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Managing Infiltration & Inflow

By: James Kello, Water Resources Specialist

Most if not all wastewater collection systems experience some influence from storm water and groundwater in the form of infiltration and inflow (I&I).

Infiltration occurs as a result of groundwater seeping into a sanitary sewer system through joints, holes, cracks, or breaks. These conditions are usually a result of poor construction, line corrosion, and ground movement or structural failure.

Inflow occurs as a result of direct storm water cross connection to the wastewater system from roof drains, basement sump-pumps, land drains and leaking manhole covers.

Laying pipe

While it is nearly impossible to construct a collection system that will never experience any infiltration over it's lifetime, with proper design considerations and sound construction practices it is possible to greatly reduce the potential for infiltration.

Inflow is a different story. Generally about 60% of a system's non-sanitary hydraulic loading is attributed to inflow and can be managed through the development and enforcement of user ordinances.

Infiltration and inflow are anticipated in the operation of a sewer collection and treatment facility and are calculated into design capacity. Large urban systems often calculate cost of I&I management vs. cost of reduction and are able to tolerate significantly higher I&I levels than smaller rural systems due to economies of scale. *Small systems with a customer base of only several hundred connections do not have a great deal of financial latitude and simply can not afford to trade customer revenue for unwanted hydraulic loading.*

Where do you start?

Smaller systems need to address I&I from a construction standpoint as well as implement and maintain sound management practices. If you are a community official faced with overseeing the construction of a sanitary sewer system, it is to your advantage to review design and construction specifications with your project engineer. Take special interest in the specifications for trenching, back fill and compaction requirements. Existing fill is often used

(continued on page 3)

Director's Notes . . .

John McCarthy

Water Infrastructure Development and Compliance— Pivotal Issues for Rural Communities

Members of small communities have a personal stake in their water and waste systems. The decisions residents make on water, sewer and solid waste improvements can directly impact their property taxes, users' rates, and both the quantity and pattern of commercial and residential growth in their community. The impacts on user rates and property taxes tend to be immediate. Impacts on community growth, tax revenues and economic development are more likely to be felt in the medium to long term.

State and federal regulators have an interest in water and waste spending decisions of small communities because these decisions affect the community's compliance with the environmental laws regulators enforce. Unless members of small communities vote to pay for needed system improvements and to set adequate user rates, it will be difficult for their systems to stay in compliance.

Regulatory compliance is also of concern to local leaders; however they have additional issues to consider about wastewater management, resource protection, water and sewer line construction and expansion and related decisions. Not only must they make choices about where to spend limited resources, but they also must consider the impact of those choices on the growth and development of their community.

Many new water and waste compliance regulations have become law over the past 20 years. For rural citizens, who ultimately own most of the systems affected, these regulations have been very complicated and expensive to keep up with. In part this is a reflection on the capability of small communities, but it may also be a reflection on the complexity and expense of uniformly applied state & federal water regulations.

Enforcement pressure can sometimes move a community in the necessary direction, but this is not always effective because there is a practical limit to how much community members can be made to pay. In recent years, Capacity Development has been identified as another means to help small communities comply with water and waste regulations. The concept has been to focus on improving the capacity of the community to understand the clean water and safe drinking water requirements, accept their new responsibilities and develop plans to pay for what is required. Since modern drinking water, sewer and solid waste requirements are both complex and expensive, there is a need for efficiency and competent management and these are not always the first nor most sought-after qualities of volunteer leaders.

To respond to this challenge, Capacity Assessment and Capacity Development efforts have been initiated by drinking water agencies in many states. These are fledgling efforts however, and most state programs to improve capacity are only designed to provide limited and basic assistance in the areas of technical, financial and managerial capacity. For many very small communities, these capacity development programs just scratch the surface of the capacity gap.

John McCarthy
Program Director

Managing I & I
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in order to save money. If the existing fill is not adequate to achieve desired compaction and stability rates, it is more likely that ground-shift and line separation will occur, contributing to groundwater infiltration during operation.

