6. Project Cost: $2,500,000

SUPPLEMENTAL DISCLOSURE

Name and Address of Proposer: ***Cameron Engineering & Associates, LLP***
100 Sunnyside Boulevard, Suite 100
Woodbury, New York 11797

FEDERAL IDENTIFICATION # OR SOCIAL SECURITY #: ***11-3313855***

Proposers will furnish the following information: List only similar type of work performed:
QUESTIONNAIR

FOR WHOM PERFORMED	CONTRACT AMOUNT	DATE COMPLETED
NCPDW – Valley Stream Brook Watershed Analysis	$450,000	1998
SCDPW – Feasibility Study, Smithtown/Kings Park	$250,000	2008
NCDPW – Consolidation of Village Sewer Systems	$1,800,000	On-going

1. Have you ever failed to complete any work awarded to you? NO
If yes, state where and why

2. Has any officer or partner of your organization ever been an officer or partner of some other organization that failed to complete a contract? ***NO***
If yes, state name o f individual, other organization and reason therefore:

3. Has any officer or partner of your organization ever failed to complete a contract in his own name? ***NO***
If yes, state name o f individual and reason therefore: _____

4. **Within the last ten years,** has any legal action, criminal or civil, ever been commenced by the Town or by any other governmental entity/agency against the corporation or against any other legal entity or subsidiary associated with the proposer, or has any legal action, criminal or civil, been commenced against any officer, principal, member, partner or employee 1) of the proposer, or 2) of the other legal entity/subsidiary associated, presently or within the last ten years, in any manner, with the proposer? YES ***NO***
If yes - state the nature of the legal action

5. In what other lines of business are you financially interested?

6. The work, if awarded to you, will have the personal supervision of whom?

Mark Wagner, Principal
(Signature and Title)

Sworn to before me this
9th day of January ~~2008~~. 2009

ELIZABETH A. O'ROURKE
Notary Public, State of New York
No. 01OR5050403
Qualified in Queens County
Commission Expires October 10, 2009

TOWN OF BROOKHAVEN BOARD OF ETHICS TRANSACTIONAL
DISCLOSURE FORM

APPLICANT NAME: ***Cameron Engineering & Associates, LLP***
APPLICANT ADDRESS: ***100 Sunnyside Boulevard, Suite 100***
Woodbury, New York 11797

NATURE OF APPLICATION: (CHECK ALL THAT APPLY)

/ /	TAX GRIEVANCE	/ /	APPROVAL OF PLAT
/ /	VARIANCE	/ /	EXEMPTION FROM PLAT OR OFFICIAL MAP
/ /	AMENDMENT	/ /	LICENSE OR PERMIT
/ /	CHANGE OF ZONE	/X/	OTHER: MUNICIPAL CONTRACT

DOES ANY OFFICER OF THE STATE OF NEW YORK, OFFICER OR EMPLOYEE OF THE TOWN OF BROOKHAVEN, OFFICER OR EMPLOYEE OF SUFFOLK COUNTY, OFFICER OF A POLITICAL PARTY IN SUFFOLK COUNTY OR HIS OR HER SPOUSE, BROTHER, SISTER, PARENT, CHILD, GRANDCHILD, OR THE SPOUSE OF ANY OF THEM HAVE AN INTEREST IN THIS APPLICATION BY VIRTUE OF BEING THE ACTUAL APPLICANT, OR BY VIRTUE OF HAVING AN INTEREST IN THE CORPORATION, PARTNERSHIP, OR ASSOCIATION MAKING SUCH APPLICATION?
YES// ***NO***//
IF YOU ANSWERED "YES", COMPLETE THE REST OF THE FORM AND DATE AND SIGN WHERE INDICATED.

IF YOU ANSWERED "NO", SIMPLY SIGN AND DATE THE FORM WHERE INDICATED.

INTERESTED PARTY AND NATURE OF INTEREST
NAME:
ADDRESS:
TITLE:
RELATIONSHIP TO PUBLIC OFFICER/EMPLOYEE AND HIS OR HER TITLE IF OTHER THAN SELF:
INTERESTED PARTY: YES NO

A.) IS THE OWNER OF GREATER THAN FIVE PERCENT (5%) OF THE CORPORATE STOCK OF THE APPLICANT WHEN THE APPLICANT IS A CORPORATION WHOSE STOCK IS LISTED ON THE NEW YORK OR AMERICAN STOCK EXCHANGES;
B.) THE ACTUAL APPLICANT;
C.) AN OFFICER, DIRECTOR, PARTNER, OR EMPLOYEE OF THE APPLICANT; OR
D.) LEGALLY OR BENEFICIALLY OWNS OR CONTROLS ANY STOCK OF A NON-PUBLICLY TRADED CORPORATE APPLICANT OR IS A MEMBER OF A PARTNERSHIP OR ASSOCIATION OF THE APPLICANT.

1-9-09 — DATE
SIGNATURE OF APPLICANT

F O R M OF AFFIDAVIT WHERE PROPOSER IS AN INDIVIDUAL

STATE OF NEW YORK)) ss:
COUNTY OF NASSAU)

_____, being duly sworn, deposes and says: I am the person described in and who executed the foregoing proposal and the several matters therein stated are in all respects true.

_____
(Signature of person who signed bid)
Subscribed and sworn to before me:
this_____day of _____20
(Notary Public)

FORM OF AFFIDAVIT WHERE PROPOSER IS A CORPORATION

STATE OF NEW YORK)) SS:
COUNTY OF NASSAU)

_____, being duly sworn, deposes and says:

I am the _____ of _____ the above named corporation, whose name is subscribed to and which the

executed the foregoing proposal. I reside at _____ in the _____ of _____, state of _____. I have knowledge of the several matters therein stated and they are in all respects true.

_____
(Signature of person who signed bid)
Subscribed and sworn to before me

this_____ day of _____2008.
(Notary Public)

TOWN OF BROOKHAVEN

EMPLOYER, CONTRACTOR/SUBCONTRACTOR, AFFIDAVIT OF COMPLIANCE WITH RESPECT TO THE HIRING OF EMPLOYEES IN ACCORDANCE WITH FEDERAL LAW (TOWN CODE CHAPTER 7A)

STATE OF NEW YORK) SS

COUNTY OF NASSAU)

Employer Firm: *Cameron Engineering & Associates, LLP*

Project name: *Planning for the Forge River Watershed*

Submission Date: *January 9, 2009*

I, *Mark Wagner*, being duly sworn, depose and state:
That I am an _Officer, _ Partner, _Owner, or ***_Member of the Firm***

By submission of this Affidavit, and each person signing on behalf of any bidder, contractor, subcontractor, owner, employer, hereby certifies, under penalties of perjury, that I affirm of my own knowledge that the above named person on behalf of the Employer has complied with the requirements of Title 8 of the United State Code (U.S.C.) Section 1324a and any amendments thereto, and that all employees, including non-citizens, aliens, which includes full-time, part-time, temporary or seasonal employees, are authorized to work in the United States and that said employees, including non-citizens, aliens, have provided the required documents for my review, which appear to be genuine and demonstrate, and that to the best of my knowledge, the employees, including non-citizens, aliens, are authorized to work in the United States; and 2) that during the term of the contract, subcontract, agreement or period of work performed by the Employer, all employees hired, retained, shall be authorized to work in the United States in compliance with Federal Law and 3) that the Employer will only employ Subcontractors who hire, retain, employees authorized to work in the United States, and 4) 'all such Subcontractors shall be required to submit an Affidavit demonstrating compliance with Federal Law regarding the eligibility of employees to work in the United States, and that the Subcontractor's employees have submitted the required documents demonstrating compliance with Federal Law, which said Affidavit shall be submitted to the Town with the Contractor's request for Subcontractor approval at the time of bid submission and at all times required by the Town Code.

By: Mark Wagner

Print: Mark Wagner, Principal

Sworn to before me this
9th **day of** January **, 2008** 2009

NOTARY PUBLIC

ELIZABETH A. O'ROURKE
Notary Public, State of New York
No. 01OR5050403
Qualified in Queens County
Commission Expires October 10, 2009

See attached documents.

Wahoo Creek and White Oak Creek Watersheds

Watershed Assessment

April 2008

Coweta County Water and Sewerage Authority
Coweta County, Georgia

Stevenson & Palmer Engineering
2430 Herodian Way, Suite 101
Smyrna, GA 30080

CH2M HILL
1000 Abernathy Road, Suite 1600
Atlanta, GA 30328

3.0 Watershed Characterization

This chapter presents a general description of the watershed, significant natural resources, and potential pollutant sources of the service area.

3.1 Description of Service Area and Watersheds

3.1.1 Current and Proposed Service Area

The WSA currently provides sewer service to a small number of industrial and residential customers as illustrated in Figure 3-1. The Shenandoah WPCP, located at 1519 Poplar Road, discharges to White Oak Creek, a tributary in the Flint River Basin, and is the largest wastewater facility operated by the WSA with a capacity of 0.89 mgd. It receives approximately half of its flow from the nearby Shenandoah Industrial Park while the balance comes from a residential population estimated at 1,500 in the White Oak Creek watershed area. The Shenandoah WPCP is currently operating at full capacity, with a planned expansion to 2.0 mgd by 2010 (CH2M HILL, 2003, and S&P, 2005a). The Arnco WPCP is located off U.S. Highway 27 in Arnco Mills while the Sargent WPCP located at 90 Ball Street, both facilities discharge to Wahoo Creek, located in the Chattahoochee River basin. The permitted capacities of these WPCPs are 0.1 mgd and 0.06 mgd, respectively.

The WSA intends to limit future sewer service to the extents of the Wahoo and White Oak Creek watersheds. As a result, these watersheds define the study area for the WA, Figure 3-2.

3.1.2 Current and Future Land Use

The County recently completed the development of its 2026 Comprehensive Plan to evaluate current conditions and predict changes in population, landuse, employment, and the services needed to support these changes. The Plan meets the recommendations of the *Standards and Procedures for Local Comprehensive Planning* as established by the Georgia Department of Community Affairs (DCA). As part of the 2026 Plan, existing land use conditions were assessed based on aerial photography, building permit activity and field verification. Table 3-1 and Figure 3-3 show existing land use characteristics for the study area as of July 2005.

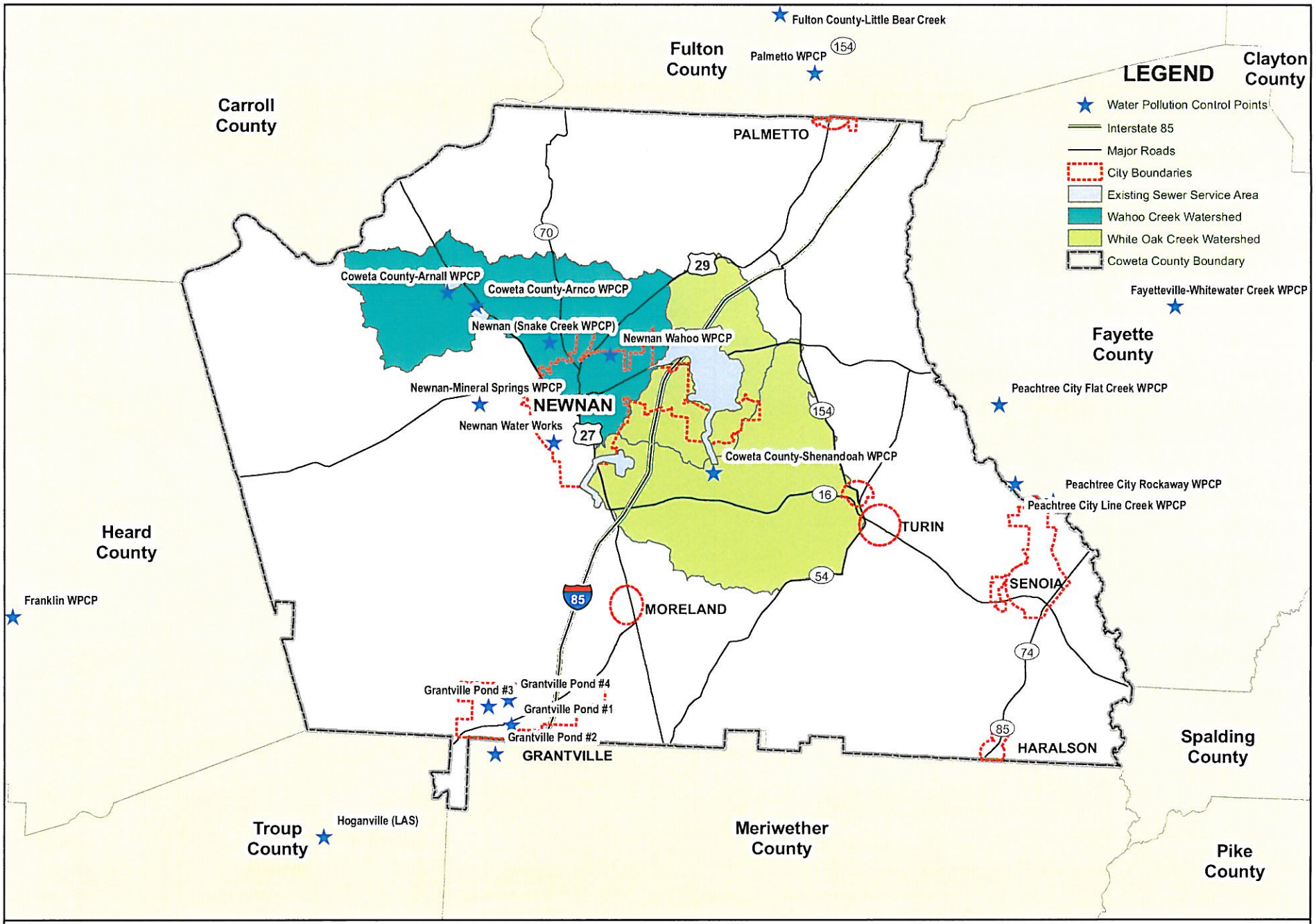

Figure 3-1
Existing Sewer Service Area and Municipal Boundaries
Wahoo and White Oak Creek Watershed Assessment

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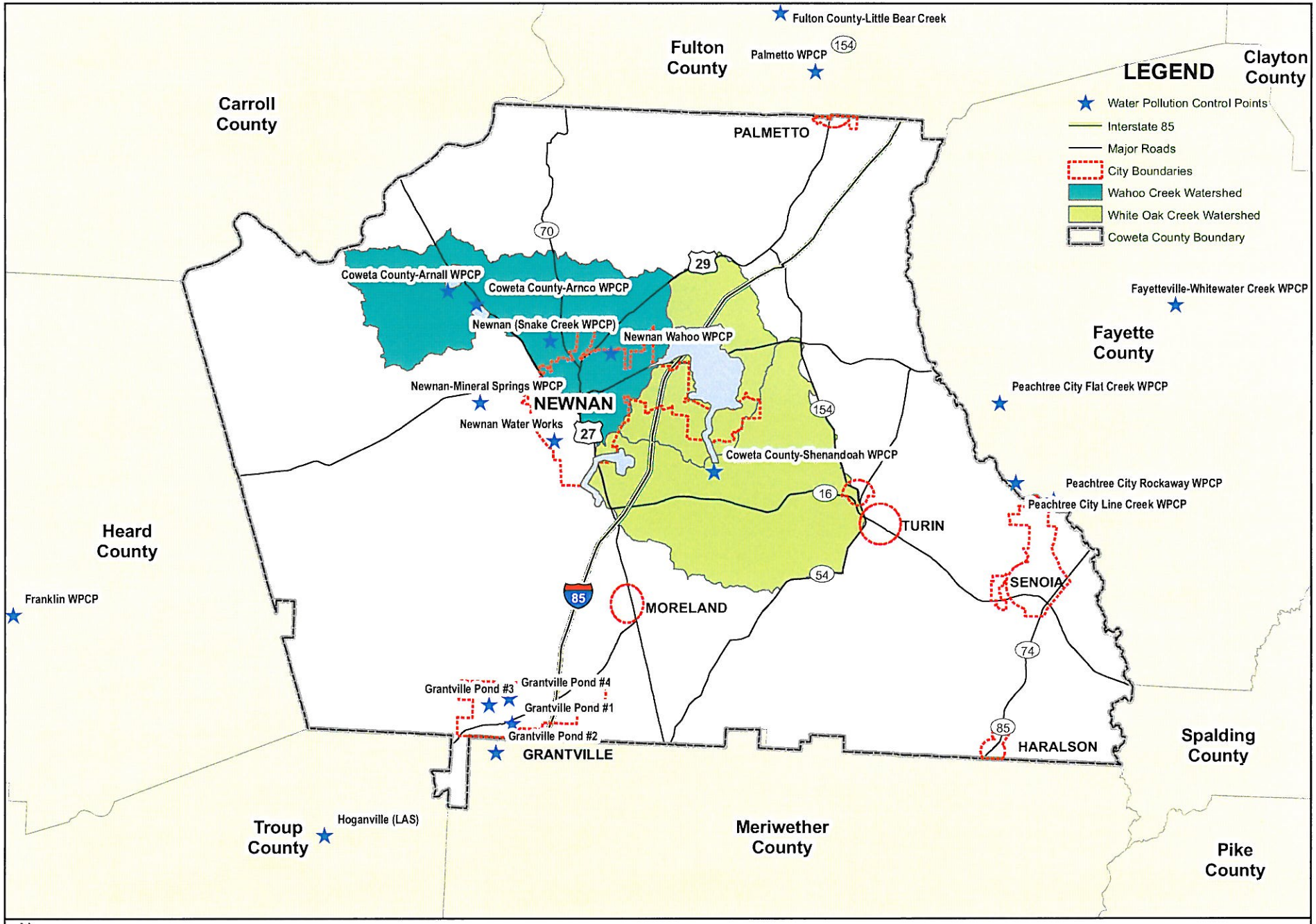


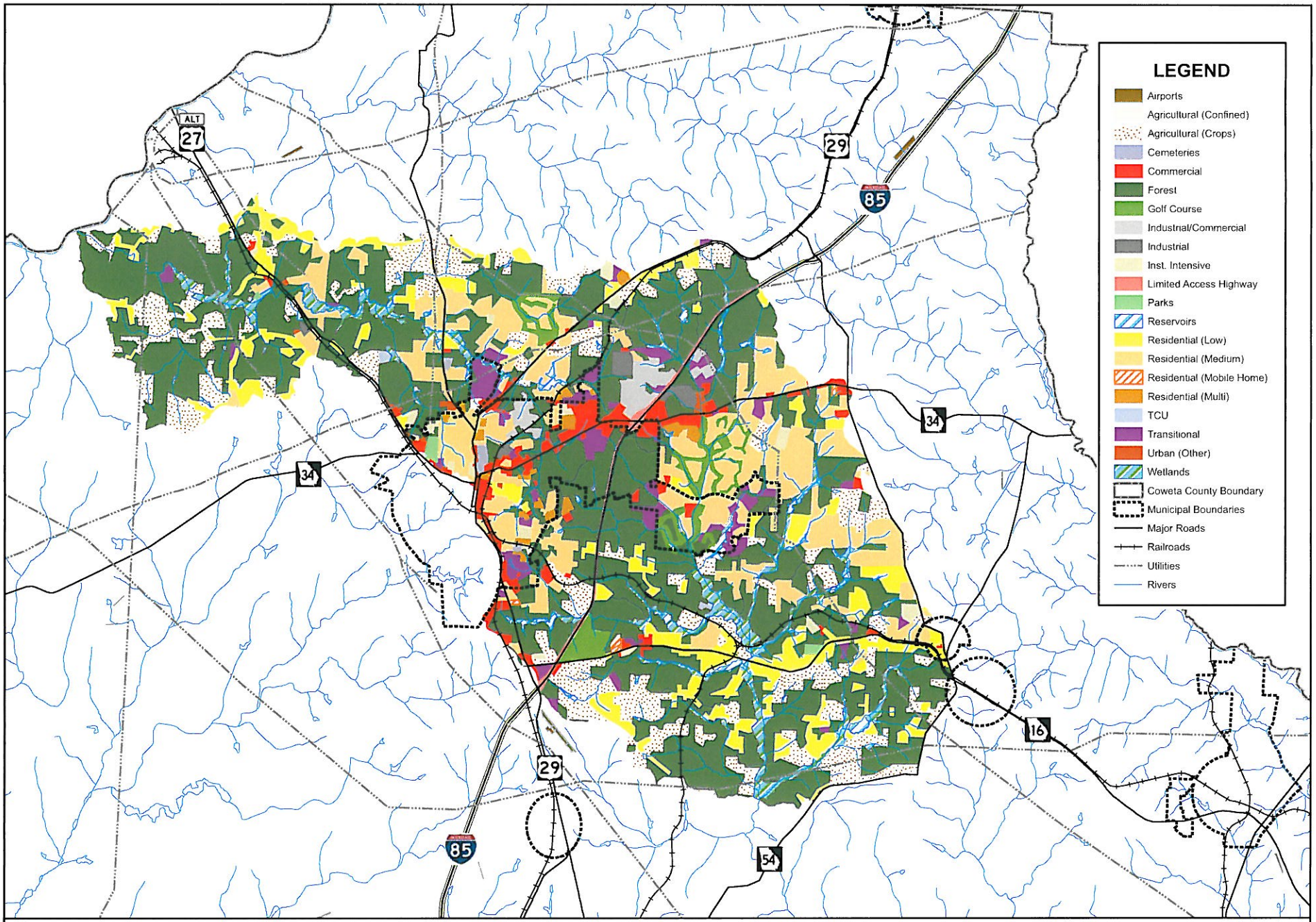
Figure 3-2
Future Sewer Service Area and Municipal Boundaries
Wahoo and White Oak Creek Watershed Assessment

File Path: \\Peachtree\proj\StevensonAndPalmer\327219CowetaCounty\maps\mxd\3-2_Future.mxd, Date: April 21, 2008, User: RKENT2

Forest land is the dominant land use in the watershed, comprising nearly 45 percent of the study area. Medium-density residential land, which is defined as single family units on ¼-acre to 2-acre lots, was the second most prevalent land cover and represented approximately 15.5 percent of the total area. Cultivation of agricultural crops is still active in the study area with 13.4 percent of the land use distribution. Dominant land use categories are fairly similar in the Wahoo and White Oak Creek watersheds. The primary differences are the prevalence of urban lands in the Wahoo Creek headwater areas and the greater amount of agriculture, low-density residential housing, and transitional areas in the White Oak Creek subwatershed. It is expected that the Wahoo Creek subwatershed will exhibit higher levels of urban contaminants such as metals and show historical degradation of stream banks and channels. White Oak Creek may have better conditions in the headwater areas due to the lower level of urban runoff. However, the prevalence of single-family residential and transitional areas is indicative of residential growth and the potential for future degradation without proper sediment and erosion controls.

