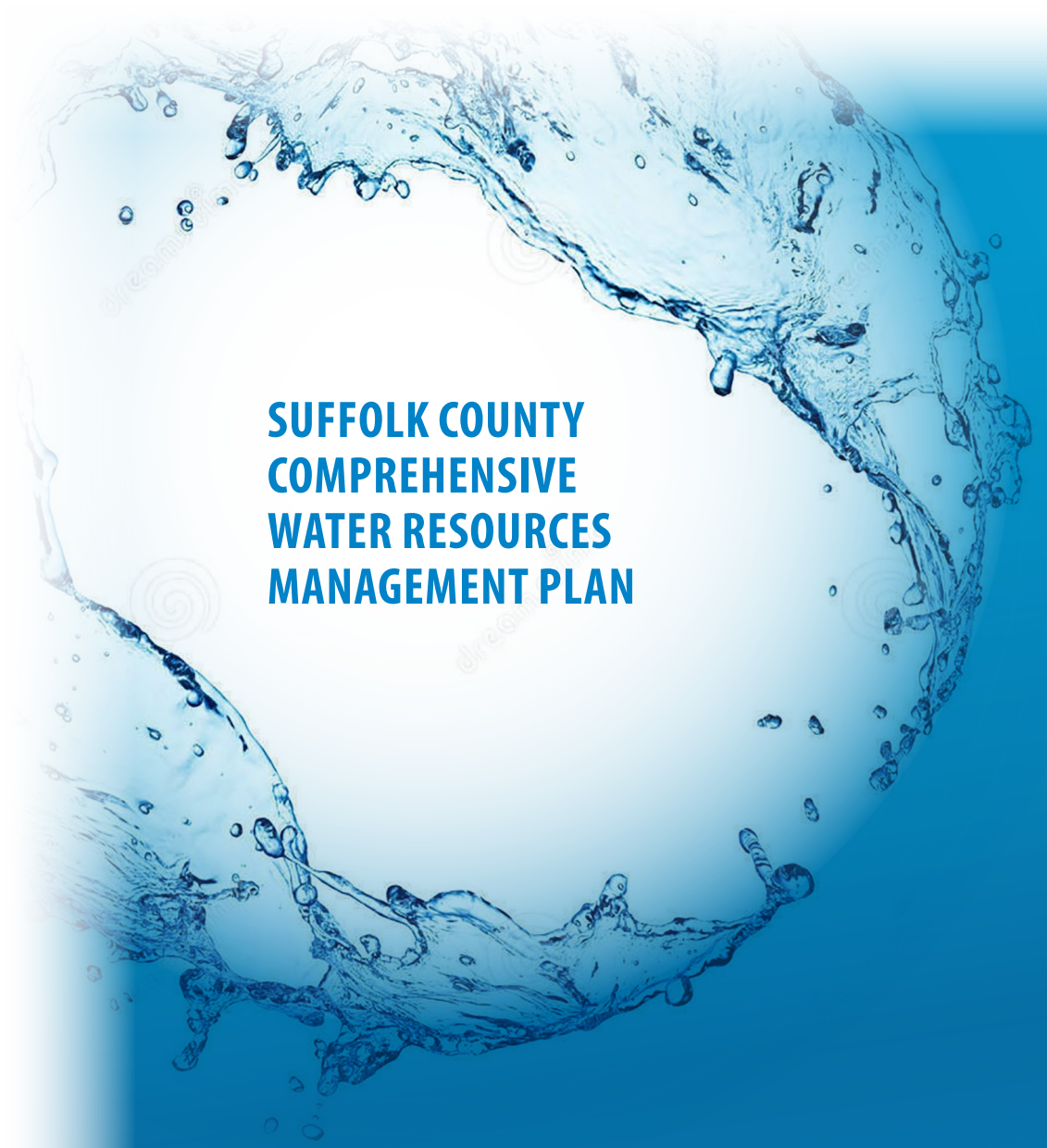


SUFFOLK COUNTY
COMPREHENSIVE
WATER RESOURCES
MANAGEMENT PLAN

Section 2

WAYS AND MEANS TO ADDRESS WATER QUALITY

Section 2
Ways and Means to Address Water Quality

If a benign monarchy were to assume the seat of power in the sovereign County of Suffolk, how might it consider water quality? Upward trends for contaminants in the drinking water drawn from beneath this majestic land are surely cause for concern. More notably, impaired surface waters have been eating away at protective ecosystems setting off alarms in the wake of Superstorm Sandy. The potentate would be relieved that relief has recently come in the form of major new sewer extensions and the launch of an on-site wastewater pilot program. With a taste for cleaner waters, sovereign subjects are showing an appetite for ever more. How to go about funding further improvements short of sowing the seeds of revolt among a populace besieged by the cost of living?

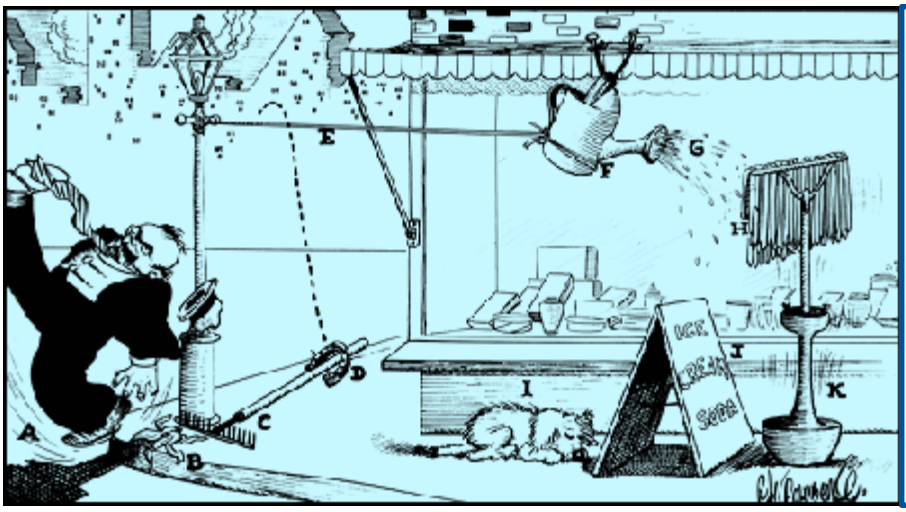
Comprehensively managing water resources holds indisputable benefits for the commonweal. Alas, water operations in the Land of Suffolk are currently Balkanized, absent benefits that accrue to a goodly number of other realms. Without linkage between delivery of water and its treatment once dispelled, there is scant means to check negative impacts. Rock-bottom water rates mean no provision is made beyond maintenance mode. In/out metering along with the leveling of disparate billing in existing sewer districts, would not only be the fair way to go, but augment some of the other ways and means to Reclaim Our Waters.

"People commonly use statistics (economics) like a drunk uses a lamp post; for support rather than illumination."

–Mark Twain

The political/legislative process is often equated to a sausage factory. You don't really want to know what went into a final product; it's tough to swallow and can clog up your system. The bottom line had best be submerged. As Thomas Barthold, currently Chief of Staff for The Joint Committee on Taxation, put it, "*politicians often prefer regulations with obvious benefits and hidden costs over regulations with hidden benefits and obvious costs.*" Or, as Massachusetts Institute of Technology (MIT) economist Martin Gruber put it, "*Lack of transparency is a huge political advantage*." The result, as one analyst observed, is typically a hodgepodge of exacting, opaque regulations, mandates, subsidies, and tax measures that would make Rube Goldberg blush.

SECTION 2 MEANS AND MEASURES



Passing man (A) slips on banana peel (B) causing him to fall on rake (C). As handle of rake rises it throws horseshoe (D) onto rope (E) which sags, thereby tilting sprinkling can (F). Water (G) saturates mop (H). Pickle terrier (I) thinks it is raining, gets up to run into house and upsets sign (J) throwing it against non-tipping cigar ash receiver (K) which causes it to swing back and forth and swish the mop against window pane, wiping it clean.

Torn between saving the world and savoring it, E.B. White said, makes it difficult to plan the day. Or, as Dwight D. Eisenhower observed, *"In preparing for battle I have always found that plans are useless, but planning is indispensable."* Planning documents are heavily weighted with "rational choice" modeling. In this model, decision making is guided by probability and utility. Economist Herbert Simon, among others, began noting in the 1950s that this model came up short in predicting how people actually make decisions. Predictions made by the so-called "rational actor" proved to be bounded by the information available, cognitive limits, undifferentiated means and ends, and will o' the wisps of all varieties. How, then, to account for the chain reaction variables resulting from decision-making?

By the 1970s, the answer behind Door #2 was heuristics, hunches based on pre-existing associations, subject to trial and error and/or Monte Carlo simulation. This process can be referred to simply as "back of the envelope calculation," or, with more gravitas, a Fermi estimate. Know that the long and winding road of public policy formulation and implementation is a random walk or a stochastic process, as academics call it. Resilience is the capacity to adjust and bounce back like a well-trained, opportunistic fighter imbued with situational awareness.

Multiple arrow types in the quiver such as adaptive skills, flexibility, anticipation and back-up plans all contribute to outcomes. What follows, then, cannot be a roadmap, but a manual of ways and means, subject to circumstances and determinations of decision-makers enroute.

2. 1 Infrastructure in the Age of Scarcity

"We've run out of money; it's time to start thinking." –physicist Ernest Rutherford

Bill Clinton has said that most Americans start out thinking the federal government couldn't run a two-car funeral. Now they worry that one of the two cars should have been recalled and the other can't go anywhere because Congress is still fighting over whether to fix the road.

"*Our infrastructure is on life support right now*," declares Ray LaHood, former secretary of transportation and currently co-chairman of Building America's Future. One disturbing example is the 70,000 bridges in America -- one out of every nine – that are considered to be structurally deficient. "*I don't want to say they're unsafe*," says LaHood. "*But they're dangerous*." Amtrak president Joe Boardman expressed the crux of the matter: "*It's less a case of wanting to get something done, than coming up with the hundreds of billions of dollars needed to do it*." (http://www.cbsnews.com/news/falling-apart-america-neglected-infrastructure/ -"60 Minutes," Steve Kroft, Nov 23, 2014).

Forty percent of the pipes used in the nation's water distribution systems are forty years old or older, and some key infrastructure is a century old. On average, about 16 percent of the nation's piped water is lost due to leaks and system inefficiencies, wasting about 7 billion gallons of clean and treated water every day (U.S. Environmental Protection Administration [USEPA] 2013; Maxwell 2013).

The share that corporate tax revenues comprise of total federal tax revenues also has collapsed, falling from an average of 28 percent of federal revenues in the 1950s to 7.4 percent in 2003 (J. Friedman, "The Decline of Corporate Income Tax Revenues," Center on Budget and Policy Priorities, 2003). Companies have been called economic traitors for seeking to lower their tax bills by moving overseas. But life insurers are accomplishing the same goal without leaving the country, saving as much as $100 billion in federal taxes, much of it in the last several years. Through complicated accounting maneuvers, the money escapes federal taxation. (M. Walsh, "Life Insurers Use State Laws to Avoid as Much as $100 Billion in U.S. Taxes," NY Times, 12/12/14)

When County Executive Steve Bellone assumed office in 2012, Suffolk was facing a half billion dollar deficit. Two years into his term he announced the County was going to "**Reclaim Our Waters**" by targeting nitrogen loading as "*Public Water Enemy #1*." Heretofore, Suffolk had been in monitoring mode, gauging disturbing upward trends in groundwater contaminants and the wholesale degradation of surface waters. These developments have coincided with a 22% loss of staff in Suffolk's Department of Health Services' Environmental Division since 1998. Despite a drop in testing and inspections, Suffolk still meets state and federal requirements.

"*We're focused on 'how do we solve' the water quality problem*," Newsday quoted the County Executive as saying. "*We've done tons of testing and we know we have water quality issues…. We need to get to actually solving the problems*…. (As) *we live in an era of permanent fiscal scarcity*," Bellone said, "*resources are better spent installing sewers and approving advanced septic systems* (Schwartz, D. "Suffolk cutbacks reduce water testing, pollution inspections," Newsday, 9/9/14)."

Over four decades ago, U.S. Surgeon General Jesse Steinfeld was asked what studies supported his contention that second-hand smoke was hazardous to health. Drawing on common sense, he simply deduced that if, as had already been determined, outdoor air pollution was hazardous, it stood to reason that indoor air pollution was as well. Studies finally produced in the '80s affirmed this deduction. For the Surgeon General, it had been a straight forward case of garbage in, garbage out, clean it up now.

Eel grass is akin to the canary in the coal mine of aquatic nitrogen loading. In certain Rhode Island locales that have been installing denitrifying wastewater systems, eel grass, reportedly, hasn't consistently rebounded. Invoking this single variable, some question the efficacy of nitrogen reduction, a conclusion that Surgeon General Steinfeld would, likely reject. There is enough evidence of nitrogen pollution's damaging impact; further granularity to that end is welcome, but will not stall action to check nitrogen loading.

Calling nitrogen pollution "a national and international problem," Governor Andrew Cuomo announced October 29, 2014 that Suffolk County would be receiving close to $400 million to extend sewers to 15,000 homes. The Governor's 2100 Commission stated that, "Our coastlines, one of our most vulnerable assets, are home to a vast majority of the State's population. Because of the significant risk of coastal problems resulting from climate change, this category… focuses specifically on immediate actions to restore and mitigate coastal infrastructure to protect communities, and on strategies for using natural as well as engineered measures to improve resilience."

This initiative was buttressed by a report several months earlier from New York State Department of Environmental Conservation (NYSDEC) that spotlights "*the noxious effect excess nitrogen pollution has on marshland systems that help to protect Long Island against storms like Sandy. Based on this information, it is imperative that efforts to improve coastal storm resiliency include actions to significantly reduce nitrogen pollution*" (NYSDEC, "Nitrogen Pollution and Adverse Impacts on Resilient Tidal Marshlands," http://www.dec.ny.gov/docs/water_pdf/impairmarshland.pdf April 22, 2014). As the first substantial addition to sewer infrastructure in Suffolk in over thirty years, County Executive Bellone declared that these projects will "*dramatically jump start our effort*."

While investment and innovation in the energy sector have soared in recent years, investments in new technology for water markets have stagnated just above zero. In sum, many of the economic mechanisms that are typically used to allocate a scarce resource—such as trading, pricing, and investment in more efficient technology—are absent from our nation's water markets.

2.1.1 Conventional Financing

In 2012, Resolution No. 18-2012: RESOLVED… to *"determine the best and most appropriate structure and method of implementing an* ***infrastructure bank*** *in Suffolk County,… as well as the potential benefits and costs associated with the County establishing same."*

With but one variation on the theme, there are no county or municipal versions of infrastructure banks (IB) akin to Federally-sponsored state IBs that address transportation and water systems, such as the New York State Environmental Facilities Corporation (EFC). The Chicago Infrastructure Trust has been the one departure which was, according to Mayor Rahm Emmanuel, going to be the "breakout strategy" for modernizing buildings and bridges without waiting to be sprinkled by Uncle Sugar. In 2012, Mayor Emanuel touted the 1,000 city buildings, $225 million in investment and $20 million in energy savings that was to create 2,000 construction jobs. Two years later all that has materialized is 100 projected jobs linked to a $12.2 million deal, notably less than the $22 million that went into the city's bike-sharing program. "*We built this grand scheme to do these great things and then we do this underwhelming project,*" said one Chicago alderman.

Finding a work-around for the MIA status of Washington is proving a heavy lift.

The infrastructure bank buzz of 2012 spurred a Long Island attorney and trade union member to suggest that, "*by establishing a public-private partnership and creating a local infrastructure bank, the trade unions here could secure work for their members while simultaneously addressing some of Long Island's most pressing needs* (M. Glennon, "Special banks can help LI rebuild," Newsday 3/2/11)." Exploratory exchanges with the County led him to conclude, "*that any workings with Suffolk County on a regional I-Bank is most probably premature at this juncture.*" Note that a mere 1 percent of pension funds worldwide are invested in infrastructure (*Pension Funds Investment in Infrastructure/A Survey*, http://www.oecd.org/sti/futures/infrastructure2030/48634596.pdf).

The premise that union pension funds could be viably invested in infrastructure has been embraced by Borealis Infrastructure, an arm of Ontario's large municipal workers union, Ontario Municipal Employees Retirement System (OMERS) that makes major international investments. The president of Service Employees International Union (SEIU) 32BJ, with more than 120,000 members in the Northeast, reported that he had been examining possible infrastructure investments for his union's pension fund. An investment in a new Tappan Zee Bridge, for instance, could generate a reasonable return. *"You don't put common good above returns,"* he noted, "*but you can accept a return that's suitable in a basket of different investments. That's the way you have to view infrastructure investments.*" It took eight years to seal the Chicago Skyway deal, and its greatest distinction is that it is the costliest interstate road in the U.S. (Federal Highway Administration). As one analyst observed, "*Many pension funds don't have a clue of the risks involved.*"

A **Public Private Partnership** (P3) is an entity that undertakes the development of all or part of an infrastructure project, which will have a public benefit, pursuant to requirements established in one or more contracts between the entity and a State or an instrumentality of a State. A P3 is an institutional arrangement in which a private entity assumes some level of risk beyond that traditionally associated with supplying its services to a government agency (projects that lend themselves to private operation: roads, rail, and water supply and wastewater treatment). The risk to the private entity of not recouping its investment often is mitigated by advantageous financing available through government sponsorship of the project and through terms that grant the private entity exclusive rights to provide the services in question, i.e. Chicago Skyway (99-year lease/$1.83 billion).

A P3 arrangement differs from conventional public procurement in several respects. In a P3 arrangement, the public and private sectors collaborate to deliver public infrastructure projects – such as roads, railways, airports, hospitals and schools. P3 contracts typically involve not only the delivery of the infrastructure, but also the management of the facility, maintenance and service delivery. Locally, energy-from-waste facilities such as the Covanta plant in West Babylon provide revenues for the private and public partners through power generation and tipping fees.

The Water Resources Reform and Development Act (WRRDA) of 2014 was overwhelmingly approved by Congress in June. At the core of WRRDA is the Water Infrastructure Finance and Innovation Act (WIFIA) which will offer low-interest federal loans and loan guarantees to help finance water projects through public-private partnerships (P3s). A five-year pilot program would authorize the Army Corps of Engineers and the Environmental Protection Agency to provide up to $175 million in direct loans and loan guarantees for the construction of critical water infrastructure projects. WIFIA loans could be used for up to 49 percent of project costs for large projects in excess of $20 million. Municipalities would not be able to use tax-exempt debt to finance the remaining 51 percent of project costs, encouraging the use of private financing. A prime driver of WRRDA is the evaluation of P3s to accelerate a $60 billion backlog of Corps projects for harbor and waterway upgrades, storm/flood mitigation, and restoration of aquatic ecosystem. P3 projects will be evaluated based on economic significance, leverage, use project delivery, and cost-savings.

The program is modeled after the Transportation Infrastructure Finance and Innovation Act (TIFIA) administered by the Federal Highway Administration, which has helped finance many P3 transportation projects nationwide, including the Capital Beltway High Occupancy Toll (HOT) Lanes in northern Virginia, the Port of Miami Tunnel expansion project in Florida. Unlike TIFIA, WIFIA does not allow project sponsors to use tax-exempt debt to cover any portion of the remaining 51 percent (or more) of project costs, including private activity bonds (PABs). Bottom Line: the WIFIA program appears to be a toe in the water. As Brown & Myers, a law firm that plies this sector, concluded, "*Given that the nation's water infrastructure needs are, by most estimates, even larger in total than its transportation needs, this is clearly a "pilot" program—with a very small "p."*

Figure 2-1 summarizes currently identified methods of financing water supply and wastewater infrastructure projects.

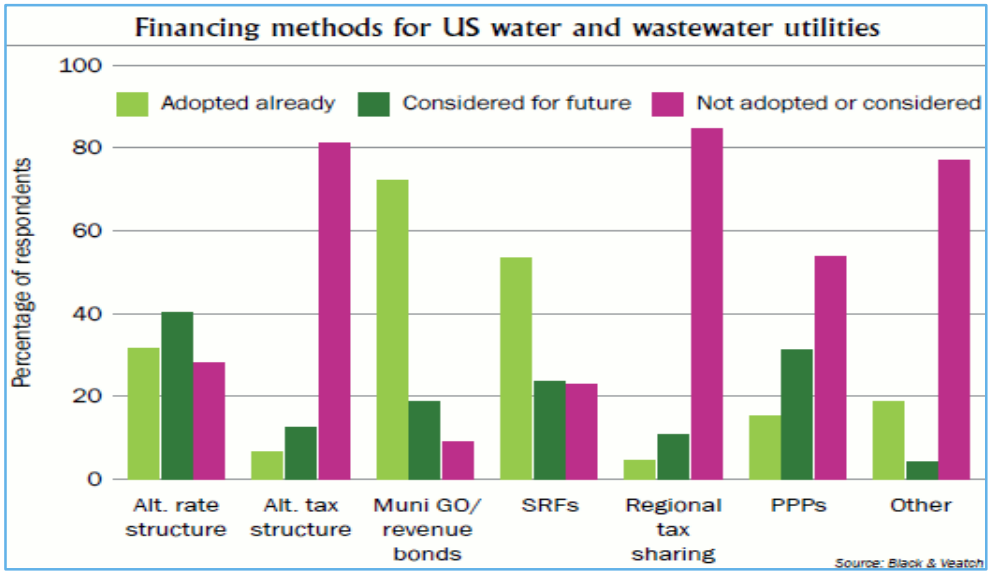
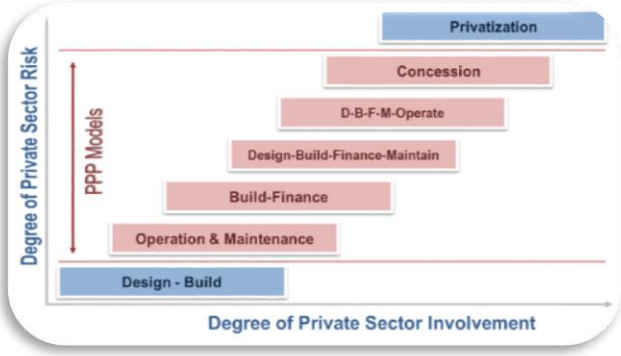


Figure 2-1 Financing Methods for Water and Wastewater Facilities in the United States

The P3 Nassau County signed its sewer system on to in mid-2014 is a 20 year operations and maintenance (O&M) contract, projected to save $158 M largely predicated upon manpower productivity. The size of dedicated workforce will be almost halved, but no current sewer employees will lose their job. Those who don't go with United Water, leave or retire will be given positions elsewhere in the county, and that added cost will, ostensibly, be balanced by cuts in overtime (Y factor). Overall, this deal does not work if Nassau walks away from capital operations. The cost of addressing the considerable capital improvements required by the large Bay Park and Cedar Creek sewage treatment plants (STPs) is the major X factor in this deal. Nassau would pay United Water $57.4 million a year -- adjusted annually for inflation -- to run three sewage treatment plants serving 1.16 million residents.



P3s typically share the following features (*A Guide to Guidance for PPPs*, European Investment Bank, Jan, 2011):

- A long-term P3 contract between a public contracting authority and a private sector P3 company based on the procurement of services, not of assets;
- The transfer of certain project risks to the private sector, primarily in the areas of design, build, operations and finance;
- A focus on the specification of project outputs rather than project inputs, taking account of the whole life cycle implications for the project;
- The application of project finance to underpin the risks transferred to the private sector;
- Payments to the private sector which reflect the services delivered. The P3 company may be paid either by users (toll motorway), by the Authority (availability payments, shadow tolls) or by a combination (low user charges together with operating public subsidies).

Many state and local governments looked at P3s as a way to monetize the market values of infrastructure-like toll roads in order to use the proceeds to alleviate public sector budget deficit. A 2011 report from the New York State Comptroller offers its take in "Controlling Risk without Gimmicks: New York's Infrastructure Crisis and Public-Private Partnerships". This procurement approach has suffered from various setbacks, including a lack of senior funding, bullish economic valuations by bidding consortia and continuing concerns over the protection of the public interest (P3 Development in the US, Brian Chase, Campbell Lutyens, Dec/10). *"I view the fundamentals of the asset class as being the equivalent, or even better, than the fundamentals of the real estate class forty* years ago," Campbell Lutyens' CEO observed. (http://www.prequin.com/docs/quarterly/INF/Infrastructure_Quarterly_-_Q1_2012.pdf)

Special purpose entities (SPE) or vehicles are pass-through frameworks used for structured finance in P3s to capture attributes from the respective sectors such as low-cost capital available to municipalities and tax credits and depreciation that can only be claimed by corporate entities, as shown by **Figure 2-2.** Pass-through structures pass along all of the principal and interest payments of assets to the respective investors.

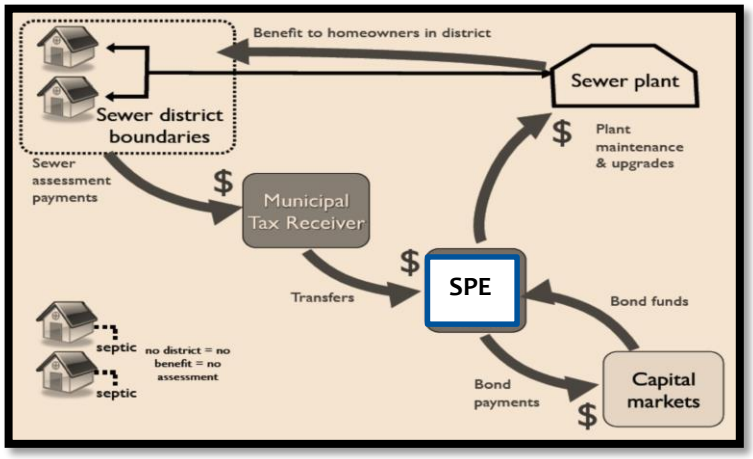


Figure 2-2 Special Purpose Entity

Pass-through structures are therefore generally passive tax vehicles and do not attract tax at the entity level. Pay-through structures allow for reinvestment of cash flows, restructuring of cash flows, and purchase of additional assets.

In 2011, operation and ownership of water and sanitary sewer services in Indianapolis transferred from the city and a public-private partnership to a Public Charitable Trust. In the transition, Citizens Water assumed operations of the water utility from Veolia Water Indianapolis and took assignment of the city's contract with United Water to operate the wastewater system. Most city and Veolia employees who served the water and wastewater systems are now Citizens employees. In the 2010 Memorandum of Understanding (MOU) between the City and Public Charitable Trust, "*Citizens' exemption from federal and state income taxes, its ability to assume or replace and to issue tax-exempt debt and its regulation as a municipal utility without a required return to equity investors will result in substantial long-term benefits to the City and to customers*." Six pages later, the MOU makes the commitment that "*rates shall increase no more than 10.75% annually through 2013*." The results and system characteristics can be summarized as follows:

- City relieved of $1.5B in public debt by Citizens Water's acquisition of the water system for the cost of debt plus $262.6M for the equity in the wastewater system;
- All assets and liabilities assumed, including EPA consent decree for sewer overflow;
- Bond for increase in future increases in payments in lieu of taxes (PILOTs) brought in $425M for infrastructure;
- Transfer expected to keep water and wastewater rates 25 percent lower than projected and save the city $60M/year;
- City will pay Veolia $29M for early termination of contract;
- Water and sewer infrastructures cover approximately 320 square miles;
- The wastewater utility serves 230,000 households in metropolitan Indianapolis;
- Citizens Water is part of 125 year-old trust - Citizens Energy Group; and
- Citizens operates the nation's second largest steam and chilled water distribution system for large commercial customers.

2014 Update on Citizens: *The Indiana state regulator found that "Citizens Water's level of executive compensation was not appropriate for a municipal utility" and limited a requested 14.7% rate increase to 9%.*

Infrastructure Bank known as a Clean Water State Revolving Fund. EFC has financed a $15 million

sewer extension to the Wyandanch Rising redevelopment and is providing financing for $83 million atop the $300 million coming via Housing and Urban Development's (HUD's) Sandy Recovery funding for major installations on four sub-watersheds feeding the Great South Bay. The EFC role in Suffolk's on-site wastewater management program is considered later in this chapter.

2.1.2 Dedicated Funding Streams

Excise taxes, user fees, systems benefit charges, sin taxes, property transfer taxes, tax credits, permits are all revenue producing mechanisms. User fees, in particular, are considered an equitable and reliable market mechanism. Adam Smith mentions that when infrastructure is privately provided and sustained with user fees, a market test filters out the waste: "*When high roads are made and supported by the commerce that is carried on by means of them, they can be made only where that commerce requires them*" (Smith, Adam. 'Wealth of Nations,' 1776. V.1.III.1). Taxes can be assessed as user fees to fund specific direct expenditure programs. This is sometimes called the benefit principle of taxation; those who benefit should pay the taxes.

As previously stated, current Chief of Staff for the (nonpartisan) Joint Committee on Taxation of U.S. Congress, Thomas Barthold, noted that "*politicians often prefer regulations with obvious benefits and hidden costs over regulations with hidden benefits and obvious costs.*" This is one reason why politicians often prefer to hand out permits to firms rather than impose a tax on them, even though the tax is more economically efficient. Free permits create winners of grandfathered firms and losers of the consumer who has to pay more for the same product (Barthold, Thomas A. (1994) "Issues in the Design of Environmental Excise Taxes," The Journal of Economic Perspectives, 8(1): 133-151).

In the aftermath of the Exxon Valdez oil spill, Congress in 1989 imposed an additional **excise tax** on petroleum and petroleum products to fund the Oil Spill Liability Trust Fund. Congress began considering legislation in the 1990s to impose a carbon tax as an approach to dealing with global warming and proposals that would use taxes and/or subsidies to promote recycling. At the same time the EPA (1991) discussed using taxes to deal with the problem of lead leaching into ground water from landfills, the disposal of used automobile tires, the disposal of pesticide containers, and other environmental concerns. President Bill Clinton weighed in with a proposal for a modified BTU (energy) tax. None of these proposals passed muster. Over the course of the '90s and '00s, ozone depleting sulfur dioxide and nitrogen oxide emitting from coal-fired power plants were brought under control in a cap and trade Acid Rain Program, an emissions trading program with similarities to transfer of development rights.