Construction inspection is also an area where community officials can play a significant role. If you do not have construction inspection experience, you could probably learn enough during the project development phase to recognize potential problems. If this is not an option, hire a qualified inspector. While this will increase the construction cost, proper inspection during construction will assure construction consistency and will reduce the threat of infiltration caused by faulty construction.

Because lateral connections are usually done by a variety of private contractors, there is a great potential for infiltration problems to occur due to inconsistent construction methods. In fact, in many collection systems, about 90% of the system's infiltration level is attributed to faulty lateral connections. While it is perfectly acceptable for property owners to select their own contractor to make their lateral connection to a public sewer system, it is strongly recommended that adequate construction specifications be provided by the system officials and enforced via inspection during time of connection. Again this adds to the cost of construction but can greatly reduce the potential for infiltration.

Watermain…

While attention to detail during design and construction can help reduce the threat of infiltration caused by faulty construction, it is equally important for community officials to understand the types of sewerage that their system is collecting and treating and how it will affect the life of their system. Although the majority of customers on small systems are residential, commercial and industrial customers often contribute the largest volumes of wastewater and can also deliver a waste stream that is corrosive to your collection system as well as toxic to your treatment process. These conditions can be easily managed through the implementation of industrial pretreatment programs and discharge limitations. It is the responsibility of the system officials to develop and enforce these preventative measures.

One of the most effective ways for community officials to help reduce the threat of I&I in their collection system is through development of sound, enforceable storm water cross connection ordinances and lateral connection specifications. This is of particular interest to small system officials because the economic effect of adding or losing as few as ten EDUs (equivalency dwelling unit) to a customer base can significantly effect the financial stability of the system.

Often a small system cannot add new customers because the system is experiencing hydraulic overload due to I&I conditions even though their customer base is not at design capacity. This is because a lot of systems have storm water cross connection control ordinances but do not enforce them. Systems that serve customers in more than one municipality need to construct ordinances which can be adopted by each participating municipality and enforced by the municipality itself or by a municipal authority. Municipal authorities in a single municipality need to adopt municipal ordinances that can be enforced. A storm water cross connection ordinance, or any other ordinance developed to protect your wastewater collection and treatment system, is worthless if it cannot be, or is not, enforced.

(continued on page 4)

Parking lot run off

In addition to proper development and enforcement of customer ordinances, inflow management requires a high level of public education to be successful. This is an area where community officials can be quite effective. Public education about storm water cross connection is most effective when a user cost relationship is identified.

Simply put, it costs the customer more to treat storm water. *By reducing storm water cross connections on the system, treatment costs are lower, less design capacity is used and the potential for expanding the customer base by adding new customers and spreading operational costs over a larger number can be realized.* More revenue in a system means more stable user rates.

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Customer information literature regarding inflow should include descriptions of problems caused by storm water cross connections, overview of system rules and regulations with reference to existing ordinances, and economic relationship of I&I management to user rates.

Commonly, after community officials provide inflow educational literature to customers they receive customer comments such as, "I wasn't aware that these ordinances existed." Customer education should be the first layer of an I&I corrective action plan. Community officials will be pleasantly surprised at the effects that a good customer education program can have on inflow (storm water cross connection) reduction.

What about municipal responsibility for I&I control?

Customer education and sound ordinance enforcement are necessary for reducing storm water cross connections. Removal of storm water from the sanitary sewer system will benefit the operation of your facility; however, storm water from residential property still has to go somewhere. If there is no other option for storm water runoff, relief inflow from storm water cross connections creeps back into a sanitary sewer system shortly after aggressive municipal efforts are applied to remove it. Storm water management plans including collection and conveyance infrastructure are an integral part of effective I&I control. Again, this is an area where community officials can be tremendously effective in I&I reduction by developing community storm water management programs.