TABLE 3-1
Comprehensive Plan County-wide Existing Land Use – July 2005
Wahoo and White Oak Creek Watershed Assessment

Category	Area (ac)	Percent
Agricultural (Confined Animal Feeding Operations)	28	0.05
Agricultural (Crops)	7,652	13.4
Cemeteries	98	0.2
Commercial	1,949	3.4
Forest	24,801	43.5
Golf Course	1,095	1.9
Industrial/Commercial	653	1.2
Industrial	274	0.5
Inst. Intensive	452	0.8
Limited Access Highway	380	0.7
Parks	98	0.2
Reservoirs	636	1.1
Residential (Low Density)	5,404	9.5
Residential (Medium Density)	8,854	15.5
Residential (Mobile Home)	55	0.1
Residential (Multifamily)	448	0.8
Transportation/Communication/ Utilities	114	0.2
Transitional	1,656	2.9
Urban (Other)	137	0.2
Wetlands	2,266	4.0
Total	57,050	100



N

2.5 1.25 0 2.5 Miles

Figure 3-3
Existing Land Use Distribution
Wahoo and White Oak Creek Watershed Assessment

CH2MHILL

File Path: P:\StevensonAndPalmer\327219CowetaCounty\maps\mxd\2-3 Existing Landuse.mxd, Computer: ATL31025185, Date: February 21, 2007 4:21:25 PM, User: KALLEN4

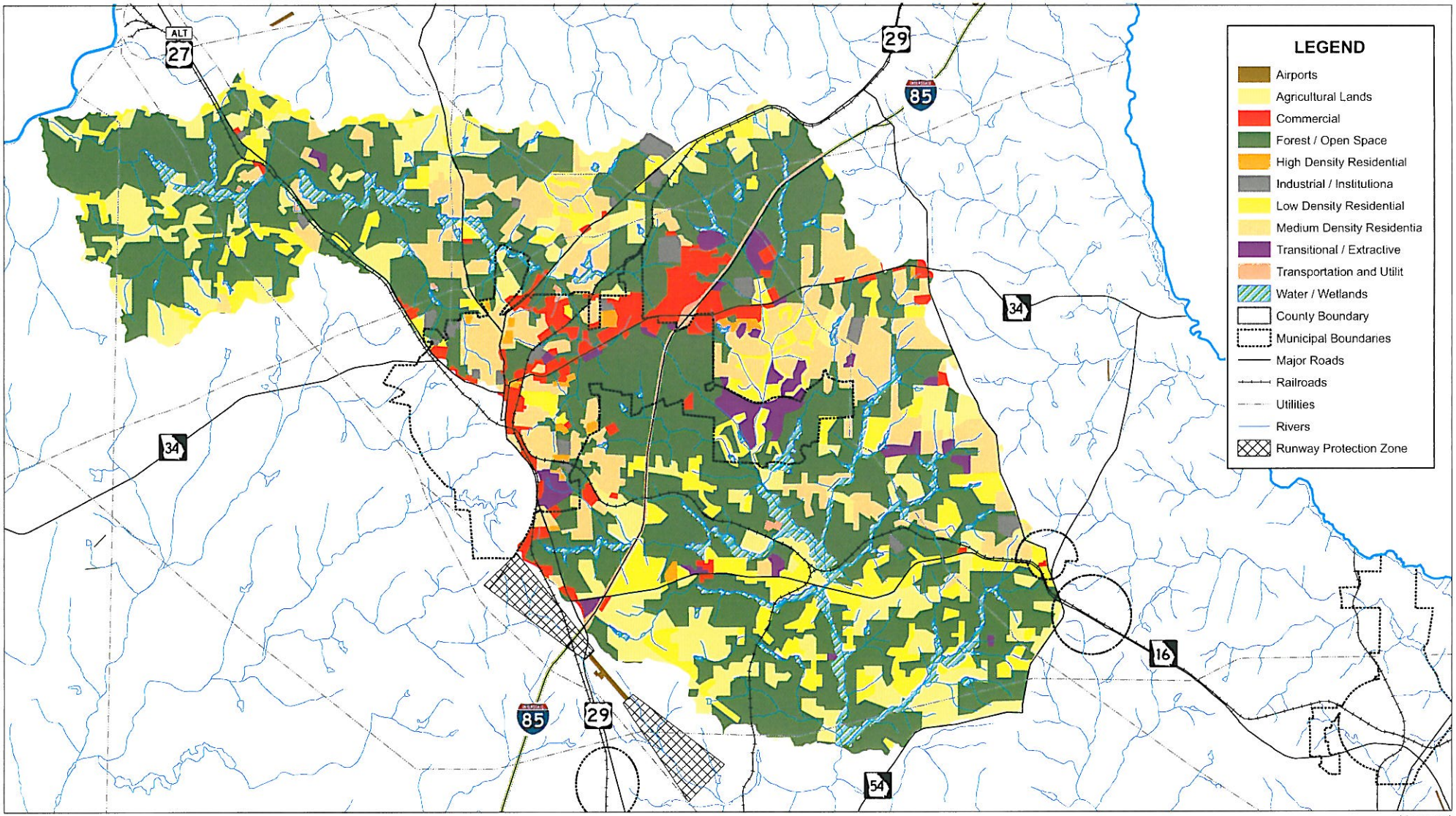
While the County is experiencing some of the effects of being part of the metropolitan Atlanta region, this growth has been limited to some extent in Coweta County due to the limited sewer service and the large lot sizes required for effective septic systems. The Coweta County 2006 - 2026 Comprehensive Plan (JJG, 2005a) was developed to assess future growth and any associated impacts and was based on an analysis and inventory of existing conditions, land use patterns, public policies, and planned improvements. Key findings from the 2026 Plan include:

- Population in Coweta County is expected to double from 2006 to 2026.
- Senior citizens are expected to make up a large percentage of the population with expectations of denser, walkable urban areas.
- Employment growth is projected to outperform the metropolitan Atlanta region.

Future land use projections for 2015 were developed as part of 2004 Draft Comprehensive Plan Amendment based on changes in population trends, revisions to municipal limits, changes in zoning, transportation infrastructure improvements, and land preservation objectives. The predicted character and distribution of land use in 2026 is summarized in Table 3-2 and shown in Figure 3-4. Overall, the general character of the study area is expected to change very little by the Year 2015. The largest increase is in single family residential with an increase of 820 acres.

TABLE 3-2
Comprehensive Plan County-wide Future Land Use –2026
Wahoo and White Oak Creek Watershed Assessment

Category	Area (ac)	Percent
Agricultural Lands	78,780	13.8
Commercial	2299	4.0
Forest / Open Space	27,363	48.0
High Density Residential	354	0.6
Industrial / Institutional	693	1.2
Low Density Residential	6,324	11.1
Medium Density Residential	7,519	13.2
Transitional / Extractive	1,280	2.2
Transportation & Utilities	444	0.8
Water / Wetlands	2,895	5.1
Total	57,050	100.0



N

0 0.5 1 2 3 4 Miles

Figure 3-4
Future Land Use Distribution
Wahoo and White Oak Creek Watershed Assessment

CH2MHILL

File Path: P:\StevensonAndPalmer\327210\CowetaCounty\maps\mxd\2-4 Future Landuse.mxd, Computer: ATL31025185, Date: February 21, 2007 4:54:40 PM, User: KALLEN4

3.1.3 Watershed Delineation

The watersheds within the service area were based on the 12-digit hydrologic unit code (HUC) boundaries generated by the US Geological Survey (USGS) and further delineated based on 1:24,000 7.5-minute USGS topographic quadrangles. Table 3-3 summarizes the basic watershed characteristics for the study area including USGS Hydrologic Unit Number, area, and overall percentage of the total service area. Wahoo Creek originates within the City of Newnan and flows approximately 13.6 miles before entering the Chattahoochee River (Figure 3-5). White Oak Creek also originates in Newnan and flows approximately 9.2 miles before leaving the service area. After leaving the service area, White Oak Creek drains southeast into the Flint River near the Joe Kurz Wildlife Management Area.

TABLE 3-3
Wahoo and White Oak Creek 12-digit Hydrologic Unit Drainage Areas
Wahoo and White Oak Creek Watershed Assessment

Name	HUC ID	Area (ac)	Area (sq mi)	Percent of Service Area
Wahoo Creek	031300020403	22,385	34.98	39
White Oak Creek (Newnan to Chandlers Ck)	031300050301	12,015	18.77	21
White Oak Creek (Chandlers Ck to Pine Creek)	031300050302	22,650	35.39	40

Source: USGS, 1999

3.1.4 Environmentally Sensitive Areas

3.1.4.1 Wetlands

The 2026 Plan identifies approximately 2,266 acres (4 percent) of the Wahoo and White Oak Creek Watersheds as wetlands, mostly clustered along the mainstream channels on both Wahoo and White Oak Creek locations, Figure 3-3. These areas typically provide a critical habitat for a number of aquatic and terrestrial species. Wetlands are a valuable asset because they mitigate flooding and also filter and purify storm water runoff. Wetlands reduce the frequency and intensity of flooding by storing water during storms and slowly release it. Especially significant is the ability of wetlands to filter pollutants including fertilizer in runoff, and heavy metals from other nonpoint sources. Due to the important role these areas play in the ecosystem and the limited area in the service area, the protection of these existing wetlands will be integrated into the management recommendations of the Watershed Protection Plan.

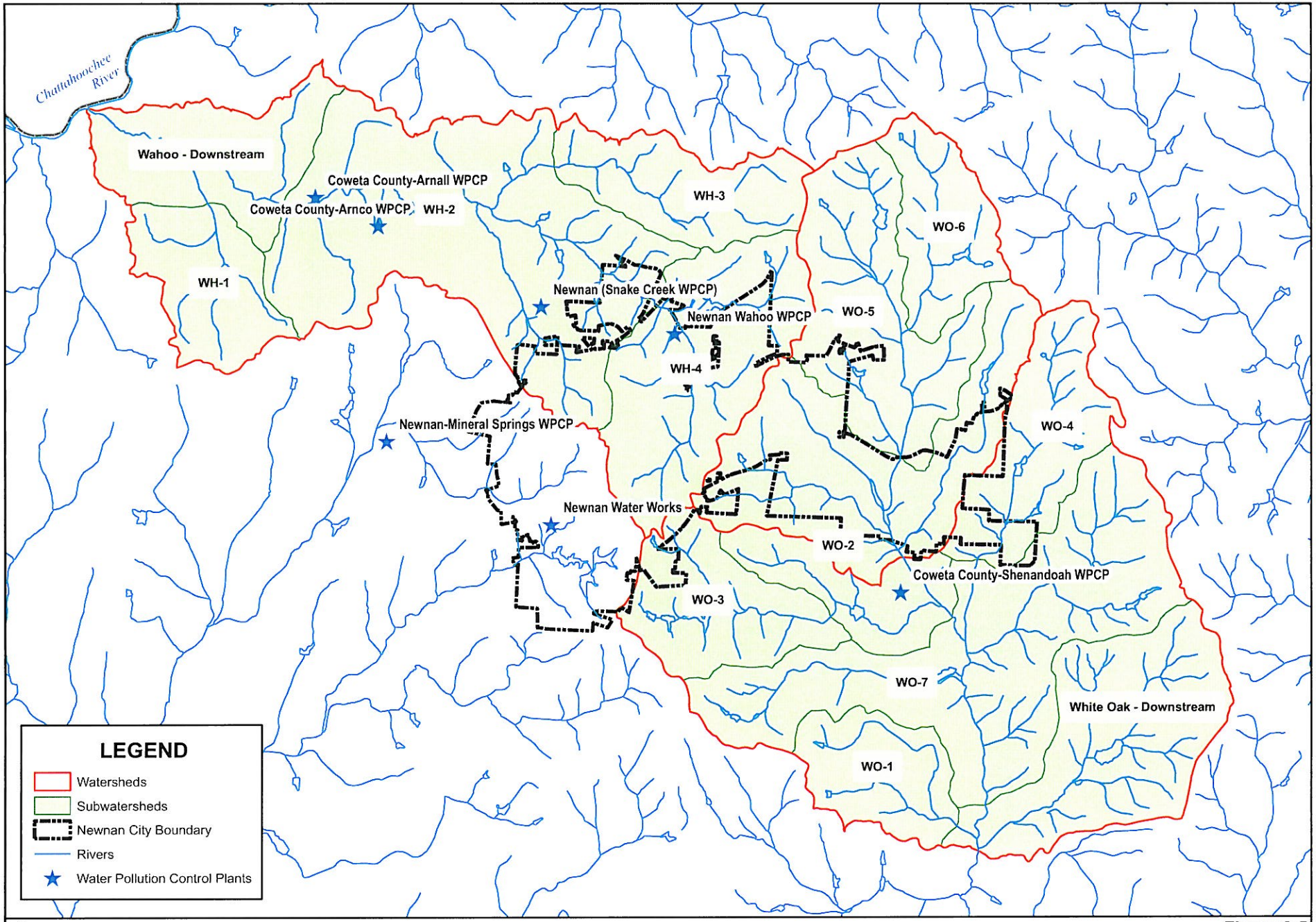


Figure 3-5
Wahoo and White Oak Creek Subwatersheds
Wahoo and White Oak Creek Watershed Assessment

CH2MHILL

3.1.4.2 Water Supply Watersheds

The 2026 Plan notes that the Coweta County Water System (Water System) provides water service to approximately 62,000 people through 21,620 metered connections. The cities of Newnan, Palmetto, Sharpsburg and Turin have their own water supply sources and distribution systems. These Water System customers are located primarily in the unincorporated portions of the County, as well as the Cities of Grantville, Haralson, Moreland, and Senoia. While approximately 90 percent of the population has water service, the remaining 10 percent obtain water from either individual wells or a community well system. Approximately 20 community systems are located in the County.

The only intake physically located within the study area is a withdrawal for the City of Newnan on White Oak Creek, water is pumped to storage reservoirs where it is then withdrawn and treated. This water supply watershed is noted on Figure 3-6. Coweta County has adopted a Water Supply Watershed Protection District overlay to establish protection along riverbanks and around reservoirs and other impoundments upstream from the raw water intakes on Line Creek, Shoal Creek, Sandy/Brown Creek, Cedar Creek, White Oak Creek, and Keg Creek. All of these areas are now protected watersheds with regulations requiring stream and reservoir buffers of natural vegetated land.

3.1.4.3 Groundwater Recharge Areas

Coweta County lies almost completely within the Piedmont and the Blue Ridge (Ridge and Valley) geologic provinces. The aquifers in the Piedmont and the Blue Ridge provinces are in crystalline rocks that form outcrops in the northern portion of the basin and extend to the Fall Line. The rock is overlain with deposits of weathered, unconsolidated rock debris (regolith) that make up the available aquifer spaces. These deposits are thickest in valleys, but generally provide insufficient yield for uses other than residential. In these areas, yields are commonly less than 50 gallons per minute (gpm).

The Georgia Geologic Survey (GGS) Hydrologic Atlas 18 database identifies multiple unconfined aquifer areas in the County (GGS, 1996). Figure 3-6 illustrates that there are two areas of potential groundwater recharge areas in the study area. The smaller area is located in the White Oak Creek subwatershed directly south of Newnan. A significantly larger area is located in the Wahoo subwatershed to the northwest of Newnan.

3.1.4.4 Endangered or Protected Species

Protected species include all species listed as threatened or endangered by the United States Fish and Wildlife Service (FWS) or National Marine Fisheries Service, and those listed as endangered, threatened, rare, or unusual by the State of Georgia. Additional species are listed as being "of concern" in Georgia, indicating that additional information on these species is needed to determine whether they should receive protection. The FWS also may designate critical habitat for a federally listed species, which provides protection for the habitat as well as the species itself. At present, there is no designated critical habitat within the District for any listed species.

The Georgia Natural Heritage Program (GNHP) maintains a database of occurrence data on protected species in Georgia, including information on both federal and state protected species and state species of concern. Table 3-4 lists the protected (threatened or endangered)

and special concern animals and plants potentially located within Coweta County. There are five federally listed species (three endangered and two threatened) and nine state-listed species (4 endangered and 5 threatened). None of the aquatic species noted were observed during biological monitoring activities in the service area.

TABLE 3-4
Threatened and Endangered Species in Coweta County
Wahoo and White Oak Creek Watershed Assessment

Common Name	Scientific Name	Federal Status	State Status	Habitat
		Birds		
Bald eagle	*Haliaeetus leucocephalus*	Threatened	Endangered	Inland waterways and estuarine areas in Georgia.
		Fish		
Bluestripe shiner	*Cyprinella callitaenia*	No Federal Status	Threatened	Brownwater streams
Highscale shiner	*Notropis hypsilepis*	No Federal Status	Threatened	Blackwater and brownwater streams
		Invertebrate		
Oval pigtoe mussel	*Pleurobema pyriforme*	Endangered	Endangered	River tributaries and main channels in slow to moderate currents over silty sand, muddy sand, sand, and gravel substrates
Purple bankclimber mussel	*Elliptoideus sloatianus*	Threatened	Threatened	Main channels of ACF basin rivers in moderate currents over sand, sand mixed with mud, or gravel substrates
Gulf moccasinshell mussel	*Medionidus pencillatus*	Endangered	Endangered	Medium streams to large rivers with slight to moderate current over sand and gravel substrates; may be associated with muddy sand substrates around tree roots
Shiny-rayed pocketbook mussel	*Lampsilis subangulata*	Endangered	Endangered	Medium creeks to the mainstems of rivers with slow to moderate currents over sandy substrates and associated with rock or clay
		Plants		
Bay star-vine	*Schisandra glabra*	No Federal Status	Threatened	Twining on subcanopy and understory trees/shrubs in rich alluvial woods
White fringeless orchid	*Platanthera integrilabia*	Candidate Species	Threatened	Red maple-blackgum swamps; also sandy damp stream margins; on seepy, rocky, thinly vegetated slopes. Also known as Monkey-face Orchid

Source: (USFWS, 2006).