The Maryland Department of Environment (MDE) uses the revenue from the Bay Restoration Fund (BRF) commonly referred to as the "**flush tax**," to fund improvements to wastewater treatment plants owned by utilities throughout the state. The upgrades primarily reduce nitrogen and

phosphorus pollution into the Chesapeake Bay. As of 2012, the BRF Fee was doubled to $60/year charged as a fixed fee generating an estimated $55M/year. Sixty percent of these funds are used for septic system upgrades and the remaining forty percent are used for cover crops. There are 420,000 onsite systems in Maryland. With priority given to failing septic systems in 'Critical Areas' – within 1,000 feet of adjoining waterways – a best available technology (BAT) nitrogen-reducing system, usually a $10,000-to-$12,000 investment, is granted through the program. More recently, '**Rain tax**' legislation would impose a stormwater pollution fee to raise revenue to clean up the Chesapeake Bay (http://mgaleg.maryland.gov/2012rs/bills/hb/hb0987e.pdf).

The State of Massachusetts offers a **tax credit** (General Laws Chapter 62) for forty percent of the repair or replacement of failed cesspools or septic systems up to $6000, spread over 4 years at $1500 per year (few have been extended to date). Despite the State's commitment, not all feedback has been positive. Comments included: "Four years of $1500 deduction. I think the amount was based on some fantasy that the average septic upgrade was about $6,000. In your dreams. Mine cost $30K …. Took 1½ years to get the foolish permit. Because I was too close to a wetlands, and have to pay $425/year for mandatory testing and checking."

The Suffolk County Water Authority (SCWA) charges $1.67/ 1000 gals of water, among the cheapest rates in the country, effectively 1/8000th the amount one pays for a pint of bottled water. The Authority assigns nary a penny to treat the water they deliver that is immediately contaminated upon delivery. Though not certifiably impaired like surrounding waters, groundwater is manifesting disturbing upward trends in nitrogen content and other contaminants. Adding a $0.25 **aquifer protection fee** to every 1,000 gallons would cost the average homeowner a mere $20/year and effectively double the amount the County currently collects for wastewater treatment, as shown on **Figure 2-3.**

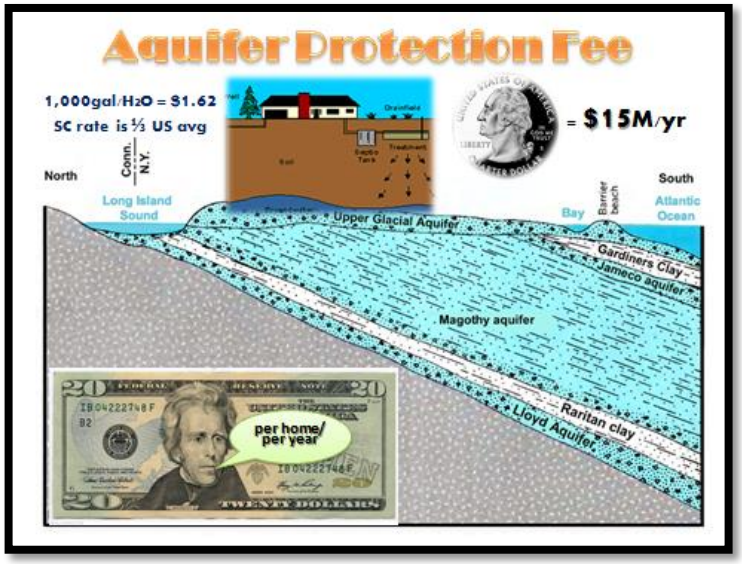


Figure 2-3 Aquifer Protection Fee

The Community Preservation Fund (CPF) was passed into law 16 years ago, bringing in $1 billion over that time (from a 2% **property transfer tax** after first $250,000) for the preservation of open space which has protected 10,000 acres in the five East End Towns. Assemblyman Fred Thiele Jr. (I-Sag Harbor), who sponsored the original CPF legislation 16 years ago, believes that 10 percent of this fund should now be used to Figure improve water quality by providing financing for water treatment systems. The plan would extend the CPF's time frame, from the current 2030 sunset through 2050. Thiele estimates that through 2030, $1.2 billion will be collected for land acquisition and $2.7 billion through 2050.

South Carolina established in 2007 **catastrophe savings accounts** that enabled residents to establish cash reserves for qualified catastrophe expenses. The amount placed in the account reduces the taxpayer's state income tax. A homeowner may deduct contributions to a catastrophe savings account to cover losses to the owner's legal residence against hurricane, rising floodwaters, or other catastrophic windstorm event damages. **Tax incentive** programs such as this one are devised to encourage homeowners to take out a larger deductible on their insurance policy and contribute more to the Catastrophe Savings Account. In the process they pay lower insurance premiums and lower taxes at the same time. The insurer benefits by having lower claims following a disaster. Many homeowners raising their deductible will reduce the insurer's catastrophic exposure. South Carolina also offers tax credits for retrofitting, allowing individuals to take tax credits for costs associated with specific fortification measures and the required materials. (http://www.doi.sc.gov/faqs/CatSavingsAcct.htm.)

Estimated 2007 Insured Value of Coastal[1] Properties by State ($B) State	State Total ($B)	Coastal Counties[2] ($B)	Percent Coastal
Alabama	744.8	92.5	12%
Connecticut	750.4	479.9	64%
Delaware	170.8	60.6	36%
Florida	3,119.6	2,458.6	79%
Georgia	1,573.3	85.6	5%
Louisiana	638.4	224.4	35%
Maine	250.0	146.9	59%
Maryland	1,078.4	14.9	1%
Massachusetts	1,426.4	772.8	54%
Mississippi	394.6	51.8	13%
New Hampshire	237.4	55.7	23%
New Jersey	1875.2	635.5	34%
New York	3,851.1	2,378.9	62%
North Carolina	1,431.8	132.8	9%
Rhode Island	189.3	54.1	29%
South Carolina	698.2	191.9	28%
Texas	3,493.0	895.1	26%
Virginia	1,409.4	158.8	11%
All States Above	23,332.4	8,890.8	38%
Total U.S.	53,495.0	8,890.8	17%

urce: Insurance Information Institute and AIR Worldwide June 11, 2008 release

Mitigation Funding has been extensively evaluated in that most vulnerable of states – Florida - where Voluntary Home Hardening Loans have been considered. While mitigated properties may increase in value due to the added mitigation features, hurricane damage to these properties should be reduced because of the new improvements. The same result should apply to newer houses built to more stringent building codes. Strategic incentive programs consisting of long-term 15 to 30 year loans that can be attached to mortgage or property tax, enabling low-interest loans secured by the improved property, and may be income tax deductible have also been weighed.

2010 Florida Property Assessed Clean Energy (PACE) legislation granted local governments the authority to establish green and/or windstorm hardening districts and to tax citizens that choose to participate in these districts which concur with property and casualty insurers, then assigned to mortgage or property tax (The Florida Catastrophic Storm Risk Management Center, "Home Hardening Incentives Programs," Florida State University (FSU, 6/30/10). Risk Management Solutions has proposed that future mitigation grants be targeted at homes most at risk, with Florida

realizing reductions in statewide 100-year storm loss of as much as $2.75 per $1.00 in mitigation grants, up from the $1.50. Examining 2,100 claims post Hurricane Charley, the Institute for Business and Home Safety (IBHS) determined that homes that meet wind-resistant standards had a claim frequency that was 60 percent less than non-fortified housing stock, claims of $14/square foot for the former, $24/square foot for the latter.

One **model program** identified by the FSU report is the **Babylon, NY Long Island Green Homes Program** operating on the south shore of Long Island. In 2008 the town committed to reducing carbon emissions 12 percent by 2012. To that end, Babylon implemented a self-financing program that draws from a solid waste revolving fund to finance energy retrofits to residential housing stock. The obligation is secured by a benefit assessment and only defaults to the property tax bill in cases of delinquency. The financing rate is 3 % with a maximum loan amount of $15,000.

What considerations would drive insurance uptake in the face of low-probability, high-consequence (LP-HC) events where the logic is not clear cut for those in harm's way (Kunreuther, H & Pauly M, "Behavioral Economics and Insurance: Principles and Solutions," Wharton, 2/14). One vital statistic speaks volumes here in the lead-up to Irene and Sandy – the number of new policies written annually on Long Island by New York Property Insurance Underwriting Association (NYPIUA), the insurer of last resort, has decreased by 23.8 percent over the past three years. NYPIUA only writes 1% of homes in Nassau County and 2.1% in Suffolk County. (http://www.edwardswildman.com/files/upload/2010-09-24_Coastal_Homeowners_Insurance_is_Available.pdf)

Well-designed insurance can play an important role in linking mitigation with financial protection should a disaster occur (H. Kunreuther, et al, "**Making America More Resilient toward Natural Disasters: A Call for Action** " *Environment: Science and Policy for Sustainable Development*, July-August 2013, 15-23). People often use good economic sense in buying insurance. They buy property insurance on their homes. They buy collision insurance on their new cars. They buy life insurance if they have dependents. But they have problems with insurance against extreme events, such as floods and earthquakes, because these events are rarely experienced. Insurance also has the potential to encourage investment in loss reduction measures if homeowners can receive premium reductions based on investment in such measures, reflecting expected reduced claims following a disaster.

Calling attention to the benefits of investing in mitigation measures by focusing on the reduction in losses from specific catastrophic storms such as Sandy or Katrina would attract more uptake than a general message framed in terms of reducing damage from future hurricanes. Even before 9/11, controlled experiments revealed that consumers are willing to pay more for insurance against a plane crash caused by terrorists than for flight insurance due to any cause, a counterintuitive finding since by definition "any cause" includes a terrorist attack.

The New York State Insurance Department (NYSID) considered Proposed Regulation 189 in 2009 that posited property insurance premiums include a charge for potential catastrophe losses, or "catastrophe loads," which would bank a reserve to fund future losses. Wilkie Farr noted concerns about the lack of favorable tax treatment for such a reserve. The Property Casualty Insurers Association of America (PCI), responding to this proposal from the New York Superintendent of Insurance, declared it was *"trying to fix a problem that doesn't exist…. These proposals could create marketplace conditions that negatively affect both the availability and affordability of coastal homeowners insurance for consumers."* The superintendent also directed the Temporary Panel on Homeowners Insurance Coverage to examine the following areas of concern:

- Market assistance programs;
- The catastrophe insurance pool;
- Existing state and local building codes, and retrofitting current structures to mitigate damage from a major weather catastrophe;
- Insurer preparedness for recovery and rebuilding after a catastrophe;
- Public education about storm risks and mitigation techniques; and
- Other coastal homeowners' insurance issues.

Is it realistic to expect the insurance industry to sign off on a mitigation reserve fund drawn from a system benefit charge on risk and casualty insurance? Economist Jonathan Gruber of MIT weighed in on this score in a 2013 exchange at Penn's Leonard Davis Institute: "*Insurance companies are incredibly conservative institutions. They don't try. They just want to be bookies; they want to take their spread off the top. They don't want to innovate; they don't want to do interesting things.*"

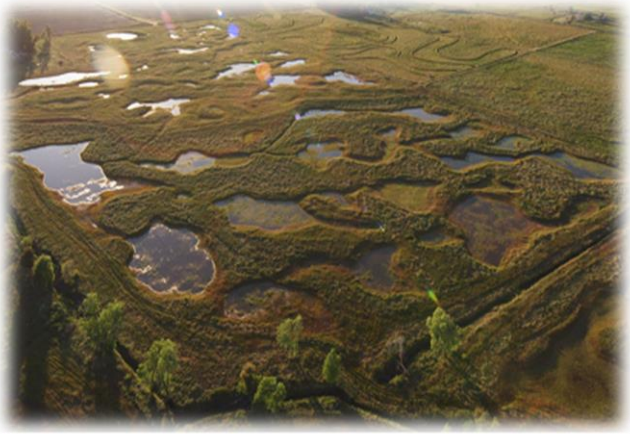
On the other hand, insurance companies doing business in New York might tear a page from the cost-benefit probe of mitigation in Florida which was linked to a proposed catastrophe reserve fund to finance house hardening, i.e. elevation in hazard zones. Could there be something akin to a systems benefit charge assigned to the $32B in New York State property and casualty insurance that could go into a mitigation fund that could fund both house hardening and green and grey mitigation measures to minimize impacts of storm events? This charge would be akin to the set-aside out of the Regional Greenhouse Gas Initiative that incents renewable installations. Current NYSID Superintendent Lawsky, who has demonstrated an appetite for challenging the insurance industry, might see the calculus in this proposition.

2015 saw a spate of proposed usage fees, including one from a MoveNY, headed by a former New York State Traffic Commissioner echoing the 2008 'Ravitch Plan' that proposed tolls for East River bridges that currently cost taxpayers hundreds of millions of dollars in annual maintenance. The City's Citizens Budget Commission proposed volume-based garbage fees (http://www.cbcny.org/sites/default/files/REPORT_SOLIDWASTE_02052015_0.pdf).

2.1.3 Niche Funding

Social Impact Bonds, Green Bonds and other 'pay-for-success' programs are currently being pursued in more than a dozen states across the country, projected to reach $300 million by 2016.

As an iteration of a pay-for-success program, a wetland mitigation bank represents a wetland, stream, or other aquatic resource area that has been restored, enhanced, or preserved which subsequently can be purchased to offset impacts of an unrelated development. In other words, these banks represent a third-party compensatory mitigation credit, in which the responsibility for implementation is assumed by a party other than the permittee. As of August, 2013, there were over 1,800 bank sites loaded into the Regulatory In-lieu fee and Bank Information Tracking System (RIBITS) database.



Wildlands Mitigation Bank, Placer County, CA

Land Banking was launched in 2002 by Genesee County, MI to forestall tax foreclosure and reuse tax-reverted property in the contracting city of Flint and its suburbs. The county has adopted a Brownfield Redevelopment Plan for its entire inventory of tax-foreclosed property controlled by its Land Bank. Utilizing **Tax Increment Financing** (TIF) relies upon taxes on cross- collateralized properties generated by the redevelopment of tax-foreclosed properties to support the bond payments. Genesee assumes the collection of delinquent taxes by borrowing against tax anticipation notes, and, in turn, making local municipalities whole. For properties it can't collect on, the county is able to transfer properties to the Land Bank without bearing the financial and legal burden of owning them. In turn, certain properties lend themselves to 'community gardens' or wastewater treatment clusters.

Pine Barrens Credit Program (transfer development rights) is designed to protect the quality and quantity of surface water and groundwater and the long term integrity of the Pine Barrens ecosystem by promoting sustainable development. "*A Pine Barrens Credit (PBC) Certificate is a document issued on behalf of the Commission which indicates the number of Pine Barrens Credits to which the owner of a particular parcel of land is entitled and which attests to the fact that the development rights of a particular parcel of land in a sending district of the Central Pine Barrens have been severed from the land by the recording of a conservation easement, and that these rights are available for sale or use* (http://www.pb.state.ny.us/chart_pbc_main_page.htm)."

Nutrient Trading Schemes

"The development of simple water trading opportunities, together with basic market institutions like exchanges or water banks, creates the opportunity to deploy more sophisticated market-based

tools that help to manage risk and vulnerability in other market settings…. Insurance companies, farmers, commodities brokers, investment banks, mutual funds, and hedge funds have each developed risk management tools of varying degrees of sophistication to control or hedge against market, weather, and environmental risks. Water markets should borrow some of these risk mitigation strategies. By developing similar tools for water resource management, we can build resiliency into and reduce the vulnerability of our water management institutions and infrastructure" ("Shopping for Water: How the Market Can Mitigate Water Shortages in the American West," Culp, Peter, et al, 2014). Long-standing nutrient control programs for the Chesapeake Bay and Long Island Sound have thus far fallen notably short of their goals. While point source nutrient control technologies have produced reductions, Long Island Sound non-point nitrogen loads have not decreased in 20 years (http://longislandsoundstudy.net/2010/07/estimated-nitrogen-load-all-ct-sources/). *"To date, water quality programs have devoted little attention and resources to exploring and developing technologies and programs to enhancing this nutrient removal pathway."* (Stephenson & Shabman, 'The Use of Nutrient Assimilation Services in Performance-based Water Quality Incentive Programs,' 2013)."

2.2 Wastewater Management District –Extending Septic Upgrades to the Untreated 74%

While Suffolk County at 74 percent may certainly have one of the highest concentrations of cesspool/septics in the country, the EPA estimates that 25 percent of U.S. homes have decentralized systems. Existing onsite systems are over 30 years old on average, and surveys indicate at least 10 percent of these systems back up onto the ground surface or into the home each year. At least 20 percent of the systems are malfunctioning to some degree.

Pursuant to an extended septic tour of the Northeast undertaken by Suffolk in concert with representatives from New York State's EFC, the USEPA, The Nature Conservancy and Peconic Green Growth, the County is piloting a septic upgrade program. This pilot is installing nineteen innovative/advanced (I/A) systems contributed by five manufacturers at homes drawn in a lottery.

By the end of the first year, with systems provisionally approved, the program is projected to expand countywide, with particular focus on critical areas. Five elements must be readied for the launch of an expanded program:

1. Current construction standards for on-site systems must be reformulated to consider the characteristics that distinguish I/A systems, in conjunction with changes to the Sanitary Code.

2. A county-wide wastewater management district must be affirmed and established.

3. The appropriate responsible management entity (RME) must be identified and prepared to function either within or in concert with the Suffolk County Department of Health Services (SCDHS) as regulators and Suffolk County Department of Public Works (SCDPW) as project engineers.

4. Operational staff and funds need to be in place.

5. A financing arrangement with NYSEFC must be formalized to provide low-interest financing.

2.2.1 Current Suffolk County Construction Standards

A variance from the following County standards was required in order to proceed with septic upgrade demonstration pilot:

STANDARDS - APPROVAL OF PLANS AND CONSTRUCTION
SEWAGE DISPOSAL SYSTEMS FOR SINGLE-FAMILY RESIDENCES

5-114 Alternative Systems

A. The treatment systems addressed thus far in these Standards are considered conventional or typical systems and may be used on sites with adequate soil percolation and vertical/horizontal separation distances unless otherwise prohibited. Many sites are not suitable for such systems. The purpose of these Standards is to assure proper treatment of sewage rather than to restrict use of land. In cases where conventional systems are not suitable, alternative designs of sewage disposal systems may be considered by the Department on a limited experimental basis or for replacement systems on difficult sites provided:

1. *The system shall be designed by a licensed professional engineer.*
2. *It is clearly demonstrated that the proposed system is physically equivalent or better than the conventional systems, in respect to storage capacity, leaching area, land area utilization, grading, accessibility, maintainability, reparability, life expectancy, energy usage, effluent quality and reliability.*
3. *An engineering report determines that the proposed design is most suitable for the building site and that the proposed sanitary system will function properly without causing any health hazard and will minimize the impact on the surrounding environment.*
4. *The design professional supervises the installation of the system and certifies that the system was built in accordance with the approved plan and submits as-built plans of the system.*

B. Alternative systems, on an experimental basis, are inappropriate for realty developments or subdivisions and will not be approved for same.

2.2.2 Use of Innovative/Alternative Systems in Massachusetts

Massachusetts Department of Environmental Protection (MassDEP) has set the pace for pilot programs (http://www.mass.gov/eea/agencies/massdep/water/wastewater/massdeps-technology-approval-process-for-ia-systems.html) that are teeing up innovative/alternative (I/A) onsite wastewater treatment systems with an eye to widespread installation:

Stage One: PILOTING

- Technologies can be piloted when available data indicate a technology is likely to perform at least as well as a conventional system. Piloting involves installations on up to 15 sites per technology, with field testing for at least 18 months and full reporting of results. A technology can proceed to the Provisional Use approval stage if 75 percent or more of the pilot systems performed as expected for at least 12 months.

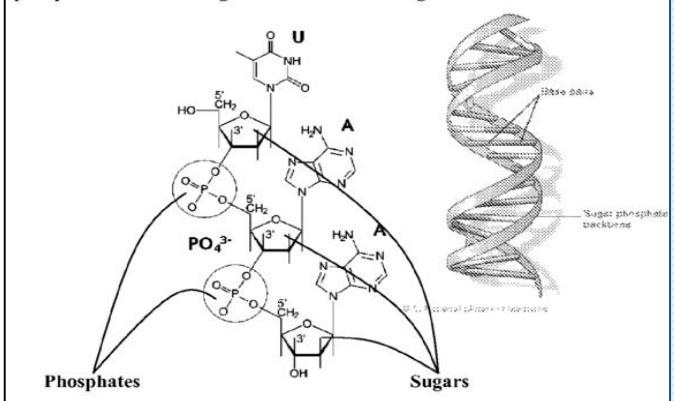
Stage Two: PROVISIONAL USE

- The Provisional Use Approval process evaluates whether an I/A technology can perform at least as well as a conventional system under local field conditions in a less controlled environment than piloting. This stage occurs after a technology has passed the pilot stage or has two or more years of successful general-use performance in one or more other states. At least 50 systems must be installed, and their operation, maintenance, and monitoring is tracked by the manufacturer with reporting to MassDEP for at least three years. Provisional Use is considered successful if 90 percent or more of the installations have, over three years, performed at least as well as a conventional system.

Stage Three: GENERAL USE

- When a technology successfully completes the Provisional Use stage, it is certified for General Use. Certified technologies can be installed at any site where a conventional system can be installed. The system owner is required to complete inspection and testing requirements on a regular schedule as required by the approval. MassDEP uses the data from the Provisional Use Approval process to set discharge standards and other conditions for General Use.

The Hydrogen ions "attack" the negatively charged Phosphate links in the sugar-phosphate backbone (ribbons) in the DNA of the bacterial matter, cleaving the electrically-induced bonds between the sugars and the phosphates and breaking the backbone into fragments.



Once the bonds have been broken, the phosphates and sugars are released into the water and carried on into the holding tank and the Cathode Chamber.

One example of a potential nitrate removal technology is shown here. Aqua Vector conducted a promising pilot application of its technology at the Village of Northport Wastewater Treatment Plant in 2012. The goal of the pilot was to consistently reduce effluent nitrate to less than 3 mg/L. For over two years, a modest flow of effluent from the Northport plant was processed employing Aqua Vector's patented tertiary treatment process. Effluent nitrogen averaged 2.5 mg/L from May to August 2012.

Pat App #: 20130277231 - Electrolytic Apparatus and Method for Treating Water to Remove Nitrates

2.2.3 Wastewater Management District

The following sections from New York State code will be referenced in the development of a countywide wastewater management district. A countywide district is necessitated for operational reasons, in that innovative/advanced septics are akin to mini sewage treatment plants requiring a professional level of maintenance to remain effective. In effect, on-site systems should have oversight comparable to sewage treatment plants and the cost of wastewater treatment should be leveled countywide. From the standpoint of financing, state administrators of the Clean Water State Revolving Fund (CWSRF) have indicated they are predisposed to providing low-interest loans, but only if it is conveyed at the county level. The obligation would then be assigned to the property as it is with sewers, along with all the associated advantages.

2.2.4 Responsible Management Entity (RME)

Responsible Management Entity (RME), as defined by the EPA, is a legal entity responsible for providing management services to ensure that decentralized onsite or clustered wastewater treatment facilities meet established criteria. Management of decentralized systems requires coordination of a cycle of components including public outreach, planning, performance, site evaluation, design, construction, operation and maintenance, residual considerations, training, certification/licensing, inspections/monitoring, corrective actions, accounting/reporting, financial assistance all of which require funding. EPA defines five models with progressively deeper responsibilities:

1. "Homeowner Awareness" model is a starting point for enhancing management programs because it provides communities with a good database of systems owned and operated by individual property owners in environmental areas of low sensitivity. Treatment technologies should be limited to conventional systems requiring little owner attention, with maintenance reminders mailed intermittently by the regulatory authority.

2. "Maintenance Contracts" program addresses more complex designs than conventional systems, including clusters, calling for contracts with qualified technicians to provide proper and timely maintenance.

3. "Operating Permits" applies to treatment systems deemed critical to public health and water quality. Limited-term operating permits are issued, renewable if a system is in compliance with the terms and conditions of the permit. Performance-based designs may be incorporated into programs with management controls at this level.

4. "Responsible Management Entity (RME)/Operation and Maintenance" model specifies program elements and activities where frequent and highly reliable operation and maintenance of decentralized systems is required to ensure water resource protection in sensitive environments. Under this model, the operating permit is issued to an RME instead of the property owner to provide the needed assurance that the appropriate maintenance is performed.

5. "RME Ownership" model specifies that program elements and activities for treatment systems are owned, operated, and maintained by the RME, which removes the property owner from responsibility for the system and diminishes disputes. This program is analogous to central sewerage and provides the greatest assurance of system performance in the most sensitive of environments. Types of RMEs that fall under corporate regulation include special purpose districts, subordinate service districts, non-profit sewer cooperatives, for-profit private utilities, private maintenance contractors, and private homeowners' associations.

The Rhode Island Cesspool {Phase-Out} Act of 2007 (RIGL § 23-19.15) mandates that all cesspools located within 200 feet of the inland edge of the coastal shoreline feature bordering a tidal water area must be abandoned and the home upgraded with a new onsite wastewater

NY CODE – ARTICLE 5-A: COUNTY WATER, SEWER, DRAINAGE AND REFUSE DISTRICTS *The board of supervisors of each county may establish, consolidate, or extend county water quality treatment, sewer, wastewater disposal, drainage or refuse districts …*

2. For the purpose of (a) the conveyance from other municipalities and districts within the county of sewage and treatment and disposal thereof, (b) collection, except as hereinafter provided, or (c) both such conveyance and collection;

3. For the purpose of administration and planning (including educational programs), design, installation, construction, rehabilitation, replacement, operation and maintenance (including pumping and inspections), monitoring, residual treatment and disposal and regulation of private on-site wastewater disposal systems of such district;

7. Except in the county of Suffolk, no county district shall be established hereunder which shall consist wholly of territory within one city, within one village or within that portion of one town outside of a village.

N.Y. CNT. LAW *§252: NY Code – Section 252: Powers of county agency*

2. In the county of Suffolk, the county sewer agency may undertake such other duties, powers and responsibilities as may from time to time be approved or delegated to it by the board of supervisors.

N. Y. CNT. LAW §256: NY Code – Section 256: Establishment of a county district

…Such resolution shall be subject to permissive referendum as hereinafter provided, except in the case of a water quality treatment district and except in the county of Suffolk. In the county of Suffolk, if the owner or owners of all of the land within the proposed district consent in writing to the formation of the proposed district and the board of elections certify that on or after the date of the first publication of the notice of public hearing hereinabove referred to, there is no registered voter within the proposed district, then and in that case the resolution adopted by the board approving the establishment of a district shall not be subject to referendum, permissive, or otherwise.

N.Y. CNT. LAW § 266: NY Code - Section 266: Water rates, water quality treatment, sewage, wastewater disposal and refuse collection charges and revenues

1. Subject to confirmation by the board of supervisors, the administrative head or body: (a) may establish, from time to time, wholesale and retail rate schedules for water sold to, or a scale of charges for the collection, conveyance, treatment and disposal of sewage, wastewater…. Notwithstanding the provisions of sections two hundred seventy, two hundred seventy-one and two hundred seventy-four, revenues derived from water rates, water quality treatment charges, sewer rents and sewage, wastewater and refuse collection charges shall be applied toward the maintenance and operation of the water, water quality treatment, sewer, wastewater.

N.Y. CNT. LAW § 270: NY Code - Section 270: Assessment of the cost

N.Y. CNT. LAW § 277: NY Code - Section 277: Establishment of certain county sewer districts in Suffolk county

NEW YORK STATE TITLE 10, APPENDIX 75-A: WASTEWATER TREATMENT STANDARDS - RESIDENTIAL ONSITE SYSTEMS

Updated NYSDOH regulations (2011) require an owner of an Enhanced Treatment Unit (ETU) be within a jurisdiction served by either a Responsible Management Entity (RME) or the local sanitary code.

treatment system or connected to available municipal sewer lines. The Act also requires cesspools located within 200 feet of public wells or within 200 feet of drinking water reservoirs to be replaced as above.

- All cesspools within the 200 foot zones identified above will have to be inspected by January 1, 2012 or upon notice from the Rhode Island Department of Environmental Management (DEM);
- All cesspools within the 200 foot zones identified above that are found to be failed will need to be replaced within 1 year;
- All cesspools within the 200 foot zones identified above that are found in already sewered areas will need to be hooked up to the sewer by January 1, 2014; and
- All other cesspools within the 200 foot zones identified above will need to be replaced by January 1, 2014.

Rhode Island's efforts at passing a **point-of-sale law** have been unavailing. RIDEM estimates that there are up to 50,000 pre-1968 cesspools; the Cesspool Act will prompt the removal of approximately 5,000 of these. Since 2008, Rhode Island has required installation of nitrogen reducing septics if a property in a critical resource area increases dwelling square footage by 50 percent, or adds two bedrooms or more. The Community Septic System Loan Program was launched by the Rhode Island Clean Water Finance Agency which governs the lending activities of the Rhode Island Water Pollution Control Revolving Fund in accordance with Title VI of the federal Clean Water Act. The Agency vets financial capability for each loan application which is tendered to the homeowner at 2 percent for a term up to ten years.