The relationship of storm water management and infiltration is significant as well. Sewerage collection systems, by the nature of their construction, change ground water patterns. Sewer line construction requires significant excavation, which changes areas of relatively undisturbed soils to a fairly porous underground conduit system for shallow depth ground water. In effect, the sewer line trenches act as underground streams. Without ground water relief mechanisms along these lines, the water erosion effects on line bedding can be significant and often lead to line separation through joint failure and breaks caused by land shift. This problem is intensified when ground water recharge is increased by focused storm water runoff.

The responsibility of managing I&I from a municipal perspective does not end with ordinance enforcement, customer education and storm water management. It is important to maintain collection line access points as well. Manhole covers and cleanout points are major contributors to inflow on a collection system. Attention needs to be given to manhole lid and riser seals especially after road repair or paving. Often, riser and lid modifications are necessary to achieve desired grade on new road surfaces but are sometimes left to the discretion of the paving contractor and are not sealed properly. Additionally, road modifications can change

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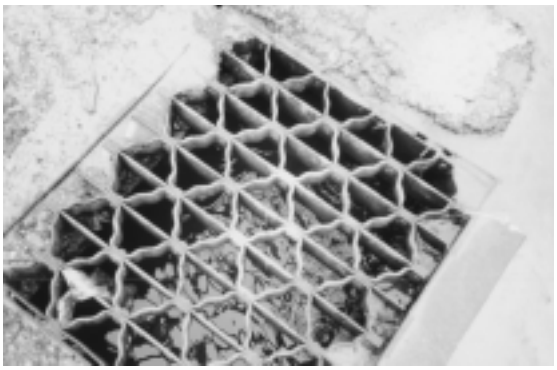

Storm drain

the slope and elevation of the surface near or over manholes. Even if the modification is slight, it may cause a focused runoff situation over a manhole where one previously did not exist.

Inflow attributed to lateral connections can be the source of significant storm water influence as well. Attention should be given to lateral cleanout positioning and height above grade. Because cleanout pipes and caps can be visually unattractive, homeowners often cut them off below grade. If the caps are not damaged by lawn mowers and if the cleanout pipe head is not in an area where storm water collects, this is not a problem. Attention should be given to a standard lateral cleanout specification and visual inspections should be part of the management program.

What about infiltration repair?

Infiltration repair can be expensive. It is suggested that stringent efforts be made to reduce inflow (storm water cross connection) prior to spending significant revenue on infiltration repair. Infiltration repair usually consists of collection line or lateral line replacement or slip lining. Slip lining is a technique that lines a pipe with a membrane from the inside. Line replacement costs can vary but infiltration repair costs usually run about $1.00 to $1.50 per gallon of daily reduction. For example; if you wanted to reduce infiltration in your system by 50,000gpd., assume capital costs of approximately $50,000 to $75,000. Keep in mind that these calculations are for the repair portion only, they do not include feasibility study costs and system flow metering costs.

Because infiltration repair costs are relatively high, it is recommended that you identify the regions of your collection system that are most significantly affected by infiltration prior to line replacement or slip lining efforts. This will enable you to reduce the highest volume of groundwater influence per dollar. Regional flow metering of your collection system during the wet season is the most effective way to generate data necessary for developing an I&I corrective action plan and monitoring its effectiveness. This is done by sectioning off regions of the collection system and strategically placing flow meters in areas that will allow for the collection of regionally isolated data. Comparison of this flow meter data can direct you to areas where I&I concentrations are the highest in your collection system.

Is I&I really all that bad?

Inflow and infiltration are present in nearly every wastewater collection system. If properly managed, I&I really isn't that bad. If poorly managed, however, I&I can be detrimental to a municipal sewer collection and treatment operation. Consideration has to be given as to how much financial flexibility your system has. If you are a small system and you need to add customers to survive financially, it does not make sense to substitute system capacity for billable EDU's with non-revenue generating I&I. Additionally it does not make sense to incur additional debt to expand treatment plant capacity to accommodate additional customers if I&I is currently using 50% of your existing design capacity. The bottom line is that your system should responsibly manage I&I to a level that allows you to operate within the discharge limitations set by your operations permit while protecting the investment of the public which you serve and provide for their sanitary sewerage needs.