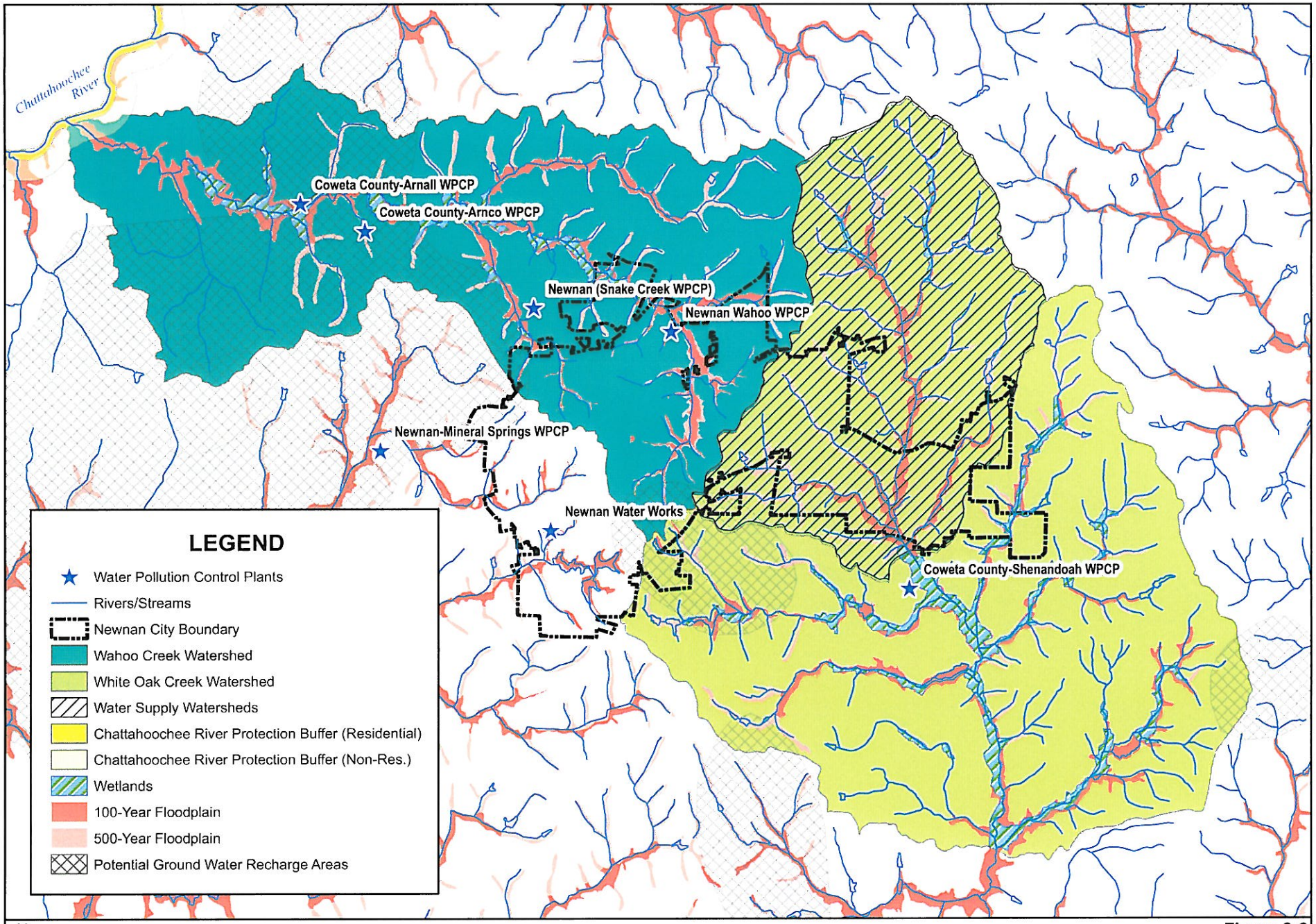


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Figure 3-6
Environmentally Sensitive Areas
Wahoo and White Oak Creek Watershed Assessment

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3.1.4.5 Recreational Assets

There are 10 parks and recreation areas located in the Wahoo and White Oak Creek Watersheds (See Table 3-5). These areas provide recreational opportunities to the community as well as preserving areas from development.

TABLE 3-5
Recreational Areas within the Wahoo and White Oak Watersheds
Wahoo and White Oak Creek Watershed Assessment

Park Name	Area (ac)	Activities
County Center	56.0	Baseball, softball, basketball, picnic tables, playground, tennis, gymnasium, bike track, community center
C. J. Smith Park	12.0	Softball, picnic tables, playground
Carl Miller Park	6.8	Walking trails, picnic tables, playground
Lynch Park	6.2	Softball, basketball, walking trails, picnic tables, playground, swimming pool
Temple Avenue Park	2.5	Baseball, basketball, picnic tables, playground
Arnco Park	No data	Baseball
Sargent Park	No data	Baseball
Coweta County Fairground Complex	No data	Walking trail, lake, nature center
Westgate Park	2.6	Baseball, basketball, picnic tables, playground

Source: Atlanta Journal Constitution, JJG 2005.

3.1.5 Water Intakes

Table 3-6 lists the surface water withdrawals in Coweta County, the City of Newnan is the only municipal user in the service area, see Figure 3-6, and is the primary wholesale supplier of potable water for the County. The County recently completed the B.T. Brown reservoir which will eventually supply up to approximately six million gallons a day from Cedar Creek, a tributary to the Chattahoochee River located upstream of the study area. No industrial surface water withdrawals are located within the service area.

TABLE 3-6
Surface Water Withdrawals in the Wahoo and White Oak Creek Watersheds
Wahoo and White Oak Creek Watershed Assessment

Facility	Permit Number	River Basin	Source	Max day withdrawal (mgd)	Monthly Average (mgd)
Coweta County W & S Authority	038-1218-02	Chattahoochee	Cedar Creek	10	6.7
Newnan Utilities	038-1103-02	Flint	White Oak Creek	7	7
Newnan Utilities	038-1221-01	Chattahoochee	Sandy/Browns Creek	8	8
Newnan Utilities	038-1221-02	Chattahoochee	Raw Water Reservoirs	14	14

Source: GAEPD Watershed Protection Branch, 2006

3.1.6 303(d)-listed Streams

Section 305(b) of the CWA requires that states develop and institute a biannual monitoring and reporting program that describes water quality conditions of state waters and their designated use status (GAEPD, 2006). The resulting report, known as the 305(b) report, provides an assessment of surface-water quality by classifying stream and river segments as supporting, partially supporting, or not supporting a designated use. The 303 (d) list includes streams not supporting or partially supporting their designated use.

In Coweta County, portions of two streams, Turkey Creek and White Oak Creek, are designated as not supporting their designated use of fishing (Table 3-7 and Figure 3-7). Both creeks are listed for violating fecal coliform standards. The potential origins of the fecal coliform include urban runoff in the Turkey Creek Watershed and nonpoint and municipal sources in the White Oak Creek Watershed. The streams in the service area that are listed as partially supporting their designated use are Wahoo Creek, White Oak, and Snake Creek. Wahoo Creek and Snake Creek streams are listed for violations of state biological standards due to urban stressors, whereas White Oak Creek is listed for low dissolved oxygen concentrations.

TABLE 3-7
Coweta County Streams Listed in Georgia 305(b) Report [a]
Wahoo and White Oak Creek Watershed Assessment

Watershed/Stream	Water Use Classification	Criterion Violated [a]	Evaluated Causes [b]	Stream Miles	303(d) Status [c]
Streams Partially Supporting Designated Uses in the Service Area					
Snake Creek – Chattahoochee Basin	Fishing	Bio	UR	4	3[d]
White Oak Creek (Chandlers Creek to Bear Creek) – Flint River Basin	Fishing	DO	UR	14	3[d]
Wahoo Creek (upstream of Arnco Mills Lake) – Chattahoochee Basin	Fishing	Bio	UR	7	3[d]
Streams Not Supporting Designated Uses in the Service Area					
White Oak Creek (Newnan I-85 to Chandlers Creek) – Flint River Basin	Fishing	FC	NP, M	6	3[e]
Turkey Creek (Newnan to Reese Lake) – Flint Basin	Fishing	FC	UR	4	3[d]

Source: GAEPD, January 2006.

[a] FC = fecal coliform bacteria

[b] NP = nonpoint sources/unknown sources; M = municipal facility; UR = Urban runoff/Urban effects

[c] "X" indicates that the segment is listed but a TMDL has not been developed, "3" indicates that that the segment is listed and a TMDL has been developed.

[d] EPD will address nonpoint source (urban runoff) through a watershed protection strategy. Phase II General NPDES stormwater permit issued 12/09/02.

[e] Impairment will be addressed by implementing a locally developed plan that includes the remedial actions necessary for problem resolution. Phase II General NPDES Stormwater Permit issued 12/09/02.

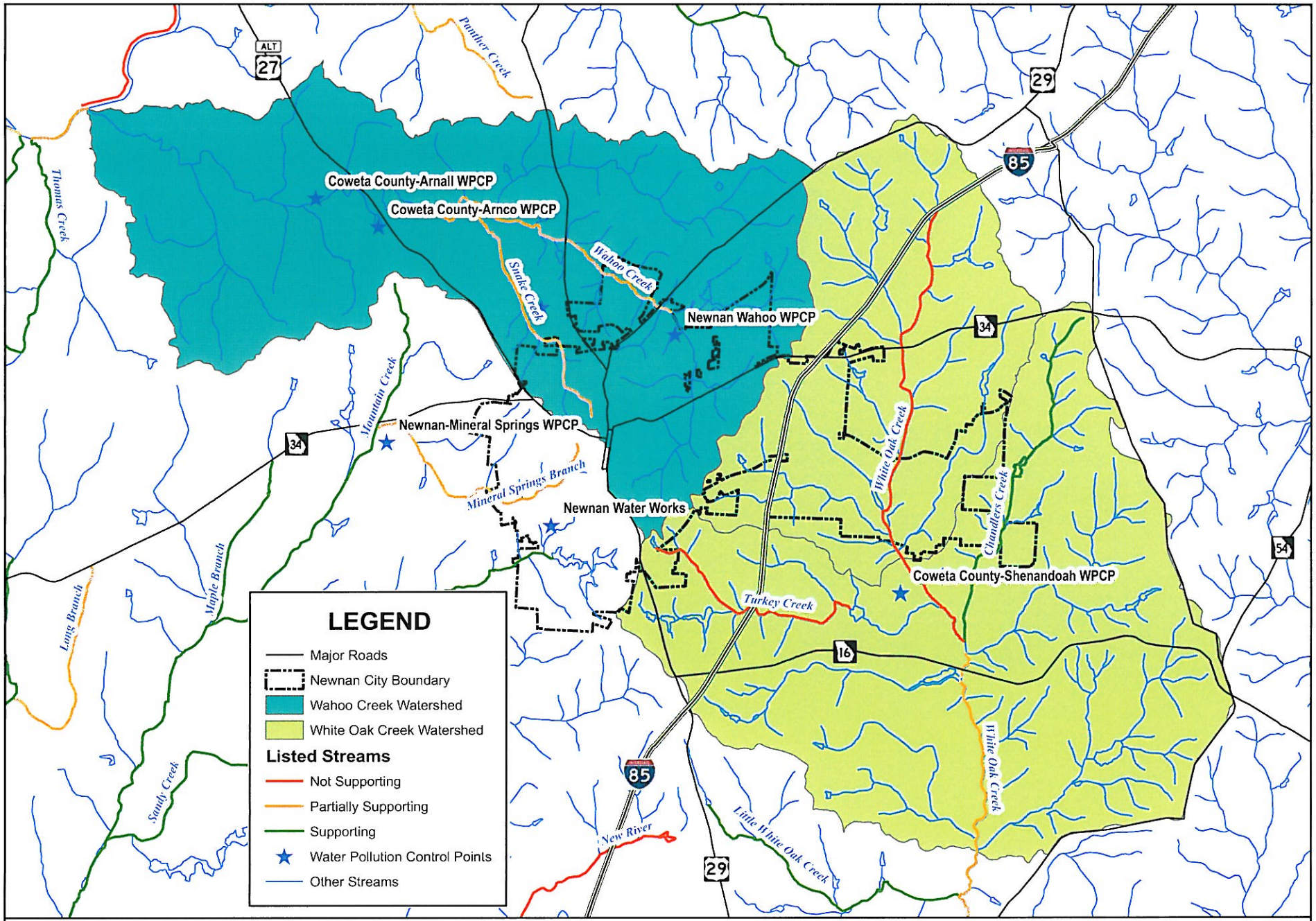

Figure 3-7
303(d) Listed Stream Segments
Wahoo and White Oak Creek Watershed Assessment

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3.2 General Watershed Features

3.2.1 Climate

Average annual precipitation in central Georgia ranges from approximately 49 to over 60 inches with the greatest precipitation in the northwest portion of the State. Evapotranspiration (the sum of direct evaporation and transpiration by plants) generally increases from north to south and ranges from about 32 to 42 inches of water per year. Average annual runoff ranges from 15 to 40 inches, depending on land cover. Although rainfall is distributed throughout the year, early spring is typically the wettest time of the year. Monthly rainfall decreases in mid to late summer, and fall is the driest season. Late fall, winter, and spring precipitation is predominantly caused by continental frontal systems, while most summer precipitation is a result of convection heating. Heavy, intense rainfall events from thunderstorms are common throughout the summer months. Average temperatures and precipitation reported by month in the City of Newnan are shown in Table 3-8. Rainfall conditions were generally above average during the Project monitoring events.

TABLE 3-8
Newnan Period of Record Monthly Climate Summary
Wahoo and White Oak Creek Watershed Assessment

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	54.6	59.1	66.7	75.3	81.9	87.1	89.5	88.8	83.6	74.7	65.1	56.2	73.5
Average Min. Temperature (F)	33.1	35.7	41.5	48.9	57.2	64.2	67.6	66.7	61.3	50.2	41.3	34.7	50.2
Average Total Precipitation (in.)	4.99	4.81	5.64	4.28	4.11	4.00	4.92	3.83	3.57	2.79	3.95	4.25	51.15

Source: Southeast Regional Climate Center, 2006. NEWNAN 4 NE, GEORGIA (096335) (SERCC, 2006).
Period of Record : 7/ 1/1948 to 12/31/2005

3.2.2 Ecoregion

Coweta County is located entirely in the Southern Outer Piedmont Ecoregion (GA DNR, 2001). This ecoregion is characterized by rolling hills and is mostly forested with loblolly-shortleaf pine, with some oak-hickory and oak-pine areas. There are two physiographic districts within this ecoregion: Greenville Slope and the Gainesville Ridges. The service areas are located mostly within the Greenville Slope District, which is characterized by rolling topography that decreases gradually in elevation from 1000 feet in the northeast to 600 feet in the southwest. All streams in this district eventually drain to the Gulf of Mexico. Those flowing to the southwest occupy shallow, open valleys with broad, rounded divides, while those flowing to the southeast occupy narrower, deeper valleys with narrow, rounded

divides. Relief varies from 150 to 200 feet in the east to 100 to 150 feet in the west (Clark and Zisa, 1976). The Gainesville Ridges forms a narrow band along the Chattahoochee River, which confines its flow. Generally, tributaries to the Chattahoochee River encounter a steep drop in elevation over a short distance as they flow through this district.

3.2.3 Geology and Soils

The Piedmont is a region of moderate-to-high-grade metamorphic rocks, such as schists, amphibolites, gneisses and migmatites, and igneous rocks like granite (UGA, 2005). Topographically, the Piedmont mostly consists of rolling hills, although faulting has produced the impressive ridge of Pine Mountain near Warm Springs. Isolated granitic plutons also rise above the Piedmont landscape to give prominent features like Stone Mountain.

The soil associations within the overall Chattahoochee and Flint River Basins, which include Coweta County, are listed in Table 3-9. This information was obtained from a digital, general soil association map developed by the National Cooperative Soil Survey. It consists of a broad-based inventory of soil associations and nonsoil (i.e., urban and water) areas that occur in a repeatable pattern on the landscape. These data were used to provide a general description of soils within the District. General soil maps for the State Soil Survey Geographic database (STATSGO) are derived from detailed, county-specific soil survey maps. As a result, a higher degree of resolution among soil associations can be obtained from Natural Resource Conservation Service (NRCS) soil surveys (Alhadeff, 1996).

TABLE 3-9
Soils Associations in the Chattahoochee and Flint River Basins*
Wahoo and White Oak Creek Watershed Assessment

Soil Association (Code)	Basin: Chattahoochee River (mi^2)	Basin: Flint River (mi^2)	Total	% of Total
Ashlar-Pacolet-Cecil	0	28	28	1
Cecil-Madison-Pacolet	729	454	1183	50
Madison-Davidson-Pacolet	488	0	488	21
Riverview-Chewacla-Cartecay	24	8	32	1
Tallapoosa-Madison	2	0	2	< 1
Urban	528	65	593	25
Water	52	0	52	2
Total	1823	555	2378	

Source: Alhadeff, 1996.

Excluding the urban and water types, five soils associations were identified in the Chattahoochee and Flint River Basins, with the Cecil-Madison-Pacolet and Madison-Davidson-Pacolet associations the most abundant. Cecil-Madison-Pacolet is associated with moderate rolling hills while Madison-Davidson-Pacolet is associated with the steeper terrain of the Chattahoochee River Basin. These soils are well drained and highly weathered, having a red to yellowish-red subsoil.

3.2.4 Topography

The topography of Coweta County is made up mostly of gently rolling ridge tops and hillsides that are dissected by drainage ways. The hillsides near major streams are usually strongly sloping (10 to 15 percent) or steep (greater than 15 percent). Floodplain areas are usually adjacent to these steep hillsides and vary in size, from narrow to wide. Elevations range from a low of 720 feet above sea level in the southern portion of the County to a high of 1,040 feet above sea level in the north. (Coweta County, 2006).

3.2.5 Hydrology

The Coweta County service area includes the 35 square-mile Wahoo Creek Watershed and 54 square miles of the White Oak Creek Watershed. The Wahoo Creek Watershed drains northwest into the Chattahoochee River, while the White Oak Creek Watershed drains southeast into the Flint River near the Joe Kurz Wildlife Management Area. The location of these watersheds and Coweta County are shown in Figure 1-1.

The Chattahoochee River Basin headwaters originate in the southeast corner of Union County in northeast Georgia. The basin occupies a relatively narrow corridor of the state averaging about 40 miles wide, starting in the northeast corner, and extending to the south-west corner. Buford Dam, which forms Lake Lanier, is the first hydrologic control point on the river. A second electric power dam, Morgan Falls Dam, re-regulates the water just above the city limits of Atlanta. West Point Lake, which is the second major reservoir and regulates flow downstream, is located approximately 21 miles southwest of where Wahoo Creek enters the main stem of the Chattahoochee River.

The Flint River Basin originates in Atlanta and drains all of Fayette County and portions of Clayton, Coweta, Douglas, and Henry Counties. Its main tributaries include Line, Morning, White Oak, and Whitewater Creeks. White Oak Creek drains to the southeast, entering the main stem of the Flint River approximately 11 miles downstream of the Coweta County border in Meriwether County. The Flint River is a major drainage basin that converges with the Chattahoochee River in southern Georgia to create the Apalachicola River that eventually flows into the Gulf of Mexico and drains portions of Florida. The existing reservoirs in the upper Flint River basin, all located outside of the service area, are primarily smaller impoundments on tributaries to the Flint River that were developed to supply drinking water.

3.2.6 Demographics

Like many communities in the metropolitan Atlanta area, Coweta County continues to grow at much greater pace than the national average of 13 percent. While the County only grew on average 16 percent between 1900 and 1970, it has consistently grown by over 20 percent each decade since then (See Table 3-10). Despite this growth, Coweta County is still the least densely populated county in the thirteen-county metropolitan Atlanta area. In addition, seven of the thirteen counties are currently growing at a faster rate than Coweta County.

The estimated population for the County was 105,376 in 2004, of which approximately one third resides within the Wahoo and White Oak Creek service area. The forecasted population growth coupled with commercial and industrial development is prompting the need for additional wastewater treatment capacity. Based on projections developed for the Atlanta Regional Commission (ARC), the County population will nearly double by 2030

with a total population of 205,223 (ARC, 2006). This growth will add approximately 41,000 new homes to the County, double the water withdrawals, and convert 54,000 acres from forest and agricultural lands to residential, industrial, and commercial uses.

TABLE 3-10
Coweta County Population Growth
Wahoo and White Oak Creek Watershed Assessment

Year	Population
2030[1]	205,023
2004[1]	105,376
2000[2]	89,215
1990	53,853
1980	39,268
1970	32,310
	Percent Change
1970-1980	21.5
1980-1990	37.1
1990-2000	65.7
2000-2004	18.1
2000-2030	129.8

[1] Data Sources: Atlanta Regional Commission, 2006.