Cluster systems for four to one hundred homes are halfway between individual onsite systems and municipal sewers. Cluster systems have three basic components: onsite pretreatment and pumping, collection lines, and the community treatment system. These could, quite conceivably, be financed through **wastewater utility districts** in which the obligations are secured by the property via a benefit-assessment. This brings down the interest rates, spreads out costs and assigns any balance to the next property owner should the current one move. The same property-assessed clean energy (PACE) principles that made Long Island Green Homes so successful are at work through this approach and is, in effect, the historical method for assigning sewer costs.

By operationalizing a countywide septic upgrade program, Suffolk will be plying the optimal route of advancing applied technology via market-based solutions. Current innovative/ alternative wastewater technology is a half measure that is more than double the cost of what would be a market maker. The market is the optimal driver of innovation and economies of scale.

Value Proposition for Homeowner:

- Proof of concept – do systems and program delivery work
- Real estate – enhanced appraisal with advanced wastewater treatment

- Reduced costs associated with eliminated pump-outs and reduced fertilizer use
- Valuation of surface water quality for recreation and tourism

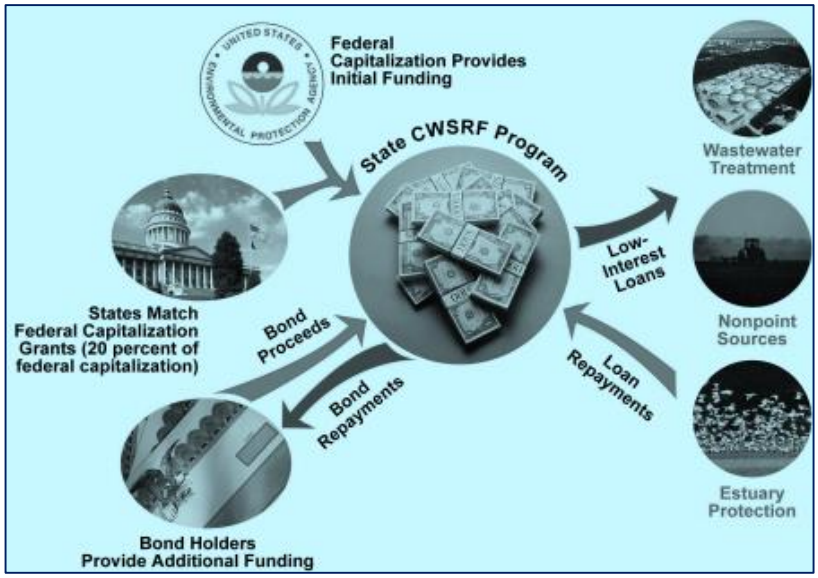
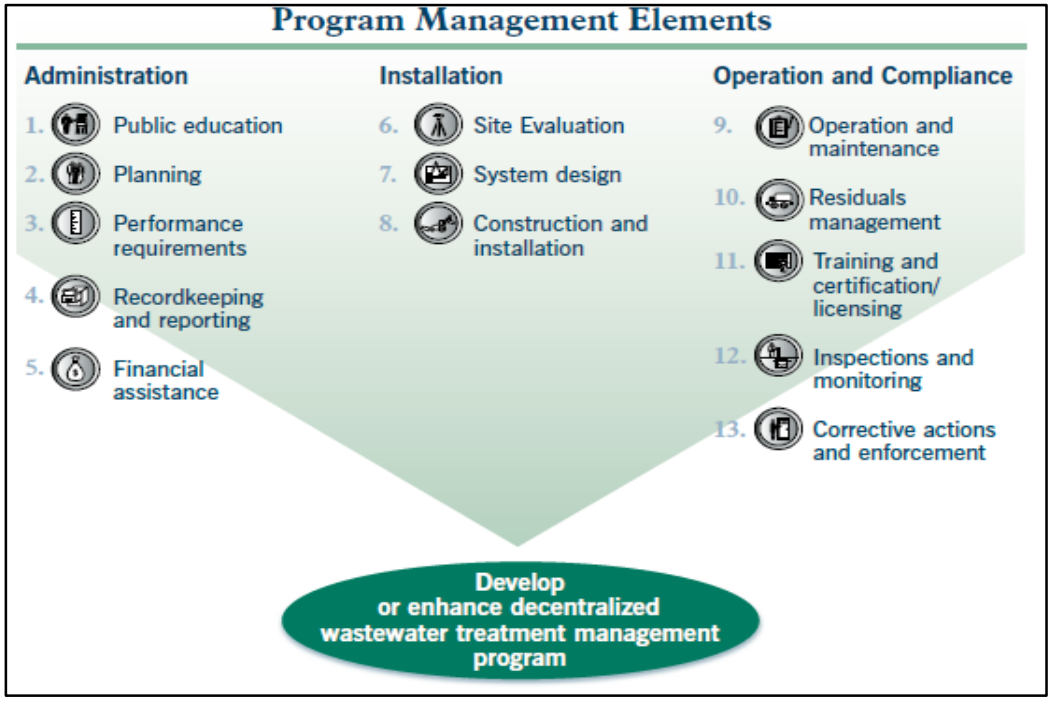


Figure 2-4 Overview of Clean Water State Revolving Funding

Low-interest financing through the CWSRF program has already gotten the green light in Rhode Island from the EPA. It has designated point-of-use treatment devices as "compliance technologies" ("*Guidance for Federal Land Management in the Chesapeake Bay Watershed,*" 5-12-10) as that ensures household charges for such devices would remain at an affordable threshold. This means that the EPA's infrastructure banks, like NYSEFC are prepared to provide millions of dollars in low-interest loans for decentralized/cluster wastewater treatment systems.

Initial funding could come via EFC purchase of a general obligation bond or note of the County or a revenue bond or note of an Industrial Development Authority (IDA), Local Development Corporation (LDC), or other public authority necessary to satisfy EFC's statutory investment and consistent with Issuer's constitutional and other applicable requirements. Debt term would be no greater than a project's useful life with interest no greater than market rates. In consideration, County/issuer will provide standard representations, warranties, covenants, and opinions as to authority to issue debt, operate the program and perform obligations. There would be no transaction costs and standard indemnification of EFC.

Program factors such as septic standards, installation process, O&M and inspection would have to accord with NYSDEC/SCDHS criteria. The County will determine contractor criteria, homeowner eligibility, credit criteria, and loan terms. Homeowner loan credit analysis, origination, collection, monitoring and collections may be subcontracted with consent. EFC would acquire no interest in financed projects but is amenable to acquisition by others.



Once the program is implemented, EFC will consider closing in advance of originations upon request and transfer all bond proceeds at closing. Bond proceeds and repayments to be maintained in a segregated account but may be redeployed into new loans or applied to EFC amortization requirements. Additional funding may be forthcoming dependent upon program pace, and may be converted or refinanced if scale or economics are preferred. EFC would bear none of the risks of homeowner loan defaults.

In terms of program analysis, the County agrees to share records and engage EFC in ways to improve program. The County will participate in publicity and marketing efforts and consult with other interested counties upon reasonable request.

Table 1: Summary of Management Models

TABLE 1: SUMMARY OF MANAGEMENT MODELS

TYPICAL APPLICATIONS	PROGRAM DESCRIPTION	BENEFITS	LIMITATIONS
MODEL 1 - HOMEOWNER AWARENESS MODEL			
• Areas of low environmental sensitivity where sites are suitable for conventional onsite systems.	• Systems properly sited and constructed based on prescribed criteria. • Owners made aware of maintenance needs through reminders. • Inventory of all systems	• Code-compliant system. • Ease of implementation; based on existing, prescriptive system design and site criteria. • Provides an inventory of systems that is useful in system tracking and area-wide planning.	• No compliance/problem identification mechanism. • Sites must meet siting requirements. • Cost to maintain database and owner education program.
MODEL 2 - MAINTENANCE CONTRACT MODEL			
• Areas of low to moderate environmental sensitivity where sites are marginally suitable for conventional onsite systems due to small lots, shallow soils, or low-permeability soils. • Small clustered systems.	• Systems properly sited and constructed. • More complex treatment options, including mechanical components or small clusters of homes. • Requires service contracts to be maintained. • Inventory of all systems. • Service contract tracking system.	• Reduces the risk of treatment system malfunctions. • Protects homeowner investment.	• Difficulty in tracking and enforcing compliance because it must rely on the owner or contractor to report a lapse in a valid contract for services. • No mechanism provided to assess effectiveness of maintenance program.
MODEL 3 - OPERATING PERMIT MODEL			
• Areas of moderate environmental sensitivity such as wellhead or source water protection zones, shellfish growing waters, or bathing/ water contact recreation. • Systems treating high-strength wastes or large-capacity systems.	• Establishes system performance and monitoring requirements. • Allows engineered designs but may provide prescriptive designs for specific receiving environments. • Regulatory oversight by issuing renewable operating permits that may be revoked for noncompliance. • Inventory of all systems. • Tracking system for operating permit and compliance monitoring. • Minimum for large-capacity systems.	• Allows systems in more environmentally sensitive areas. • Operating permit requires regular compliance monitoring reports. • Identifies noncompliant systems and initiates corrective actions. • Decreases need for regulation of large systems. • Protects homeowner investment.	• Higher level of expertise and resources for regulatory authority to implement. • Requires permit tracking system. • Regulatory authority needs enforcement powers.
MODEL 4 - RESPONSIBLE MANAGEMENT ENTITY (RME) OPERATION AND MAINTENANCE MODEL			
• Areas of moderate to high environmental sensitivity where reliable and sustainable system operation and maintenance (O&M) is required, e.g., sole source aquifers, wellhead or source water protection zones, critical aquatic habitats, or outstanding value resource waters. • Clustered systems.	• Establishes system performance and monitoring requirements. • Professional O&M services through RME (either public or private). • Provides regulatory oversight by issuing operating or NPDES permits directly to the RME. (System ownership remains with the property owner.) • Inventory of all systems. • Tracking system for operating permit and compliance monitoring.	• O&M responsibility transferred from the system owner to a professional RME that is the holder of the operating permit. • Identifies problems needing attention before failures occur. • Allows use of onsite treatment in more environmentally sensitive areas or for treatment of high-strength wastes. • Can issue one permit for a group of systems. • Protects homeowner investment.	• Enabling legislation may be necessary to allow RME to hold operating permit for an individual system owner. • RME must have owner approval for repairs; may be conflict if performance problems are identified and not corrected. • Need for easement/right of entry. • Need for oversight of RME by regulatory authority.
MODEL 5 - RESPONSIBLE MANAGEMENT ENTITY (RME) OWNERSHIP MODEL			
• Areas of greatest environmental sensitivity where reliable management is required. Includes sole source aquifers, wellhead or source water protection zones, critical aquatic habitats, or outstanding value resource waters. • Preferred management program for clustered systems serving multiple properties under different ownership (e.g., subdivisions).	• Establishes system performance and monitoring requirements. • Professional management of all aspects of decentralized systems through public/private RMEs that own or manage individual systems. • Qualified, trained, owners and licensed professional owners/operators. • Provides regulatory oversight by issuing operating or NPDES permit. • Inventory of all systems. • Tracking system for operating permit and compliance monitoring.	• High level of oversight if system performance problems occur. • Simulates model of central sewerage, reducing the risk of noncompliance. • Allows use of onsite treatment in more environmentally sensitive areas. • Allows effective area-wide planning/watershed management. • Removes potential conflicts between the user and RME. • Greatest protection of environmental resources and owner investment.	• Enabling legislation and/or formation of special district may be required. • May require greater financial investment by RME for installation and/or purchase of existing systems or components. • Need for oversight of RME by regulatory authority. • Private RMEs may limit competition. • Homeowner associations may not have adequate authority.

Table 2-1 Summary of On-site Wastewater Treatment Systems Management Models

Source: EPA: Voluntary National Guidelines for Management of Onsite and Clustered (Decentralized) Wastewater Treatment Systems

Program projections on what is, essentially, a large-scale home improvement operation can and should be based on market-based precedents, such as the following:

- From PSEG's web-site: "Since 2000, through LIPA's nationally recognized Solar Pioneer and Solar Entrepreneur Program, rebates of approximately $170,000,000 for the installation of more than 8,000 solar roofs on Long Island have been provided." The 8,000 number includes commercial installs as well as the 32 megawatt (MW) installation at BNL. Residential rebates are now down to $.75/W and with tax credits will now cover up to $5K or 25 percent of the solar system install. That's now all backed by the RGGI (Regional Greenhouse Gas Initiative) administered by New York State Energy Research and Development Authority (NYSERDA).

- Long Island Green Homes is up around 1,400 houses or 2.3 percent of Babylon's housing stock. It reached the 600/year level in year 5 or 1 percent/year (the external force of Federal Housing Finance Agency (FHFA) put the brakes on). Homeowners were not out-of-pocket up front, interest rate 3 percent, utility savings covered the monthly obligation which could be passed along to the next homeowner, and after approximately 10 years the average annual savings to homeowners of $1,340 was in pocket. An attractive home improvement, indeed, particularly considering the enhanced property value of a house that is also healthier and cheaper to operate (http://www.frbsf.org/community-development/publications/community-development-investment-review/2014/march/urban-city-innovative-energy-retrofits-single-family-homes/).

- Rhode Island with approximately 150,000 cesspool/septics has been overseeing 442 installs per year over the previous decade with 581 in 2013 for a total of 5,809. That translates to 2.8 percent market penetration at an annualized clip of 0.21 percent. Maryland, which provides grants from statewide flush tax, is coming in with around the same total.

In the past, SCDPW has commissioned a number of feasibility studies for **extending sewers**. *Project Feasibility for No. 3 Southwest Sewer District Service Area Expansion* was completed in 2012. 29 sub-areas contained within three prioritized tiers were under evaluation, which would add flow of 12 to 15.9 million gallons per day (MGD) from approximately 40,000 new connections and cost nearly $2.1B ($52,500 per connection). "*The overall objective of this study was to delineate and prioritize cost-effective, fundable project areas*." The Southwest Sewer District (SCSD #3 or SWSD) covers 57 square miles with over 950 miles of pipe and 14 pumping stations serving 85,000 parcels (approximately 1/5 of the county). It is connected to the Bergen Point wastewater treatment plant (WWTP) that can treat 30 MGD and is slated to increase that capacity to 40 MGD inclusive of 3.6 MGD of slack. In the *Rocky Point Business District Sewering Feasibility Study* prepared for SCDPW (May, 2010), Cameron Engineering "estimated annual cost for a residential property owner varied from $4,600 to $8,000," exclusive of one-time costs in the thousands.

With the $300M in Sandy Recovery funding plus the $83M EFC low-interest loan, sewering can be extended upwards to 15,000, the most significant since completion of SCSD #3 in the early '80s. IBM's estimated cost to Suffolk for sewering and septic system upgrades is US $8 billion (over 40

years). Conventional funding for these capital programs will be drawn from sewer district capital funds, EFC, ESD, and County general obligation bonds.

2.3 Operational Efficiencies: Synergies of Consolidation

The flip side of SCWA distribution which reaches 85 percent of Suffolk is the hodge-podge of wastewater treatment. There are 28 sewer districts served by 24 county sewage treatment plants (STPs) of various sizes that discharge a total of 31.5 MGD. Fourteen areas are served by a combination of village, town and federal STPs discharging 9.1 MGD. Added to the mix are 157 private STPs with a permitted flow of 8.9 MGD. Approximately 74 percent of Suffolk County's 1.5 million residents have an on-site sanitary wastewater treatment and disposal system. While the density of western Suffolk approximates that of Nassau, the county as a whole is one-third as dense. A rough estimate from SCDPW places the asset value of SCSD #3 and 21 other sewer districts at $1.25B and replacement cost at $5.8B over 20 years (SCDPW Chief Engineer Ben Wright, 11/28/11). If SCDPW operates/oversaw all STPs for network optimization (of 197 public and private STPs, 23 are currently operated by Suffolk County accounting for 90 percent of volume) the following could be realized:

- Consistency of operation;
- Enhanced nitrogen reduction (61 non-SCDPW STPs identified as "high risk" for producing in excess of 10 mg/L N);
- Cost uniformity and price parity countywide and increased revenue, and
- Expanding mission from STPs to include wastewater treatment for the majority of houses that will not be sewered.

With a $25,000 *government efficiency grant*, the County has retained a consultant to assess the synergies of consolidation who has provided an advance assessment:

- Billing methodology, owing to the manner in which Suffolk County acquired its 22 sewer districts over time, has never been integrated. Annual residential bills range widely based on sewer district-specific characteristics (e.g., size, age, etc.) from $63 in Kings Park to $940 in Strathmore-Huntington. While the residents receive similar services, the amount they pay varies greatly from district to district. A portion of one-quarter per cent of the County sales tax supports these circumstances. However, negative net revenues are projected in the future, factoring in capital O&M costs as well as enhanced mitigation. Consolidating districts could convert billing to equitable usage-based fees and enable leveraging sewer system value in extending beyond the approximate 26 percent currently sewered.
- Amalgamating budgets, personnel and tasks and aggregating systems' revenues of all the municipal districts that now operate separately would enhance leverage. The next step

would be to implement the regionalization of wastewater infrastructure services. Uniform automated billing along with economies of purchasing would realize significant savings.

- Operating deficits could be redressed. Currently, each district is autonomous, generating its own revenues and operating expenses. In the majority of districts, operating revenues alone are insufficient to cover operating costs with each of these districts dependent on additional funds from the County to meet their respective sewer budgets. Beyond annual 3 percent adjustments in rates (a requirement for eligibility to receive Assessment Stabilization Reserve Fund (ASRF) funding), increases in sewer fees to control the growth in these operating deficits have been negligible. The exception to this pattern of deficient operating revenues has been SWSD that services large portions of the Town of Babylon and parts of the Town of Islip, operating the largest sewage treatment plant in the County.

- The Assessment Stabilization Reserve Fund generates approximately $16 million in annual tax revenues which, in addition to operating revenues, subsidizes the districts whose revenues (after 3 percent rate increase) fall short of meeting operating expenses. The ASRF is scheduled to expire in 2030. Extending and realigning the ASRF must be a priority.

- Capital Needs of the County sewer system are pronounced. The Proposed 2015 Capital Budget calls for a portion of the $240 million estimate to replace the ocean outfall pipe from the SWSD plant which is close to catastrophic failure (CDM Smith).

- Rate equity is a key factor in that it would level sewer costs and fees, extending parity to both future sewer extensions as well as the vital upgrade of hundreds of thousands of on-site systems. In fact, assuring those with on-site treatment systems that they will be the recipients of service comparable both in terms of performance and price is elemental to widespread acceptance.

- A Base Case Analysis will be prepared by the consultant. This analysis will reflect current revenues and operating expenses by district with normalized growth projections. In addition to projected operating costs, the analysis will incorporate identified capital requirements over a 5 to 10 year period. Revenues will include current and projected sewer fees as well as ASRF funds applied in accordance with statutory requirements.

- A financial analysis will illustrate the impact of a consolidation of sewer districts and will include the following scenarios:

  - More closely aligning sewer fees with the cost of delivering the sewer services;

  - Assume alternative uses for the ASRF beyond currently authorized purpose of subsidizing sewer revenues in districts with insufficient fee income to meet operating costs;

  - Reflects an extension of the ASRF beyond its current expiration date of 2030;

- Illustrates the financial flexibility of consolidation which allows operating revenues to be applied where most needed on a system-wide basis;
- Assumes a level of operating efficiency that current configuration of individual sewer districts impairs;
- Examines the impact of basing some portion of sewer fees on use versus property value.

2.4 Comprehensive Water Resources Management

2.4.1 Integration of Water Supply and Wastewater Management

One of the key recommendations of the IBM Smarter Cities Challenge Report (2014) is that Suffolk County should consolidate water supply and wastewater management, as summarized in **Table 2-2**.

N.Y. PBA. LAW § 1075: NY Code - Section 1075: 3. It is hereby determined and declared that the authority (Suffolk County Water Authority) and the carrying out of its powers, purposes and duties are in all respects for the benefit of the people of the county of Suffolk and the state of New York, for the improvement of their health, welfare and prosperity and that the said purposes are public

Table 2-2 IBM Smarter Cities Challenge Report Recommendation

Recommendation 3: Integrate water and wastewater operations: The County should consolidate its water and wastewater management processes through the integration of the SCWA with the 193 STPs."

Expected Outcomes:
Consolidating water and wastewater operations will provide Suffolk County with the following benefits:

- An integrated view for effective management of the total water cycle
- Tighter orchestration between water management and Department of Health Services regulation
- Network optimization through the elimination of redundant activities and fewer repeat visits to specific sites
- Increased savings and synergies through the integration of key support services, such as sampling, laboratory services, call centers, control centers and management structures
- New revenue opportunities and funding options in addition to water-specific fees
- Uniform pricing for water and wastewater services for a majority of Suffolk County citizens
- Improved management of stormwater runoff.

Costs of inaction:
Continuing to operate water and wastewater operations separately will result in more duplication of services and operations, often within the same facility. In addition, investment decisions about capital construction and refurbishment will not be aligned and may not cover the full water cycle.

(The IBM Smarter Cities Challenge Report follows this Section.)

purposes and that the authority is and will be performing an essential governmental function in the exercise of the powers conferred upon it by this title.

A scan of water systems in New York State reveals that there are a number of public benefit corporation water authorities comparable to SCWA. There is one in Monroe County (Rochester) and one in Erie County (Buffalo), both of which envelop mid-size cities with installed sewer infrastructure. SCWA has no wastewater treatment charge delineated on its bill nor, by first flush, does Monroe. Erie has an "infrastructure investment charge" which, doubtless goes to the water delivery system. It should be noted that SCWA and these other authorities are pre-historic in that they were established decades before the premise that in-coming water might require treatment as it outflows. So, in Fairfax County (and neighboring counties in Northern Virginia), a sanitary sewer charge appears on the Fairfax Water bill (both departments are under the authority of the county) and is 70% higher than water usage. New York City wastewater charges ($5.88/100 cubic feet – FY 2015) are levied at 159% of water charges ($3.70/100 cubic feet – FY 2015) (http://www.nyc.gov/html/nycwaterboard/pdf/blue_book/bluebook_2015.pdf).

In contrast to Suffolk, Erie and Monroe, *"the New York City Municipal Water Finance Authority ("NYW") is a public benefit corporation created in 1985 pursuant to the New York City Municipal Water Finance Authority Act. NYW's purpose is to finance the capital needs of the water and sewer system of the City of New York (the "System") which is operated by the New York City Department of Environmental Protection. The New York City Water Board sets water and sewer rates for New York City sufficient to pay the costs of operating and financing the System."*

SCWA is the largest provider of groundwater in the nation, pumping approximately 70 billion gallons of potable water each year through nearly 6,000 miles of pipe from 400 active wells in 180 well fields drawn by 231 pump stations. Its May 31, 2014 financial report, SCWA showed water service operating revenues of $138.45M and assessed its net capital (water plant) assets of $1,077.32M.

Long Island voters are willing to pay to see water quality improvements.

- Fully **69%** say "placing a fee on water bills that would be higher for those that use a lot of water and lower for those that use less" is acceptable.
- The average voter is willing to pay $17 per month, and the funding mechanism that draws broadest support is a fee on water bills.

If a sewerage usage charge were incorporated into SCWA's billing comparable to that in Fairfax, approximately $236M would be generated per annum to address wastewater treatment. As a point of comparative business performance, FCWA more than doubles SCWA's operating income to sales ratio, 0.37:0.15, and the FCWA's debt-to-asset ratio is ⅔ of SCWA at 0.36:0.56 (*Water Utility Privatization: A Comparison of Commercially-Owned and Government-Owned Utilities,* Maryland Tax Education Foundation, 2008).

Note that the principle of linkage, i.e. water *and* wastewater agency, as opposed to separate operations, prevails throughout larger-scale systems across the United States.

- How best to measure outflow than by inflow, attaching related usage and remediation fees?

  - How best to reduce waste than to put pressure on use through market mechanisms?

- To provide the most cost-effective solutions for water quality, the county would need to leverage all its assets. Absent its crown jewel water authority, county infrastructure would be substantially undervalued with significantly less leverage, limiting access to market, while increasing the cost of capital, which requires steady, predictable revenue streams.

  - Private sector models like French-based Veolia and Suez (United Water) are integrated utilities, combining energy, drinking water and waste treatment (resource recovery). Indianapolis' Citizens Energy, constituted as a public charitable trust, reclaimed its water system (Citizens Water) from Veolia in 2011 and off-booked its debt in the process. The principle demonstrated here is the market-based synergy of a unified utility, which is also

manifest in the largest public utility in the country, Los Angeles Department of Water & Power.

It may indeed be the case, as per opinions rendered both by counsel for SCWA and New York State Department of Health (NYSDOH) that, in order for the SCWA to charge an aquifer protection fee, the New York State Legislature would need to amend the New York Public Authorities Law Article 5, Title 4. The SCWA was created under this authority and is statutorily defined under New York Public Authorities Law Article 5, Title 4. Under Section 1078(6) {Powers of the Authority} they have the ability to charge and collect rates as described below:

> "6. To fix, alter, charge and collect rates and other charges for the use of water by the inhabitants of the county or other consumers thereof, at reasonable rates to be determined by the authority for the purpose of providing for the payment of the expenses of the authority, the construction, improvement, repair, maintenance and operation of the water supply and distribution system of the authority, the payment of the principal of and interest on the obligations of the authority, and to fulfill the terms and provisions of any agreements made with the purchasers or holders of any such obligations."

In addition, there are some existing provisions in N.Y. PBA. LAW § 1075: NY Code - Section 1075 beside (3.) cited above that could be liberally interpreted to enable expanded responsibility for a "public benefit corporation":

> "12. To enter into cooperative agreements with other water authorities, municipalities, or utility companies, for the interconnection of facilities, the exchange or inter-change of services and commodities or for any other lawful purposes necessary or desirable to effect the purposes of this title, provided, however, that any such agreement with a municipality located in a county, other than Suffolk county, shall be subject to the approval of the board of supervisors of such county, if any."

There are also "additional powers of the county of Suffolk and towns and villages within Suffolk County:"

> "b. In areas of documented groundwater contamination where potable water may be more economically supplied by a municipal water authority, special district or improvement area established to provide water improvement or by a village, than by the Suffolk County Water Authority, the county board of supervisors and any town board or village board of trustees within Suffolk County may appropriate sums of money to said municipal water authority, special district of improvement area or village, and enter into a contract or contracts, in accordance with this subdivision."

Note the combined authority of Dutchess County, which has the second most septics (52,000) of any New York State county after Suffolk:

> "§ 1123. Dutchess County water and wastewater authority. 1. A public corporation, to be known as the "Dutchess County water and wastewater authority" is hereby created for the

public purpose and charged with the duties and having the powers provided in this title. The authority shall be a body corporate and politic constituting a public benefit corporation and shall be a "public district" for purposes of section eighty-nine-l of the public service law, the objects of which in the judgment of the legislature cannot be attained under general laws.

§ 1124. Powers of the authority. The authority shall have the power:

14. To supply and sell water for domestic, commercial and public purposes at retail to individual consumers within the county or wholesale to municipalities, water districts or district corporations within the county and to collect, treat and discharge sewage produced for such purposes by such generators;".

2.4.2 Case in Point: Seeking Means beyond Grants…

One of ten mega-proposals selected by HUD's '***Rebuild by Design***' (RBD) is Interboro's "Living with the Bay*: A Comprehensive Regional Resiliency Plan for Nassau County's South Shore***.***" Interboro, which teams a domestic and Dutch contingent, has been granted $125M out of the $930M allocated to RBD via Sandy recovery funding. The 'Green Corridor' component of this Interboro's proposal addresses a stretch of Sunrise Highway from Valley Stream to Freeport, shown in a rendering by **Figure 2-5**. Presently underdeveloped, its post-Sandy desirability lies in the fact that it is high and dry, just beyond the reach of a category 2 surge, a 6-foot sea level rise, and the FEMA flood zone. The corridor is also highly impermeable: its roads and parking lots are a major source of both flooding and polluted stormwater runoff. In addition to transit-oriented, walkable, mixed-use downtowns and relief from river choke-points, the 'Green Corridor' proposes to reuse abandoned water infrastructure under Sunrise Highway for water storage and flow augmentation. This abandoned system, which includes a 72-inch steel force main, a 48-inch cast iron main, a 36-inch cast iron main, and a network of pumping stations, once provided Brooklyn with its drinking water from Long Island's aquifers. The estimate for 'Green Corridor' is $175.4M; the (partial) projected total for 'Living' comes in at $1,874M. With less than 7 percent of the interim estimate in hand, Interboro is clearly obliged to cast about for other funding/financing, three of which they identify:

Figure 2-5 The New Sunrise Corridor as Proposed by the Rebuild by Design/Interboro Team

- Because investments in flood prevention and stormwater retention make the protected land and properties more valuable, Tax Increment Financing (TIF) can stake current investment from the long-term cash flow forthcoming from higher property tax revenues. With other infrastructure work, TIF has been a proven means of using future tax gains to subsidize current upgrades.

- Mitigating measures for at-risk properties reduces storm damage and loss which, in turn, should be reflected in reduced insurance premiums. This provides a premise for applying some measure of insurance receipts to support mitigation. Interboro, however, "encountered a lot of complexities—mainly related to potential free riding—in further structuring this option," How the 'potential' of 'free riding,' i.e. illegal underwriting practice, arises in these kinds of transactions is not explained, though it may be another excuse provided by insurance companies to avoid the linkage of premiums to mitigation.

- Alternatively, it was Interboro's sense that the potential link with a specific tax or fee would experience "less complexity." The government could levy a property-related stormwater tax, or temporary fee or establish a business improvement district thus realizing lower insurance premiums and enhanced property value.

- Interboro proposes use of the 'availability payment' model of Public-Private Partnerships (P3s) for dikes, roads, marshlands, and stormwater systems. Moody's reports (9/8/14) that P3s are trending to the availability model away from the demand-risk model (as exemplified by the bankrupt Indiana toll road). From the standpoint of the private partner that makes sense, as it offloads most of their risk, in that the public partner is contractually bound to provide regular payments as long as the private partner meets performance measures, like construction cost overruns, schedule delays, long-term O&M and lifecycle costs. This past year the Port Authority of NY & NJ closed a $1.5B 'availability payment' model P3 for a new Goethals Bridge and will be contractually obligated to make availability payments over 40 years to compensate the special purpose vehicle (SPV) chosen to design, build, finance, and maintain the new bridge.