Six Initial Steps Toward Improving Your Utility

By Robert E. Morency, Ph.D., Water Resources Specialist

Here are the first six steps that any small, rural utility (wastewater, drinking water, solid waste management, etc.) should consider taking to improve the services of the utility. The order in which they are listed is significant, although there might be some overlap in many cases. Each will be discussed below.

1. *Ask your State Primacy Agency for their opinion;*
2. *Get technical assistance;*
3. *Form a committee or strengthen an existing one;*
4. *Contract with professionals;*
5. *Identify and prioritize areas of need;*
6. *Explore funding options.*

Ask your State Primacy Agency for their opinion.

Primacy Agencies are the designated regulatory authority in any given state, and are charged with developing rules and regulations for the public health- and safety-related functions of a utility. These are the people who conduct periodic inspections, and who pass along to the system the results and suggestions on what the system needs to do to come up to modern-day standards. Since the standards are continually evolving and changing (due mostly to actions taken by the agency), representatives of the agency are the first source for advice on what your system needs to do to be in compliance (i.e., a modern utility, capable of sustaining itself into the future).

Get technical assistance.

The Primacy Agency can point you in the direction of free or low-cost assistance. Technical Assistance Providers, such as the six Regional RCAPs, are often funded, in part, by the Primacy Agencies themselves, as a way of helping to reduce the instance of non-compliance, thus promoting their responsibilities to ensure the public health. In many cases, technical assistance may solve the problem at hand, and will point you in the direction of deeper and more permanent solutions to the problems of running a small public utility.

Form a committee or strengthen an existing one.

If a single individual is operating your utility, you are running a great risk of being overwhelmed by new regulations. Despite jokes about the products of committees, it is almost universally recognized that the more points of view that can bear down on a problem, the more likely that the best solution will be found. While many communities rely on the Board of Selectmen to oversee the water system, the 1996 Amendments to the Safe Drinking Water Act has introduced a new level of complexity to managing the affairs of a system. Appointing an advisory committee, made up of 5–7 interested citizens, working with a Technical Assistance Provider, has proven to be an effective means of informing the community about the issues facing utilities, and even rescuing troubled systems from the brink. There are many instances of community leaders beginning a career of public service after serving on such a committee, the work of which can have significant, positive impact on the quality of life in the community.

Contract with professionals.

Free or low-cost technical assistance can take you only so far. Part of a Technical Assistance Provider's job is to let you know at what point you should seek and be prepared to pay for a professional (engineer, hydrogeologist,

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Chemical processing area, drinking water treatment facility

lawyer, accountant, etc.). Initially the fees for professional services will have to come from the utility's operating budget. As a project proceeds, however, professional services will be rolled into the project's cost, and will then either be at no cost (if the funding is through a grant) or become part of the utility's debt service payments. By attempting to do too much without competent professional help, you will certainly spend more over the long term.

Identify and prioritize areas of need.

Working with the Technical Assistance Provider and the professional engineer (for example), the committee should take a hard look at the present state of the system's infrastructure. Customer complaints may point you in the direction of which problem to address first. The results of a sanitary survey or a compliance problem also are points to be aware of in the assessment. An attitude survey taken of the customers may give an idea of the extent of a problem. Planning for future compliance may point out what outlays will have to be made to meet new regulations. A timely example is that maximum contaminant levels of radon, radionuclides, and arsenic are being set at lower levels than at present. If your system has levels of these contaminants that will be out of compliance, you must make plans as soon as possible to either treat the water, or replace the source.

Explore funding options.