[2] US Census Bureau, 2006.

3.2.7 Municipal Areas

The majority of the service area, approximately 81 percent, is located in unincorporated Coweta County. However, the service area does have a number of cities and towns located within or near its borders (See Figure 3-2). These municipalities are:

- City of Newnan
- Town of Turin
- Town of Sharpsburg

Municipalities have their own independent forms of government and operate various service functions according to the individual municipality's ordinances. The City of Newnan has the greatest potential to impact conditions in the service area due to its more urban character and its location in the headwaters of both subwatersheds.

3.3 Source Identification

Water quality and aquatic integrity are affected by both point and nonpoint pollutant sources. Point sources discharge directly into receiving waters at a fixed location (such as pipe outfall). Nonpoint sources are those that cannot be easily traced to a specific location, such as stormwater runoff from parking lots and roofs. This section provides an overview of the point and nonpoint sources of pollutants within the service area.

3.3.1 NPDES Permitted Discharges

3.3.1.1 Wastewater

The County operates three WPCPs: Arnall/Sargent and Arnco WPCPs in the Wahoo Creek Watershed (part of the Chattahoochee River Basin) and Shenandoah WPCP in the White Oak Creek Watershed (part of the Flint River Basin), Figure 3-8. Each of these facilities has a separate collection system area. East Newnan, has its wastewater collected and pumped to the Wahoo Creek WPCP, which is owned and operated by Newnan Utilities (JJG, 2005a).

The following presents a brief description of other WPCP's in and near the study area. The Shenandoah Creek WPCP discharges to White Oak Creek in the Flint River Basin. Four other WPCPs discharge their treated effluent into Wahoo Creek, located within the Chattahoochee River basin. The following is a description of the discharge capacities of these plants:

- Arnall/Sargent WPCP (GA0000299) has a permitted capacity of 0.06 mgd. Virtually all flow is from residential development in the City of Sargent; population served is 500.
- Arnco Mills WPCP (GA0000311) has a permitted and estimated design capacity of 0.10 mgd serving an estimated residential population of 500. In the past, the plant has had difficulty meeting its fecal coliform limits (CH2M HILL, 2003).
- Snake Creek WPCP (GA0021431) has a permitted discharge of 0.40 mgd. The configured trickling filter facility permitted in 1962 originally discharged to Snake Creek. In 1997, the discharge was diverted to Wahoo Creek.
- Wahoo Creek WPCP (GA0031721) maintains a permitted and design treatment capacity of 3.0 mgd and provides service to the City of Newnan.

3.3.1.2 Municipal Separate Storm Sewer Systems (MS4)

Stormwater runoff is regulated within the NPDES permitting system via the Phase I and Phase II programs for municipal separate storm sewer systems (MS4s) and industrial activities. Permit coverage can be either under an individually tailored NPDES permit, used by MS4s and some industrial facilities, or a general NPDES permit, used by most industrial facilities and construction sites. Coweta County and the City of Newnan are both individual MS4 Phase II communities and are currently implementing their stormwater management programs and plans, which address the following NPS management components:

- Post-Construction Storm Water Management in New Development and Redevelopment Minimum Control Measures
- Illicit Discharge Detection and Elimination Minimum Control Measures
- Pollution Prevention-Good Housekeeping for Municipal Operations Minimum Control Measures
- Public Education and Outreach Minimum Control Measures
- Public Involvement/Participation Minimum Control Measure

Additionally, the County revised its code of ordinances in 2005 to meet the intent of the District Model Ordinances. These ordinances address the following topic areas:

- Post-Development Stormwater Management for New Development and Redevelopment
- Floodplain Management / Flood Damage Prevention
- Conservation Subdivision/ Open Space Development
- Illicit Discharge and Illegal Connection
- Litter Control
- Stream Buffer Protection

3.3.1.3 Other NPDES Permitted Wastewater Discharges

In addition to the County and City operated WPCPs, a number of industrial wastewater permits exist in Coweta County (See Table 3-11 and Figure 3-8). In spite of the number of industrial facilities, they are generally smaller (mgd) dischargers projected to total less than 2 mgd in the future (JJG, 2003).

TABLE 3-11
Wastewater Permittees in Coweta County
Wahoo and White Oak Creek Watershed Assessment

Facility Name	Permit Holder	Permit #	Type
Madras Quarry	Vulcan Materials	GA0036749	I
Days Inn	No data	GA0022632	I
Coweta McCollum Utilities LLC	No data	GAU030992 (LAS)	O
Newnan Water And Sewerage WTP	No data	GAG640027	O
Autumn's Gate MHP	No data	GAG550010	O

Source: List of Wastewater Permittees, Revised September 2004. GAEPD Web Site: http://www.dnr.state.ga.us/dnr/environ/regcomm_files/regcomm.htm
I = Industrial, O = Other.

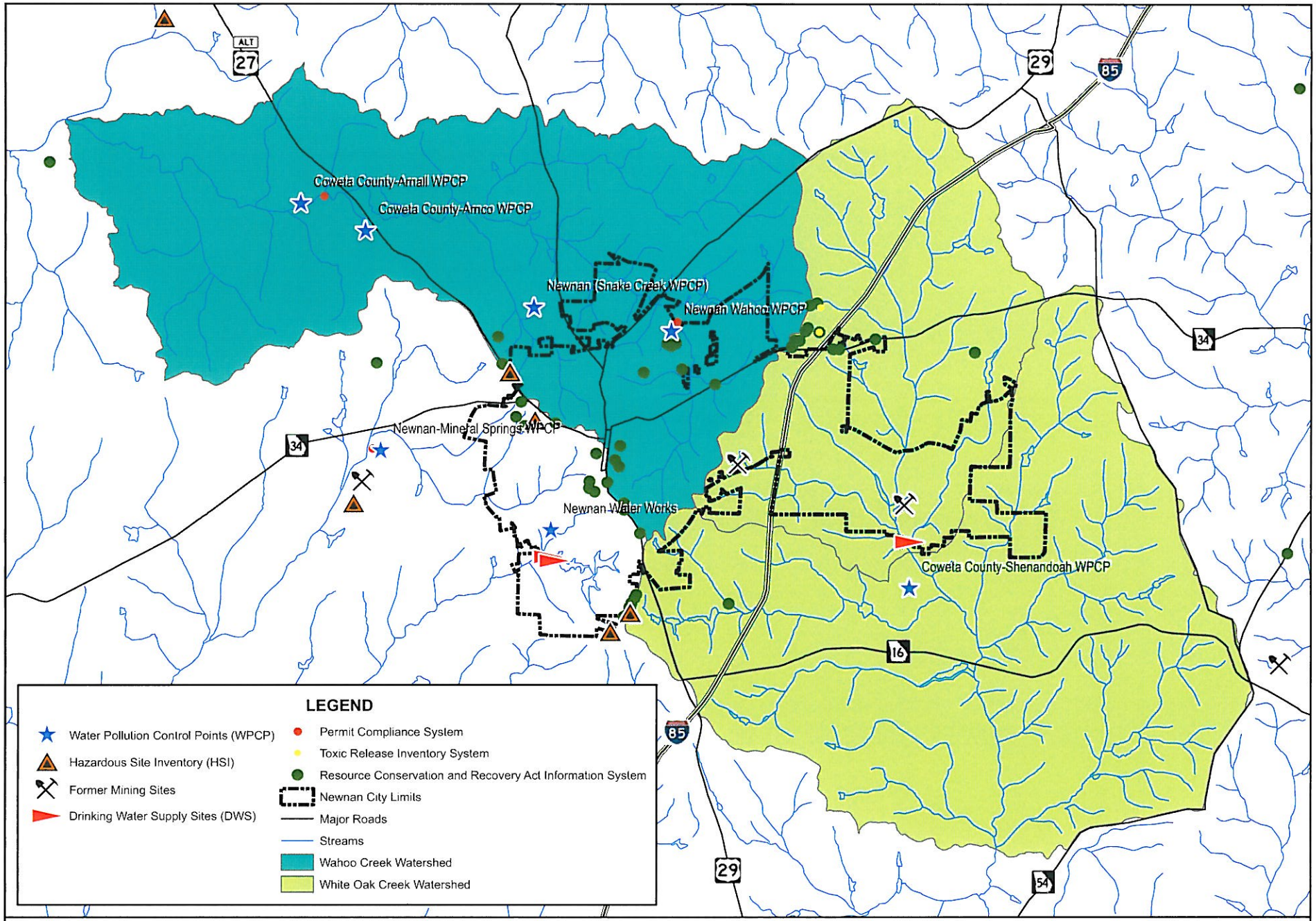

Figure 3-8
Potential Point Sources
Wahoo and White Oak Creek Watershed Assessment

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3.3.2 Landfills

There are currently no solid waste facilities located in the service area; the County disposes of its waste at the Pine Ridge landfill in Griffin. The county has a ten-year contract with Pine Ridge. There is an old landfill west of Newnan, outside of the service area. The County does maintain a construction and demolition landfill in the County, a transfer station, and 16 collection sites (12 manned). Recycling centers are located at the 12 manned sites (JJG, 2005b).

3.3.3 RCRA and Hazardous Waste Sites

Information regarding hazardous waste site locations is compiled in the Resource Conservation and Recovery Information System (RCRIS), a national program management and inventory system. Most generators, transporters, storers, and disposers of hazardous waste are required to provide information about their activities to regional and national USEPA offices. The Resource Conservation and Recovery Act (RCRA), as amended by the Hazardous and Solid Waste Amendments of 1984, regulates these locations. The list of RCRA facilities includes numerous small facilities that handle or store hazardous materials. For example, any facility that has a permit to dispose of waste oil or paint is included on the list. The potential for a release of toxic substances from the majority of these facilities is very small. GAEPD's Hazardous Site Inventory, which includes RCRA sites and was revised in 2005, notes the following three sites in the service area, Figure 3-8:

- 10154, Douglas & Lomason Company
- 10340, CPI Plastics, Inc., Newnan Plant
- 10586, Brown Steel Contractors Inc.

The Douglas & Lomason Company site is located on Temple Avenue south of Newnan By-Pass Road in the headwaters of an unnamed tributary to Wahoo Creek. This site has a known release of 1,1-Dichloroethene in groundwater at levels exceeding the reportable quantity. Other substances found in the groundwater included: Benzene, 1,1-Dichloroethane, 1,1,1-Trichloroethane, Dichloromethane, Toluene, Trichloroethene, Carbon disulfide, Chloroform, 1,2-Dichloroethane, trans-1,2-Dichloroethene, Tetrachloroethene, 1,1,2-Trichloroethane, Vinyl chloride, Carbon tetrachloride, and Acetone. Cleanup activities are currently being conducted for source materials, soil, and groundwater.

CPI Plastics is located on Corinth Road near its intersection with Pine Road in the headwaters of Turkey Creek, a tributary to White Oak Creek. This site has a known release of Tetrachloroethene in groundwater at levels exceeding the reportable quantity. The nearest drinking water well is between 0.5 and 1 miles from the area affected by the release and no human exposure via drinking water is suspected. Other substances in the groundwater included: Xylenes, Benzene, Trichloroethene, 1,1,1-Trichloroethane, and 1,1-Dichloroethane. Cleanup activities are currently being conducted for source materials, soil, and groundwater.

Brown Steel Contractors is located in the headwaters of Wahoo Creek on East Broad Street in downtown Newnan. It has a known release of Benzo(a)pyrene in soil at levels exceeding the reportable quantity with unlimited site access, the nearest resident individual is between

301 and 1000 feet from the area affected by the release. Other substances on the site included: 1,1,1-Trichloroethane, 1,1-Dichloroethene, Aroclor 1254, Arsenic, Barium, Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, bis(2-Ethylhexyl) phthalate, Cadmium, Carbon disulfide, Chrysene, Ethylbenzene, Lead, Silver, and Xylenes. Investigations are currently being conducted to determine how much cleanup is necessary for source materials, soil, and groundwater.

3.3.3.1 Toxic Release Inventory

Information from the USEPA Toxic Release Inventory (TRI), a database that contains information about releases and transfers of more than 650 toxic chemicals and compounds to the environment, was used to document potential pollutants in the service area (US EPA, 2003). TRI stores release transfer data hierarchically by facility, by year and chemical, and by medium of release (air, water, underground injection, land disposal, or offsite). Information such as the facility name, address, latitude/longitude, parent company, and USEPA identification number is provided by the database.

The list of TRI facilities includes numerous small facilities that handle or store hazardous materials; however, the potential for a release of toxic substances from the majority of these facilities is very small. They have been included in the evaluation of existing potential pollutant sources because they represent areas of industrial or commercial land uses. There are eight TRI facilities located in the service area, Table 3-12 and Figure 3-8.

TABLE 3-12
US EPA Toxic Release Inventory locations in Service Area of Coweta County
Wahoo and White Oak Creek Watershed Assessment

Facility Name	Facility ID	SIC Code	Street Name	City
Wahoo Creek Watershed (Chattahoochee River Basin)				
Brown Steel Contractors Inc.	GAD984270637	3443	57 East Broad Street	Newnan
James River Corp.	GAD003913159	2657	76 Sprayberry Road	Newnan
White Oak Creek Watershed (Flint River Basin)				
Crain Industries, Newnan Division	GAD095854428	3086	374 Corinth Road	Newnan
CPI Plastics, Inc., Newnan Plant	GAD981266208	3089	434 Corinth Road	Newnan
Kason Industries	GAD097395693	3429	57 Amlajack Boulevard	Shenandoah
Yamaha Motor Manufacturing Corp.	GAD981264880	3799	1000 Highway 34 East	Newnan
Andrew Corp.	GA0000684951	3272	27 Amlajack Boulevard	Newnan
Bonar Plastics, Inc.	GA0001310069	2761	125 Christopher Court	Newnan

3.3.3.2 Mining Operations

There has been a limited history of mining in the service area which has contains no active mining sites. There are two "past producers" of granite located in the White Oak Creek watershed off Lower Fayetteville and Poplar Roads, Figure 3-8.

3.3.4 Department of Human Resources Waste Treatment Systems

The County does not have any waste treatment systems greater than 10,000 gpd which are under the control of the Department of Human Resources.

3.3.5 Land Application Systems (LAS)

There are no permitted land application systems (LAS) in the Wahoo and White Oak Creek watersheds and therefore do not have an affect on conditions within the service area.

3.3.6 Stormwater Treatment Facilities

As part of their MS4 permit as well as the District, Coweta County is required to initiate an inventory their stormwater management facilities and discharges and create a monitoring database that maintains and evaluates samples of water quality for the discharges. Information, such as the location, size, and discharge rate of stormwater management facilities in Coweta County will be entered into a Geographic Information System (GIS) so that the information can be mapped and tracked. The vast majority of stormwater management facilities in Coweta are privately owned and maintained. Most publicly owned and maintained stormwater management facilities have been constructed in conjunction with the construction of highway and utility projects.

3.3.7 Land Disturbance Permits

On December 8, 1999, USEPA published the Storm Water Phase II Final Rule, which expands the Phase I program by requiring additional operators of small MS4s and operators of small construction sites (1 to 5 acres) to be covered by NPDES permits. Thus, under the Phase II requirements, all development sites that disturb greater than one acre are required to receive a permit before they can begin land disturbance. Larger development sites (those with more than 5 disturbed acres) must prepare an approved erosion sedimentation and pollution control plan with Best Management Practices (BMPs) to control soil erosion and sedimentation at the site, and maintain onsite water quality monitoring during construction. The County also reviews pre- and post-development activities for compliance with the Georgia Stormwater Management Manual, which includes specific guidance and design criteria for BMPs to address the potential impacts from new and redevelopment projects in the service area.

3.3.8 Septic Tanks

The County's approach to residential wastewater management in areas outside the sewer service area addressed by this WA is to utilize on-site septic systems. To ensure proper function of these systems and to protect water quality, a minimum lot size of 1.6 acres is required. Overall, the septic tanks are performing well for residential developments; however, older homes that had septic systems installed over 30 years ago are beginning to fail and require replacement (JJG, 2005b). Commercial developments on septic systems have had issues with raw sewage backing up in the system and flooding the establishments. Commercial use of septic systems is being discouraged, where possible, and monitoring and maintenance standards implemented.

3.3.9 Agriculture and Confined Animal Feeding Operations (CAFOs)

Agriculture is on a severe decline in much of metropolitan Atlanta, as many pastures give way to new subdivision development (JJG, 2005a). However, nearly one-quarter of the County's land is still classified as farmland. The number of farms and farmland acreage has actually increased in Coweta County between 1997 and 2002, but the average farm size has decreased from 135 to 127 acres. This recent increase follows several decades of decline. In 1964, the County had an inventory of 683 farms compared to 421 farms in 1997 and 480 farms in 2002. One explanation of this recent upturn is that Coweta County has recently attracted new residents seeking an equestrian or large-estate lifestyle.

Combined animal feeding operations (CAFOs) are not a potential source of pollutants in Coweta County. On a County-wide basis, cattle operations are limited with approximately 3,000 head of cattle being maintained. No active poultry breeding operations are in existence in the County.

3.3.10 Commercial Forestry Harvesting Sites

Commercial forestry is still active in the County. Nearly 46.5 percent of the service area is currently forested (JJG, 2005b). The amount of forest land available for active forestry has decreased in recent years as forest is converted to development or is being held privately as part of large lot residential parcels. While active forest harvesting may not be as prevalent as early in the century, the small scale harvesting associated with development can have significant impacts on water quality and biological habitat. A number of the stormwater control measures discussed in Section 3.5.3 are specifically intended to mitigate the significant potential sediment and erosion impacts associated with the land disturbance phase of construction.

3.3.11 Other Significant Facilities

No other significant sources of pollution have been identified in the service area.

Final Report

Total Maximum Daily Loads for the East Branch of the DuPage River, Illinois

Submitted to

Illinois Environmental Protection Agency

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October 2004

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3 Watershed Characterization and Source Assessment

This section describes the data acquired and the watershed characterization conducted to develop the East Branch TMDLs. The available historical data for each 303(d)-listed pollutant are presented and discussed and followed by an assessment of available data for watershed modeling.

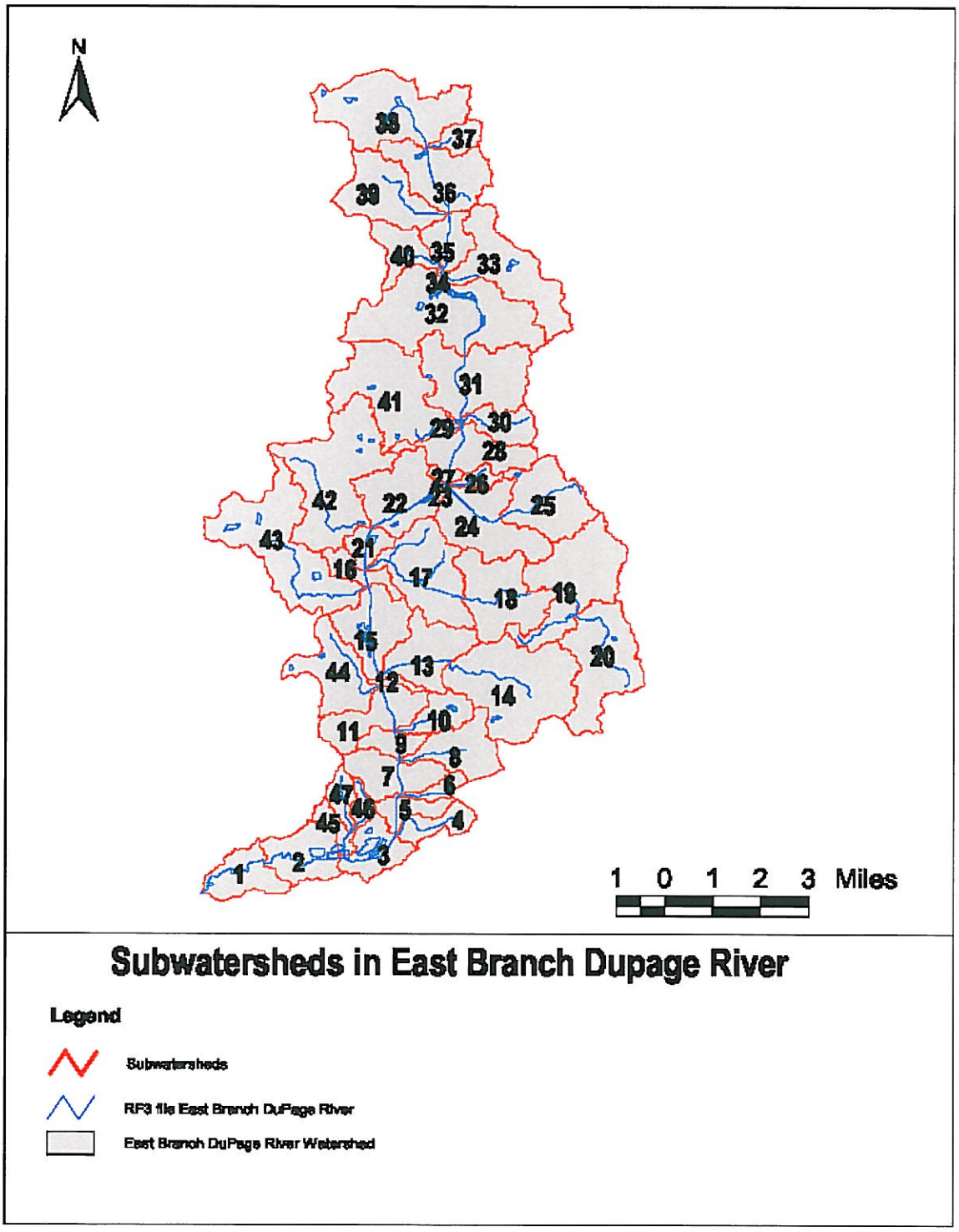
3.1 Watershed Description and Background Information

The East Branch watershed encompasses about 79.3 square miles of northeastern Illinois. The DuPage County Department of Environmental Concerns (DEC) Stormwater Management Division (DCDS) developed subwatershed boundaries for its stormwater management program. The boundaries take into account areas in DuPage County that are drained by storm sewer systems, with sometimes nontopographically based drainage characteristics. The subwatershed areas range from 0.2 to 2,109 acres and average 119 acres. Because of the watershed's complex nature, existing subwatershed delineations that include storm sewer areas were used wherever possible in the TMDL modeling process. Figure 3-1 shows the subwatersheds in the East Branch watershed.