- NYS Office of the Comptroller ("Private Financing of Public Infrastructure: Risks and Options for New York State," June, 2013) calls it a new form of "backdoor finance" that "include some sort of payment guarantee to the private partner, so that the public is obliged to pay for years, with no consideration of changing circumstances or ability to pay…. The public may end up paying far more for the facility than it would have using traditional procurement methods." P3s want to have their cake and eat it too.

IMG Rebel, headquartered in the U.S. and the Netherlands served as financial advisor for the Interboro team. They proselytize for P3s which is, for example, how they structured privatization of Milwaukee's sewer utility operations, purportedly reducing costs by 35 percent. Rebel was retained by the Ministry of Infrastructure and Environment of the Netherlands to evaluate the "enormous investment need in water-related climate adaptation projects while funding is lacking." The

European Commission estimates that 80 percent of needed financing will come from private sources. The challenges to this end are formidable with climate adaptation projects:

- Capital-intensive with benefits very long term and dispersed, therefore hard to collect and use to pay back the investment.
- Returns are largely non-guaranteed and non-financial, consisting mainly of avoided costs.
- Offers limited autonomous earning power.

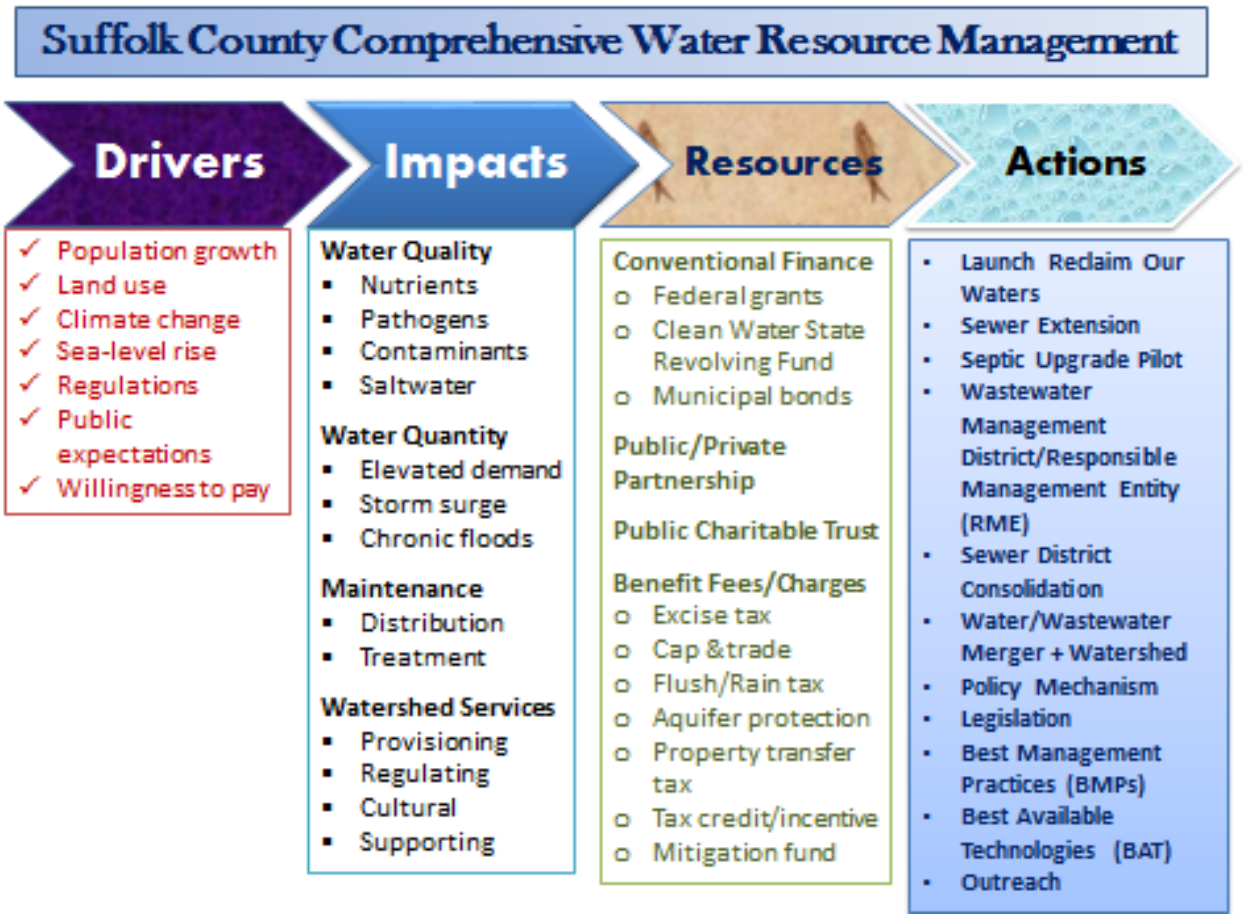
Rebel contends that P3s offer comparative advantage with superior private sector business discipline, productivity and market dynamic while positioning obligation off government books. Here's the catch: "Only a sound funding mechanism will attract private finance." Funding deals with the question who is paying the bill, whereas financing deals with the question how the time gap between the necessary investment and the availability of funding can be closed. Financing is what banks and investors do, funding is what end-users and taxpayers do.

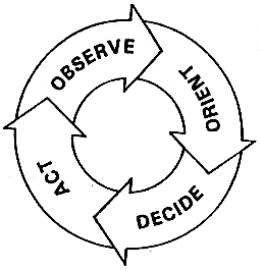
To make the funding component viable on a significant scale, will require engagement of the insurance sector, either through the fiscal instrument of an insurance surtax, or through regulatory instruments. In the latter case, a portion of the investment would be made by insurers adding a surcharge to premiums. Involvement of the insurance sector is contingent on the maturity of the insurance market.

Realization of comprehensive water resource management in Suffolk County cannot be a linear progression. Unlike a straightforward engineering project such as the installation of sewers its development is not subject to a Gantt chart. Contained heretofore, then, is a policy maker's tool chest that can be drawn upon when, where, how and if circumstances reveal themselves and the stars align. Take the following three elemental recommendations from Stanford Woods Institute for the Environment as a jumping off point:

- Pricing policies that would both better align with the full economic cost of supplying water and decouple revenues from the volume of water supplied and to foster more private-sector innovation;
- Regulatory frameworks to create an open and flexible governance environment that is innovation-friendly and encourages valuable new technologies; and
- Financing and funding mechanisms, such as a public benefit charge on water, that can help raise sufficient funds to implement innovative solutions.

("The Path to Water Innovation" (Ajami, Newsha, et al, 2014, p2&6)





Finally, in matters of public policy application, one is well-served to defer to that profound 21st Century existential observation: *"There are known knowns. There are things we know that we know. There are known unknowns. That is to say, there are things that we now know we don't know. But there are also unknown unknowns. There are things we do not know we don't know."* And "*Stuff happens.*" (D. Logan, "Known knowns, known unknowns, unknown unknowns and the propagation of scientific enquiry," J. Exp. Bot. (2009) 60 (3): 712-714.).

Suffolk County recognizes that Comprehensive Water Resource Management must consider potable water supply, collection and treatment of sanitary wastewater, stormwater management and coastal resiliency. Suffolk County's ***Reclaiming Our Water Initiative*** *will require establishment of an integrated water resource management structure, as well as identification of a source – or more likely, sources -- of funding and financing.*

Suffolk County is currently exploring potential water resource management organizational structures as well as a variety of funding options, including:

- *Benefit Charges*
- *Taxes or Fees*
    - *Property transfer tax*
    - *Aquifer protection fee*
    - *User fees -- Flush Tax/Runoff Tax/Toilet Paper Tax*
    - *Tax credits*
    - *Insurance Surcharges*
    - *Tax increment financing*
- *Conventional Financing*
    - *Infrastructure Bank - Clean Water State Revolving Fund*
    - *Federal Grants*
    - *Municipal Bonds*
- *Public –Private Partnerships (P3)*
- *Increased Rates for Potable Supply (Consistent with Average Market Rate)*

The anticipated investment needed to protect our water resources is significant – but then, so is the value of a clean and healthy water supply, thriving wetlands and ecosystems, our renowned beaches and estuaries and a resilient coastline. Recognizing that sufficient funding to accomplish all of our water quality protection and coastal resiliency goals is not currently available, Suffolk County is committed to identifying and accessing all available funding to implement the programs designed to Reclaim Our Waters, described in the following pages.

Suffolk County, New York, United States

Smarter Cities Challenge report

IBM

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1. Executive summary

Introduction

In 2010, IBM Corporate Citizenship launched the Smarter Cities Challenge® to help 100 cities around the world over three years become smarter through grants of IBM talent. These cities have made great progress on the road to becoming more instrumented, interconnected and intelligent (see www.smartercitieschallenge.org).

Suffolk County, New York, US, was one of 16 cities awarded an IBM Smarter Cities Challenge grant in 2014 as part of ongoing citizenship efforts by IBM to build a Smarter Planet®. In June 2014, a team of six IBM experts spent three weeks in the county working with stakeholders to help solve key challenges as identified by County Executive Steven Bellone.

Nitrogen pollution presents a significant risk to Suffolk County's water quality and is impacting surrounding bays, marshes and rivers. The main source of this nitrogen pollution is domestic properties with on-site treatment systems for waste, such as cesspools and septic systems.

The challenge

The County has noted a decline in the quality of Long Island's surface water as evidenced by brown and red tides, reduced levels of shellfish and marsh pannes. Excessive contaminants in the water bodies, particularly nitrogen, are responsible for this degradation, with 69% of this nitrogen production coming from the septic systems of individual properties. Other sources include agriculture, residential fertilizers and sewage treatment plants.

This contamination can potentially have a significant impact on not only the quality of life for residents and visitors to Suffolk County, but also the economy on the island. This could result in major economic challenges for the County, leading to reduced industry, reduced coastal resiliency, restrictions on development and lower house prices plus a negative impact on tourism. The County has placed a potential value on this of approximately $2.3 billion, with fishing contributing $900 million, use of beaches $670 million and boating $760 million.

The key challenge is to make recommendations that address the County's nitrogen problem and account for the following factors:

- Lack of funding and resources
- Different challenges across the County's various geographies
- Multiple stakeholders with conflicting objectives
- A fragmented structure and management system across the county that limit the County's ability to take action
- Lack of water quality awareness and understanding among citizens and visitors
- Lack of overall information management strategy to support decision making and the long-term management of nitrogen reduction in the county
- Lack of integrated water and wastewater management strategy
- Lengthy timescales for water quality restoration
- Efforts to manage water quality that must be sustained over a long period of time

Findings and recommendations

During its three-week visit, the Smarter Cities Challenge team conducted a series of interviews and workshops with more than 90 stakeholders representing 38 organizations. The team focused on addressing excessive nitrogen loads in the County's water supply. With so many interrelated challenges, this issue could not be solved in isolation. Instead, it required collaboration, coordination and alignment to achieve a sustainable solution.

The people of Suffolk County clearly prioritize the quality of their water and have a passion for addressing and resolving this issue. Residents, businesses and visitors alike value water and the central role it plays in their quality of life on the island, but they need help developing and implementing a plan to improve and protect water quality. For instance, a common misconception is that failing septic systems are the cause of nitrogen pollution when, in fact, on-site septic systems are not designed to remove nitrogen in the first place.

The County and other stakeholders have conducted a significant amount of work to identify the cause of contamination and potential tactics to resolve the problem. However, one of the team's key findings was that this work is not always done in a coordinated manner and at times lacks common objectives or goals. This results in potentially conflicting findings and inadequate management of (or planning for) certain phases of the water cycle. While there is a significant quantity of relevant data across the county, it is distributed across many organizations and is available in various forms. The absence of an overarching strategy for data structure, usage and storage makes it even more difficult for the County to uncover insights and inform actions.

To help Suffolk County achieve a successful platform for integrated water management, the team identified 11 recommendations in four key areas:

1. Blueprint for the future

Suffolk County should establish a long-term Water Resource Plan with a set of target outcomes and a baseline that will inform future decisions on change. This plan should build on existing planning, but the format should become a "living template" that is used regularly within a governance process for water management for the island. The plan should outline the architecture for water management and drive core programs to improve water management and quality. Our recommended initial programs focus on solutions to reduce nitrogen pollution for the properties within Suffolk County currently on cesspools or septic systems, as well as improving the control and management of waste treatment within the existing 193 sewage treatment plants (STPs).

2. Execution

Execution recommendations support the blueprint and focus on establishing a means of sharing and managing data across the entire water cycle, from rivers and streams to water treatment plants and agriculture to aquifers and oceans. This will help ensure that different organizations involved in water management will maintain ownership and security of data and enable sharing of information to support decision making and progress in monitoring water quality. A core principle of integrated water management is to plan and manage water and wastewater in a cohesive manner to ensure the full water cycle is regulated (see Appendix F). The team also recommends a process for compliance management to ensure that processes are followed and improvements are identified on an ongoing basis.

3. Engagement

Water is at the heart of Suffolk County, and its quality directly impacts the lifestyle, health and economy of the County's 1.5 million residents, as well as its five million annual visitors. The Engagement recommendations focus on helping residents and visitors understand the role they play in managing and improving water quality, motivating them to take action.

4. Enablers

Improving the County's water quality and implementing a sustainable solution could take several years. These final recommendations focus on funding the necessary efforts, while ensuring that the processes and organizational structure will be able to meet future needs and continue to support county-wide integrated water management.

Conclusion

Water quality impacts not only the ecological aspects of Suffolk County but also the lifestyle, economy and health of its residents and visitors. Current levels of nitrogen and other pollutants in local bodies of water are the result of water infrastructure and septic systems that evolved over many years with no overall plan. If Suffolk County wants to continue to grow its economy, attract tourists and deliver a high quality of life for its residents, it must tackle water management with common goals, shared information and an integrated approach to managing water and wastewater services.

Highlights

These recommendations will help Suffolk County accomplish the following:

- **Agree on common nitrogen load goals and actions for reduction**
- **Establish a Water Resource Plan that sets out the infrastructure and architecture for robust water and wastewater management**
- **Optimize the water and wastewater management network/ infrastructures with improved operations, capacity and costs and minimize nitrogen output**
- **Increase the number of septic systems with nitrogen removal technology**
- **Share water-related data more easily with key stakeholders through the implementation of a data integration model**
- **Increase civic engagement and active public participation in solving water quality issues**
- **Reduce nitrogen levels in ground and surface waters**

2. Introduction

A. The Smarter Cities Challenge

By 2050, cities will be home to more than two-thirds of the world's population. Cities wield more economic power and have access to more advanced technological capabilities than ever before. However, they are struggling with a wide range of challenges that threaten the sustainability of their core support and governance systems, including transportation, water, energy, communications, healthcare and social services.

Meanwhile, trillions of digital devices, connected through the Internet, are producing tremendous amounts of data. All of this information — from the flow of markets to the pulse of societies — can be turned into knowledge, because we now have the computational power and advanced analytics to make sense of it. With this knowledge, cities could reduce costs, cut waste and improve efficiency, productivity and quality of life for their citizens. In the face of the mammoth challenges of economic crisis and increased demand for services, ample opportunities still exist for the development of innovative solutions.

In November 2008, IBM initiated a discussion on how the planet is becoming "smarter." By this it meant that intelligence is becoming infused into the systems and processes that make the world work — into things no one would recognize as computers: cars, appliances, roadways, power grids, clothes and even natural systems, such as agriculture and waterways. By creating more instrumented, interconnected and intelligent systems, citizens and policymakers can harvest new trends and insights from data, providing the basis for more informed decisions.

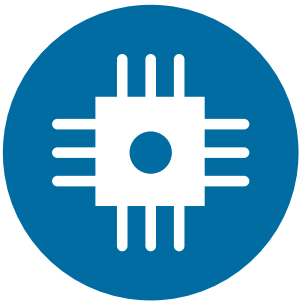
A Smarter City uses technology to transform its core systems and optimize finite resources. Since cities grapple on a daily basis with the interaction of water, transportation, energy, public safety and many other systems, IBM is committed to a vision of Smarter Cities® as a vital component of building a Smarter Planet. At the highest levels of maturity, a Smarter City is a knowledge-based system that provides real-time insights to stakeholders and enables decision makers to manage the city's subsystems proactively. Effective information management is at the heart of this capability, and integration and analytics are the key enablers.

Intelligence is being infused into the way the world works.

As IBM aligns its citizenship efforts with the goal of building a Smarter Planet, it realizes that city leaders around the world face increasing economic and societal pressures. Given the growing demand for services, they have to deliver new solutions ever more rapidly.

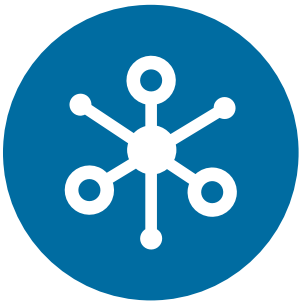
With this in mind, IBM Corporate Citizenship has launched the Smarter Cities Challenge to help 100 cities around the world over a three-year period become smarter through grants of IBM talent. Suffolk County, New York, was selected through a competitive process and awarded a Smarter Cities Challenge grant in 2014.

During a three-week period in June 2014, a team of six IBM experts worked in Suffolk County to deliver recommendations around key issues for County Executive Steven Bellone.



Instrumented

We can measure, sense and see the condition of practically everything.



Interconnected

People, systems and objects can communicate and interact with each other in entirely new ways.

Intelligent

We can analyze and derive insight from large and diverse sources of information to predict and respond better to change.

Figure 1: Instrumented, interconnected, intelligent

B. The challenge

The County has recognized a decline in the island's surface water quality, as evidenced by an increase in brown and red tides, reduced levels of shellfish and marsh pannes. The cause of this decline is excessive contaminants in the ground and surface water bodies, particularly nitrogen. The majority (69%) of this nitrogen comes from cesspools and septic systems on individual properties. Other sources include agriculture, lawn fertilizer and outputs from sewage treatment plants.

This contamination may result in economic challenges for the County, including reduced industry, reduced coastal resiliency, restrictions on new development and a negative impact on tourism.

The key challenge is to make recommendations that address the County's nitrogen problem and account for the following factors:

- Lack of funding and resources
- Different challenges across the County's various geographies
- Multiple stakeholders with conflicting objectives
- A fragmented structure and management system across the county that limit the County's ability to take action
- Lack of water quality awareness and understanding among citizens and visitors
- Lack of overall information management strategy to support decision making and the long-term management of nitrogen reduction in the county
- Lack of integrated water and wastewater management strategy
- Lengthy timescales for water quality restoration
- Efforts to manage water quality that must be sustained over a long period of time

3. Findings, context and roadmap of recommendations

A. Findings and context

Based on its three-week visit, the IBM team made the following observations with key supporting points:

- Today's current operating model, which includes multiple organizations, does not address the full water cycle:
  - It lacks long-term network planning and coordinated water and wastewater handling solutions across the entire water cycle, which are necessary to achieve a balanced approach to water quality.
  - There is no regular testing, monitoring or management of septic system maintenance.
  - There is no agreement on required metrics to manage water quality, such as total nitrogen load.
  - There is limited or no coordination across different organizations on similar programs of work.

- Levels of infrastructure monitoring and understanding, particularly for individual households, cannot support or sustain the improvement of water quality:
  - Staff shortages and limited cross-training result in the postponement of preventive maintenance activities to handle emergencies and other reactive work.
  - New technologies and regulations may require additional resources or different skills.
  - Current housing options do not meet the needs of changing demographics and are particularly lacking for young professionals.

- After potential federal and state funding, there is still a US$7 billion gap for wastewater treatment upgrades in Suffolk County (based on Suffolk County Department of Economic Development and Planning cost estimates for septic system upgrades and changes).

- Residents and businesses value water quality but do not understand how they influence it or know what they can do to improve and protect it:
  - Citizens with individual septic solutions generally take action on maintenance only when there is an issue with the septic system.
  - The County lacks a common way to quantify the economic impact that poor water quality has on Suffolk County.
  - Many citizens do not recognize the relationship between their water use and overall water quality; many do not know that their water comes from an aquifer below their homes.

- Lack of coordination across organizations prevents collective and deliberate action:
  - Diffused responsibilities, varying objectives and lack of agreement limit how and when to engage the public.
  - There is no common measure or goal for the amount of nitrogen loading that is acceptable.
  - Interested stakeholders do not meet on a regular basis to discuss water issues.

- Suffolk County recognizes cesspools and septic tanks as the primary contributor of the nitrogen load in the water:
  - There are 360,000 individual properties with an on-site cesspool or septic system.
  - These technologies are not designed to remove nitrogen.

- Current Department of Health Services codes for septic solutions do not address nitrogen reduction needs:
  - Alternative approaches and innovative technologies are not encouraged enough due to a lack of information, resources and incentives, as well as failed previous trials.

- The County lacks an overall data strategy:
  - Relevant data is fragmented and owned by different stakeholders in different formats.
  - There is no single electronic registry or repository that tracks cesspools and septic systems in Suffolk County.

During the three-week visit, the IBM team referenced a number of documents to consolidate its understanding of the issues and support its conclusions. The core documents are identified in Appendix C (see references 4, 8, 9, 18 and 19).

B. Roadmap of recommendations

Based on these findings, the IBM team recommends that Suffolk County develop an Integrated Water Management model. The model should address the granularity and variety of nitrogen sources, the several paths by which nitrogen reaches the water, the limited options of reduction treatment for on-site septic systems and the limited feasibility of new sewers in the county. The County also must consider the multiple interrelated factors that influence water quality in Suffolk County. This comprehensive plan should be resilient enough to absorb and mitigate the impact of factors that are outside the County's control (including federal and state grants, tax revenues, regulations and weather events). The team established multiple action plans to give the County a full scope of considerations it must take into account when approaching nitrogen reduction in water.

The deployment of the Integrated Water Management model is supported by 11 distinct recommendations across four elements: Blueprint for the future, Execution, Engagement and Enablers (see Figure 2).

Blueprint for the future includes three recommendations: the creation of the robust Water Resource Plan, the consolidation of the STP network and the definition of the right technologies for areas where sewers are not a feasible option in the Water Resource Plan.

The Execution of these recommendations covers the full set of available solutions for wastewater disposal. Based on data analytics, the County will be able to identify the most appropriate and cost-effective geographies to serve with new sewers, where to extend existing sewers, which STPs require a capacity increase, locations to install small clusters and which septic/treatment technologies should be installed where sewers are not feasible.

Within this comprehensive model, it is recommended that Suffolk County consolidate existing STPs under the same governance and operations to improve wastewater treatment. The priority is to focus on those plants that have high levels of nitrogen load or are within areas nominated as a priority for sewer construction or extension. Blueprint adoption and implementation is closely connected to the other three elements of the Integrated Water Management model. In fact, the Blueprint can be effective only when it is supported by Execution and Engagement.

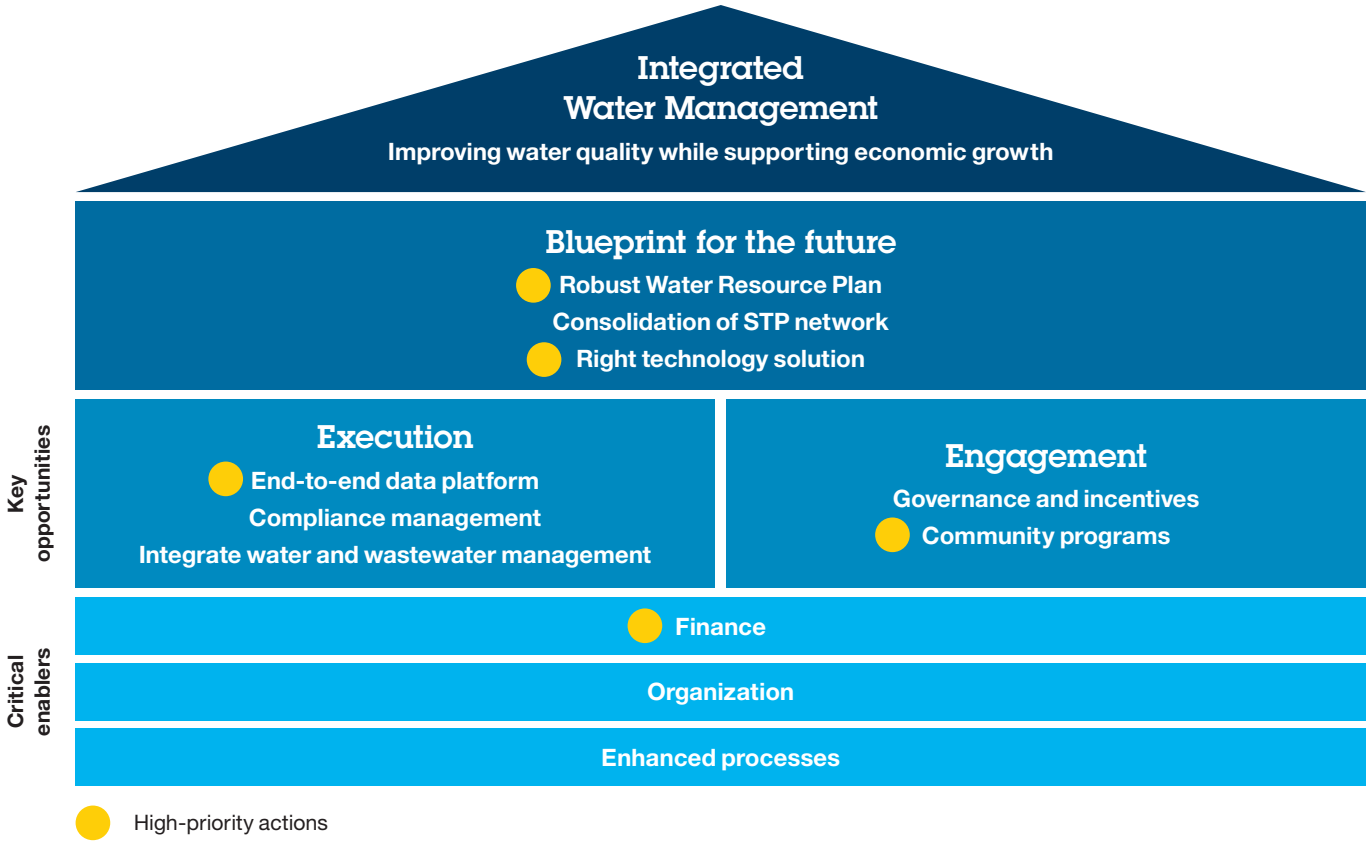


Figure 2: Overview of recommendations, with yellow circles indicating high-priority actions

Critical to the overall success of Integrated Water Management is the implementation of an end-to-end data model, which enforces a common language and is a central source of information for decision makers. The number of stakeholders and the difference in their current data structures is the main inhibitor to data-driven management. The implementation of such a model will provide the data necessary to execute the County's water quality mission and responsibilities in a more effective manner. Compliance management is important for the County to ensure all key processes in the water cycle are monitored, assessed and executed in a way that allows nitrogen reduction goals to be met. Another recommendation is to consolidate water authority and wastewater management activities. There are several examples of improved effectiveness in such a combined operation mode, including the optimization of back-office processes, such as invoicing, procurement and laboratory testing. The consolidation will allow the County to manage the water cycle in an integrated fashion, with potential new opportunities to harmonize water fees and increase revenues for managing wastewater.

In order to achieve the overall plan, the County must address the three key enablers of finance, organization and process. The first enabler of finance is particularly challenging because the funding must be ongoing. Funding all the components, which are much more granular than the 11 recommendations themselves, is a complex puzzle of grants, bonds, fees and savings at several different levels (federal, state, county, municipal and so on). Planning, application, prioritization and monitoring for all must be meticulously controlled. It is recommended that the County appoint a financial team to specifically address the funding of the overall Water Resource Plan execution. This team should have strong leadership, high accountability to the County Executive and a clear understanding of the Water Resource Plan, along with the ability to coordinate funding and expenses.

The organization must be redesigned to support the recommended changes in management oversight of the water cycle. The inclusion of additional STPs, the release of the revised Sanitary Code, the expansion of some responsibilities and the creation of more robust compliance require a more senior and skilled workforce. This may mean an increase of resources and a potential shift in careers generated by new opportunities in the full water cycle.

Finally, it was noted that several processes within County operations should be reviewed for inefficiency or duplication of efforts. The County should consider implementing a continuous improvement process, employing "lean" principles to help improve customer responsiveness and potentially free up valuable resources to be employed in new areas.

Although implementation of most of the recommendations will be led by County staff, a successful outcome requires the participation of the communities, people and organizations of greater Suffolk County. Under the topic of Engagement, two recommendations are made to address this participation. The first is governance and incentives, for which the goal is to define methods to encourage homeowners to become active participants in the Water Resource Plan, primarily by upgrading their on-site septic systems. The definition of appropriate and affordable incentives, supported by financial plans, will increase the success of the County in achieving its upgrade goals.

Remediating all 360,000 individual septic and cesspool installations will require awareness and self-initiation of action from the residents and communities owning these systems. It is recommended that Suffolk County undertake significant engagement activities to encourage residents and visitors to contribute to the solution for excess nitrogen. Engagement programs should offer a broad spectrum of initiatives to increase awareness, achieve an appropriate and distributed level of understanding and obtain adequate commitment. Those initiatives should directly link the value of water quality to daily life. For example, the adoption of such programs as the Blue Flag (see reference 5 in Appendix C) will make the impact of individual behaviors on the surrounding area immediately visible.

Such engagement is vital to this program. In order for the County to achieve its water quality goals, the people must be sufficiently committed to act.