In any given state there are usually very few choices for funding work on a utility. Among these are Community Development Block Grants, USDA Rural Utility Services Water and Waste Loan and Grant Program, State Revolving Loan Funds, Bond Banks, and private lenders (i.e., banks). Your situation may make you eligible for one or more of the options. Eligibility is dependent on such factors as: the income level of the users; the rates being charged; the utility's level of indebtedness; the amount of money being sought; and the nature of the project. It is worth taking the time to consult with the agencies involved in providing funding in order to find creative ways of "leveraging" funds. For instance, using loans as matching funds to improve grant eligibility, or providing self-funding where it might do the most benefit in terms of eligibility (i.e., self-payment for the installation of water meters). Funding agencies are more than willing to work with systems to assist with application requirements and to provide specific information on what the terms of the loan are (payback schedules, reporting requirements, administrative matters, etc.).

Summary

These six steps can be thought of as belonging to three stages: First, ***information gathering*** (asking your Primacy Agency for their opinion, getting technical assistance); Second, taking action to ***synthesize the information*** (forming a committee and contracting with professionals); and Third, ***informed decision making*** (identifying and prioritizing needs and exploring funding options).

Once the decisions have been made, and a project or a strategy has been identified, there is much challenging work to be done. However, if you have been wise to get help and advice, you will be in a decision-making role, and will have the guidance of regulators, technical assistance providers, and consultants, all of which will make the job easier. In fact, there are many examples of communities who have been strengthened by such an undertaking. We wish you luck!

Decentralized Wastewater Management at the 2001 RCAP National Conference

by Candace Balmer, Water Resources Specialist

RCAPers from around the country came together in San Diego this March for the 2001 Rural Development Conference, jointly sponsored by RCAP, U. S. Department of Agriculture (USDA), and the U. S. Department of Labor. The theme was "Rural Voices: Sharing Our Stories", and the topics were varied and plentiful. One session, on decentralized wastewater management, featured presentations from three RCAP Technical Assistance (TA) providers, and one from a USDA Rural Utilities Service Program Director.

H. B. Calvert from the Midwest Assistance Program (MAP), Iowa, summarized the mechanisms of a properly operating septic system and the causes of system failure. All types of failures, including improper design and construction, improper usage, and inadequate monitoring and maintenance, can be addressed through a centralized management scheme. However, Mr. Calvert stressed that education of community leaders and residents is the most important key to success, largely because of the widespread lack of understanding of the benefits and limitations of on-site septic systems. Homeowners need to be reminded about what should not be flushed, and why, as well as why regular inspection and maintenance can prevent problems for both the homeowner and the environment. All project participants, including local officials and residents, engineers, regulators, funders, planning and TA providers, need to be informed about both the technological options available as well as the components of a successful management program. Ultimately, he said, it really does take a village (well, a community).

Candace Balmer, presenter

The next speaker, Kathy Cartwright from the Wisconsin Community Action Program (WISCAP), noted that, while decentralized management is still in its infancy in the state, Wisconsin regulators have made strides in streamlining agency oversight of onsite systems. The division of agency authority used to be along the lines of municipal versus privates. Now, systems treating waste from the equivalent of 85 bedrooms or more are regulated by the Department of Natural Resources, while those handling less are handled by the Department of Commerce.

The Department of Commerce's onsite code, which had been strictly design-based, has shifted to allow approval based on performance as well. No blanket approvals are given for specific technologies: applications are reviewed on a case-by-case basis by the Department of Commerce's Technical Advisory Committee. Ms. Cartwright noted that the new code, implemented last summer, was a very controversial issue across the state.

In closing, Ms. Cartwright discussed a community with whom WISCAP is exploring implementation of centralized management. The Bad River Tribe has 140 tribally-owned and 140 non-tribal septic systems in need of repair and upgrading. The goal is to bring these systems under central management by either the tribe, or the local electric cooperative. Although the State's funding agencies are willing to fund the upgrade and construction of centrally-managed onsites, progress has been slow, mainly due to lack of start-up money.