The Illinois Environmental Protection Agency (IEPA) also provided 14-digit Hydrologic Unit Code (HUC) watershed boundaries for the entire East Branch watershed. For areas in DuPage County, these boundaries were checked against the DCDS data. For areas outside DuPage County, the 14-digit HUC boundaries were verified using U.S. Geological Survey (USGS) 1:240,000-scale digital elevation models (DEMs) to match the Reach File version 3 (RF3) stream segments. RF3 is the most detailed stream network data layer available from the Better Assessment Science Integrating Point and Nonpoint Sources (BASINS) data set and is identical to the National Hydrography Data (NHD) for the East Branch of the DuPage River. The HUC watershed boundaries were not detailed enough to use for East Branch subwatershed data in this report, but they were investigated and compared with the other data sources.

Topographic data were obtained in a digital format from the USGS and the DCDS. USGS topographical mapping was downloaded from the Illinois Geographic Information Council Website as a digital raster graphic (DRG) file. The topographic data were used to confirm drainage patterns established by the state 14-digit HUC and DCDS subwatershed delineation. No significant differences were found between the DRGs and DEMs. Therefore, only the DEMs from the USGS were used in the final data selection and subwatershed delineation.

FIGURE 3-1
Subwatersheds in the East Branch of the DuPage River



3.2 Land Use

Land use data were obtained from the DCDS, the Northeastern Illinois Planning Commission (NIPC), and BASINS.

The DCDS land use data were defined for a higher resolution than NIPC data but were not available for areas outside DuPage County. The NIPC data covered the entire study area with adequate detail for characterizing nonpoint sources of pollution and for modeling. BASINS land use data were out of date and did not provide the necessary detail for modeling. A data set showing forested areas was obtained from the Illinois Department of Natural Resources (IDNR). In the NIPC data, forested areas were classified under open space. To identify what portions of the open space were forested areas, the IDNR forest coverage was overlaid with the NIPC data to produce the final land use coverage for use in modeling. In addition, the category called "vacant excluding wetlands" in the geographic information system (GIS) layer was combined with the open space category for modeling purposes.

Figure 3-2 shows the East Branch watershed land use. The watershed consists primarily of developed areas. According to the land use data obtained from NIPC, only 3 percent of the East Branch watershed is agricultural; approximately 40.3 percent is residential. Table 3-1 shows a complete list of land use categories. Therefore, nonpoint source pollution from agricultural activities would be low for most listed pollutants when compared with the amount of pollution from other land uses. Nonpoint source loads from residential areas may contribute significantly to some pollutant loads.

Land use data were used to characterize nonpoint source pollution sources in the watershed and to complete the load allocation (LA) portion of the TMDL. The East Branch watershed was listed for several pollutants that are transported by stormwater runoff. These include total dissolved solids (TDS)/conductivity, chloride, and oxygen-demanding materials that affect DO. During modeling, these pollutants were linked to contributing types of land use (see Section 6).

3.3 Hydrographic Data

To model the stream network in a watershed, the selected models (Hydrologic Simulation Program Fortran (HSPF) and QUAL2E) required the stream network to be broken into reaches representing the stream characteristics. Flows and pollutants were routed through these reaches using trapezoidal channel geometry. Stream reach data were available from DuPage County and BASINS data sets.

The DCDS provided hydrographic data that were compared with RF3 data in USEPA's BASINS 2.1 model. Both data sets had identical basic reach information. The DCDS data included smaller and isolated water bodies, but the stream network connectivity was poor. The RF3 data included all the connected streams in the watersheds and additional attribute information that were required to set up the model. Therefore, the RF3 data were used to develop the TMDLs. Appendix A includes a detailed summary of the reaches used for modeling.

FIGURE 3-2
Land Use in the East Branch of the DuPage River

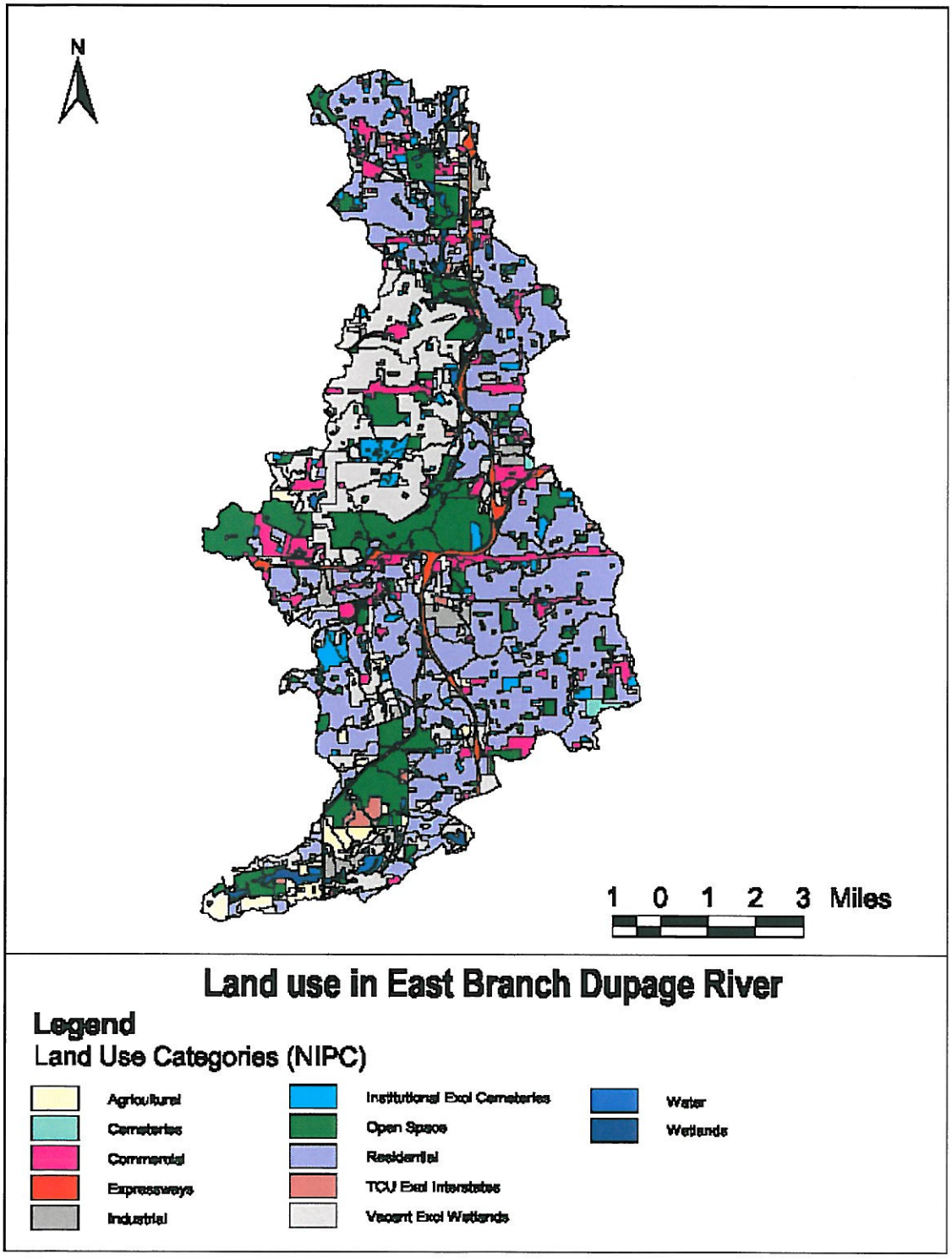


TABLE 3-1
NIPC and IDNR Land Use Distribution in the East Branch of the DuPage River

Land Use	ID	Area (Acres)		
		Impervious	Pervious	Total
Cemeteries and vacant land	1		10,715.34	10,715.34
Commercial	2	3,113.35	549.42	3,662.77
Forest	3		2,389.19	2,389.19
Industrial	4	1,303.18	229.99	1,533.17
Institutional	5	572.97	1,339.27	1,912.24
Open space	6		5,461.34	5,461.34
Residential	7	1,615.07	18,573.45	20,188.52
TCU excluding Interstates	8	541.17	360.80	901.97
Expressways	9	606.39	404.25	1,010.64
Wetlands	10		686.54	686.54
Agricultural	11		1,520.81	1,520.81

TCU, transportation land use.

3.4 Meteorological Data

Weather data were needed to calibrate hydrologic and water quality models and were used by the models to generate runoff volumes. The modeled runoff volumes were routed to determine streamflow values that were compared with data from several streamflow gauges in the East Branch watershed (see Section 3.5). Model input parameters were adjusted using this comparison of observed and modeled values.

NIPC provided National Climatic Data Center (NCDC) and other weather data in a Watershed Data Management (WDM) file format. Table 3-2 shows the data included in the WDM files. NIPC obtained precipitation data primarily from the NCDC and from a gauge at Argonne National Laboratory. Daily precipitation data were disaggregated using nearby hourly recording gauges. The Wheaton weather station, located in the East Branch watershed, was used to obtain necessary weather data for TMDL development because it had the most long-term hourly data. Figure 3-3 shows the location of each station from which precipitation data were collected for East Branch.

In addition to precipitation data, NIPC provided potential evapotranspiration (PET), cloud cover, solar radiation, air temperature, dew point, temperature, and wind movement data in a WDM format. Most of these data came from the NCDC.

The spatial variability of rainfall throughout the study area was verified using annual rainfall data found at Oregon State University's software system Website (http://www.ocs.orst.edu/prism/). The Parameter-Elevation Regressions on Independent Slopes Model (PRISM) on the Website uses point data and a DEM to generate gridded estimates of climate parameters, including precipitation. The annual precipitation for Illinois

was downloaded from this site. Review of the data shown in Figure 3-4 indicated that there were no significant spatial variations in rainfall patterns across the study area that would require special consideration. The average annual precipitation value at Wheaton (36.5 in.) for the 30-year period used for developing the PRISM data (1961–1990), corresponds to the average annual value from PRISM.

TABLE 3-2
Weather Data Provided in NIPC WDM Files

Start Date	End Date	Station ID	Source of Data	Data Type and Interval
01/01/1948	07/31/1996	Chicago O'Hare WSE ARP R	NCDC	Hourly precipitation
01/01/1948	09/30/1999	Chicago Midway AP 3 SW	NCDC	Hourly precipitation
06/30/1948	09/30/1988	McHenry WG Stratton L&D	NCDC	Hourly precipitation
09/30/1948	07/31/1996	Aurora	NCDC	Daily data distributed to hourly using Argonne data
01/01/1948	12/31/1999	Wheaton 3 SE	NCDC	Daily data distributed to hourly using Argonne data
09/30/1948	07/31/1996	Elgin	NCDC	Daily data distributed to hourly using Argonne data
12/04/1996	12/31/2000	Elmhurst	USGS	5-minute precipitation data aggregated to hourly
01/01/1948	07/31/1996	Argonne	NCDC	Adjusted Argonne precipitation

For detailed description of data, refer to *Application Guide for the Hydrologic Modeling in DuPage County Using Hydrologic Simulation Program - Fortran (HSPF): Model Organization and Use, Data Collection and Processing, Calibration* (May 1996). Tom Price, Northeastern Illinois Planning Commission.

Hourly data from Wheaton were used for meteorological data such as solar radiation, wind speed, cloud cover, temperature, and dew point temperatures for the entire East Branch watershed.

Pan-evaporation data were obtained from the Midwestern Regional Climate Data Center (National Oceanographic and Atmospheric Administration (NOAA)) for the Urbana weather station in Champaign County. To adjust these to East Branch watershed conditions, the NOAA pan-evaporation charts were used to calculate a ratio of annual pan-evaporation from Urbana to East Branch. The data from Urbana were multiplied by this ratio to obtain a pan-evaporation time series for the East Branch watershed. The pan-evaporation was assumed to be equivalent to PET. To obtain the actual evapotranspiration from the PET, the NOAA pan-coefficient was applied (National Weather Service, 1982c). Evapotranspiration data packaged with the USEPA's BASINS software were significantly higher than the values reported by NOAA.

FIGURE 3-3
Weather Stations with Precipitation Data

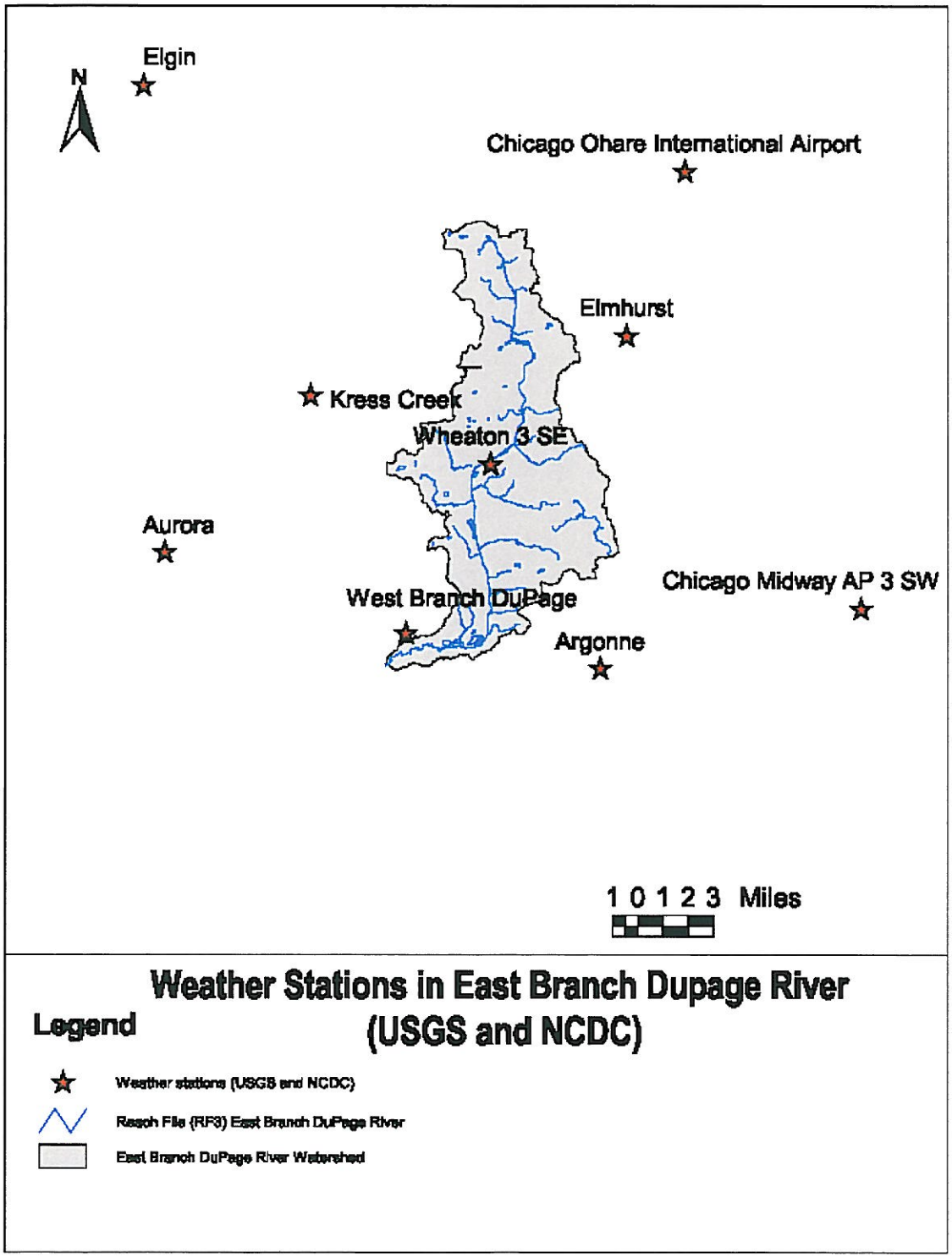
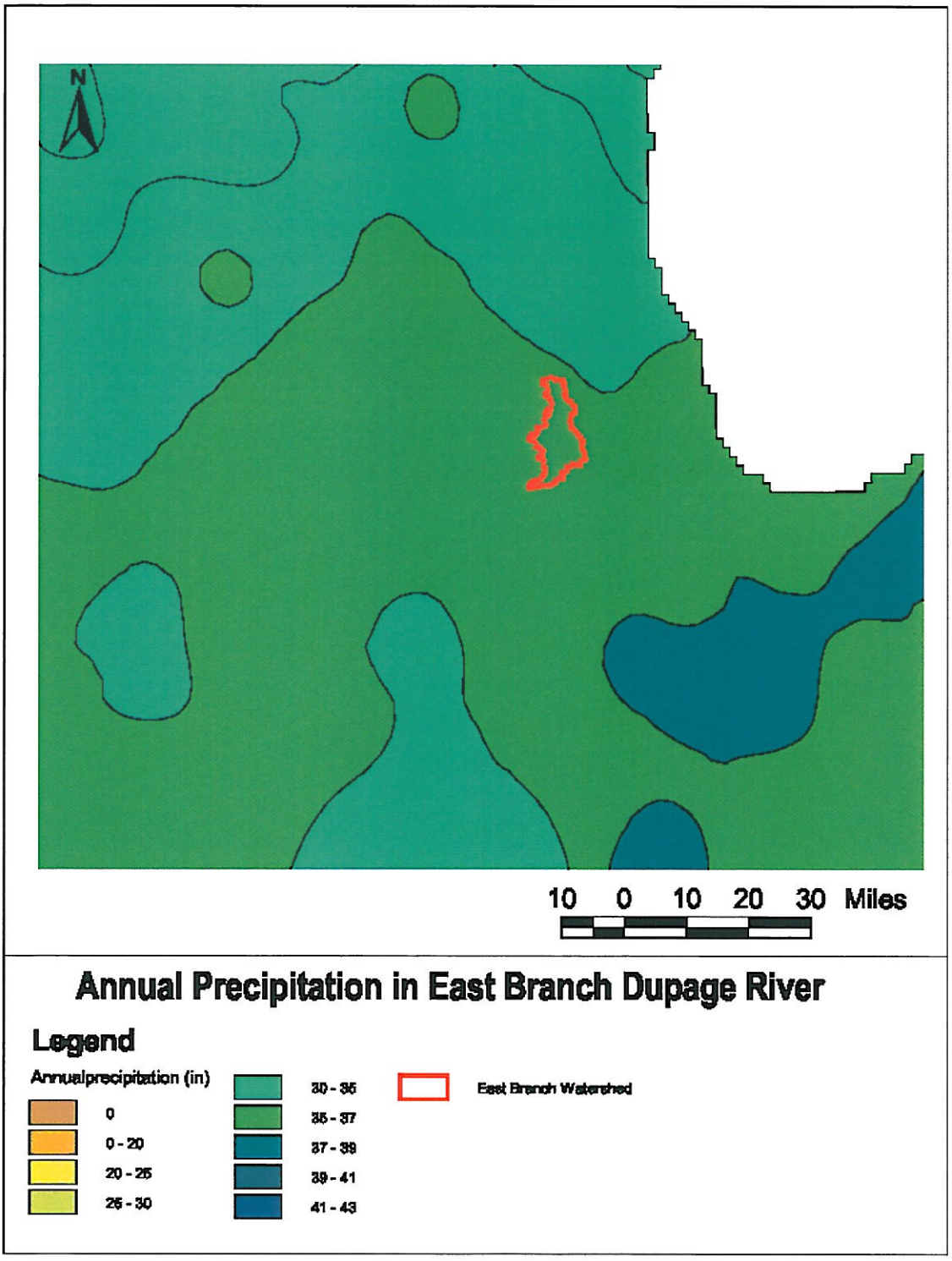


FIGURE 3-4
Annual Precipitation



3.5 Streamflow Data

Streamflow data are needed to calibrate hydrologic and water quality models. As mentioned earlier, first the weather data are used to generate the runoff volumes from the watershed. Modeled runoff volumes are routed to determine streamflow values that are compared with data from several streamflow gauges located in the East Branch watershed. The USGS gauge station cover provided in EPA's BASINS 2.1 model was used to determine the location of gauges. Figure 3-5 shows the location of all USGS gauge stations in East Branch.