This recommended program is highly ambitious and comprehensive. To build momentum and demonstrate near-term progress, the following high-priority activities must begin as soon as possible:

- Establish common nitrogen load allocation goals
- Create a comprehensive water resource management plan
- Launch a Blue Flag pilot
- Develop an on-site/cluster systems inventory
- Release Sanitary Code updates to support new on-site wastewater management options
- Establish a financing plan to accompany the Water Resource Plan
- Identify priority data sources to integrate into a common water management platform

These actions are reflected in a summary roadmap (see Figure 3). A roadmap of all recommended actions is available in Appendix I.

In order to provide the County with initial guidance for planning purposes, order-of-magnitude cost figures have been estimated for each recommendation. These costs have been estimated in ranges and classified as high (up to $30 million), medium (up to $10 million) and low (up to $1 million). The County has previously estimated total infrastructure costs for septic system upgrades to be approximately $8 billion, which is not included in our cost estimates.

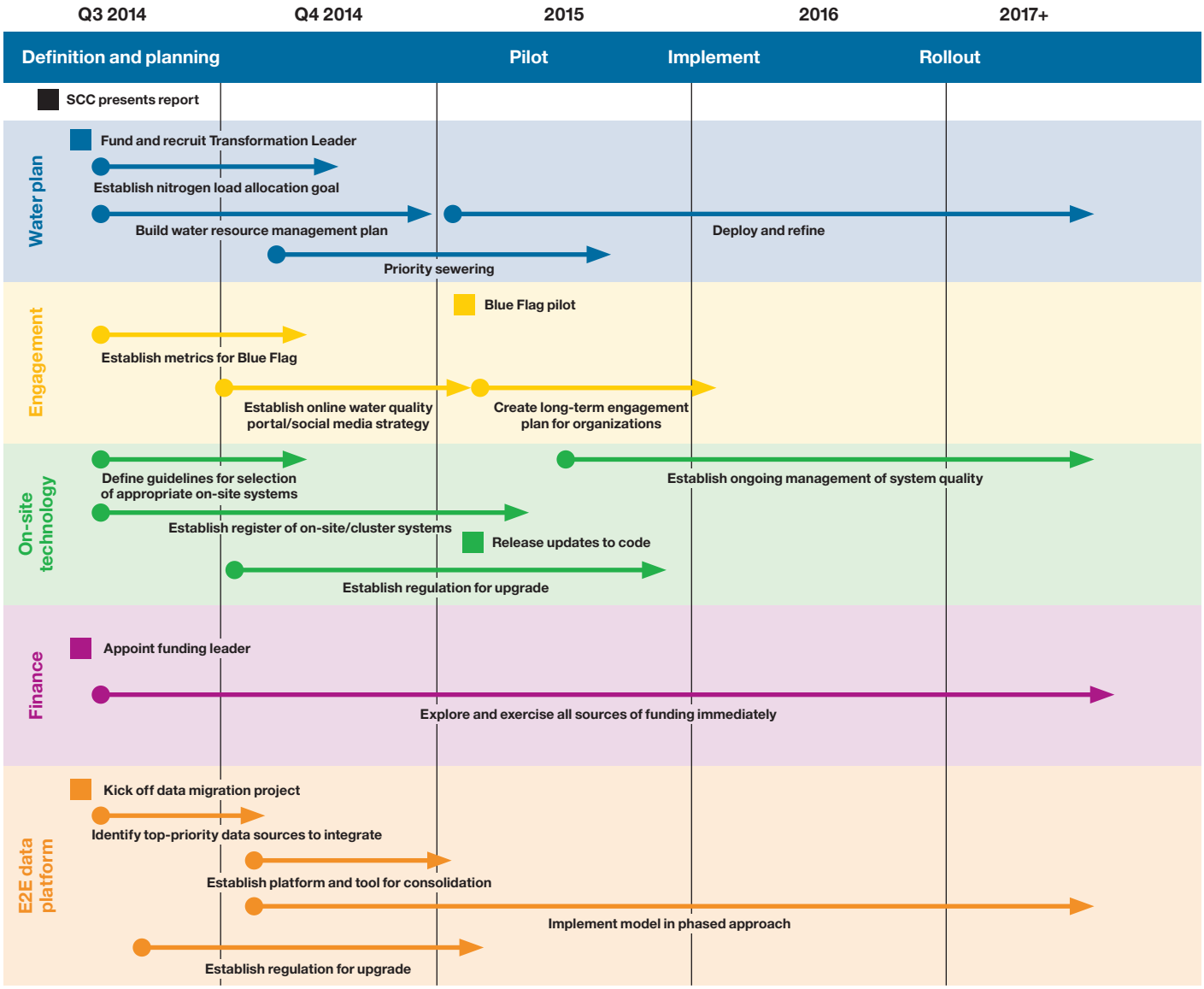


Figure 3: Roadmap of high-priority actions

4. Recommendations

The following paragraphs detail the 11 recommendations for Suffolk County, highlighting the scope, key milestones and stakeholders for each. The recommendations described have been developed based on the information covered within the three week period. The owners identified will need to plan the implementation of these recommendations in the context of the overall priorities and budget for Suffolk County.

Recommendation 1: Finalize and deploy a robust and integrated Water Resource Plan

The recognized problem of high nitrogen loads in ground and surface water cannot be addressed in isolation. All contributing elements (households, industry and agriculture) must be considered in an integrated manner (see Figure 4), with the numerous interactions among the components of the water cycle taken into account. Such an integrated approach is not yet implemented in Suffolk County, mainly due to the multiple stakeholders and the variety of needs involved.

There is a need for an integrated water resource management plan supported by clearly identified sponsors and sustained by a related organization. Suffolk County must identify responsibility for water management across the island, and the plan must take into account all contributing or mitigating elements impacting the water resources of Suffolk County. The high diversity of situations in sub-watershed geographies necessitates specific approaches for individual areas, which must be considered in the plan. In addition, the plan should consider future scenarios, such as population growth, water body levels and flows, to help ensure that actions and plans taken today support the long-term outcomes desired for water quality and overall county development.

The proposed Water Resource Plan must serve as a master plan that will help decide the most appropriate scenarios, trigger their translation into action plans and follow up on their impacts. It is important that this plan can be used on a regular basis and is easily maintained to support decision making on water management. In this way, the plan can steer actions and support decisions to help reduce total nitrogen loads on water bodies. Consequently, this will translate into better quality of life and suitable economic development.

The team's proposal is to build the plan incrementally, based on the existing comprehensive plan (see reference 21 in Appendix C), while engaging its use and making outcomes visible at the earliest stage possible. This will help to foster plan acceptance and hasten the development of the surrounding governance structure.

An integrated approach to planning and managing water bodies is being established in many other countries and cities, and this work may help inform Suffolk County during the development of its plan. Examples can be found in Appendix C (see references 20, 23, 25, 26, 29, 30, 33, 34, 35 and 36).

Figure 4: An incremental plan with specific sponsors and immediate outcomes will foster acceptance

Recommendation 1: Finalize and deploy a robust and integrated Water Resource Plan

The County should finalize and deploy an integrated Water Resource Plan supported by clearly identified sponsors and sustained by a related project organization.

Scope and expected outcomes

Scope

Develop a master plan for water management that will be used as a framework to support decisions related to agreed-upon outcomes for water quality and related activities.

To achieve desired results, the plan should do the following:

- Provide a vision and overview regarding agreed-upon goals (what the future will look like)
- Offer a common view of the current situation as well as future developments and scenarios
- Contain tools for supporting operational decision making
- Trigger, monitor and integrate specific programs and action plans
- Ensure and streamline related monitoring and communication

Expected outcomes

Developing a master plan for water management and related activities will help to ensure the following outcomes:

- Common goals are defined and an agreed-upon strategy is defined to reach these goals
- All areas of the water cycle are efficiently managed and integrated, including water supply, storm water runoff, wastewater treatment, water production, industrial and agricultural water use and surface and groundwater
- Adequate solutions are developed and implemented that consider local conditions and future development needs

Cost of inaction

The costs of inaction are a lack of plan information, resulting in uncoordinated actions, wasted efforts, duplicated tasks and redundant investments. Key nitrogen reduction goals may be missed without properly synthesizing a full range of actions.

Proposed owner and stakeholders	Suggested resources needed
Owner: Suffolk County Department of Health Services supported by the Department of Economic Development and Planning **Stakeholders:** • All County agencies • Suffolk County Water Authority (SCWA) and other water authorities • STP operations operated both privately and by the County • Towns, villages and hamlets • Nonprofits • Businesses and trade associations • State agencies, such as the New York State Department of Environmental Conservation (NYSDEC) • Federal agencies • Universities	• An external vendor to provide guidance and knowledge transfer to the Suffolk County Department of Economic Development and Planning • Part-time input from other departments and stakeholders during the joint planning phase • A dedicated team to maintain, update, communicate and coordinate efforts according to the plan **Cost estimate:** Medium

Recommendation 1: Finalize and deploy a robust and integrated Water Resource Plan (continued)	
Dependencies	**Key milestones, activities and timeframe**
This recommendation requires the consolidation of the STP network (described in Recommendation 2), as well the establishment of a framework to visualize, monitor and manage water quality (see Recommendation 4).	**Short term (up to 6 months):** • Develop initial plan • Establish governance and leadership • Set preliminary goals for nitrogen load allocation • Build resource management plan • Define and launch initial programs **Long term (1 - 5 years):** • Implement program • Launch actions • Measure progress • Manage integrated management resource plan
Priority	
High	

Recommendation 2: Operate the sewage treatment plant network under the control of the Suffolk County Department of Public Works

There are currently 193 sewage treatment plants (STPs) within Suffolk County, of which 23 are operated by the Suffolk County Department of Public Works (SCDPW), including the Bergen Point plant, which accounts for approximately 51% of total STP volume. The STP Report for 2013 (see reference 11 in Appendix C) states that by the end of 2014, all County STPs will be treating for nitrogen reduction. However, 61 plants have been identified as "high risk," a consequence of producing average nitrogen levels in excess of the 10 mg/L target. The recommendation is to include all 193 STPs under the management of SCDPW. This may mean that private operators continue to operate certain STPs under the management of the SCDPW.

Recommendation 2: Operate the STP network under the control of the SCDPW

The County should manage all 193 public and private STPs under the authority of the SCDPW to facilitate the smooth transformation of operations that support a reduction in nitrogen loads. Although the SCDPW will have overall control, there may be instances in which private operators continue execution of operations at the individual plant level.

Operational transfer will be prioritized based upon STP location (proximity to potential areas for new or extended sewers feeding the STP) as well as the plant's history for producing high levels of nitrogen.

Scope and expected outcomes

Scope

To achieve the desired results, the County should take the following actions:

- Transfer operational control of privately run STPs to the SCDPW, covering all 193 plants
- Maintain Suffolk County Department of Health Services (SCDHS) risk-based approach to monitoring STP output

Expected outcomes

Moving STPs under the direction of the SCDPW will help to ensure the benefits listed below:

- Consistent operation, management and monitoring of STPs
- Network optimization and improved overall performance in nitrogen reduction efforts
- Increased revenue and the opportunity to achieve parity on charges for wastewater services across the county
- Waste collection cost uniformity across the county, reducing transport and logistical costs for waste disposal while optimizing waste management capacity
- More focused efforts for addressing areas with high levels of nitrogen

Costs of inaction

The costs of inaction include the continued operation of STPs releasing unacceptable nitrogen levels. Without proper maintenance and oversight, these plants will continue to worsen nitrogen pollution, ultimately undermining economic development and tourism.

Proposed owner and stakeholders	Suggested resources needed
Owner: Head of SCDPW **Stakeholders:** Commissioner of the Department of Health Services, private STP operators, civil services and unions	• Program management and transition planning • Teams to manage new plant operations **Cost estimate:** High
Dependencies	**Key milestones, activities and timeframe**
This recommendation requires the establishment of a Water Resource Plan (see Recommendation 1) and will impact the consolidation of water and wastewater operations (see Recommendation 3). A workforce model and practices also must be designed to meet future needs (see Recommendation 9). Potential solutions for decentralized wastewater treatment (see Recommendation 11) also will influence the consolidation of STP operations.	• Confirm criteria, priority and control of transfer (Month 1) • Develop high-level transition plans aligned to the overall resource plan and place identified resources (Months 2 - 3) • Define STP management and operational approach based on service levels (Months 3 - 9) • Schedule service management meetings with privately run STPs (Months 4 - 12) • Transfer initial tranche of STPs to new network (Months 4 - 24) • Manage ongoing program for STP transfer (Year 2 onward)

Priority

Medium

Recommendation 3: Integrate water and wastewater operations

A number of businesses provide drinking water to Suffolk County, with the Suffolk County Water Authority (SCWA) serving 72 percent of the population (see reference 15 in Appendix C). These water companies operate independently from wastewater services, as well as from one another. Such separation may cause investment decisions to be made in a localized manner without full consideration of overall county needs or the water cycle. In addition, this situation causes a number of support services to be duplicated, including sampling, lab services, customer contact centers and billing.

As part of the Water Resource Plan, bringing water and wastewater services together will allow a more integrated view for management across the county, which may result in a more effective investment portfolio. The combined operations also bring alignment on water consumption and the related level of service requirements for wastewater.

The recommendation is to first assess the feasibility and business case for consolidation, followed by the definition of a future operating model for water and wastewater management across the county. A diagram in Appendix G outlines the core operational and customer cycles for a combined water and wastewater company. Highlighted on the diagram are some best practices that should inform the design and help optimize these services for Suffolk County.

Recommendation 3: Integrate water and wastewater operations

The County should consolidate its water and wastewater management processes through the integration of the SCWA with the 193 STPs currently in operation. This will entail developing a business case and target operating model for the combined water and wastewater services, which may present savings and process improvement opportunities.

This recommendation does not include multiple water providers for approximately 30 percent of the population. Including these companies may be worth considering at a later stage.

Scope and expected outcomes

Scope

To achieve the desired results, the County should do the following:

- Integrate the operations, billing and support services of the SCWA and SCDPW for water and wastewater services
- Integrate the operations and support services of the transferred STPs as they are on-boarded (see Recommendation 2)

Expected outcomes

Consolidating water and wastewater operations will provide Suffolk County with the following benefits:

- An integrated view for effective management of the total water cycle
- Tighter orchestration between water management and Department of Health Services regulation
- Network optimization through the elimination of redundant activities and fewer repeat visits to specific sites
- Increased savings and synergies through the integration of key support services, such as sampling, laboratory services, call centers, control centers and management structures
- New revenue opportunities and funding options in addition to water-specific fees
- Uniform pricing for water and wastewater services for a majority of Suffolk County citizens
- Improved management of storm water runoff

Costs of inaction

Continuing to operate water and wastewater operations separately will result in more duplication of services and operations, often within the same facility. In addition, investment decisions about capital construction and refurbishment will not be aligned and may not cover the full water cycle.

Recommendation 3: Integrate water and wastewater operations (continued)	
Proposed owner and stakeholders	**Suggested resources needed**
Owners: • Commissioner of SCDPW • Commissioner of SCWA **Stakeholders:** Commissioner of the Department of Health Services	Support from transition teams, human resources teams, business representatives and department heads **Cost estimate:** Medium
Dependencies	**Key milestones, activities and timeframe**
Integrating water and wastewater operations depends on the success of the following recommendations: • Recommendation 1: Finalize and deploy a robust and integrated Water Resource Plan • Recommendation 9: Develop workforce model and practices to meet future needs Integrating water and wastewater operations will impact the following recommendations: • Recommendation 2: Operate the STP network under the control of the SCDPW • Recommendation 10: Adapt the business processes in the SCDPW and the SCDHS to meet expanded integrated water management responsibilities	• Define business case and identify synergies (2 months) • Determine the target operating model to combine water and wastewater services (4 months) • Establish an implementation plan and budget (3 - 4 weeks) • Agree on working patterns and structures with unions (6 - 9 months) • Transition and consolidation of shared services (6 - 9 months) • Transition and implementation of combined operation (9 months with stabilization of operations for an additional 6 - 12 months)
Priority	
Low	

Recommendation 4: Establish a framework to visualize, monitor and manage water quality

The County currently faces a number of data-related challenges:

- Fragmented data owned by different stakeholders in different formats
- Lack of a unified electronic registry/repository that tracks cesspools and septic systems
- No management or uniform reporting for wastewater disposal companies, such as sludge collectors/haulers
- Data collaboration and data sharing among stakeholders is limited and cumbersome
- Little or no data exchange between the County and towns/villages
- Large amounts of data are paper-based and difficult to collect
- Electronic data may be outdated, inaccurate or missing, including the following examples:
  - Inaccuracies exist in manhole data post-INI-study
  - As-built sewer plans are missing or inaccurate
  - Sewer permits before Merlin 2013 are all on paper
  - No inventories exist for pumping stations that connect to the sewer main
- Freedom of Information Law (FOIL) requests are necessary in some cases to share data among stakeholders
- Household information is limited
- Data is not standardized, and there is no integration layer
- Limited data sharing is currently done via email, PDF, Excel spreadsheets and .csv files
- Data analysis and data reporting are often performed by running custom SQL queries
- Shortage of IT professionals
- IT/software/systems knowledge for certain applications resides with a single person
- Perceived reluctance from some stakeholders to use common systems for particular functions, making data sharing more difficult:
  - GIS systems: Esri vs. MapInfo
  - Operator10 vs. Oper32
  - iFIX used by District 3 vs. Genesis used by the other districts
- Proliferation of data sources created by in-house applications
- Lack of an overall strategic approach to IT
- High reliance on non-production databases, such as MS Access
- Disaster recovery (D/R) approach is based on backups
- No high-availability architecture for IT
- The County's preference is to have open data access for external users
- For some software systems, the County relies on niche software vendors

The team recommends that Suffolk County consolidate its IT into a pool of shared resources that can serve all agencies across the county and create an integrated data platform. This will lead to the rationalization of software licenses, data sources and applications, as well as lead to greater levels of openness, data sharing and collaboration among the different stakeholders. The County is currently using a federated approach to IT that results in a fragmented IT organization in which knowledge sits with individuals instead of in a resource pool of IT specialties, such as GIS, web design and development, data architecting and administration, system administration and many others.

Suffolk County should create a single, non-federated IT organization with computer science professionals to carry out the full software development lifecycle as well as data management for all County agencies. A single integrated data platform will allow the County to easily share its data with other County agencies and external stakeholders, such as towns, research organizations, universities and nonprofits. The data platform can incorporate information owned by other stakeholders, such as zoning data, and it can serve as the repository for data that the County does not currently have but needs, such as a cesspool/septic system registry. Examples of similar data integration platforms are highlighted in Appendix C (see references 1, 2, 27, 28, 31, 32 and 38).

Finally, a disaster recovery program and high-availability architecture are recommended.

Recommendation 4: Establish a framework to visualize, monitor and manage water quality

The County should create a centralized data integration platform to establish a "single source of truth" that is accessible to all stakeholders, promoting collaboration and data sharing.

Scope and expected outcomes

Scope

To achieve desired results, the County should do the following:

- Implement this recommendation in phases
- Start by creating a common information model with a few data sources and add incrementally as the model is enriched
- Create mechanisms (SOA, API management, MDM or data federation) to enable access (interagency and citizen-facing) to the data in the new common information model
- Clean and modify applications that use consolidated data sources per the new common information model
- Migrate existing citizen-facing applications to the newly created data integration platform
- Consolidate the County's currently scattered IT teams into a single IT department that can service all County organizations and departments and act as the owner of the data integration platform
- Digitize existing information and data on key information sets
- Implement a high-availability architecture for the centralized data integration platform
- Define and implement a more robust approach to disaster recovery

Expected outcomes

This recommendation should result in the following outcomes:

- Every stakeholder will have access to current status and insights, enabling them to remain informed and drive decisions and investments that need to be made
- Relevant stakeholders can share water-related information, including the nitrogen loading model, overall water resource management and total maximum daily load (TMDL) across the platform
- Different stakeholders will have information tailored to their requirements to help them take the right actions
- A centralized data integration platform used across the County will make data readily available
- Reduced risk of limiting the management of an application or data set to a single skilled individual
- Reduced risk of data loss
- Operational cost reduction for infrastructure and licenses

Costs of inaction

The result of inaction would be the continued use of fragmented and isolated data owned by different stakeholders across different organizations, making it difficult for anyone to get a single view of the information. In addition, software license cost savings — from multiple GIS systems, databases, operations systems and asset management systems — would not be realized. The County would continue to create one-off applications that require their own databases and fragment the data even more.

Inaction will hinder the modernization of applications and data management systems, compromising County efforts to improve nitrogen pollution levels. The County would continue to use MS Access, a non-production database, and would also continue to store paper-based network and infrastructure information in a single location. Limited disaster recovery planning would continue to present an unacceptable business/operations risk. The County would continue to run the risk of poor availability of IT applications through ongoing use of non-production databases and multiple applications.

Recommendation 4: Establish a framework to visualize, monitor and manage water quality (continued)	
Proposed owner and stakeholders	**Suggested resources needed**
Owner: Deputy County Executive — Operations **Stakeholders:** • All County agencies • SCWA and other water authorities • STP operations — private, County • Towns, villages, hamlets • Nonprofits • Businesses and trade associations • State agencies, such as NYSDEC • Federal government agencies • Universities	• Consolidated IT department • SCDHS • SCDPW • Towns • SCWA • State agencies (such as NYSDEC) • STP operators **Cost estimate:** Medium
Dependencies	**Key milestones, activities and timeframe**
Fulfilling this recommendation is dependent on the County completing the following recommendation: • Recommendation 1: Finalize and deploy a robust and integrated Water Resource Plan	**Short term:** • Creation of a unified County IT department (3 months) • Identify initial priority data sources and confirm data ownership and governance (Weeks 2 - 4) • Define information model for pilot sources, for example, select two or three data sources owned by SCDHS to start consolidating a common information model (Weeks 2 - 4) • Implement subset of common information model (Week 5) • Establish a platform and tools to consolidate and share initial models (Weeks 6 - 11) • Enable access to this model subset (Weeks 8 - 10) • Migrate application(s) that use(s) this subset of the model (Weeks 11 - 14) • Identify next set of data sources and models and implement (Weeks 10 - 20) **Long term:** • IT department to chair and continue work to complete the creation of a common information model (all stakeholders involved) (1 year) • Continue work to migrate applications (ongoing) • Enable mobility for applications (ongoing) • Consolidate all distributed County data centers into one, including Hauppauge and Yaphank (1 year) • Develop a resilient D/R strategy (1 year) • Define overall data governance and measurement objectives
Priority	
High	

Recommendation 5: Establish governance to enable the installation of appropriate technology and to motivate responsible behavior

This recommendation addresses three key issues for Suffolk County's governance structure. Local residents in Suffolk County must upgrade their on-site cesspool or septic systems, as these systems do not treat nitrogen, a main pollutant of the water bodies on Long Island. In addition, the majority of residents use their cesspools or septic systems to manage general domestic wastewater, some of which may not be compliant with the Suffolk County Department of Health Services Sanitary Code. Finally, the current Sanitary Code does not encourage or allow residents to upgrade their cesspools or septic systems.

Suffolk County cannot proactively address water quality issues with the current governance structure in place. By permitting new technology, the County will enable local residents to upgrade septic systems to treat nitrogen, helping to improve water quality and quality of life in Suffolk County. Education of the public, proactive and regular septic system checks and quicker permit approval processes will encourage the variety of stakeholders to upgrade their systems.

The governance structure needs to not only allow for new technology but also must establish a system for enforcement and compliance across the county. Currently, Suffolk County does not regularly check or monitor the performance of cesspools and septic systems. Effective public communication, as well as a governed operational regime that includes monitoring and checks, may make residents more likely to maintain their septic systems. The EPA guidelines for management of decentralized septic solutions should be taken into consideration in the definition of this governance structure (see Appendix H).

As Suffolk County combats the harmful effects of nitrogen pollution, an established and enforceable governance structure must begin to manage and monitor pollution reduction progress across the county.

Recommendation 5: Establish governance to enable the installation of appropriate technology and to motivate responsible behavior

Suffolk County should create a governance structure for updated wastewater management systems in individual residences to improve sanitation and minimize nitrate loads in the groundwater. New septic technologies that reduce localized nitrogen levels can help improve water quality, resulting in better quality of life and economic development. The County should encourage citizens to upgrade their septic solution infrastructure.

Scope and expected outcomes

Scope

To achieve desired results, the County should take the following actions:

- Create a governance structure for updating the Suffolk County Department of Health Services Sanitary Code to allow for new and improved technologies
- Launch the pilot program for septic system technology that treats nitrogen and allow homeowners to test new technology
- Communicate alternative system options to citizens and private operators in a timely manner
- Educate citizens about nitrogen in lawn fertilizers and incentivize the use of organic or nitrate-free fertilizer and other acceptable products
- Facilitate removal and upgrade of cesspools across the county through public education and awareness
- Require point-of-sale certifications for residences to upgrade septic solutions and designate homes as "nitrogen free"
- Expedite permit approval process by the Department of Health Services to allow builders, towns, individuals and estate agents to upgrade or install new on-site septic systems that treat nitrogen

Expected outcomes

By following this recommendation, the County should experience the following:

- Decreased number of cesspools in Suffolk County
- Increased number of upgraded septic solutions in Suffolk County that help reduce nitrogen
- Decreased amount and concentration of nitrogen in water bodies in the county
- Expanded public awareness of the impacts of individual septic systems on collective water quality
- Quicker approvals of permits for advanced septic systems or other adapted wastewater treatment technology
- Reduced impact on nitrogen levels from domestic fertilizer
- Septic solutions will no longer be a reason to restrict development of towns and villages in Suffolk County

Recommendation 5: Establish governance to enable the installation of appropriate technology and to motivate responsible behavior (continued)

Scope and expected outcomes (continued)

Costs of inaction

Inaction will perpetuate water contamination from individual septic tanks and cesspools. Residents will remain unaware of the impact of their systems, and County staff will be unable to monitor, evaluate and correct issues with water contamination in an effective and efficient manner. With a lack of maintenance, more septic solutions will begin to fail over time, causing higher operational costs for households and increased health risks from untreated sewage.

Proposed owner and stakeholders	Suggested resources needed
Owner: Commissioner of the Department of Health Services **Stakeholders:** • Department of Economic Development and Planning • Individual residents • Septic system manufacturers • Septic system installers/operators • Towns/communities	• County team to operate transition and manage governance • Communications initiative to raise citizen awareness • County legislature representatives • Owner from Department of Health Services • Representatives from private operators/installers **Cost estimate:** Low
Dependencies	**Key milestones, activities and timeframe**
Establishing a successful governance depends on the following recommendations: • Recommendation 4: Establish a framework to visualize, monitor and manage water quality • Recommendation 10: Adapt the business processes in the SCDPW and the SCDHS to meet expanded integrated water management responsibilities • Recommendation 11: Establish a framework for decentralized wastewater handling solutions	**Short term:** • Complete application for the Sewer Repair Program for pilot septic system upgrades to receive funding (30 days) • Select pilot technology system and initial pilot residents to install new systems (90 days) • Update DHS Sanitary Code to eliminate outdated technologies in Suffolk County (6 months) • Construct a governance structure for monitoring, enforcing and incentivizing citizens to upgrade their wastewater treatment or contribute to county-wide investment (6 months) • Update process for assessment and authorization of new technologies for treatment of nitrogen to include in DHS Sanitary Code (Year 1) • Implement governance structure for monitoring, enforcing and incentivizing citizens to upgrade their wastewater treatment or contribute to county-wide investment (Year 1) **Long term:** • Incentivize citizens to upgrade septic systems with denitrification (Years 1 - 2)

Priority

Medium

Recommendation 6: Excite communities to embrace the solutions for improving water quality

Local citizens, governments and organizations understand the fundamental value of water but have yet to create a streamlined and all-encompassing civic engagement strategy to address water quality. Citizens do not yet relate water usage with water and wastewater quality. Suffolk County must engage communities and visitors to embrace local resources for water quality improvements, reaching across diffused interests and uniting them to take action.

To engage citizens, Suffolk County should establish positive reinforcement, such as the global Blue Flag program (see references 3 and 5 in Appendix C), to highlight water quality and safety standards. Beaches and marinas with Blue Flag distinctions have higher attendance and contribute to a thriving tourism industry that benefits local economic development.

Suffolk County also must improve public awareness of water quality, specifically around water usage and its impact on the environment. Social media and online portals provide easy opportunities for citizens, visitors and stakeholders to engage with one another on water quality (see references 1, 2, 6, 7, 10 and 39).

Twitter, Facebook and smartphone apps like Creek Watch and WaterQuality (see Appendix C) provide stakeholders with a place to learn and provide information on water quality. Users can upload photos of issues, check Blue Flag beach conditions and learn about county-wide or local initiatives on water quality. Giving stakeholders the tools to take action is a necessary first step in addressing declining water quality in Suffolk County.

As media platforms spur interest and engagement, Suffolk County must create a cohesive and all-encompassing strategy for public awareness. Continued town hall meetings, as County Executive Steven Bellone has previously held, draw input from stakeholders and provide a structure for engagement. Education and workshops, in which students learn about the water cycle and how to manage wastewater, can engage the community and educate the next generation of water quality stewards in Suffolk County. Focused activities that benefit the local community tend to receive more support, making the towns and villages a pivotal part of the engagement strategy.

Ultimately, citizens' desire to act, in conjunction with a proactive and clear strategy from Suffolk County, can spur collective action in the community and begin to address water quality in a comprehensive way.

Recommendation 6: Excite communities to embrace the solutions for improving water quality

Suffolk County must motivate the various stakeholders and community members to embrace water quality improvements by clearly identifying the importance and benefits these improvements deliver at the local level. The County must explain the value of water across political, social and environmental lines to improve civic engagement and local economic development.

Scope and expected outcomes

Scope

To achieve desired results, the County should perform the following actions:

- Establish positive reinforcement by adopting the Blue Flag approach, or a similar program, to create clean, safe and environmentally friendly beaches and coastal areas as well as make visitors associate closed attractions with poor water quality
- Provide easily accessible information on water quality through online and social media outlets for public knowledge and use
- Engage the public and other stakeholders via social media to help provide information on pollution incidents or risks
- Communicate the economic value of water to the public and translate this understanding into action
- Develop a long-term plan for improved water quality with collective action opportunities for local residents
- Promote civic buy-in from local organizations with regular town hall meetings regarding water quality
- Link sustainable economic development with the inherent value of water to motivate citizens to contribute socially and financially
- Target schools and public buildings to educate children about water usage and pollution as well as the role they play in protecting water quality

Expected outcomes

This recommendation should result in the following outcomes:

- Established water quality and safety standards for beaches with Blue Flag distinctions
- Increased access to information on water quality for residents and visitors
- Improved awareness of beach closures and contaminations
- Shared financial information on the economic impact of clean water throughout Suffolk County, including its effect on sales and tourism and pollution-related expenses
- Cleaner beaches with fewer algae blooms, less prevalent red and brown tides and reduced nitrogen levels
- Increased civic engagement, meetings and volunteer opportunities for citizens to express concerns and share insights related to water quality

Recommendation 6: Excite communities to embrace the solutions for improving water quality (continued)

Scope and expected outcomes (continued)

Costs of inaction

Economic development, specifically development of tourism and water-related industries, will continue to suffer from deteriorating water quality if the County does not act on this recommendation. Citizens will remain unaware of their role as stewards of water quality in Suffolk County and will, therefore, take no action to improve water quality.

Proposed owner and stakeholders	Suggested resources needed
Owner: Suffolk County Department of Economic Development and Planning **Stakeholders:** • Suffolk County Department of Health Services • Long Island Chambers of Commerce • Towns and villages • Long Island Commission for Aquifer Protection • Business owners • Suffolk County Department of Public Works • Nonprofits	• Incremental funding for the establishment and monitoring of the Blue Flag system • Social media expansion • Portal for easy access to information • Town hall meetings with citizen groups for input and feedback • Advocacy and promotion team • Additional resources to monitor and follow new guidelines **Cost estimate:** Low
Dependencies	**Key milestones, activities and timeframe**
Engaging the community in water quality issues hinges on the completion of the following: • Recommendation 4: Establish a framework to visualize, monitor and manage water quality	**Short term:** • Establish metrics, based on Blue Flag criteria, to evaluate safety and environmental quality of beaches and waterways (90 days) • Design and establish a structure for social media use with clear guidelines and goals on how it will help the County manage nitrogen pollution and establish a plan for two-way use of information (4 months) • Publish water quality levels and information online via a portal or social media, as well as on-site with positive reinforcement (6 months) • Establish programs for local school children on water quality education (6 months) • Engage and work with towns regarding application for Blue Flag (6 months) **Long term:** • Update and monitor beach and waterway cleanliness and provide information to the public (Year 1) • Create a long-term engagement plan for organizations to excite individual residents and visitors about water quality protection (Years 1 - 3) • Establish checkpoints and engagement days to reignite dedication to improved water quality (Year 3 and ongoing)

Priority

High

Recommendation 7: Create a structure to drive compliance

With its diverse group of stakeholders and distinct and complicated processes, Suffolk County must ensure citizens and stakeholders comply with the governance established in the Water Resource Plan (see Recommendation 1).

This recommendation defines the appropriate level of control for compliance, showing how and when to keep citizens and organizations accountable. EPA guidelines on the management of decentralized solutions also should be considered (see Appendix H).

Initially, Suffolk County should gather input from key stakeholders involved in protecting water quality. The newly established compliance team should compare stakeholder processes, metrics and milestones to relevant KPIs from the Water Resource Plan.

Suffolk County should define a governance model and approach to manage and adapt the monitoring framework through the different phases of implementation.

Recommendation 7: Create a structure to drive compliance

Suffolk County and vested stakeholders should establish a compliance framework for managing and monitoring key milestones set out in the Water Resource Plan (see Recommendation 1). This includes defining roles and responsibilities to monitor and control key processes and targets to achieve clean water.

Scope and expected outcomes

Scope

To achieve desired results, the County should establish the following roles and responsibilities:

- Suffolk County Department of Health Services
  - Monitor septic system upgrade programs and share progress
  - Perform sample testing, share results in real time and enforce recovery plans when necessary
- Suffolk County Department of Public Works
  - Hold regular governance meetings to discuss STP operations, ensure they meet compliance standards and identify action if needed
  - Monitor operating volumes in STPs and analyze the sample testing of wastewater before and after treatment, driving recovery plans when necessary
  - Monitor source waste location and quality and identify follow-up actions for locations with high levels of nitrogen or septic system failure
- Suffolk County Water Authority
  - Perform sample testing, share results and create timely alerts for critical situations
  - Share records for water sources, locations and volumes
- Towns and villages:
  - Link zoning with the Water Resource Plan and the compliance measures

Expected outcomes

Creating a structure to drive compliance should result in the following:

- Increased stakeholder awareness of issues, such as failing STPs or deficient septic systems
- A cross-functional dashboard with compliance and progress statuses for system upgrades
- A recovery plan for system failures, in place and at the ready
- Adoption of a relevant, recommended EPA management model

Costs of inaction

Without compliance, an established governance structure cannot improve water quality. Lack of monitoring and enforcement prevents Suffolk County from proactively addressing issues with STPs or on-site septic systems, an issue that will continue if the County does not take action.

Recommendation 7: Create a structure to drive compliance (continued)	
Proposed owner and stakeholders	**Suggested resources needed**
Owner: Suffolk County Department of Health Services **Stakeholders:** • Water authorities • Suffolk County Department of Public Works • US Environmental Protection Agency	• New role for ownership of these processes • Data framework • Transition coordination • Assurance role for the County **Cost estimate:** Low
Dependencies	**Key milestones, activities and timeframe**
Establishing a structure to drive compliance depends on the County's ability to fulfill the following recommendations: • Recommendation 1: Finalize and deploy a robust and integrated Water Resource Plan • Recommendation 4: Establish a framework to visualize, monitor and manage water quality • Recommendation 5: Establish governance to enable the installation of appropriate technology and to motivate responsible behavior	**Short term:** • Form an interdisciplinary meeting between owner and stakeholders to outline a plan of action and discuss key themes (Week 1 and ongoing) • Confirm initial priority measures for compliance and align with Recommendation 4 focus areas (Weeks 2 - 10) • Develop supporting materials (Weeks 7 - 8) • Execution (Week 13) • Measurement (Week 16 and ongoing) **Long term:** Annually review the critical KPIs, validate compliance processes and modify them as appropriate, based on water quality status, new pollution/water quality factors and improvement of processes
Priority status	
Medium	

Recommendation 8: Continue to develop a funding mechanism

Funding is a pressing issue for the County as it works to solve its nitrogen challenges. We recommend appointing a financial team with strong leadership to generate a funding plan specifically for wastewater management goals.

Suffolk County's Water Resource Plan calls for a multitude of actions that vary in nature and scale, balancing complex needs across the county. Each of these projects, both short- and long-term, will require significant investment. Some recommendations will produce additional revenue, like the consolidation of the STP network. Others, including the Suffolk County Water Authority and wastewater management consolidation and organizational changes, will result in savings. The financial team should coordinate all funding actions, grant applications and bond issuance (see references 16 and 22 in Appendix C). The team must direct resulting revenue and operational savings toward the execution of the Water Resource Plan.

Funding is directly connected to federal, state and county regulations and is not always guaranteed. For this reason, the County should establish a global view of grant applications (to-do, pending, granted, rejected), other funding actions and statuses (such as bonds), new revenue, water fees and expected savings. With this framework in place, the County can plan, prioritize and/or redirect available funding as well as drive the execution of individual projects based on a comprehensive view. Suffolk County may find the Smarter Cities Financing Guide from the Smarter Cities Council useful in identifying various funding options for municipalities (see reference 24 in Appendix C).

Recommendation 8: Continue to develop a funding mechanism

Suffolk County's estimated cost of additional sewers and septic system upgrades is US $8 billion and requires an extensive, long-term approach to finance the entire plan. To get started, the County should construct a complete financial picture of spending along with a timeline and funding options.

Scope and expected outcomes

Scope

To achieve desired results, the County should take the following actions:

- Explore existing and applicable grants at the state and federal level
- Evaluate existing taxes/funding that can be redirected toward water quality issues
- Consider the following options for revenue generation:
  - County loans (including the option to place the repayment responsibility with the homeowners)
  - Adjustments to sales, tourist, property, toll road and vice taxes
  - Wastewater management fee, potentially determined by water consumption for waste services
  - Water consumption—based fee
  - Fees from citizens for their wastewater services managed by the County following the integration of privately operated STPs
  - Leverage efficiencies in the overall water management processes, including testing, invoicing and chemical purchase
- Align the priority and timing of septic system upgrades or sewer extension deployments with the availability of confirmed funding and the priorities defined in the Water Resource Plan
- Define a set of affordable incentives, based on priority, to help ensure earlier upgrades

Expected outcomes

Developing an approach to managing the funding mechanism should result in the following advantages:

- A clear understanding of funding availability within a five-year timeframe, enabling execution and implementation in the very near term
- Generating new revenue sources
- Establishing a regional funding model
- Effective reduction of nitrogen pollution

Costs of inaction

Without a funding mechanism and an approach to managing it, integrated water management efforts will fail and communities will lack the awareness they need to make investments in improving water quality.

Recommendation 8: Continue to develop a funding mechanism (continued)

Proposed owner and stakeholders	Suggested resources needed
Sponsor: The County Executive **Owner:** Finance **Stakeholders:** • County legislators • Federal and state legislators • Suffolk County water authorities and local communities	• Financial leadership • Legislators **Cost estimate:** Medium
Dependencies	**Key milestones, activities and timeframe**
Successful management of the funding mechanism depends upon the County's strong partnership with federal and state governments, as well as the existing management of bonds. The recommendation also depends on the completion of the following recommendations: • Recommendation 1: Finalize and deploy a robust and integrated Water Resource Plan • Recommendation 2: Operate the STP network under the control of the SCDPW • Recommendation 11: Establish a framework for decentralized wastewater handling solutions	**Short term:** • Appoint a financial lead • Engage all the stakeholders • Agree on priorities • Implement a funding plan and contingencies to deliver the following: – Proactive application and securing of grants – Development of new revenue sources – Mechanism for progress tracking **Long term:** • Ongoing management and tracking of the funding structure over a multi-year roadmap to monitor the following: – Bond repayments – Distribution of the savings/benefits – Collection of revenue
Priority status	
High	

Recommendation 9: Develop workforce model and practices to meet future needs

Suffolk County must adjust its resource model with the appropriate number and type of resources for present and future needs. Currently, staffing concerns in the Department of Health Services and the Department of Public Works limit Suffolk County's ability to manage water effectively (see reference 14 in Appendix C).

First, open positions and staffing shortages limit the County's proactive maintenance capabilities and effective infrastructure management. Specialized job roles limit flexibility and staff transfers across organizational borders, impacting retention rates.

Finally, an aging workforce and limited new hires with the necessary skills will prevent Suffolk County from effectively planning, managing and monitoring water-related quality improvements.

Suffolk County must establish a succession plan to recruit new employees with the most critical necessary skills.

If Suffolk County allows advanced on-site septic systems (see Recommendation 6) with consolidated governance structures, skill demand in the county will increase significantly.

Ultimately, Suffolk County must build a vigorous and proactive staffing plan to service customers effectively, perform proactive asset maintenance and maintain a workforce with high levels of organizational knowledge.

Recommendation 9: Develop workforce model and practices to meet future needs

The County should update its staffing plan and workforce practices to proactively manage and prepare for changing requirements.

Scope and expected outcomes

Scope

The proposed plans for updating standards, code and management oversight of on-site septic and cluster systems will drive increased workload for the Suffolk County Department of Health Services. The recommendation to consolidate the STP network will potentially drive increased needs for the Suffolk County Department of Public Works. A proactive organizational strategy and staffing plan will help prepare the County to handle the anticipated increase in workload while delivering a higher level of service to constituents.

To achieve desired results, the County requires the following:

- Fast and effective wastewater permit process, especially for new technologies
- Proactive monitoring and maintenance of expanded wastewater network
- Efficient and accurate data gathering, as well as skills to enable data sharing
- Distribution of key skills across several employees, preventing isolated capabilities in the organization, which can be risky
- Career path development to ensure roles within the organization can attract and retain skilled staff

Expected outcomes

With a future-focused workforce model, the County should benefit from the following:

- Improved response times to requests for new on-site permits/variances
- More complete and accurate water quality data
- Reduced overtime costs and optimized labor costs
- Improved workforce retention rates
- Business resilience and continuity for critical skills

Costs of inaction

The result of inaction would be critical skill gaps for operational roles, duplicated waste activities and data management, extended turnaround times for on-site and cluster system permits and potential widespread events due to the lack of critical maintenance and monitoring prioritization.

Recommendation 9: Develop workforce model and practices to meet future needs (continued)

Proposed owner and stakeholders	Suggested resources needed
Owners: • Commissioner of the Department of Public Works • Commissioner of the Department Health Services **Stakeholders:** • Civil service organization • Union representatives • County finance	• Workload planner/staffing leader • Managers of relevant departments • Advocacy by County leadership team • Representation from human resources (HR) **Cost estimate:** High
Dependencies	**Key milestones, activities and timeframe**
Implementing a new workforce model depends on the successful completion of the following recommendations: • Recommendation 2: Operate the STP network under the control of the SCDPW • Recommendation 4: Establish a framework to visualize, monitor and manage water quality • Recommendation 5: Establish governance to enable the installation of appropriate technology and to motivate responsible behavior • Recommendation 11: Establish a framework for decentralized wastewater handling solutions This recommendation will be impacted by the following implementation: • Recommendation 3: Integrate water and wastewater operations	**Short term:** • Identify staffing plan owner and form an interdisciplinary team of owner and stakeholders to outline plan of action (Month 1) • Map workflow processes, determine demand-side and supply-side inputs (such as expected volume of permits, testing, retention levels, expected retirements, skill levels) (Months 2 - 3) • Build gap analysis of skill demand vs. supply (Month 4) • Define and implement communications plan with staff (Month 7 and ongoing) • Develop strategy for supply of needed skills, consider retention strategies and work process redesign (Months 5 - 6) • Develop succession plan for key positions and demand for new roles (Month 6) • Gain financial support for staffing as necessary (Months 6 - 7) • Execute staffing plan (Months 7 - 12) – Deploy training program to keep current staff up-to-date and ready for transitioning into new roles – Work with union representatives to staff new positions – Work with HR to confirm and approve new role descriptions as well as recruitment/deployment plans and processes **Long term:** • Establish regular reassessment (suggest annually) of one- to three-year resource plan (Year 1 and ongoing) • Deploy work process redesign program to reduce process burden and improve responsiveness to customers (Years 1 - 2) • Work with civil service and union representatives to develop apprenticeship programs to meet demand (Ongoing) • Establish strategic relationships with local schools to foster recruitment into the field (Ongoing)
Priority	
Medium	

Recommendation 10: Adapt the business processes in the Suffolk County Department of Public Works and the Suffolk County Department of Health Services to meet expanded integrated water management responsibilities

Consolidation of water cycle management will require continuous process improvement in the Suffolk County Department of Public Works (SCDPW) and the Suffolk County Department of Health Services (SCDHS). Suffolk County has an opportunity to reduce functional duplications between departments and agencies, eliminating unnecessary events, such as multiple visits to a single residence to draw well and pool samples.

Citizens and various stakeholders believe inefficient processes and duplicate responsibilities will continue to slow permit processing times and agency responsiveness. With improved operational efficiencies, Suffolk County departments can absorb the anticipated workload associated with increased management involvement in the overall water cycle.

Recommendation 10: Adapt the business processes in the SCDPW and the SCDHS to meet expanded integrated water management responsibilities

Suffolk County must prepare for increased wastewater treatment volumes by expanding the scope of responsibility and control of the Department of Public Works and Department of Health Services. To do that, the County should improve its operational processes and prepare its organizations and businesses for additional responsibilities using end-to-end management systems.

Scope and expected outcomes

Scope

To achieve desired results, the County requires the following:

- Increased responsiveness to customer needs through waste reduction and cost savings
- Defined goals and metrics across networks and functions
- Expanded access to data, readiness to integrate and effective data use
- Use of economies of scale, such as integrated purchasing, operations, billing and waste disposal

Expected outcomes

Improving processes to help the Department of Public Works and Department of Health Services meet an expanded scope of responsibilities should help the County achieve the following:

- Process alignment with defined outcomes and goals for improved water quality
- Improved service levels with more responsive processes
- Eliminated areas of duplication and wasted effort

Costs of inaction

The County's inaction would result in lost opportunities for cost reduction and efficiency improvements. The County would continue to invest time and money into duplicate efforts and would not be able to measure progress because of continued data fragmentation.

Recommendation 10: Adapt the business processes in the SCDPW and the SCDHS to meet expanded integrated water management responsibilities (continued)

Proposed owner and stakeholders	Suggested resources needed
Owners: • Commissioner of the Department of Public Works • Commissioner of the Department of Health Services **Stakeholders:** • County leadership • Line operators and managers • County finance	• Process optimization program manager • Managers, line leaders and operators • Advocacy by County leadership team **Cost estimate:** Medium
Dependencies	**Key milestones, activities and timeframe**
None	**Short term:** • Identify program owner and form an interdisciplinary team of owners and stakeholders to outline plan of action (Month 1) • Determine client value metrics and common goals (Months 2 - 3) • Identify process owners and change agents to prioritize and lead improvement initiatives (Months 2 - 4) • Conduct value stream mapping workshops and determine areas of duplication and waste (Months 3 - 6) • Create action plans to eliminate pain points and duplicate work (Month 6) • Execute action plans (Months 7 - 12) • Measure improvements (Month 13 and ongoing) **Long term:** Establish regular continuous improvement process discipline (Years 1 - 3)
Priority status	
Medium	

Recommendation 11: Establish a framework for decentralized wastewater handling solutions

The Water Resource Plan will define which areas of the county are sewered. In non-sewered areas, the most appropriate on-site wastewater handling method — decentralized wastewater handling — must be defined separately. In Suffolk County, the on-site legacy methods are cesspools and septic systems connected to leaching pools, which do not remove nitrogen. In addition, these methods are generally poorly maintained and have limited follow-up programs in place.

There are different needs in different areas of the county, so selecting the appropriate technology will be specific to a particular property and location (see references 13 and 17 in Appendix C). Citizens should be able to select their on-site wastewater treatment method from a range of possible solutions (see references 12 and 37 in Appendix C). But even the best on-site solution requires correct operation and maintenance to meet performance requirements for waste treatment and nitrogen reduction.

Therefore, a framework is necessary to monitor and manage compliance to ensure that decentralized wastewater treatment systems are meeting operational requirements. The framework should consider control and certification intervention not only at installation but also at other points in the system's lifecycle, such as transfer of ownership, house development/renovation and upgrade.

This recommendation addresses the needs for the following:

- Improved support for the selection of adequate technology within a broad range of possibilities
- Enhanced follow-up processes to improve existing decentralized wastewater handling facilities throughout the entire lifecycle
- Improved data gathering and performance monitoring of on-site waste disposal facilities
- Increased nitrogen-removing wastewater handling solutions across the county

Recommendation 11: Establish a framework for decentralized wastewater handling solutions

Finalize and implement a framework for the selection, deployment and management of appropriate local wastewater handling solutions for both individual and cluster systems.

Scope and expected outcomes

Scope

To achieve desired results, the County should perform the following actions:

- Provide access to a broader set of adequate technology solutions
- Encourage innovative solutions for wastewater handling
- Set up a framework for the operation and maintenance of decentralized systems
- Set up a framework for the permitting and monitoring of decentralized systems, encouraging an upgrade to nitrogen-removing solutions
- Promote the consideration of cluster systems in situations where it makes sense, considering economies of scale for better operations

Expected outcomes

With a framework for decentralized wastewater handling solutions, the County can expect to experience the following advantages:

- An accessible and available knowledge base for decentralized water treatment possibilities
- Improved solution selection (on-site or cluster) for each property
- A consistent prioritization strategy to determine timing for solution implementation
- An established approach to ensure ongoing management and monitoring of wastewater treatment solutions
- An overall plan that determines what solutions to implement and when, aligning with the overall resource management plan
- Smooth and simple data gathering at all stages of the decentralized system's lifecycle

Costs of inaction

If the County does not establish this framework, it will continue to implement solutions that do not treat nitrogen and will have no visibility of on-site treatment facilities. This will impede the identification and upgrade of poorly operated systems, and the overall nitrogen load will continue to increase.

Recommendation 11: Establish a framework for decentralized wastewater handling solutions (continued)

Proposed owner and stakeholders	Suggested resources needed
Owner: Department of Health Services **Stakeholders:** • Academic institutions (for research/innovation) • Private service companies and treatment facility operators • Towns and villages • Department of Public Works	• Department of Public Works to assess technologies • Universities and wastewater treatment companies to expand innovation and continue research on cluster systems **Cost estimate:** • Develop framework: Medium • Implement infrastructure changes (as estimated by Suffolk County): High
Dependencies	**Key milestones, activities and timeframe**
The successful development and implementation of this framework is contingent on the following recommendations: • Recommendation 1: Finalize and deploy a robust and integrated Water Resource Plan This recommendation will impact the following: • Recommendation 3: Integrate water and wastewater operations • Recommendation 5: Establish governance to enable the installation of appropriate technology and to motivate responsible behavior • Recommendation 6: Excite communities to embrace the solutions for improving water quality • Recommendation 7: Create a structure to drive compliance	**Short term:** • Gather knowledge and provide information regarding on-site and cluster systems (3 - 4 months) • Define guidelines for the selection of appropriate on-site and cluster technology (2 months) • Establish governance and a shareable mechanism: – Establish a register of on-site/cluster systems with self-register capabilities (6 months) – Provide guidelines and training information for private operators (3 - 4 months) – Require certification and inspection for ongoing quality management of on-site solutions (Month 9 and ongoing) • Establish an inspection record information system for on-site and cluster systems (1 month and ongoing) • Establish regulations to ensure the implementation or upgrade of on-site treatment systems during renovation or when property ownership changes (2 months and ongoing) **Long term:** • Establish a “Low-N certified” label for properties that meet nitrogen reduction standards (Year 1 and ongoing) • Define the framework and create a toolkit to help select technology for small cluster/grouping of properties, considering cost-benefit analysis and known environmental impact (6 months, starting Year 2)
Priority status	
High	

5. Conclusion

Water quality in Suffolk County, NY — Long Island's largest county — has a fundamental impact on the quality of life of the County's citizens. Long Island is the second most visited tourist destination in the state of New York, and it relies on water to attract these visitors. Water is critical to local economic development, recreation and industry. As water quality deteriorates and pollution in the local waterways becomes more apparent, Suffolk County has many compelling reasons to address water quality issues immediately. Suffolk County's rich agricultural and seafood history highlights the value of environmental conservation and waterway protection in the region.

Suffolk County faces many challenges that impede water quality improvement:

- A weak economy and limited funding
- A fragmented network of stakeholders
- Outdated standards for septic tank solutions
- Aging infrastructure
- Decentralized land use and zoning
- A geographically diverse land mass with varying challenges
- An outdated governance structure
- Constrained resources for monitoring and permitting
- Numerous data repositories
- A declining population
- High local property taxes
- Concerned residents

As Suffolk County begins to address its water quality challenges, it understands that a comprehensive water resource strategy with actionable and measureable goals, along with support from a diverse group of stakeholders, is the key to success. This report identifies a number of recommendations that together will help Suffolk County transform its water quality now and in the future. The following are key elements that will help the County drive this change:

- An integrated approach to water and wastewater management
- A more proactive and data-driven stakeholder action plan
- A secure funding base
- Engaged communities

The IBM team created an actionable roadmap that enables Suffolk County to take an incremental approach to solving its water quality issues. Each milestone provides necessary actions, key stakeholders and desired outcomes to help Suffolk County become the "gold standard" in managing water contamination from nitrogen pollution. The desire for improvement and change is apparent, as Suffolk County has taken the necessary first step of addressing the importance of water for its community, its economy and its future. Suffolk County, with its passion for change and its commitment to improvement, can position itself as a Smarter County to revitalize its local economy and reclaim its water.

6. Appendix

A. Acknowledgments

Individuals interviewed:

The following is a list of the individuals we met with during our engagement with Suffolk County. We would like to thank them for their contributions and valuable insight.

Name	Title	Organization
Mark Lesko	Executive Director	Accelerate Long Island
Thomas Gallagher	Director of Sales & Operations	Aparo, Sanitary & Environmental Services
David L. Berg	Associate LEED Accredited Professional	Cameron Engineering & Associates, LLP
Mark Wagner, C.E.P.	Partner, LEED Accredited Professional	Cameron Engineering & Associates, LLP
Marianne Garvin	President & CEO	CDC of Long Island
Joel Moser	Adjunct Professor of International & Public Affairs at Columbia University	Columbia University
Lorne Brousseau	GIS & Stormwater Manager, Marine Program	Cornell University, Cooperative Extension of Suffolk County
Frank Castelli	Environmental Projects Coordinator — Water Quality Improvement	Suffolk County Department of Economic Development and Planning
Barry S. Paul	Deputy Commissioner	Department of Health Services
Larry Stipp	Office Systems Analyst III	Department of Health Services, Division of Environmental Quality
Walter J. Hilbert	Chief Principal Public Health Engineer	Department of Health Services, Division of Environmental Quality, Office of Wastewater Management
Kristina Heinemann	Agriculture and Decentralized Wastewater Treatment Coordinator, Watershed Management Branch	US Environmental Protection Agency (EPA), Region II
Robert Riekert	Deputy Director	Huntington
Margo Myles, AICP	Senior Environmental Analyst, Coordinator of Open Space Conservation	Huntington
Jen L. Jordon-Sweet	Research Staff Member, Silicon Technology, Research Division	IBM NSLS 725A/X20, Brookhaven National Laboratory
Damon McMullen	Trustee, Commissioner of Police, Commissioner Wastewater Treatment System	Incorporated Village of Northport
Cara Longworth	Executive Director	Long Island Regional Planning Council
Mitchell H. Pally	CEO	Long Island Builders Institute
Tony Leung	New York State (NYS) Department of Environmental Conservation (DEC)	NYSDEC
Julie Nace	Peconic Estuary Program Coordination NYSDEC, Bureau of Marine Resources	NYSDEC
Glynis M. Berry	Director	Peconic Green Growth
Marshall Brown	Founder	Save the Great South Bay
Alison Branco, Ph.D.	Marine Biologist	Suffolk County Department of Health Services, Office of Ecology Peconic Estuary Program
Joseph M. Fusillo, P.E.	Director of Water Quality and Laboratory Services	Sidney B. Bowne & Son, LLP
Swaroop Puchalapalli, P.E.		Sidney B. Bowne & Son, LLP

Name	Title	Organization
Harold Walker	SBU/CE	Stony Brook University
Christopher Gobler	SBU/SOMAS	Stony Brook University
Larry Swanson	SBU/SOMAS	Stony Brook University
Minghua Zhing	SBU/SOMAS	Stony Brook University
Robert Wilson	SBU/SOMAS	Stony Brook University
David L. Calone	Chairman	Suffolk County Planning Commission
John C. Donovan	Chief Engineer	Suffolk County Department of Public Works, Division of Sanitation Engineering
Steven Bellone	County Executive	Suffolk County
Camilo Salazar, M.S.C.	Environmental Analyst	Suffolk County Department of Economic Development and Planning, Division of Water Quality
Cynthia DiStefano	Director of Classification	Suffolk County Department of Civil Service
Dorian Dale	Director of Sustainability, Chief Recovery Officer	Suffolk County Department of Economic Development and Planning
Sarah Lansdale	AICP, Director of Planning	Suffolk County Department of Economic Development and Planning
Walter Dawydiak, Jr. P.E., J.D.	Director	Suffolk County Department of Health Services, Division of Environmental Quality
Eric Rotondi	Legislative Aide, Office of Presiding Officer DuWayne Gregory	Suffolk County
John M. Kennedy, Jr.	Legislator, District 12	Suffolk County
Jay Schneiderman	Legislator, District 2	Suffolk County
Sarah Anker	Legislator, District 6	Suffolk County
Robert Trotta	Legislator, District 13	Suffolk County
Steve Stern	Legislator, District 16	Suffolk County
William R. Spencer	Legislator, District 18	Suffolk County
Al Krupski	Legislator, District 1	Suffolk County
Robert Calarco	Legislator, District 7	Suffolk County
Kara Hahn	Legislator, District 5	Suffolk County
Monica Martinez	Legislator, District 9	Suffolk County
Ben Wright, P.E.	Principal Engineer	Suffolk County Department of Public Works, Division of Sanitation Engineering
R. Boris Rukovets, P.E.	Public Works Special Project Supervisor	Suffolk County Department of Public Works, Division of Sanitation Engineering
Pamela Donovan	Staff to Sarah Anker, Legislator, District 6	Suffolk County
Dominick Ninivaggi	Superintendent	Suffolk County Department of Public Works
Colleen Capece	Special Projects Coordinator	Suffolk County Office of Budget and Management
Edward Lyons		Suffolk County
Carl Lind	Cartographer	Suffolk County
Kate Oheim	Assistant Cartographer	Suffolk County
Neil Ralph	District 3 Bergen Plant Senior Instrumentation Technician	Suffolk County
Jonathan Schneider	Deputy County Executive	Suffolk County

Name	Title	Organization
Samuel Chu	Chief of Operations and Commissioner of Labor	Suffolk County
Joanne Minieri	Deputy County Executive and Commissioner of Economic Development and Planning	Suffolk County
Vanessa Baird Streeter	Director of Communications	Suffolk County
Connie R. Corso	Budget Director	Suffolk County Executive Office
Robert M. Lipp	Director of Budget Review, Budget Review Office, Suffolk County Legislator	Suffolk County Legislature
Christine M. Lasher	Assistant Laboratory Director	Suffolk County Water Authority
Timothy Kilcommons, P.E.	Chief Engineer, Department of Public Works, Division of Sanitation Engineering	Suffolk County Water Authority
Larry Kulick, C.P.A.	Chief Financial Officer	Suffolk County Water Authority
Jeffry Szabo	Chief Executive Officer	Suffolk County Water Authority
Joseph Pokerny P.E.	Deputy CEO for Operations	Suffolk County Water Authority
Paul Kuzman	Director of Production Control	Suffolk County Water Authority
Karen A. Randazzo	Director of Water Quality and Laboratory Services	Suffolk County Water Authority
Carrie Meek Gallagher	LEED Green Associate, Chief Sustainability Office	Suffolk County Water Authority
Michael G. Mullowney	Systems Analyst	Suffolk County Water Authority
Amy C. Engel	Executive Director	Sustainable Long Island
Stuart R. Lowrie	Conservation Finance & Policy Advisor	The Nature Conservancy
Stephen Lloyd	Conservation Information Manager	The Nature Conservancy
Elizabeth C. Smith	Environmental Economist	The Nature Conservancy
Chris Clapp	Marine Specialist	The Nature Conservancy
Carl LoBue	Scientist	The Nature Conservancy
Andrew Manitt	Research Coordinator	The Sustainability Institute, Molloy College
Tim Carden	Managing Director	The PFM Group
Richard Groh	Chief Environmental Analyst, Dept. of Environmental Control	Town of Babylon
Jeanmarie Buffet	Senior Environmental Analyst	Town of Babylon
Anthony Graves	Principal Environmental Analyst, Division of Environmental Protection	Town of Brookhaven
Edward P. Romaine	Supervisor	Town of Brookhaven
Thomas Talmage, P.E.	Town Engineer	Town of East Hampton
Larry Cantwell	Town Supervisor	Town of East Hampton
Philip C. Ingerman	Director of Intergovernmental Relations, Office of Supervisor Frank P. Petrone	Town of Huntington
Joseph Cline, P.E.	Director, Dept. of Engineering	Town of Huntington
Eric M. Hofmeister	Deputy Supervisor	Town of Islip
Jefferson V. Murphree, AICP	Town Building and Planning Administrator	Town of Riverhead
Stephanie Hurd	Senior Environmental Analyst, Dept. of Environment & Waterways	Town of Smithtown
Allyson Murray	Director	Peconic Green Growth
Kyle Collins	Dept. of Land Management	Town of Southampton

Name	Title	Organization
Jennifer Garvey	Deputy Chief of Staff Officer of the Supervisor	Town of Southampton
Anna Throne-Holst	Supervisor	Town of Southampton
Mark Terry	Principal Planner, LRWP Coordinator	Town of Southold
Michael Collins	Professional Engineer, Office of the Engineer	Town of Southold
Maureen A. Tooke	Decentralized Wastewater Mgmt. Program/SepticSmart	US EPA Office of Wastewater Management — Idaho Operations Office
Kyle Strober	Long Island Regional Director	US Senator Charles Schumer's Office
Debbie Tinnirello	Long Island Regional Director	US Senator Kirsten Gillibrand's Office
Kevin P. Walsh	Managing Director, Long Island Operations	VHB Engineering, Surveying and Landscape Architecture
Tawaun Weber	Assistant Director	Vision Long Island
Elisabeth Muehlemann		Vision Long Island
Conrad Teller	Mayor	Westhampton Beach
Peter Scully	Regional Director	NYS Department of Environmental Conservation
Adrienne Esposito	Executive Director	Citizens Campaign for the Environment
Scott Martella		NYS Office of Governor Andrew Cuomo
Joshua Slaughter	Legislative Aide	representing Kate Browning, Legislator
Ann Golob	Long Island Index Project	Rauch Foundation
Steven Romalewski	Director	CUNY Mapping Service, Center for Urban Research

Organizations represented:

We spoke with individuals who represented the following organizations and stakeholders in Suffolk County and its surrounding areas. Each contributor was extremely knowledgeable, passionate and engaged in the water quality issues of Suffolk County, NY.