From all the USGS flow gauges in East Branch, only two contained the long-term data needed for model calibration: Downers Grove (USGS Gauge ID 05540160), in the upper portion of the watershed, and Bolingbrook (USGS Gauge ID 05540250), in the lower portion of the watershed. Therefore, these two stations were used for model calibration. Figure 3-6 shows the location of the two gauges in the East Branch watershed.

3.6 Point Sources

Point source discharge data are needed to complete the waste load allocation (WLA) portion of the TMDL. All point source data were obtained from the IEPA and the Permit Compliance System (PCS) database of EPA.

The IEPA provided effluent concentrations, flow rates, and permit limits for NPDES permitted point sources from the discharge monitoring report (DMR) system. In addition, IEPA provided locations of point sources. The geographic information provided by IEPA and the BASINS 2.1 permit compliance system (PCS) GIS data were used to locate point sources in the East Branch watershed; Figure 3-7 shows the point source locations. Only point sources with a significant flow rate were considered in the modeling efforts; this included all WWTP and other major point sources. Table 3-3 lists the point sources and notes which ones were included in the modeling analyses.

Glenbard-Lombard is a wet weather discharge. Including it in the HSPF model would have double-counted the stormwater - the model would have accounted for it in both the discharge and in the nonpoint source runoff. Stone Barber is a quarry, and its flow is accounted for through groundwater runoff; its discharge will not contain high amounts of chlorides.

For the QUAL2E model, Glenbard-Lombard was not discharging during the calibration study. Since it is a wet weather discharge, it is unlikely that it would discharge during low flow conditions, the conditions upon which the DO TMDL is based. Stone Barber does not contain oxygen-consuming waste, and its flow is accounted for in the incremental inflow rates.

FIGURE 3-5
Location of USGS Gauges in the East Branch of the DuPage River Watershed

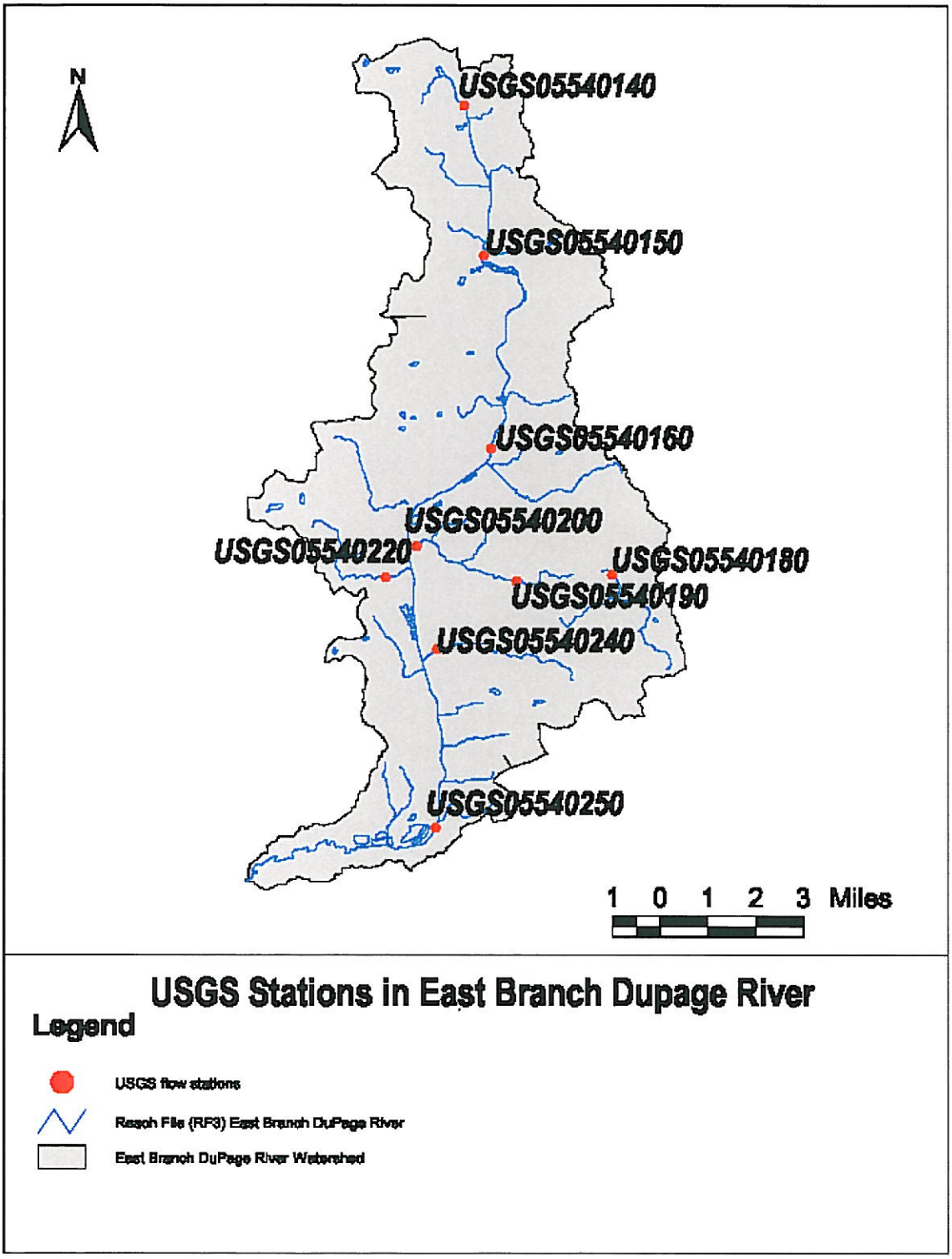


FIGURE 3-6
Location of USGS Gauges Used for Hydrologic Calibration

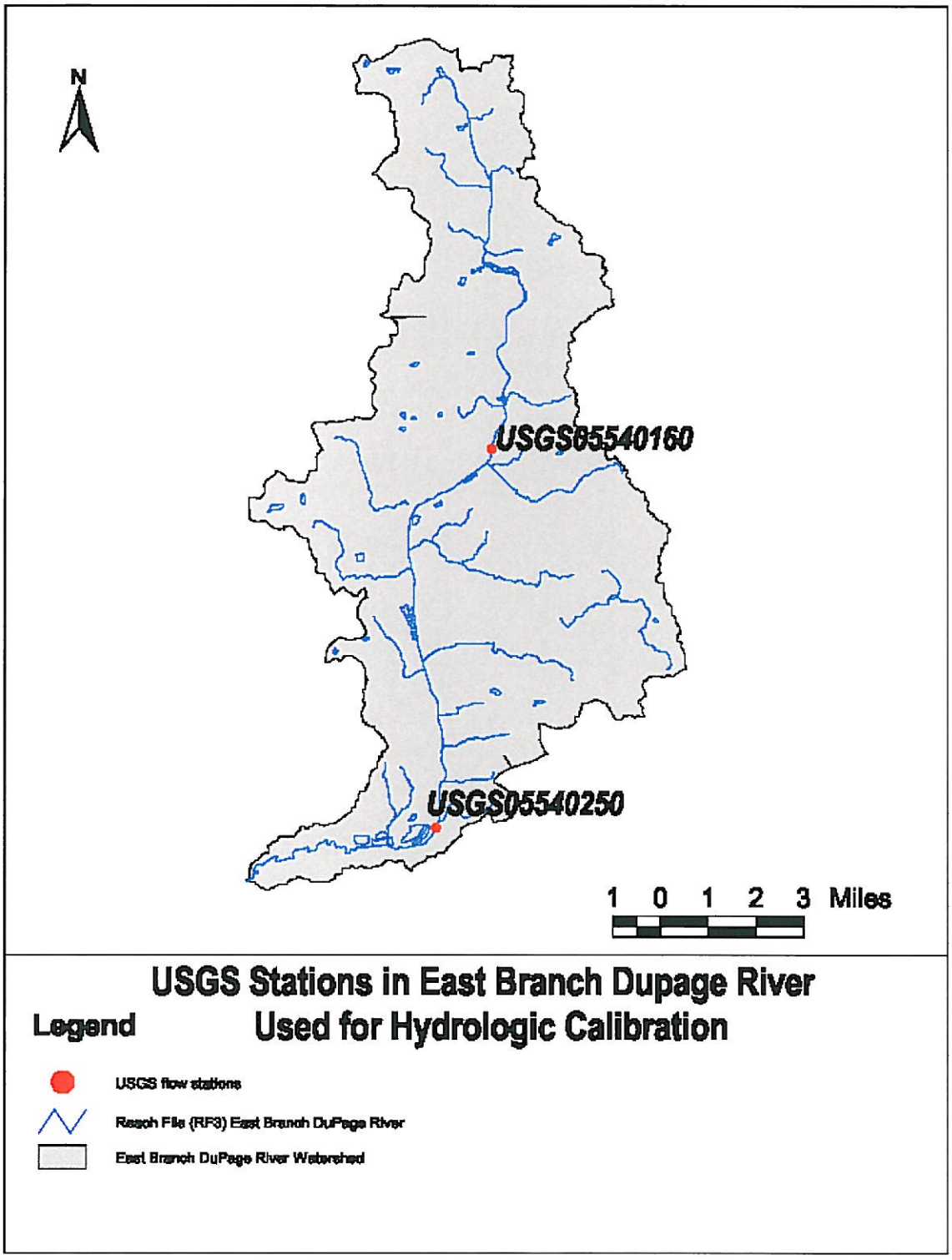
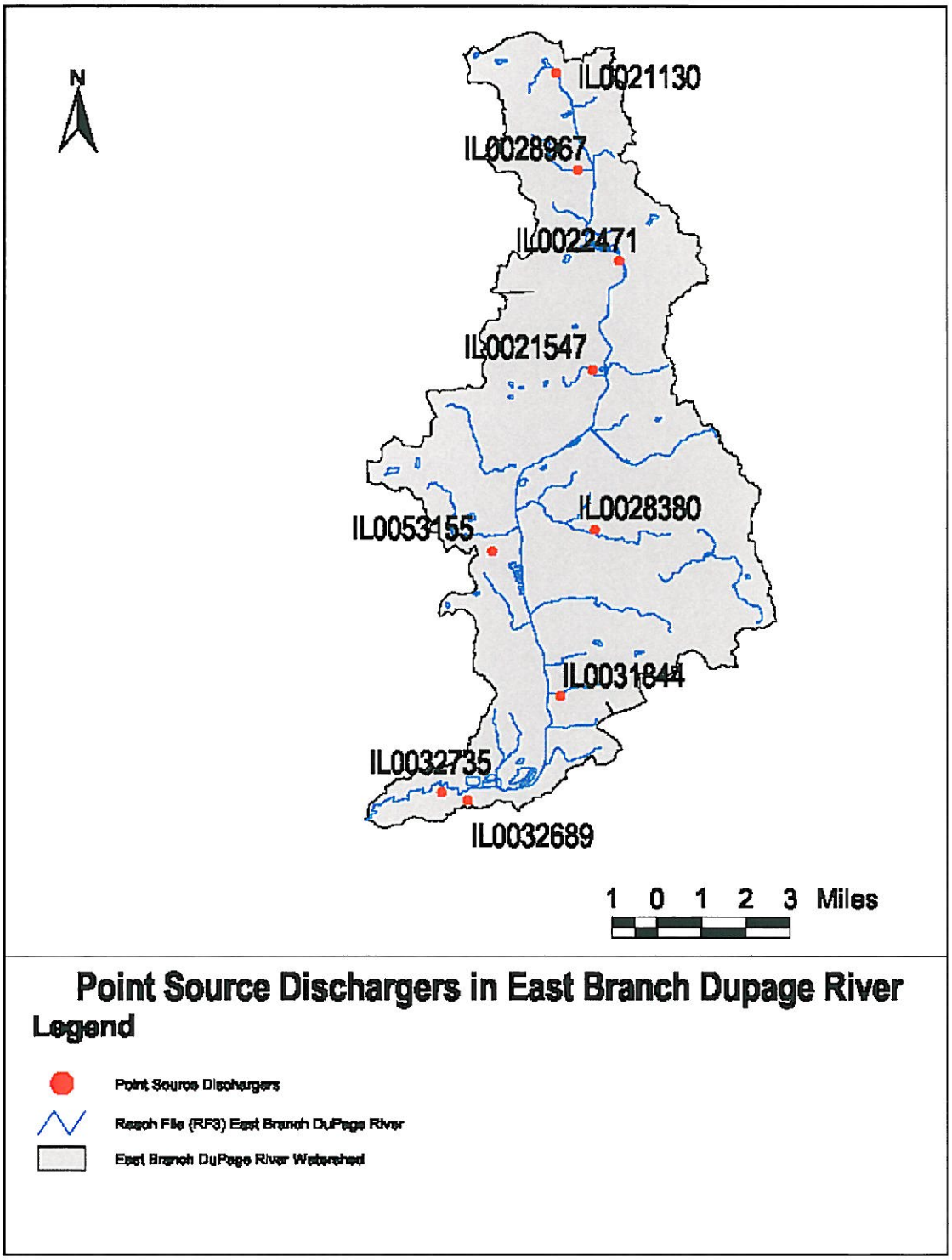


FIGURE 3-7
Point source Dischargers in the East Branch of the DuPage River



3.7 Nonpoint Sources

3.7.1 Sewered and Unsewered Areas

Three impaired segments of East Branch were listed for not meeting DO water quality standards. No combined sewer or sanitary sewer data were available to suggest that significant biochemical oxygen demand (BOD) load to the East Branch reaches originates from combined sewers or leaky sanitary sewers. The sewer network data obtained from DCDS show that several sewer (possibly storm sewer) pipes terminate at East Branch. Storm sewer outfalls at these locations may transport nonpoint source BOD load associated with urban runoff.

TABLE 3-3
Point Source Dischargers in East Branch DuPage River Watershed

Name	NPDES	County	Subwatershed ID[a]	Included in the Models?[b]
Elmhurst Chicago Stone-Barber	IL0053155	Will	15	No
Glenbard WW Auth-Lombard	IL0022471	DuPage	32	No
Citizens Utility Company #2 STP	IL0032735	Will	2	Yes
DuPage County Woodridge STP	IL0031844	DuPage	8	Yes
Bolingbrook STP #1	IL0032689	Will	2	Yes
Downers Grove SD WTC	IL0028380	DuPage	17	Yes
Glendale Heights STP	IL0028967	DuPage	39	Yes
Glenbard WW Auth-Glenbard	IL0021547	DuPage	41	Yes
Bloomingdale-Reeves WRF	IL0021130	DuPage	38	Yes

[a]Indicates which subwatershed in East Branch the point source is located.
[b]"Yes" indicates that the point source is being considered in the watershed modeling for TMDL development.

STP, sewage treatment plant.

3.7.2 Best Management Practices

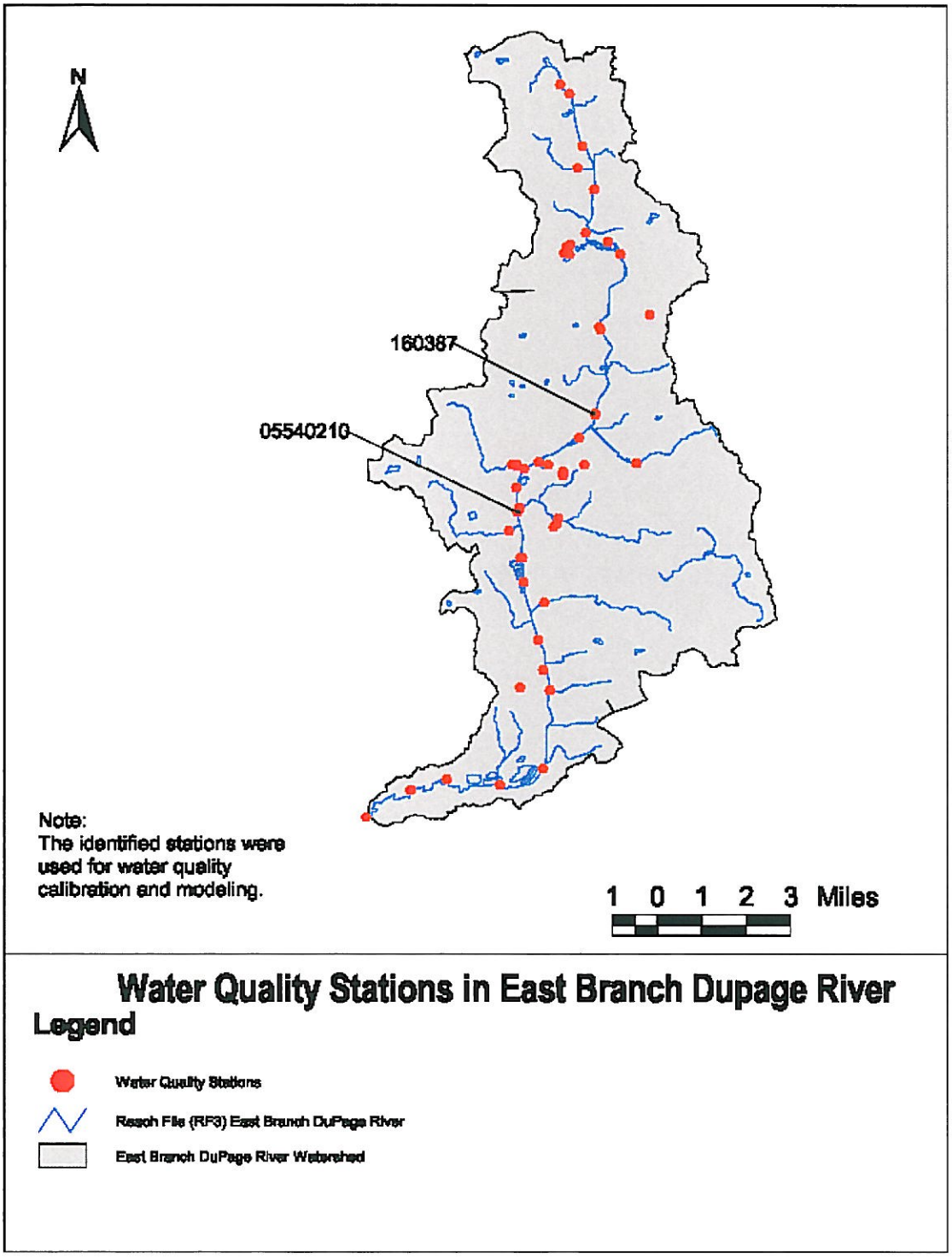
Existing best management practices (BMP) data were requested from the DCDS and NIPC. Although no detailed information for these facilities was available from either agency, review of the DuPage County Countywide Stormwater and Floodplain Ordinance (September 1994) revealed that the ordinance promotes the application of BMPs to new development through riparian buffer zones, erosion control plans, detention basins, etc.

No BMPs were included specifically in the modeling because no detailed information could be obtained about BMP locations.

3.8 Water Quality Data

Water quality data were obtained from two sources. Water quality data through December 1998 were available from STORET (http://www.epa.gov/storet), a national database maintained and operated by USEPA. The IEPA provided in-stream water quality data for 1997 intensive sampling events and monitoring data from 1999. The data from both sources were carefully reviewed to determine the basis for development of the 1998 303(d) list, to select appropriate modeling approaches, and to identify water quality stations for model calibration. Figure 3-8 shows the location of all water quality stations in the East Branch watershed.