Accelerate Long Island	Brookhaven National Laboratory	Save the Great South Bay
Aparg, Sanitary and Environmental Services	Incorporated Village of Northport	SCDHS — Office of Ecology Peconic Estuary Program Suffolk County
Cameron Engineering and Associates, LLP	Long Island Regional Planning Council	Sidney B. Bowne and Son, LLP
CDC of Long Island	Long Island Builders Institute	Suffolk County
Columbia University	Sustainable Long Island	Town of Brookhavenw
Come!! University, Cooperative Extension of Suffolk County	The Nature Conservancy	Town of East Hampton
Suffolk County Department of Environment and Energy	The Sustainability Institute, Molloy College	Town of Huntington
Suffolk County Department of Public Works	Town of Babylon	Town of Islip
Suffolk County Executive Office	VHB Engineering, Surveying and Landscape Architecture	Town of Riverhead
Suffolk County Legislature	Vision Long Island	Town of Smithtown
Suffolk County Water Authority	Westhampton Beach	Town of Southampton
Environmental Protection Agency (EPA) Region II	Peconic Green Growth	Town of Southold
Suffolk County Department of Health Services	New York State Department of Environmental Conservation	Stony Brook University
Public Financial Management, Inc.		

B. Team biographies

Jan Bowen
Executive Partner and Water Industry Leader
IBM UK (Bristol)

Bowen has more than 20 years of experience working within supply chain management and operations, focusing on realizing performance improvement across both geographic and organizational boundaries. She has worked in a variety of industries spanning automotive, aerospace and defense, chemicals and petroleum and more recently utilities. Her leadership has driven significant improvement-focused projects that address not only the change in business process and organization but also the associated enabling technologies. Bowen's experience within the utilities industry has involved the design and implementation of work and asset management solutions for water and wastewater companies. She recently led a project in which IBM helped establish a new national water utility in the Republic of Ireland.

Kelly Clifton
Strategy and Analytics Consultant
IBM North America (Charlotte)

Clifton's work focuses on business strategy and transformation services for external clients. She has acted as a consultant for large industrial clients and has extensive experience with innovative business opportunities within IBM, such as cloud, mobile, social and analytics. She assists with business development opportunities and research for the Smarter Cities Center of Excellence and IBM Smarter Water. Clifton has worked in local government reorganization and urban planning in the Commonwealth of Virginia. While in graduate school, she consulted for a multinational company in North Carolina, providing effective social media strategies to improve business-to-business marketing. Clifton holds a BA from the University of Virginia in government and history and an MA in management from Wake Forest University.

Antonio Nasuto
Director of Operations and Sales Transformation for Central and Eastern Europe
IBM (Prague)

Nasuto has more than 25 years of IBM experience, and most recently he led the integration of Sales Management Support into the global CRM model. Previously, he held several management roles in Sales and Business Operations, leading Global Technology Services CoE, Europe Sales Reporting CoE and Sales Management Support CoE in Bratislava. Nasuto has successfully managed global teams' transformation, integration and sales support. Prior to his international assignment, Nasuto specialized in services and was responsible for such clients as Exxon, Generali, Telecomitalia and many more.

Vincent Mottier
Application Innovation Services Managing Consultant
IBM (Zurich)

Currently, Mottier's work focuses on Smarter Water™, enterprise asset management and business process analysis and design projects for transportation and water/wastewater utilities companies. He has 12 years of experience in the IT and telecommunications industries — with positions that span market research, product management and corporate strategy — combined with more than eight years working for renowned water research institutions on topics like wastewater treatment, runoff water handling and information management and data modeling for urban water management. Mottier holds a PhD and a Master's degree in environmental engineering from the Swiss Federal Institute of Technology, as well as an MS in hydrology from the University of Montpellier, France.

Allison McFadden

Director of Integrated Supply Chain, Business Integration and Transformation
IBM North America (Raleigh)

McFadden has 15 years of experience in supply chain management, operations and business process transformation, during which she has focused on global and cross-functional team leadership. She has led large-scale projects for multiple product lines within IBM, including the launch of IBM systems software manufacturing in Dublin, Ireland. After this successful launch, McFadden served as the senior leader of the Dublin Software Center where she was responsible for the manufacturing and fulfillment of all IBM software products for the European and Growth Market regions. She has also led significant transformation projects for the IBM hardware division, the most recent of which was recognized as a finalist for both the Institute of Supply Chain Management and Supply Chain Council awards for excellence in supply chain. Her current responsibilities include developing strategic direction for the IBM Integrated Supply Chain and partnering with business services to provide supply chain talent and assets to clients. She holds a BS in industrial engineering from Purdue University and an MBA from Duke University.

Cesar Saavedra

Worldwide Software Systems and Data Management Consultant
IBM North America (Orlando)

Saavedra has 24 years of IT experience, focusing primarily on architecting, implementing, testing, integrating and maintaining software and data systems. He holds BS and MS degrees in computer science from the University of Kansas, as well as an MBA from the University of Florida. Saavedra has experience in a variety of industries and sectors, including airlines, city and federal government, energy, telecommunications, retail, logistics, semiconductor manufacturing and many others. Currently, he is part of the IBM Worldwide WebSphere Competitive Team and works with sales teams around the world advising on IBM competitors in a variety of areas, including integration, BPM, SOA, API management, databases and the Internet of Things. Before joining IBM, Saavedra worked at Oracle, TIBCO, Lucent Technologies and AT&T Bell Laboratories. He is TOGAF certified.

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www.beachlive.co.uk

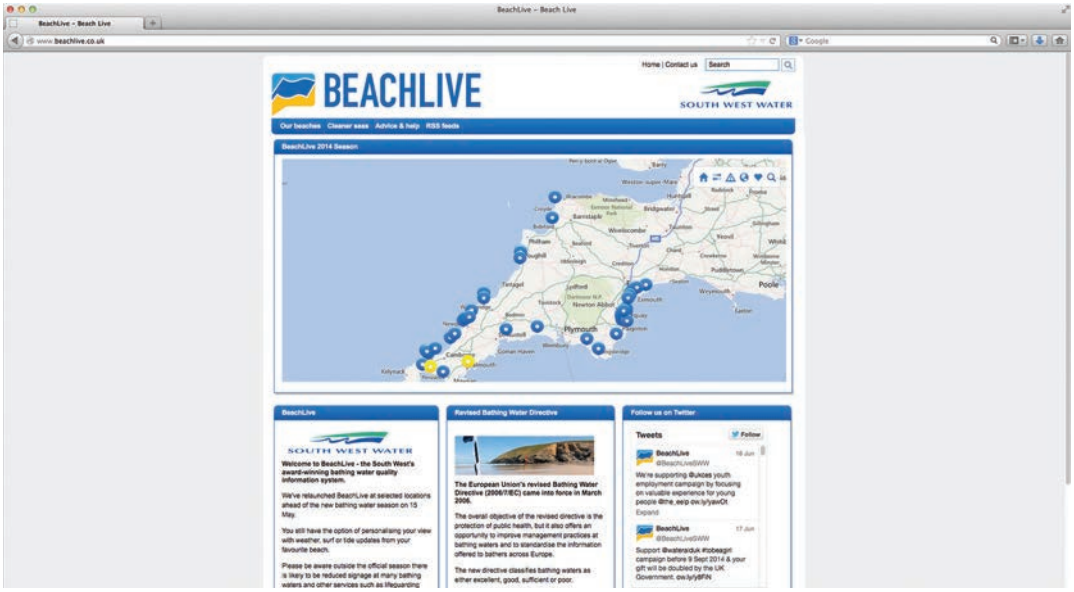

Figure 5: A BeachLive view gives the public access to information about water quality at public beaches and other factors that may affect beach use

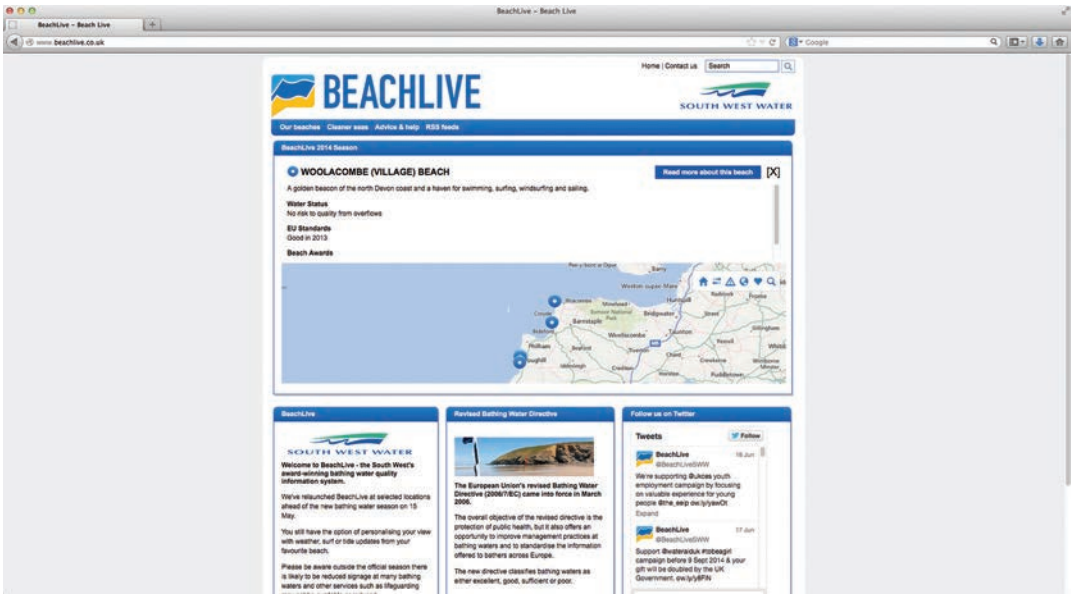

Figure 6: A detailed BeachLive view about a particular beach's status

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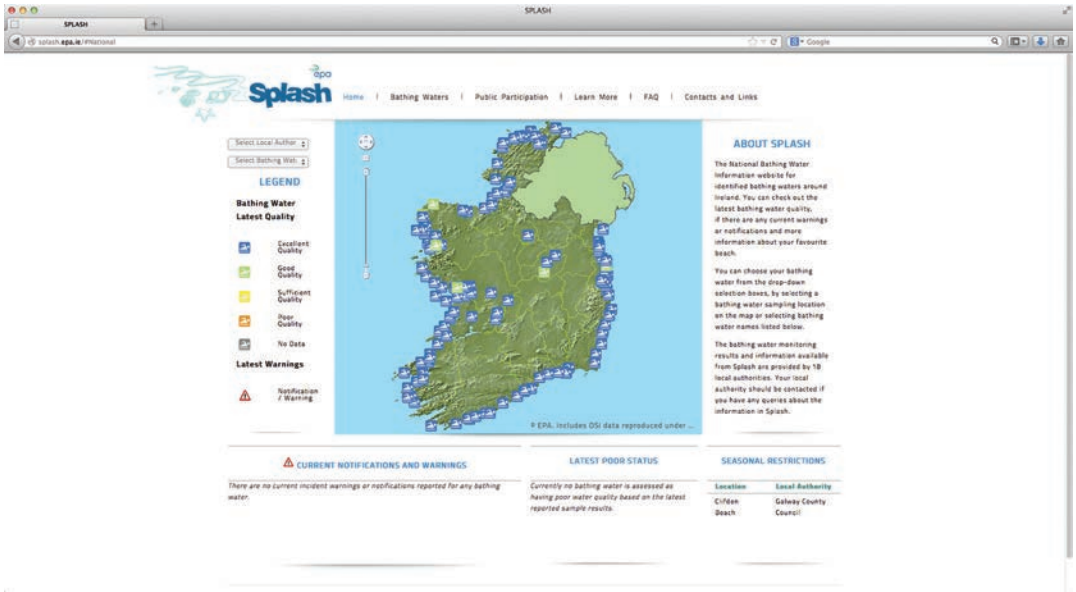

Figure 7: A view of Splash, a site where the public can learn about the quality of water at public beaches in the Republic of Ireland

Figure 8: Splash view displaying details about a particular beach

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12 "Voluntary National Guidelines for Management of On-site and Clustered (Decentralized) Wastewater Treatment Systems." Office of Water, Office of Research and Development, US Environmental Protection Agency. March 2003. http://water.epa.gov/scitech/wastetech/upload/septic_guidelines.pdf

13 "Standards: Approval Of Plans And Construction — Sewage Disposal Systems For Single-Family Residences." Suffolk County Department of Health Services, Division of Environmental Quality. November 13, 1995. www.suffolkcountyny.gov/Portals/0/Documents%20and%20Forms/Health%20Services/Wastewater%20Management/Residential%20Standards.pdf

14 "Office of Wastewater Management Organizational Chart and Manpower Estimates for 2014 and 2016." Suffolk County Department of Health Services, Division of Environmental Quality.

15 2014 Drinking Water Quality Report. Suffolk County Water Authority. http://65.36.213.246/dwqr2014/water-quality-report-2014-scwa_v2.html

16 Hurricane Sandy Coastal Resiliency Competitive Grants Program Mitigation Funds. Suffolk County. Environmental Projects Coordinator.

17 "Request for Expressed Interest in: A Demonstration of Innovative Alternative On-site Wastewater Treatment Systems in Suffolk County." Issued April 14 2014. www.suffolkcountyny.gov/Portals/0/planning/general/RFEI-WQ-I-AWSS.pdf

Submissions reviewed the following companies:
- AK Industries and AK/HA Mfg. LLC
- Orenco Systems
- Biogard Inc.
- Busse, Green Technologies Inc.
- Norweco

18 Suffolk County Atlas. Suffolk County Department of Economic Development and Planning.

19 Suffolk County Save Open Space Bond Act Workforce Housing Transfer of Development Right Implementation Plan. February 2005. Suffolk County Department of Planning. February 2005. www.suffolkcountyny.gov/Portals/0/planning/Publications/SOS_DevRights022005.pdf

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26 The Water Agencies. Public Institutions of the Ministry for Sustainable Development. France. Accessed June 17, 2014. www.lesagencesdeleau.fr/en/les-agences-de-leau/les-six-agences-de-leau-francaises/

The water agencies in France are public institutions of the Ministry for Sustainable Development. Their primary objective is to help reduce pollution and protect water resources and aquatic environments. The six water agencies employ some 1,800 employees who are organized around the catchment management of river basin districts. They fulfill their duties within the framework of multi-year action programs.

27 Digital Delta. Accessed June 19, 2014. www.digitaledelta.nl/en

28 "Digital Delta transforms Dutch water system using Big Data." IBM Smarter Cities. YouTube video. Accessed June 18, 2014. www.youtube.com/watch?v=O8gsNsgFYBo

The Digital Delta project brings together the Dutch Ministry of Water, the Delfland local water authorities, the University of Delft, IBM and other organizations. The project focuses on the provisioning of unlimited and readily accessible water and climate services. One of the key objectives is to integrate and open up water-related data from more than 100 ongoing projects, making it available to organizations, scientists and businesses involved in water management.

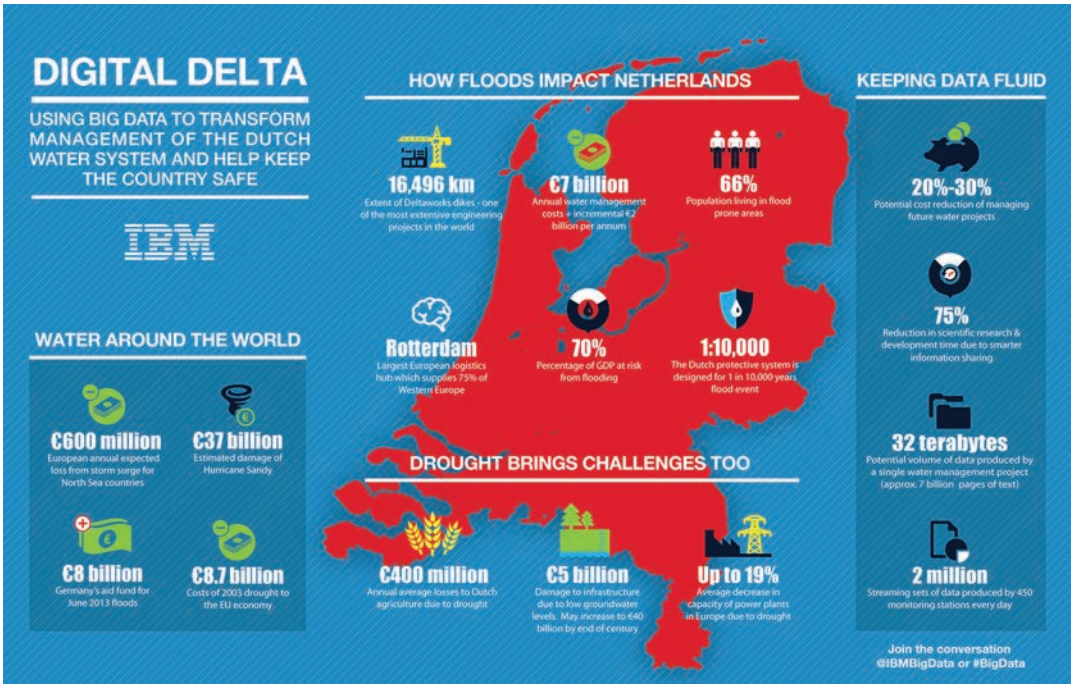

Figure 9: The Digital Delta approach

29 "Watershed Scale Platform for Research, Development, Testing & Demonstration of Water Technologies and Services." Southern Ontario Water Consortium. Accessed June 18, 2014. http://sowc.ca

30 "The Southern Ontario Water Consortium (SOWC). A major force in international water expertise." Ontario Business Report. Accessed June 20, 2014. www.mri.gov.on.ca/obr/2012/07/the-southern-ontario-water-consortium-sowc

The Southern Ontario Water Consortium uses a data integration and management platform for near real-time watershed monitoring and watershed management. The platform synthesizes numerous information sources and formats within the framework of the Grand River Watershed (CA). The data integration platform supports water management professionals and researchers to develop efficient tools to predict floods, protect the water supply sources and forecast the impact of growth and urbanization on vital ecosystems.

31 Singer, N. "Mission Control, Built for Cities. IBM Takes 'Smarter Cities' Concept to Rio de Janeiro." *The New York Times*. March 3, 2012. Accessed June 18, 2014. www.nytimes.com/2012/03/04/business/ibm-takes-smarter-cities-concept-to-rio-de-janeiro.html?pagewanted=all&_r=0

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Figure 10: The Rio de Janeiro operation center integrates data from the city's public agencies to improve response to events, such as floods and landslides

33 "Watershed Management: Guiding Principles for Integrated Management of Water in Switzerland." Federal Office for the Environment (FOEN). Swiss Confederation. 2011. Accessed June 19, 2014. www.bafu.admin.ch/publikationen/publikation/01576/index.html?lang=en

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34 "Handbook for Developing Watershed Plans to Restore and Protect our Waters." United States Environmental Protection Agency. Accessed June 20, 2014. http://water.epa.gov/polwaste/nps/handbook_index.cfm

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38 "SmartBay." Marine Institute, Ireland. Accessed June 20, 2014. www.smartbay.ie

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D. Component Business Model

IBM uses a tool called a Component Business Model (CBM), which sets out a range of components for which an organization requires capability. It helps to provide a framework for an organization to assess current capability levels and future needs against proposed changes or future events. It can be used to help understand the gaps and define priority actions to build capabilities within the organization. It is commonly used in conjunction with a maturity matrix, which is a set of qualitative statements against key criteria, to help an organization assess its capabilities against accepted best practices.

Our CBM comprises five vertical silos that represent the key areas we believe are vital to water/wastewater management in Suffolk County:

1. Engagement and customer management
2. Water sourcing, distribution and treatment
3. Wastewater/recycling strategy
4. Resiliency and environmental management
5. Manage business

Within these silos, the different functions fall into one of three categories:

- **Direct —** These activities set direction and strategy
- **Control —** Actions that manage or monitor performance
- **Execute —** Transactional activities performed in execution of processes

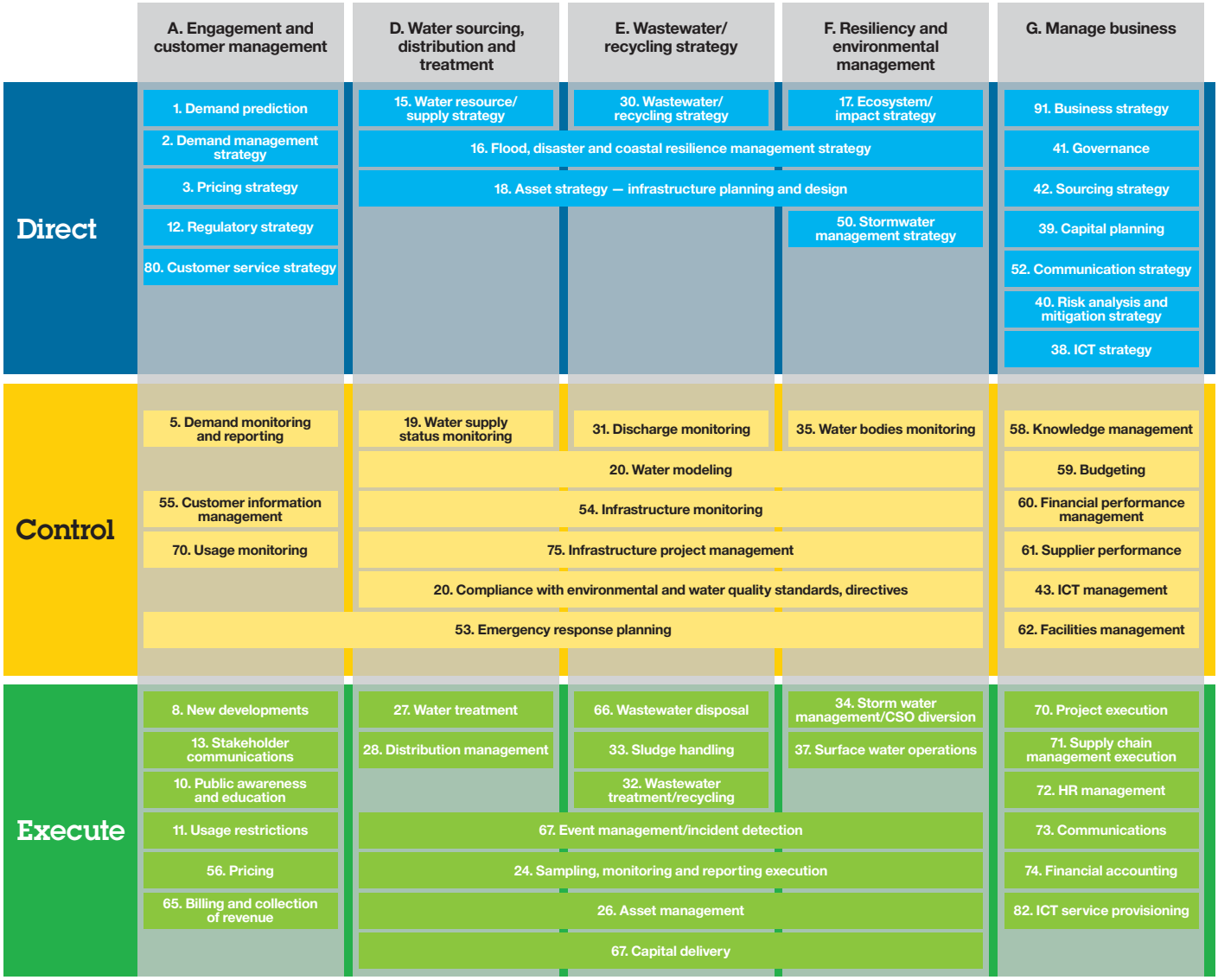


Figure 11: Our approach

Summary of the maturity matrix

A maturity matrix is a set of qualitative statements for defined criteria to assess a capability against known best practices. The statements describe different levels of maturity for organizations to help them understand current maturity levels and define objectives for improvement. A maturity matrix is a tool that helps organizations identify where change is necessary and aligns thinking on where to focus improvement.

The maturity matrix for Suffolk County highlights the County's six focal areas for water and wastewater management:

1. Water and wastewater resource planning
2. Infrastructure and asset management
3. Monitoring and meeting regulatory requirements
4. Customer/stakeholder management and engagement
5. Finance, planning and management
6. Governance and compliance

Suffolk County can use the following maturity matrices to gain a slightly more detailed perspective on how their water/wastewater management approach measures up. By benchmarking its maturity on the matrix, the County can begin to understand where it needs to prioritize and focus resources to improve water quality.

Criteria	Level 1	Level 2	Level 3	Level 4	Level 5
Water and wastewater resource planning	• Local or informal approach to planning not consistent • Lack of information on water systems and water cycle • No current management and progression plans	• Formation of plans for resources shared across districts/town boundaries • Limited alignment of career progression and performance management to future demand plans • Inconsistent and incomplete information in multiple systems	• Common and integrated plan for complete water cycle • Recognition of the importance of high-quality information • Plans for job rotation and cross skilling in place • Clear strategy on what technology is needed where for on-site wastewater and water treatment.	• Complete inventory of data, common format and shared information • Documented decision criteria and repeatable process to update investment plans and budgets • Job rotation and cross skilling fully aligned to future resource plans	• Use of analytical techniques to capacity plan all resource types for future use, with investment planning and funding aligned • Career progression and skills planning aligned to future demand • Clear goals and measures in place for water evaluation
Infrastructure and asset management	• Inconsistent and incomplete asset information in multiple systems (including paper-based data) • Maintenance and service decisions are reactive, not proactive • Wasted effort on accessing reporting; processes localized	• Recognition within the organization of the importance of high-quality and timely asset information to support strategy • Approach for specification, tracking, inventory and event history of assets under development • Initial ideas of proactive/ preventative asset maintenance plans	• Single integrated view of asset specification, location, history and inventory developed • Proactive/ preventative maintenance schedules established • Mechanisms in place to ensure collaboration and share learning between engineering and operations (for example, treatment and distribution) • Mobile working and optimization of field work	• Preventative maintenance schedules based on up-to-date and fact-based performance data • Asset specifications regularly reviewed and challenged to drive service and cost improvements • Mobile working with data capture at source • Standardized data dictionaries and information repositories	• Use of simulation tools to support asset investment decisions • Information available across organizations through end-to-end visibility • County can readily access data on asset trends, such as repair histories and so on • Proactive event management with full County view of infrastructure

Figure 12: Maturity matrix: Details

Criteria	Level 1	Level 2	Level 3	Level 4	Level 5
Monitoring and meeting regulatory requirements	• Limited/no monitoring of treatment facilities or natural systems — core mandatory only • Basic legislative compliance understood and achieved • No comprehensive and systematic reporting on quality • Informal discussions with regulators held — usually reactive • Treatment status is largely behind the fact, based on manual reading of the wastewater treatment process(s)	• Performance metrics around compliance and quality agreed across all functions but not fully monitored or enforced • Regulatory management seen as core competence • The agency gets regular data from treatment operations, supported by manual sampling	• Collaboration between central compliance teams and wider organization established • Performance metrics around compliance and quality agreed with all stakeholders and residents • Data model analysis associated KPIs defined and in use • County has target for nitrogen load	• Link training, leadership, values and performance metrics to establish and maintain a continuous improvement culture • Quality program defining all stakeholder requirements through information collaboration • Policies on customer revenue, environment and assets integrated and aligned • Collaboration among stakeholders for sampling and analysis	• Compliance and quality levels optimized with nearly real-time data • Influential, highly coordinated regulatory and stakeholder management • County tracks all wastewater/waste treatments activities, using automated sensors • Single, integrated platform sharing relevant information to applicable stakeholders
Customer/ stakeholder management and engagement	• County does not have a consolidated view of key stakeholders and interaction history • Limited awareness of how water quality can be addressed in the community • Limited communication from County — only on specific issues	• Discussions started with wider groups of stakeholders around collective action for water quality • County and key stakeholders provide some information available online, but not a complete picture, for addressing water quality • Feedback systematically acted on by County	• Understanding individual stakeholder positions on water quality and use these to drive engagement • Route customer feedback to process owners to drive continuous improvement • County has some water quality priorities with some actions started to support and execute against these	• Collaborative planning with key stakeholders to further optimize impact and motivation • Robust and centralized networks of key stakeholders to proactively leverage organizational strengths • Proactive use of social media and other collaboration platforms to capture water quality information and share	• Proactive communications to citizens regarding incidents and water quality issues • Water-centric culture, citizens "live" the values and are empowered to "go the extra mile" • Maximum use of stakeholders to engage and educate the public in an orchestrated and strategic way

Figure 12: Maturity matrix: Details (continued)

Criteria	Level 1	Level 2	Level 3	Level 4	Level 5
Finance, planning and management	• Planning and budgeting processes are separate, with minimal coordination • Manual compilation and validation of data for reporting • Pricing for water and wastewater does not link to usage • No structured approach to identity funding	• Planning and budgeting processes are separate, with moderate coordination • Some manual corrections/control in financial planning and data usage for decision making • County has some view of capital project priorities, but these are not fully informed	• Some alignment of planning and budgeting with strategic, long-term direction • Contains financial and non-financial data • Pricing for water links to usage; wastewater is not included in same billing system • Addresses priority projects for investment on a reactive basis • Basic KPIs in place	• Planning and budgeting aligned to strategize together for the long term • Key investment milestones are built into plans and budgets, with various options for funding streams and resource needs in place • Proactive management and diversified funding streams	• Planning and budgeting are web based, and processes are fully integrated reporting tools • Optimized pricing model that allows County to explore pricing and project scenarios • Pricing for water and wastewater directly linked to usage in the same billing system – parity across population
Governance and compliance	• Compliance reporting is manual • County stakeholders do not as a rule collaborate with water agencies • Enforcement of water quality regulation violations does not exist • Local regulations do not allow for innovative and new technologies to improve wastewater treatment processes • Informal and reactive discussions at the state level	• Delay in identifying compliance events, with moderate risk of legal or cost implications • Some exceptions given for new technology but after tedious application process • Enforcement for water quality regulation violations exists but is not regularly performed • Local initiatives to drive improvements in water quality and water use • Compliance management seen as core competence	• County shares compliance data between departments and water agencies • New technology permits issued in a timely manner • User's consumption is not fully customized or tied to wastewater treatment • Regular enforcement of treatment systems compliance occurs • Common understanding forming of how state, County and local entities work together	• An integrated view aligning financial, environmental and societal factors linked to citizen compliance for wastewater • County allows pilots for new and advanced technologies for wastewater • Enforcement and public awareness are linked and communicated regularly to citizens • Consistent levels of quality across County with systematic sharing • Informal collaboration between state, County and towns on compliance	• County manages enforcement by a predetermined schedule • County prioritizes key areas for enforcement and system upgrade • Stakeholders share data related to water quality compliance — two way sharing • Pull from communities to identify initiatives for improving water quality • Aligned and working closely at state level on common goals and compliance issues

Figure 12: Maturity matrix: Details (continued)

E. Estimates

The team estimated order of magnitude implementation costs for each of its 11 recommendations to Suffolk County. We categorized these implementations as low, medium and high. Low costs are under US $1 million, medium costs are up to US $10 million and high costs are up to US $30 million. These estimates are designed to help the County support its planning activities.

Recommendation description	Estimated cost of implementation	Potential benefit/revenue
1. Finalize and deploy a robust and integrated Water Resource Plan	< $10 m	
2. Operate the sewage treatment plant network under the control of the Department of Public Works	< $30 m	Revenue ~ $50 m
3. Integrate water and wastewater operations	< $10 m	Lab consolidation
4. Establish a framework to visualize, monitor and manage water quality	< $10 m	Savings in licenses, application support
5. Establish governance to enable the installation of appropriate technology and to motivate responsible behavior	< $1 m	
6. Excite communities to embrace the solutions for improving water quality	< $1 m	
7. Create a structure to drive compliance	< $1 m	
8. Continue to develop a funding mechanism	< $10 m	
9. Develop workforce model and practices to meet future needs	< $30 m	
10. Adapt the business processes in the Department of Public Works and the Department of Health Service to meet expanded integrated water management responsibilities	< $10 m	Process savings
11. Establish a framework for decentralized wastewater handling solutions	< $10 m	

Figure 13: Estimate of costs and potential benefits: Order of magnitude

F. The water cycle

We strongly recommend that Suffolk County consider the full water cycle in its future planning and management of water quality to help ensure an integrated approach. The water cycle is the full cycle of water, from precipitation through water treatment, distribution, use, collection, wastewater treatment and return to the source (see Figure 14).

We included a set of statements as suggestions for key objectives and outcomes that Suffolk County may want to adopt as a set of outcomes for an integrated approach to water and wastewater management.

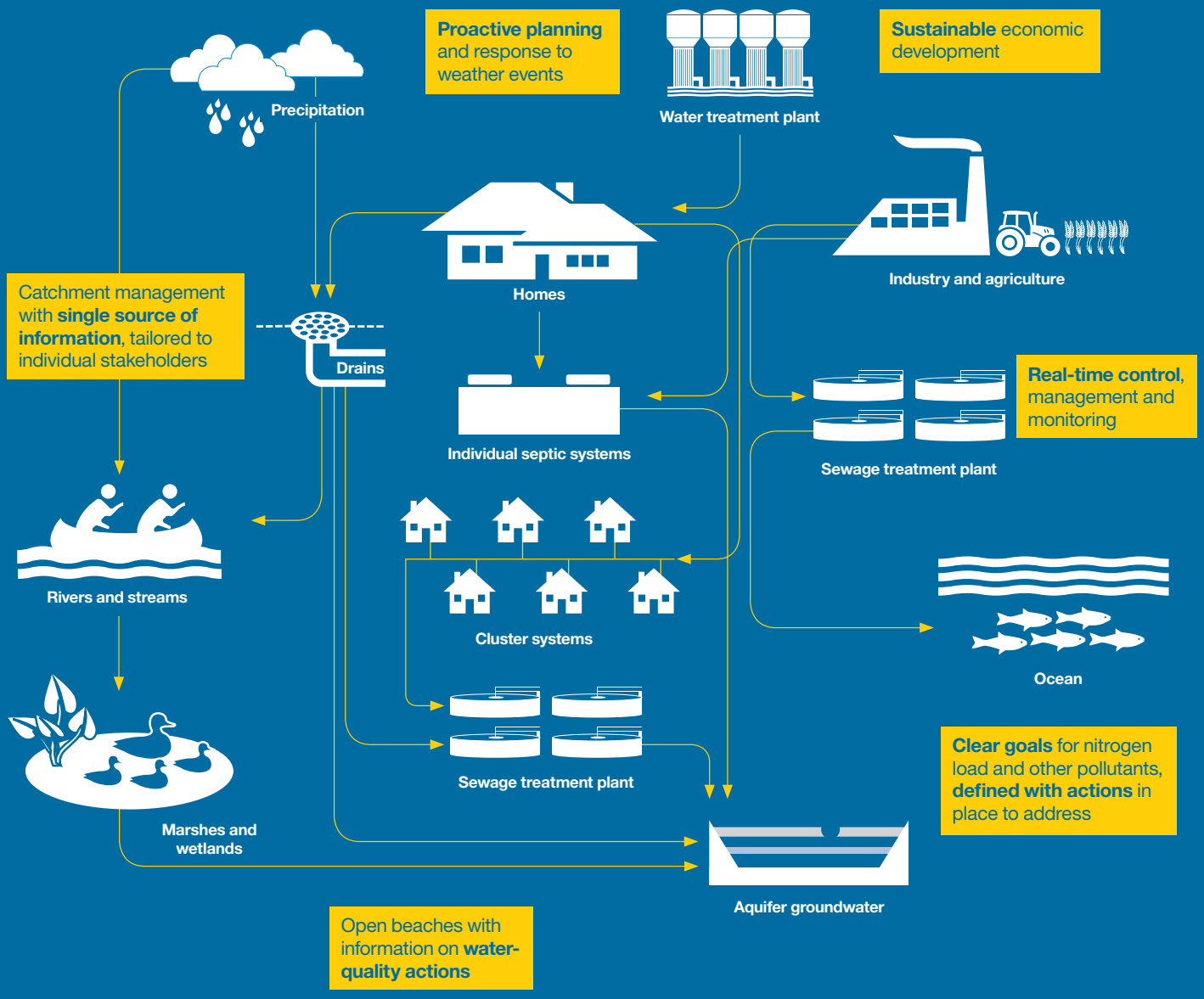


Figure 14: The water cycle with key objectives and outcomes from an integrated approach

G. Core operational and customer cycles for best practices in a combined water and wastewater company

In a combined water and wastewater company there are three core cycles:

1. The asset lifecycle

This cycle begins with long-term investment planning to determine capital needs. The next phase is the delivery of the capital assets, as prioritized during investment planning, and ongoing asset maintenance and operation. At the end of an asset's lifecycle, which is typically 30 years but varies depending on the asset, it is decommissioned.

2. The work management lifecycle

This cycle focuses on the daily activities behind the execution of planned and unplanned work. The goal is to operate and maintain the assets in a way that will ensure continued delivery of water and wastewater services while maximizing the life of the assets. This cycle integrates and optimizes the asset maintenance plans, addressing emergency and proactive work with the available skills, resources, materials and equipment.

3. The customer lifecycle

From meter reading to receiving and handling customer calls to processing bills, this lifecycle encompasses all customer contact.

These lifecycles are key to delivering best practices within water and wastewater utilities companies. In recent years, companies have focused on the following best practice areas:

- Integration across the three lifecycles to enable end-to-end visibility of processes to better serve customers
- Using a single asset hierarchy and integrated register to manage both financial and operational processes in an integrated manner
- Improving the customer experience and responsiveness to customer requests/complaints
- Integrated asset management for improved performance, proactive maintenance and reduced costs from installation through to decommission
- Increased mobile field work to capture data at its source
- Improved reporting to provide real-time or nearly real-time performance analysis to support decision making

Figures 15 and 16 illustrate these three lifecycles, as well as best practices in water utilities.

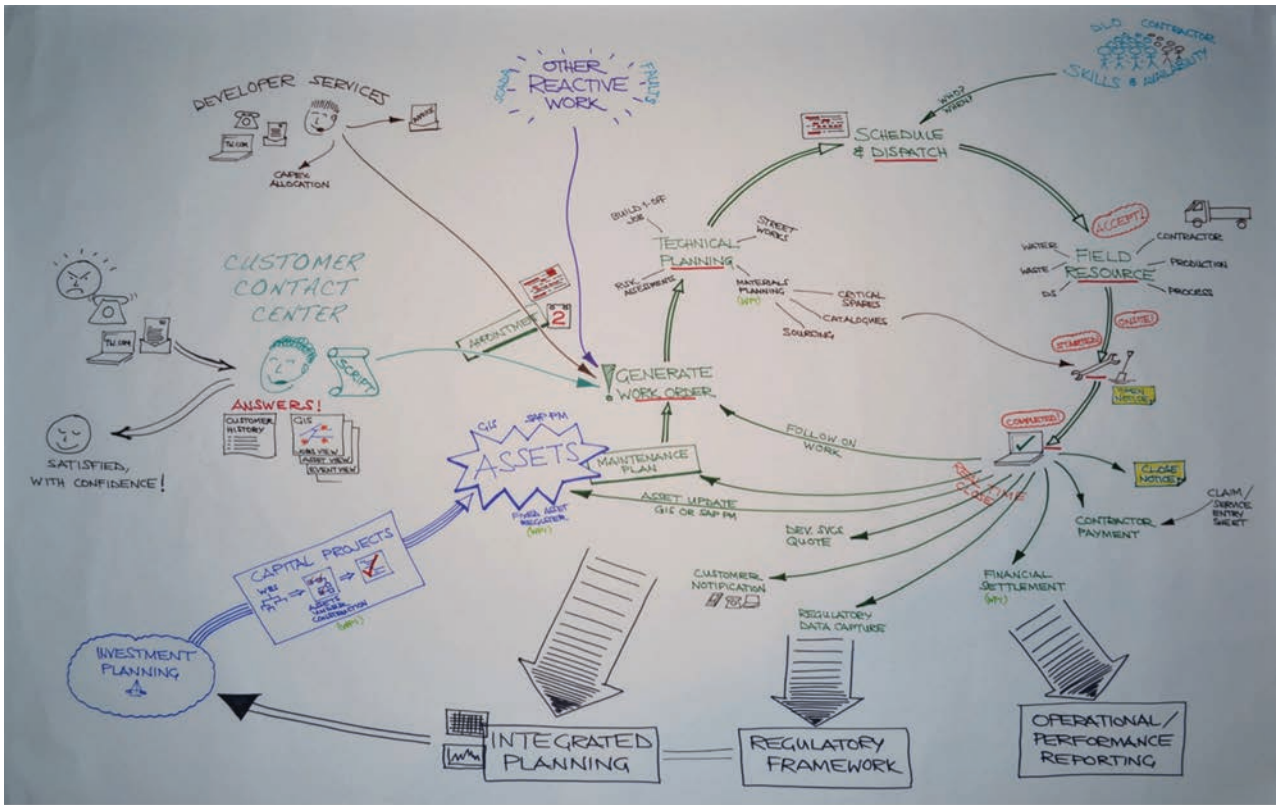
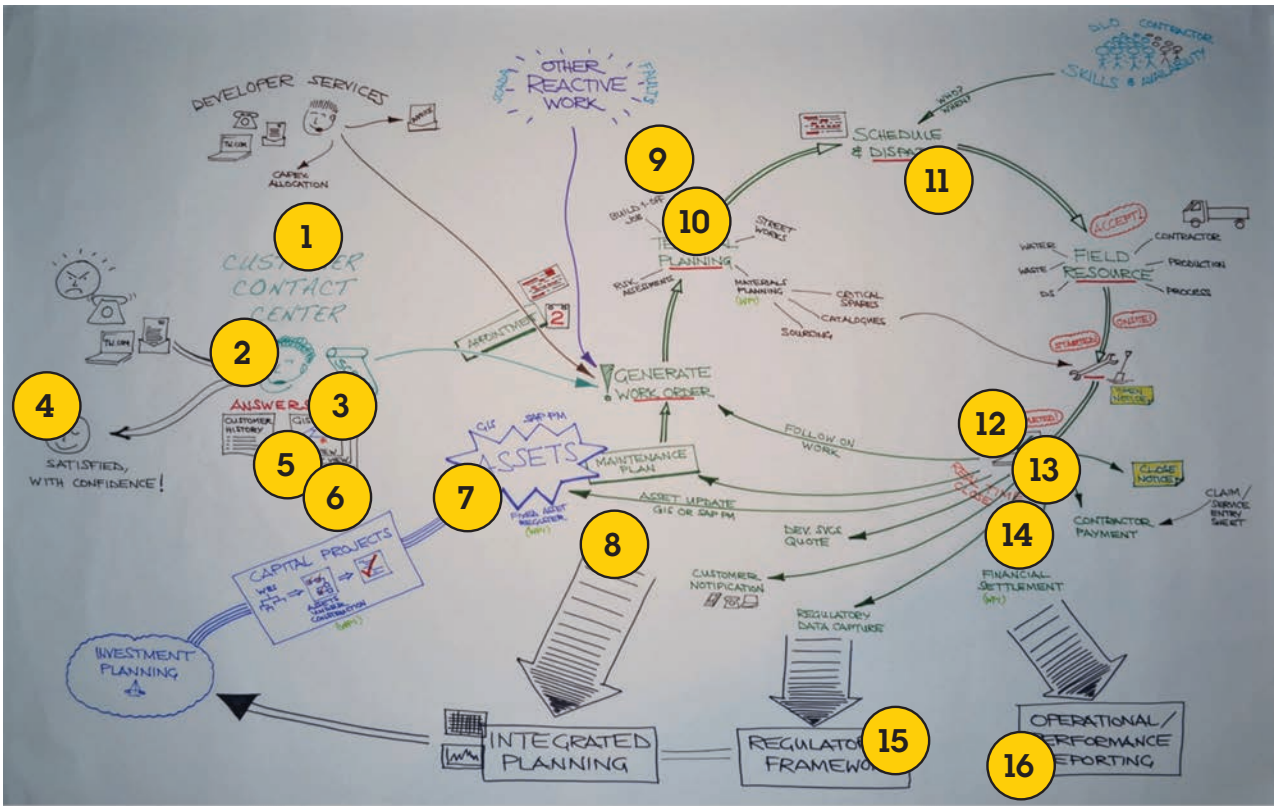


Figure 15: Managing water and wastewater services, from investment planning to work execution and billing



1. Booking appointments during the call based on the schedule
2. Structured scripts to improve the customer experience
3. Automation of penalty payments
4. Customer correspondence visible to agents
5. Real-time visibility of events and work for the contact
6. Integrated planning solution for waste process
7. Commissioning and depreciation of assets at an equipment level
8. Process-centric asset hierarchy integrated to fixed asset register
9. Using attachments via web services to help manage
10. Technical planning workbench provides an integrated solution to plan work in line with customer need, permitting, notices and availability of resource
11. Scheduling solution for sampling
12. Fully integrated purchase to pay for contract work
13. Mobile GIS and GPS integration data capture at source
14. Real-time visibility of work order status and data captured
15. Performance and monitoring framework
16. Daily dashboard to help drive performance

Figure 16: Best practices for managing water and wastewater services

H. Assessment of EPA management models for Suffolk County

Suffolk County should consider applying the EPA Management Model methodology for oversight of its decentralized wastewater treatment systems. In order to apply any of the models, it is critical that Suffolk County establish an inventory of on-site and cluster systems. For simplicity and efficiency, we recommend Suffolk County pursue one county-wide model described in the EPA Management Model Summary Assessment table below. The County should pursue Model 3 for its short-term goals. For cluster systems, we recommend Model 4 as a long-term goal. Program features that Suffolk County must develop to advance along the maturity curve are in red text.

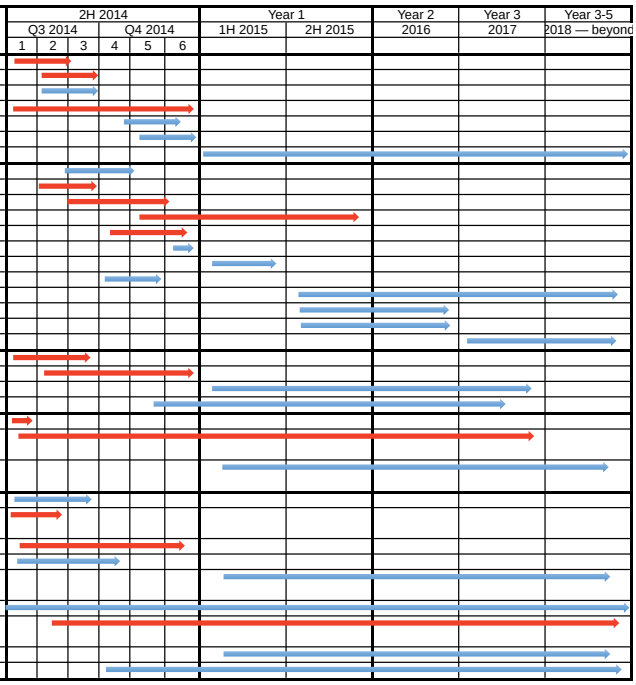
Table 1: Summary of management models

Typical applications	Program description	Comments
MODEL 1 — Homeowner awareness model		
• Areas of low environmental sensitivity where sites are suitable for conventional on-site systems.	• Systems properly sited and constructed based on prescribed criteria. • Owners made aware of maintenance needs through reminders. • Inventory of all systems.	As a baseline for implementing any EPA management model, Suffolk County should prioritize creating an inventory of all on-site systems in the county.
MODEL 2 — Maintenance contract model		
• Areas of low to moderate environmental sensitivity where sites are marginally suitable for conventional on-site systems due to small lots, shallow soils or low-permeability soils. • Small clustered systems.	• Systems properly sited and constructed. • More complex treatment options, including mechanical components or small clusters of homes. • Requires service contracts to be maintained. • Inventory of all systems. • Service contract tracking system.	This model is not recommended for Suffolk County.
MODEL 3 — Operating permit model		
• Areas of moderate environmental sensitivity, such as wellhead or source water protection zones, shellfish growing waters or bathing/water contact recreation. • Systems treating high-strength wastes or large-capacity systems.	• Establishes system performance and monitoring requirements. • Allows engineered designs but may provide prescriptive designs for specific receiving environments. • Regulatory oversight by issuing renewable operating permits that may be revoked for noncompliance. • Inventory of all systems. • Tracking system for operating permit and compliance monitoring. • Minimum for large capacity systems.	Model 3 is a recommended near-term model for Suffolk County. Tracking of performance and monitoring mechanisms must be developed in order to manage under this model.
MODEL 4 — Responsible management entity (RME) operation and maintenance model		
• Areas of moderate to high environmental sensitivity where reliable and sustainable system operation and maintenance (O&M) is required, e.g., sole source aquifers, wellhead or source water protection zones, critical aquatic habitats or outstanding value resource waters. • Clustered systems.	• Establishes system performance and monitoring requirements. • Professional O&M services through RME (either public or private). • Provides regulatory oversight by issuing operating or NPDES permits directly to the RME. (System ownership remains with the property owner.) • Inventory of all systems. • Tracking system for operating permit and compliance monitoring.	Model 4 is a recommended target model for Suffolk County. Robust inventory, performance requirements and monitoring mechanisms must be established. Once this baseline has been established, Suffolk County can consider defining an RME model to operate and maintain on-site systems.
MODEL 5 — Responsible management entity (RME) ownership model		
• Areas of greatest environmental sensitivity where reliable management is required. Includes sole source aquifers, wellhead or source water protection zones, critical aquatic habitats or outstanding value resource waters. • Preferred management program for clustered systems serving multiple properties under different ownership (e.g., subdivisions).	• Establishes system performance and monitoring requirements. • Professional management of all aspects of decentralized systems through public/private RMEs that own or manage individual systems. • Qualified, trained owners and licensed professional owners/operators. • Provides regulatory oversight by issuing operating or NPDES permit. • Inventory of all systems. • Tracking system for operating permit and compliance monitoring.	Model 5 is at the upper end of the maturity curve and may be assessed at a future date. A cost-benefit analysis should be conducted to understand if the cost of training and implementation for the entire population would support the benefit for the additional requirements of this model.

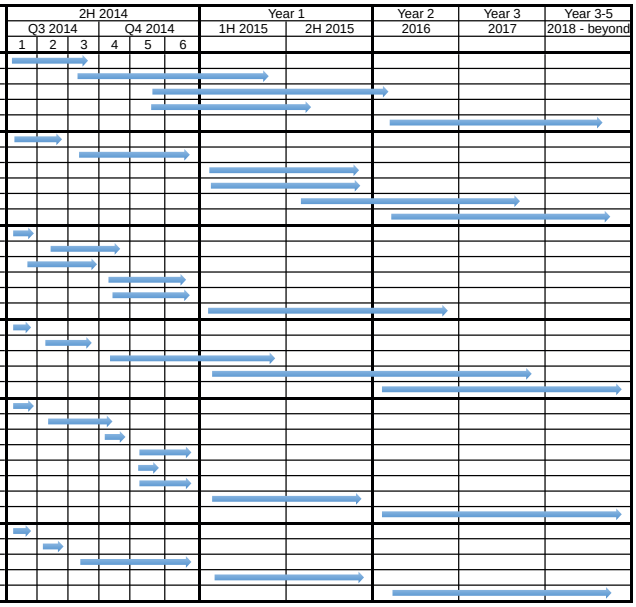
I. Roadmap of recommendations

The team defined key milestones and estimated timescales for each of the recommendations. We have not accounted for wider County timescales or initiatives in preparing this roadmap should more time be necessary. The intent of this roadmap is to provide input for the County's overall planning to develop an integrated plan.

#	Recommendation	Pr.	Owner/sponsor	Key milestones and action
1	Finalize and deploy a robust and integrated Water Resource Plan	1	Department of Economic Development and Planning	Fund and recruit transformation leader
				Establish goal for nitrogen load allocation
				Identify and agree other pollutant goals
				Build water resource plan
				Define plan's governance
				Define maintenance to keep the plan on track
				Deploy plan: launch actions and measure progress
4	Establish a framework to visualize, monitor and manage water quality	1	Deputy County Executive — Operations	Establish a new integrated IT Team
				Kick off data migration project
				Identify top priority data sources to integrate
				Implement model in phased approach
				Establish platform and tool for consolidation
				Enable access to integrated model
				Migrate applications
				Define overall data governance and objectives
				Continued integration of common information model
				Develop resilient disaster recovery strategy
				Consolidate distributed County data centers
				Enable mobility
6	Excite communities to embrace the solutions for improving water quality	1	Department of Economic Development and Planning	Establish metrics for Blue Flag
				Establish online water quality portal/social media strategy
				Provide data on beach environment/Blue Flag status to public
				Create long-term engagement plan for organizations
8	Continue to develop funding mechanism	1	Deputy County Executive — Finance	Appoint funding leader
				Explore and exercise all sources of funding immediately — ongoing until goals attained
				Establish ongoing management and tracking to targets of the funding structure
11	Establish a framework for decentralized wastewater handling solutions	1	Department of Health Services	Gather knowledge/provide information re: decentralized systems
				Define guideline for selection of appropriate on-site and cluster technology
				Establish a register of onsite/cluster
				Provide guidelines and training information for private operators
				Certification and inspection for ongoing management of quality and operation
				Establish inspection record information systems
				Establish a regulation ensuring the implementation or upgrade of onsite treatment when renovation/ownership changes
				Establish Low N Certified for properties
				Definition of long-term technology and innovation



#	Recommendation	Pr.	Owner/sponsor	Key milestones and action
2	Operate the STP network under the control of the SCDPW	2	Head of DPW	Develop criteria and priority for transfer
				Define approach to management and control of STPs
				High priority STPs transferred
				Service meetings in place with privately run STPs
				2nd tranche priority plants transferred
3	Integrate water and wastewater operations	4	Head of DPW and Head of SCWA	Develop business case
				Define target operating model
				Information plan/budget defined
				Agree with unions on working structures
				Transition and consolidation of shared services
				Transition and implementation of combined operations
5	Establish governance to enable the installation of appropriate technology and to motivate responsible behavior	3	Director of the Department of Health Services	Apply for septic repair program for pilot septic systems
				Select pilot technology system and residents to install new systems
				Communication strategy
				Construct governance structure to monitor, enforce
				Update DHS Sanitation Code for new tech
				Continue incentive programs for upgraded septic
7	Create a structure to drive compliance	3	Suffolk County Department of Health Services	Kick off compliance task force
				Confirm initial high-priority measures for compliance (align w/4)
				Measurement
				Execution of compliance
				Annually review critical KPIs, validate and modify as appropriate
9	Develop workforce model and practices to meet future needs	2	Director of the Department of Public Works and Director of the Department of Health Services	Establish staffing leader and kick off project
				Map workflow processes, determine inputs
				Gap analysis
				Develop strategy for supply of skills
				Succession planning
				Gain financial support
				Execute staffing plan
				Establish regular staffing cadence
10	Adapt the business processes in the SCDPW and the SCDHS to meet expanded integrated water management responsibilities	3	Director of the Department of Public Works and Director of the Department of Health Services	Assign process improvement leader, kick off
				Determine priority processes, change agent
				Run value stream mapping workshops
				Execute improvement actions
				Establish ongoing continuous improvement program



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