FIGURE 3-8
Location of Water Quality Stations in the East Branch of the DuPage River



Writing Sample

Section 6, Task 1 – Sewer System Infrastructure Analysis

Infiltration & Inflow Study

6. Recorded Water and Wastewater Flows

6.1. Introduction

A number of methodologies were employed to determine the extent of infiltration and inflow within the study areas. These included the analysis of water consumption records, recorded flows obtained from DPW staff, computation of baseline sewage flow from population estimates (using recognized factors) and actual flow measurements from both weirs and flow meters installed in manholes within the collection system.

It should be noted that there are inherent flaws in each of the methodologies. Water consumption is not consistent within any group of users; the factor applied to how much water results in sewage is variable; flow rates from DPW are calculated from hours of pump operation and flow meters have limitations and this can be more pronounced at times of low level and velocity. These issues notwithstanding, the evaluation methodologies will be explored and analyzed for recurring commonalities and trends within the data.

Other factors were also evaluated including groundwater elevations, testing of wastewater for chlorides, and visual observations to further contribute to the overall analysis of the collection systems within each study area.

6.2. Water Use and Sewage Generation Rates

Water consumption generally displays seasonal variation, with usage being lowest during the winter months and highest during the summer months. During the winter months, water is primarily used for drinking and household purposes such as bathing, cooking, and washing of clothes. Water use during this time of year can be referred to as "baseline water use," since at other times of the year additional water is consumed for irrigation, filling of pools, washing of cars, etc. Water consumption most closely matches sewage flow during the baseline period. Thus, baseline water consumption was used to estimate wastewater flows, which are presented in section 6.3 of this report.

Wastewater flow measurements were taken in the winter to verify the accuracy of baseline water use as a means of estimating sewage flow and to establish baseline Infiltration and Inflow. See section 6.5 for a discussion of flow measurement results.

Actual water use records were reviewed for 25 residences in West Islip (sanitary sewage collection area No. 1) and 25 residences in Brightwaters (sanitary sewage collection area No. 3) from the Suffolk County Department of Public Works (SCDPW) in Yaphank. The County accessed these records from the Suffolk County Water Authority (SCWA). Water consumed by these 25 homes was determined from actual meter reading records. The

dates corresponding to the four (4) quarters (February, May, August and October) are listed in Table 6-1. Total water consumption for 2003 is shown in Table 6-2 and Figure 6-1.

Table 6-1. Quarterly Divisions of Weekly Sewage Flow for Sewage Collection Areas #1 & #3.

Quarter	Week Numbers	From 2nd Week of	To 1st Week of	No. Days
February	45-5	November	February	94
May	6-18	February	May	89
August	19-31	May	August	91
October	32-44	August	November	91

Table 6-2. Water Consumption for 25 Homes in West Islip and 25 Homes in Brightwaters.

2003	Quarterly Water Consumption (gallons) for 2003								Annual Consumption
Collection Area	Feb (Nov-Feb)	%	May (Feb-May)	%	Aug (May-Aug)	%	Oct (Aug-Nov)	%	Gallons
West Islip	727,500	14	633,000	13	2,019,000	35	2,274,750	38	5,654,250
Brightwaters	1,107,000	18	677,250	12	1,761,750	30	2,407,500	40	5,953,500

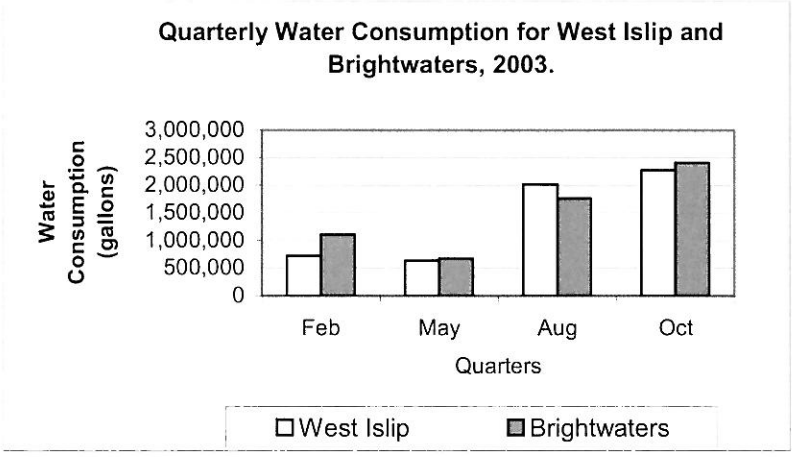


Figure 6-1. Water Consumption for 25 Homes in West Islip and 25 Homes in Brightwaters.

The average water consumption per house for the lowest consumption period (May quarter - February though April) was (633,000 gallons/25 houses) 25,320 gallons per house in West Islip and (677,250/25) 27,090 gallons per house for Brightwaters.

Quarterly water consumption for the West Islip and Brightwaters collection areas for 2004 was estimated by applying 2003 quarterly percentages (Table 6-3) (Figure 6-2) to actual annual totals for 2004. The resulting estimated baseline water consumption for 2004 for

West Islip was 6.22 million gallons (MG) and 3.48 MG for Brightwaters during the May quarter (second week of February to the first week of May).

Estimated West Islip water consumption during the May 2004 quarter was approximately 1.7 times greater than usage in Brightwaters. This corresponds exactly to the 1.7 times greater number of residences in the West Islip collection area (209) vs. the Brightwaters collection area (118). On average, water usage in the collection areas appears to be similar. Wastewater flow should therefore show the same relationship.

Estimated water consumption in both collection areas was 3.5 times greater during the October (August-October) quarter than the base usage during the May (February-April) quarter. Water consumption decreased sharply during the February quarter (November-January), which correlates with the expected seasonal drop in irrigation, pool, and other outdoor water use.

Table 6-3. Total Estimated Water Consumption, 2004

	Estimated Quarterly Water Consumption (gal)				
Collection Area	**Feb (Nov-Feb)**	**May (Feb-May)**	**Aug (May-Aug)**	**Oct (Aug-Nov)**	**Annual Gallons**
West Islip	6,699,784	6,221,228	16,749,460	18,185,128	47,855,601
Brightwaters	5,216,655	3,477,770	8,694,425	11,592,567	28,981,417

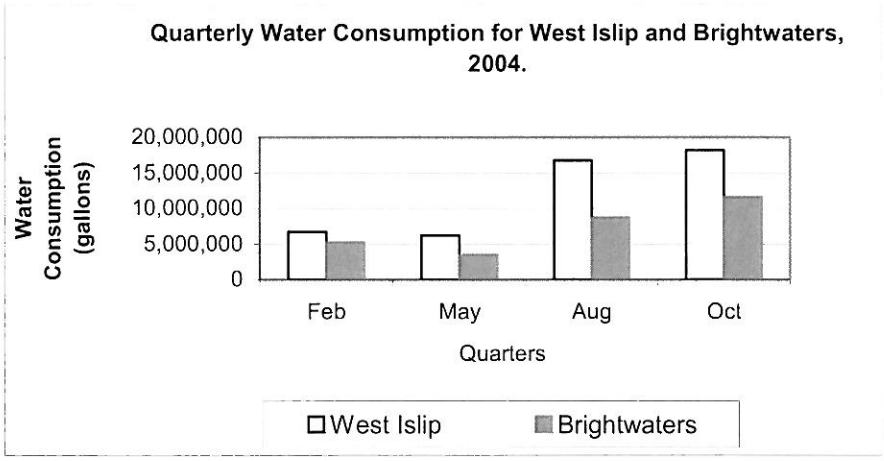


Figure 6-2. Estimated Quarterly Water Consumption for West Islip and Brightwaters, 2004.

Over the 89-days of "baseline" water consumption by the 25 selected residences during the May quarter (February-April), water consumption in West Islip was 633,000 gallons (25,320 gallons per residence, or 284 gallons per day) and 677,250 gallons in Brightwaters (27,090

gallons per residence, or 304 gallons per day). Water usage in the 25 Brightwaters residences was seven percent (7%) greater than in the 25 West Islip residences.

Utilizing US Census household data, water usage per person in Brightwaters (2.96 persons per household) was estimated at 103 gallons per person per day and 87.5 gallons per person per day for West Islip (3.25 persons per household). As sewage flow is generally accepted as 90% of low flow water usage, the sewage generation rate for Brightwaters would be 92.7 gpd per person and in West Islip would be 78.8 gpd per person. The difference of 14 gallons is related to the slightly higher water consumption rate in Brightwaters.

These values are close to the 75 to 100 gallons per person per day commonly used in wastewater generation estimates for recognized engineering references (Metcalf & Eddy) and the 80 gallons per capita per day (gpcd) utilized by the EPA (Sewer System Infrastructure Analysis and Rehabilitation, 1991).

6.3. Water Usage as Percentage of Sewage

It is important to know how the use of water relates to sewage generation. As noted above, we have used the water consumption in the lowest period (winter quarter) to most accurately estimate the resultant sewage. The following tables will provide insight to how much water is actually used in the two (2) study areas.

Annual water usage records were obtained for several streets within the sewer collection districts. To estimate wastewater usage from water records, the number of occupants per residence is multiplied by a typical water usage value. Estimates were generated for the Brightwaters (Table 6-4) and West Islip (Table 6-5) collection areas. Based on these approximations, an average of 52 percent of annual water usage in Brightwaters is destined for the wastewater system and 61 percent of total water used in West Islip results in sewage.

Table 6-4. Brightwaters Collection Area Water Usage and Estimated Wastewater Flow

Street Name	Number Homes (from aerial)	Number Water Records	Water Usage (gal/yr)	Average Water Use per Account	Estimated Wastewater Flow (gal/yr)	Percent of total Water Use
West Lane	38	37	**6,889,679**	186,208	3,818,250	55
Lawrence Lane	27	27	**9,092,143**	336,746	2,710,125	30
S. Windsor Avenue	36	36	**8,471,869**	235,330	3,613,500	43
E. Concourse	15	15	**4,127,759**	275,184	1,505,625	36
Oconokee Walk	2	2	399,967	199,984	200,750	50
Totals	**118**	**117**	**28,981,417**	**1,233,451**	**11,844,250**	**40**

Water usage records were not available in Brightwaters for the following streets: Marine Court, Lagoon Court, Windsor Place, Cove Walk, and Manatuk Lane or for 32 West Lane.
Note: Estimated annual wastewater flow = number houses x 2.96 occupants/house x 93 gpd x 365 days

Table 6-5. West Islip Collection Area Water Usage and Estimated Wastewater Flow

Street Name	Number Homes (from aerial)	Number Water Records	Water Usage (gal/yr)	Average Water Use per Account	Estimated Wastewater Flow (gal/yr)	Percent of Water Use
Oak Neck Lane	32	32	**8,479,201**	264,975	2,998,840	35
Larry Lane	9	9	1,506,876	167,431	843,424	56
Athena Court	6	5	952,004	190,401	562,283	59
Kennedy Lane	9	9	1,825,393	202,821	843,424	46
Carolee Court	11	11	1,928,682	175,335	1,030,851	53
Celano Lane	16	16	2,995,919	187,245	1,499,420	50
Trues Drive	14	14	3,025,623	216,116	1,311,993	43
Sexton Drive	13	13	2,945,647	226,588	1,218,279	41
Shoal Drive	19	19	**6,032,831**	317,517	1,780,561	30
S. Pace Drive	65	65	**14,216,402**	218,714	6,091,394	43
Quay Court	3	3	1,097,639	365,880	281,141	26
Surfside Cove	1	1	300,052	300,052	93,714	31
Old Pond Court	4	4	814,147	203,537	374,855	46
Landing Ln	4	4	1,735,185	433,796	374,855	22
South end of Pace (?)	3	3	-------	-------	-------	
Totals	**209**	**208**	**47,855,601**	**3,470,408**	**19,305,033**	**40**

Note: Estimated annual wastewater flow = number houses x 3.25 occupants/house x 79 gpd x 365 days

The ten (10) residences in Brightwaters with the greatest water use in 2003 were located on Concourse, Lawrence Lane, Windsor Avenue, and West Lane, with a majority of the use occurring on Lawrence Lane and West Lane (Table 6-6). Residences on these streets also had the largest wastewater flow in 2003 as shown by the bolded values in Table 6-4.

Table 6-6. Residences with the greatest amount of water use in Brightwaters, 2003

Street name	Total Use (gal/yr)	
57 Lawrence Ln	197,250	
58 Lawrence Ln	180,750	
29 Lawrence Ln	947,250	
115 Windsor Ave	699,000	
100 Concourse	267,750	
110Concourse	622,500	
34 West Lane	72,750	
65 West Lane	311,250	
75 West Lane	207,750	
89 West Lane	459,750	

The ten (10) West Islip residences with the greatest water use in 2003 were located on Oak Neck Lane, Pace Drive, Shoal Drive and South Pace Drive, with a majority of the use occurring on Pace Drive and Shoal Drive (Table 6-7). Residences on these streets also had the largest wastewater flow in 2003 as shown by the bolded values in Table 6-5.

Table 6-7. Residences with the greatest amount of water use in West Islip, 2003.

Street name	Total Use (gal/yr/house 03)	
3 Oak Neck Ln	363,000	
133 Pace Dr	177,000	
137 Pace Dr	213,750	
161 Pace Dr	202,500	
148 Pace Dr	212,250	
100Pace Dr	213,750	
4 Shoal Dr	500,250	
20 Shoal Dr	528,000	
28 Shoal Dr	598,500	
32 Shoal Dr	348,750	

This data highlights the large variation in water consumption between individual residences. Without further investigation it is not possible to determine if this water use is related to the generation of sewage. However, the top water users should be contacted to determine if there might be a problem that the resident is not aware of such as a major leak. Such high water usage is unusual and would be a waste of a resource if its use is not intentional.

6.4. Wastewater Generation Estimates from Pump Station Reports

Weekly pump station reports were obtained from the SCDPW. The reports listed the total gallons of sewage pump station effluent for stations #1 and #3, from January 5, 2004 to December 20, 2004. The weeks were divided into the same four 13-week quarters as utilized in the 2003 water consumption records (Table 6-8) (Figure 3-2).

Table 6-8. Estimated Base Sewage Flow from Pumping Records for West Islip and Brightwaters.

	Quarterly Sewage Generation (gallons)				
Collection Area	**Feb (Nov-Jan)**	**May (Feb-Apr)**	**Aug (May-Jul)**	**Oct (Aug-Oct)**	**Estimated Base Sewage Flow/Qtr**
West Islip	6,531,360	6,357,120	6,247,560	6,786,120	**4,901,311**
Brightwaters	6,329,280	7,219,440	5,641,920	7,964,160	**2,961,063**

As noted earlier, sewage flow rates based on pumping records are not accurate. These rates are based on pump run times multiplied by the stated design capacity of the pumps. Sewage flow rates based on pumping records would be overstated particularly when both pumps are running. There is some indication that the force main is undersized resulting in extended run times to move the sewage. Yet, the data does offer an approximation of sewage generation from which important inferences can be made.

Based on DPW pumping records, the lowest sewage generation occurred in the August quarter (May-July) for both collection areas. As this period was extremely dry, infiltration

and inflow would be expected to be low due to low groundwater levels. The greatest volume of sewage was generated during the October quarter (August-October). This period was impacted by the abnormally large rainfall that occurred in the second week of October. Almost 13 inches of rain fell in a seven (7) day period or the equivalent of a 100-year storm event. Groundwater less than one (1) mile from the West Islip study area rose more than three (3) feet during this event (as evidenced by basement water in a local residence). It is estimated that a similar rise in groundwater occurred within the two (2) study areas. On an annual basis, Brightwaters generated slightly more sewage flow than West Islip. This is believed to be due to the overstated pumping records from Pump Station #3.

Estimated West Islip water consumption during the May 2004 quarter was approximately 1.7 times greater than usage in Brightwaters (Table 6-8). This corresponds exactly to the 1.7 times greater number of residences in the West Islip collection area (209) vs. the Brightwaters collection area (118) and assumes an equal number of persons reside in each household. On average, water usage in the collection areas appears to be similar. Wastewater flow should therefore show the same relationship.

However, base sewage flow estimated from water records is 1.7 times greater in West Islip (4.9 MG) than Brightwaters (3.0 MG), while estimated sewage generated from DPW pumping records in Brightwaters was 7.2 MG and 6.3 MG in West Islip. The difference between the amount of sewage estimated from water records and sewage generated from pumping records is 4.3 MG in Brightwaters and 1.5 MG in West Islip. This difference is likely due to the presence of infiltration and inflow in the pipes of each collection area, particularly in the Brightwaters area and the overstated pumping rates from Pump Station #3.

Estimated water consumption in both collection areas was 2.5 times greater during the August quarter than the base usage during the May quarter. Usage increased during the October quarter to three (3) and four (4) times the base flow for West Islip and Brightwaters, respectively. Water consumption decreased sharply during the February quarter (November-January), which correlates with a seasonal drop in irrigation, pool, and other outdoor water use (Figure 6-3).

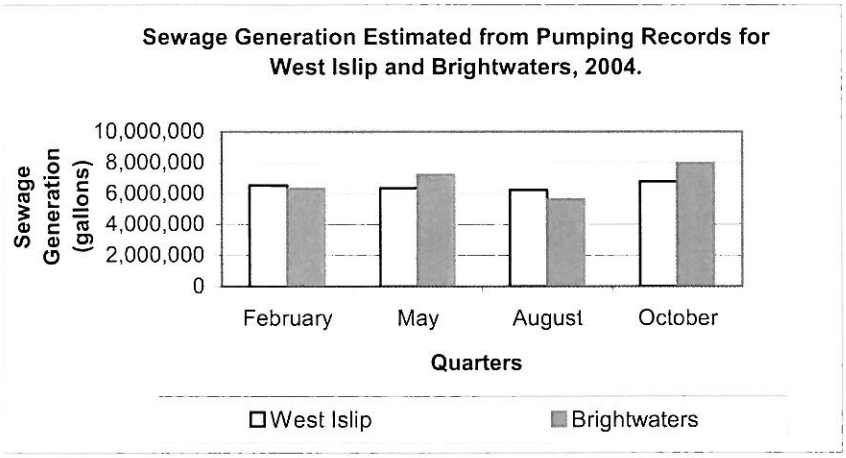


Figure 6-3. Quarterly Sewage Generated for West Islip and Brightwaters, 2004.

6.5. Wastewater Flow Measurements

Baseline wastewater flows were established in each collection area. Flow meters were installed at different times in an attempt to establish flow patterns during wet and dry periods. Wastewater flow was measured by installing a Marsh McBirney model 260 FloTote flow meter in collection pipes, just upstream of the collection area pumping stations, for a several week period. A total of three (3) deployments of flow meters were made in the collection areas. Of particular note was the failure of one (1) flow meter in the Brightwaters as a result of the October 2005 storm. The flow meter was submerged for a week and was unable to be pulled due to surcharging of the manhole (MH 227D) in front of the pump station on Shore Road. This situation remained until approximately one (1) week following the storm when the meter could be recovered. Flow meter deployment locations and operational dates are listed in Table 6-9.

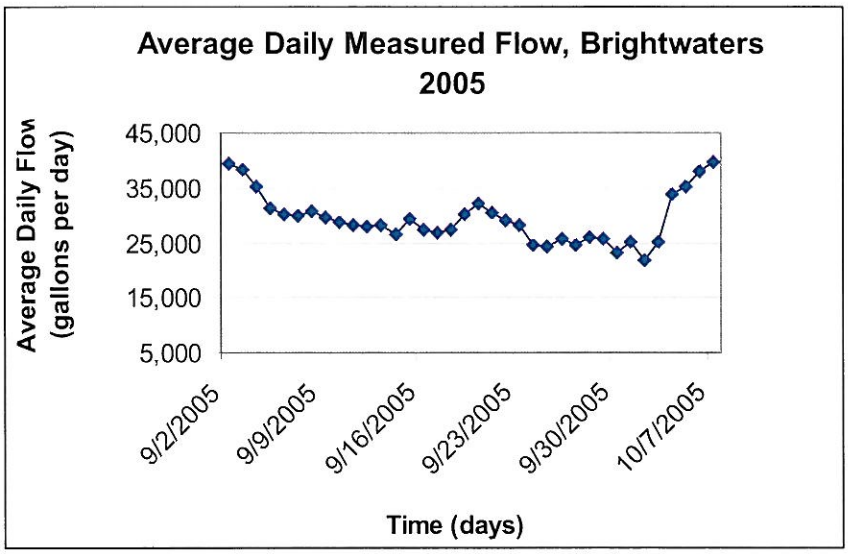
Table 6-9. Flow Meter Deployments

Collection Area	Location	No. Homes	Deployment #	Dates
Brightwaters	Pump Station No.3	118	1	9/3/05-10/1/05
West Islip	Pump Station No.1	209	2	11/10/06-12/23/05
Brightwaters	Pump Station No.3	118	3	1/13/06-2/16/06

6.5.1. Trends in Measured Flow

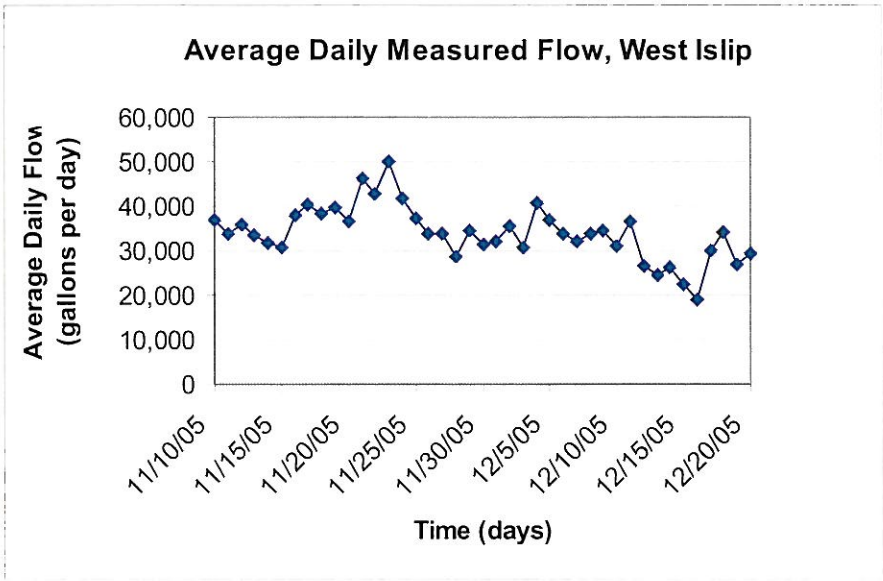
In Brightwaters (deployment #1), flow ranged from 21,958 gallons per day (gpd) to 39,730 gpd (mean = 29,376 gpd) from September 2 to October 7, 2005 (Figure 6-4). Flow displayed little variation during this period with the exception of a slight decrease from 28,123 gpd (9/23) to 24,566 gpd (9/24). Flow then decreased to its lowest point 21,658 gpd (10/2) and quickly climbed to a maximum of 39,730gpd on 10/7/05. Flow was not significantly influenced by precipitation or tidal events occurring during this deployment.

Figure 6-4. Flow Measured at Pump Station No. 3, Brightwaters 2005.



In West Islip (deployment #2), flow ranged from 16,474 gallons per day (gpd) to 45,014 gpd (mean = 31,460 gpd) from November 10 to December 20, 2005 (Figure 6-5). Flow increased from 11/15 to 11/23/05, where it peaked at 45, 014 gpd. Flow then decreased and fluctuated around 33,500 gpd until 12/11/05. Flow decreased to a low of 16,474 gpd (12/16/05) and quickly rebounded until the end of the monitoring period (12/20/05). The mid-November increase in flow may be the result of the 1.73 inches of rain that fell from November 16 to November 24, 2005. Peaks in flow corresponded to precipitation events but that increase was delayed by approximately one day. Flow was not influenced by the high tidal cycles that occurred during the new and full moon phases on 11/15, 12/1 and 12/15/05.

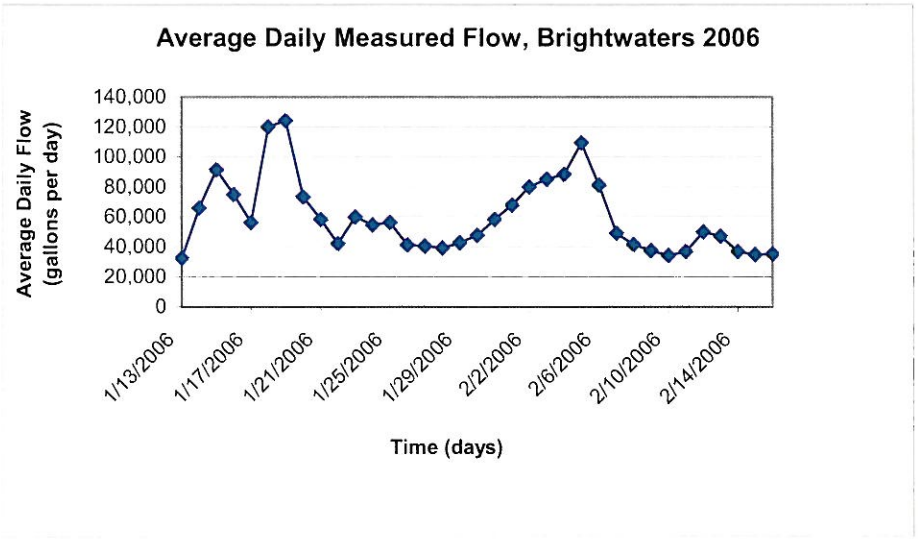
Figure 6-5. Flow Measured at Pump Station No. 1, West Islip 2005.



During deployment #3, which took place in Brightwaters from January 13 to February 16, 2006, flow varied from 34,123 gpd to 124,342 gpd (mean = 59,794 gpd) (Figure 6-6). Flow increased from 1/13 to 1/19, where it peaked at 124,342 gpd. Flow then decreased and fluctuated between 40,000 to 60,000 gpd before increasing to 109,322 on 2/5/06. Flow continued to decrease until the end of the deployment period (2/16/06), with the exception of a small peak on 2/12/06 (49,866 gpd). Flow averaged 59,317 gallons during this monitoring period. Peaks in flow coincided with precipitation events that were equal to or greater than 0.3 inches. Flow was not influenced by the high tidal cycles that occurred during the new and full moon phases on 1/29/06 and 2/13/06.

According to 2003 water records, water use is lowest from November through February and highest from August through November. Deployment #3 took place during what should be the period of lowest use, yet flow rates are approximately twice the flow measured during deployment #1 (Figure 6-4). Groundwater levels may have remained elevated from the 12.53 inches rain that fell from October 7 to October 14, 2005, resulting in excess flow. DPW staff noted that pump run times increased since the October storm on a regular basis independent of rain events.

Figure 6-6. Flow Measured at Pump Station No. 3, Brightwaters 2006



6.6. Flow Measurement by Zone – Infiltration and Inflow

An accepted methodology for determining baseline infiltration and inflow (I&I) is to divide the collection area into sub-zones and to identify key manholes that will allow measurement of flow generated within the sub-zone. By taking wastewater flow readings during low flow periods at key manholes located within the collection area, a baseline of infiltration and inflow can be established. It is best to conduct this flow monitoring during periods of minimal water usage. For the study area the quarter minimal was usage occurred during the February through April quarter.

The fall of 2005 was extremely wet, due in part to the October rains. December and January were wetter than usual. For these reasons, the first week in March was selected as it reflects a time period of low water usage and a period of relative dryness. March 2006 is the month that best fits the requirements.

In conducting this work, the field team used both a 90 degree calibrated weir and an ISCO Model 920 dual channel flowmeter. Both readings were collected during the field work. Prior deployment of Marsh McBirney flow meters indicated that the low flow periods in the study areas occur between 3AM and 4AM. Flow data collection commenced earlier at approximately 11:15PM and concluded by 3AM as it was impossible to cover all key manholes during the one (1) hour low flow period. The first reading was taken furthest from the pump station and the last reading at the influent manhole to the pump station.

6.6.1. West Islip

West Islip collection area was divided into 12 sub-zones. Figure 6-7 shows the zones and the key manholes that were entered for collection of the flow data. Prior to initiation of the data collection, the ISCO flow meter was calibrated by factory representatives in the offices of Cameron Engineering. Field work conducted on March 7, 2006 from 11:15PM until 2:45 AM on March 8, 2006. Table 6-10 shows the number of the zones and their respective flows.

Table 6-10. West Islip Flow Meter Measurements

Zone Number	MH Number	Meter (gpd)	Weir (gpd)	Street Location	Number Conn.	Net Flow	Flow/ Conn
1	12	7,997	NA	So.Pace Drive	25	7,997	**320**
2	12	3,823	NA	So.Pace Drive	24	3,823	159
3	236	6,739	5,082	Trues Drive	16	-5,081	-318
4	236	11,311	8,272	Oak Neck Lane So.	41	11,643	**284**
4A	227	NA	3,091	Shoal Drive	20	3,091	155
4B	231	7,888	NA	Sexton Drive	13	7,888	**607**
5	245	0	0	New Subdiv.	8	3,057	**382**
6	245	0	0	Celano Drive	27	0	0
7	246	0	0	Oak Neck	3	0	0
8	259	6,246	2,474	Larry Lane	14	1,308	93
9	252	0	Min.	True Harbor	17	1,582	93
10	252	5,815	4,934	Kennedy	36	3,356	93
PS	260	33,649	NA	Pump Station	All	33,649	

Note: Net flow rates are derived by deducting flow from upstream zones.
NA = Not Available. Bolded Flows per connection represent higher values.

Flow meter accuracy appears to decline when flow depth is less than 0.5 inches. While the manufacturer disputes this, Cameron Engineering weir measurements were consistently less than the flow meter in the low flow pipes. All of the flow meter values were greater than the values from the calibrated weir. The calibrated weir is more accurate in the low flow pipelines. The rates stated in the table are in gallons per day. The calibrated weir was not available until midway through the first night of field work accounting for the missing data in the table. Visual observations made through the night would indicate that in the earlier hours, presence of sewage in the piping was obvious and indicated the residence time of the flow to the pump station.

In some areas some cleaner water was present indicating dilution of the sewage by infiltration. Dividing net flow by the number of connections highlights those zones where the flow per connection is higher. Higher flows per connection may be an indication of the presence of I&I.

Figure 6-7. West Islip Subzones for Flow Measurement

Total flow entering Pump Station No.1 was approximately 33,649 gallons measured as a total of flow from the northern end of the collection system (21,234 gpd) and the southern end (12,446 gpd). This was opposite of what was expected as the streets adjacent to canals are located to the south. It is noted that a stream runs from Montauk Highway to the bay just west of Pace Drive South. There is a connection on Old Pond Court that runs from Pace Drive South to Kennedy on Oak Neck Lane. Streets of concern include Pace Drive South, Sexton Drive and Kennedy Lane.

At night (11 PM on), a commonly accepted value for sewage generation would be approximately 15 gallons per capita. Given the 209 connections for the collection area and the estimated 3.25 occupants per residence, the estimated nighttime contribution would be approximately 10,189 gallons. This is approximately one-third of what was seen at the last manhole (Pump Station influent).

Based on this particular night of sampling, the amount of I&I would be the difference between the measured flow of 33,649 gallons per day and the estimated sewage generation rate of 10,189 gpd or approximately 23,460 gpd. This is equal to an I&I rate of 16.3 gpm.

The meter was left in Manhole 260 and will continue to record until the first week in May. The longer metering period should yield additional data to confirm the estimated base flow and determine the change in flow during the coming wet weather month of April.

The sampling event revealed that the overall condition of the West Islip collection system is relatively good. Manholes were in good condition except for a few leaks and step problems in a few of the key manholes. Certain areas of the system exhibited some higher than expected flow rates, yet the higher values occurred in the early hours of the field work (11:30PM) when evidence of sewage was present indicating prior discharges to the system. Longer term flow metering may provide confirmation of the flow pattern seen on that particular night.

6.6.2. Brightwaters

Field work was conducted on March 9-10, 2006, between 11:55 PM and 2:45 AM. Field measurements were collected using a calibrated 90 degree weir and a second ISCO Model 920 Flow Meter. The collection area was divided into the zones shown in Table 6-11. Figure 6-8 shows the zones and the key manholes that were entered for collection of the flow data.

Figure 6-8. Brightwaters Subzones for Flow Measurement

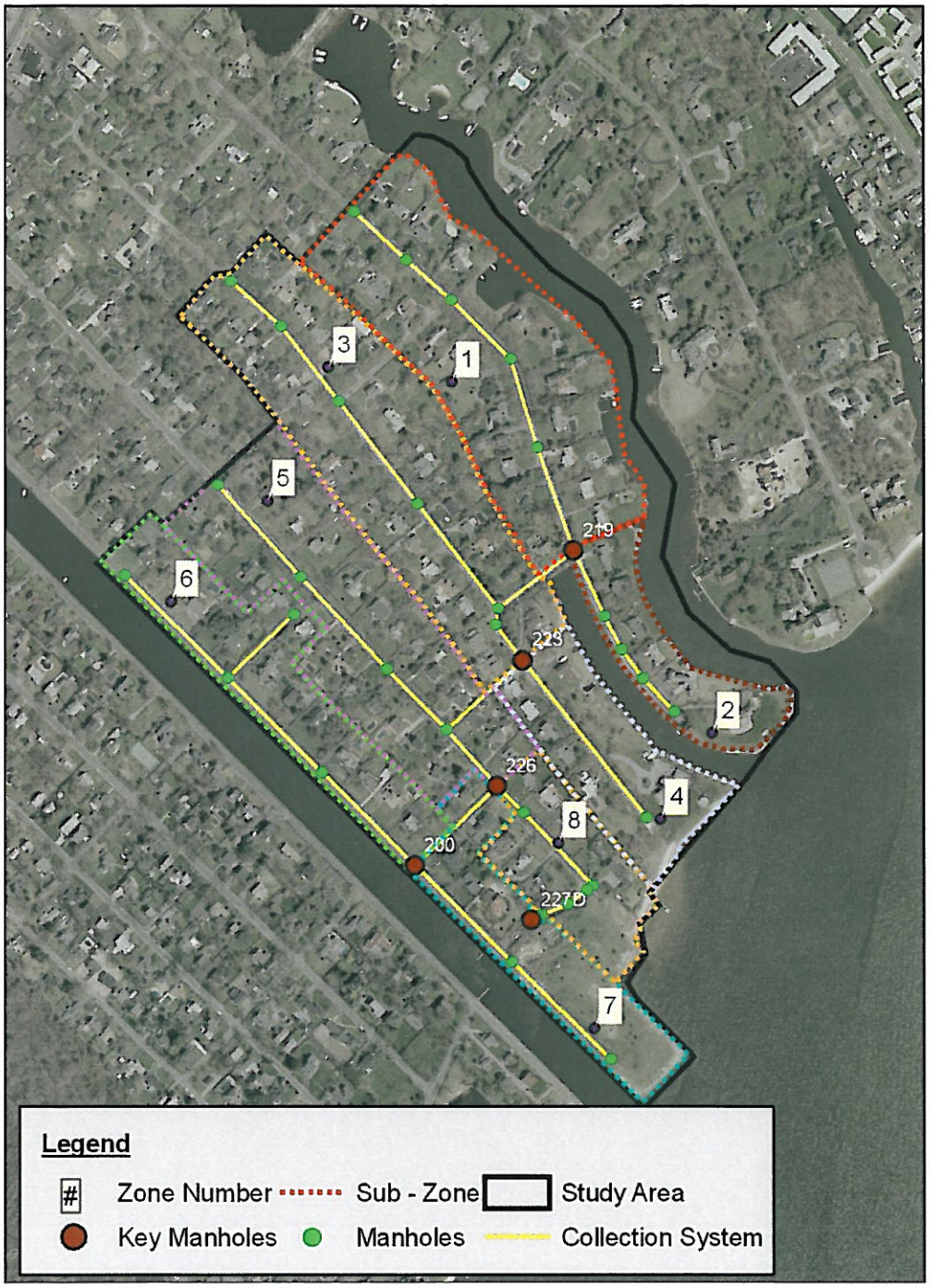


Table 6-11. Brightwaters Flow Meter Measurements

Zone Number	MH Number	Meter (gpd)	Weir (gpd)	Street Location	Number Conn.	Net Flow Rate	Net Flow/ Connection
1	219	7,997	3,700	Lawrence Lane-No.	22	3,700	168
2	219	3,823	5,300	Lawrence Lane – So.	6	5,300	**883**
3	223	6,739	5,082	West Lane + Oconee	33	8,000	**242**
4	223	11,311	8,272	West Lane So.	7	600	86
5	226	12,898	3,091	So. Windsor Ave	22	-400	-18
6	200	7,888	1,000	East Concourse – No.	9	932	104
7	200	0	0	East Concourse-So.	17	1,218	72
8	227C	24,990	21,800	South Windsor Ave–So.	8	3,050	**381**
PS	227D	24,990	21,800	East Concourse	All	21,800	

Note: Net flow rates are derived by deducting flow from upstream zones.
NA = Not Available. Bolded Flows per connection represent higher values.

Table 6-11 shows the flow rate recorded in each zone using both the weir and the ISCO Model 920 Flow Meter. The last flow reading taken at Manhole 227D directly upstream of Pump Station No.3 was 23,395 gpd (average of meter and weir). Applying the 15 gpd nighttime sewage flow per resident would yield an expected flow rate of 5,239 gallons.

The I&I volume is therefore the difference between the measured flow of 23,395 gpd minus the estimated sewage nighttime flow of 5,239 gallons per day or approximately 18,156 gallons per day or 12.6 gpm.

Dividing net flow by the number of connections highlights those zones where the flow per connection is higher. Higher flows per connection may be an indication of the presence of I&I.

6.6.3. Infiltration by Inch-Mile

Another check on the magnitude of the infiltration of a collection system is to divide the calculated infiltration and inflow by the total length of the collection system. This gives a result in gallons of I&I per inch mile of sewer. One mile of 8-inch diameter sewer is considered 8-inch miles of pipe. A value of 2,000 gpd of infiltration per inch mile is typically considered a significant value that requires action.

West Islip has 15,573 linear feet of lateral connections. Adding 40 feet per house connection for 209 connections (8,360 lf) there is a total of 23,933 linear feet resulting in 36.26 inch-miles of pipe (assuming the house connection is also an 8" pipe). Dividing the estimated I&I flow of 23,460 gpd by 36.26 inch-miles of pipe yields 647 gpd per inch mile. This is well below the EPA action standard of 2,000 gpd per inch mile.

Brightwaters has 11,449 linear feet of laterals. Adding 40 feet per house connection for 118 connections (4,720 lf) there is a total of 16,169 linear feet resulting in 24.49 inch-miles of pipe. Dividing the estimated I&I flow of 18,156 gpd by 24.49 inch-miles of pipe yields 741 gpd per inch mile. This is below the EPA action standard of 2,000 gpd per inch mile.

These data indicate that during dry periods that coincide with low water use periods, the amount of I&I recorded is within acceptable levels. All indications suggest that this is not the case during wet weather periods. Indications are that I&I during wet weather periods is significant.

6.7. Estimated Infiltration and Inflow from Flow Measurements and Water Records

Infiltration and inflow is estimated by comparing measured wastewater flow to the baseline estimated sewage generation extrapolated from water usage records and from actual flow measurements taken during low flow low water use periods. Infiltration and inflow flows would be considered problematic if measured wastewater flows were significantly higher during the baseline period than the projected water consumption and subsequent calculated sewage flow.

The table below shows the estimated Infiltration and Inflow by comparing the low use water records to the flows recorded during the initial deployments. Of particular interest is that the first deployment in Brightwaters shows that I&I flow is non-existent. This is consistent with DPW records as the September period was following an extremely dry July, August and September. The second deployment in Brightwaters following the October storm shows that I&I has now jumped from a negative 8,442 gallons per day to a positive 26,953 gallons per day.

The West Islip deployment shows a negative value as well. This would indicate that the system did not suffer the same lasting after effects of the October storm that the Brightwaters system did.

Table 6-12. Infiltration and Inflow Estimates from Sewer Flow Measurements and Water Records.

Item No.	Collection Area	Brightwaters (Sept-Oct 05)	West Islip (Nov-Dec 05)	Brightwaters (Jan-Feb 06)
0	Number of days in measurement period	26	54	34
1	Measured wastewater flow (gallons per day)	23,922	35,399	59,317
2	Baseline Sewage Flow West Islip	0	53,720	0
3	Baseline Sewage Flow Brightwaters	32,364	0	32,364
4	**Estimated I & I (Item 1-Item 3/Item 4)**	**-8442**	**-18,321**	**26,953**

50% of water use used to estimate this quantity since usage is higher during this quarter.

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