Jim Caldwell, from the Georgia Rural Community Assistance Program, is assisting Lake Lanier in Hall County to implement a decentralized wastewater management plan. There are over 25,000 septic systems within the watershed, and there is evidence to suggest that deteriorating lake quality can be directly attributed to

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Art Astarita, Carol Hess and John McCarthy, RHI conferees

system failures along the lakeshore. The National Small Flows Clearinghouse has provided $100,000 to construct a demonstration project and prepare a master plan. Additional construction funds will be sought through a combination of state grants and, ideally, through USDA RD's wastewater loan/grant program.

Throughout the project, emphasis will be on public participation, particularly in the review and selection of technical and managerial alternatives. Mr. Caldwell noted that although funding limitations restrict the pilot project to a small region of the lakeshore, community participation will be encouraged on a much wider scale, to educate and build support for future improvements. Following construction of the project, the University of Georgia will conduct a two-year performance-monitoring program.

The last speaker, Jim Maras, is Program Director for USDA Rural Development in Minnesota. In Minnesota, a system is eligible for RD funding if it can be demonstrated that a Responsible Management Entity (RME) has legal authority to operate the system (either through outright ownership or permanent easement). The RME can be any public, private or quasi-public body which provides operation, maintenance and management of a utility system. It is the RME's responsibility to ensure system managerial, technical and financial health. Types of RME's include homeowner groups, private businesses, and cooperatives. Rural electric coops, in particular, have shown to possess a compatible structure for successful oversight and management.

Mr. Maras cited the benefits of RME's and noted that preliminary models have shown that very small, decentralized systems are not only financially viable, but they also can actually reduce public funding needs. Acceptance of the concept, however, is hampered by: limited knowledge on the part of residents and designers alike; regulatory hitches; significant inherent management responsibilities; and the community's own fiscal discipline.

Mr Maras said that to get RD funding, projects need to show creative thinking and objectivity. The agency looks to see that the community is an intellectually and financially responsible partner, with a sustainable long-term plan and solid cost estimates based on supportable research. Other good advice:

- avoid passing delayed maintenance off as new infrastructure work, and,
- get the most out of existing components such as piping and tanks.

As you observe through this summary, workshops bringing together technical assistance advisors from all over the country not only provide opportunities to share information on emerging technologies but also offer opportunities to discuss and review the pluses and minuses of regulatory formulations.

Wastewater settling tanks

Consider the Basics When Managing Your Water Systems' Information

by Barry Woods, Water Resources Specialist

Information collection and management is an important task of every utility. Gathering, storing and retrieving information apply to all systems whether public or private, community or non-community. While specific data may be necessary to meet reporting requirements of the regulatory authorities, local boards and/or commissions, it also serves as a very valuable tool in assisting operators and managers when making informed decisions.

Sources

A basic log should be maintained at all of your facilities. Each visit to the facility should be identified as to date and time and by whom. What was the purpose: routine visit, scheduled maintenance or an emergency: at a minimum, routine visits should record such conditions as air temperature (in and out); water temperature; level of propane or other fuel supplies; pump status (operating; yes or no); position of controls (hand, off or automatic); hour meters, electric meters, water meter readings; system pressure; pump discharge pressure; well levels (dynamic or static); alarm conditions; flow recorder rate and totalizer readings to calculate water pumped.

Operator updating logs

If chemicals are utilized, consider operational status and record chemical feed pump settings, tank levels, residuals or dosages, total gallons used and any other necessary performance data. Providing an area for comments is advisable. If auxiliary power sources are present, record pertinent information and identify time and length of operation. A separate facilities log should be available to identify any routine maintenance, repairs or rehabilitation and emergency situations. Consideration should be given to reporting date and time, task undertaken, materials used, outcome and identity of all involved.

Drawings, prints, plans and/or reference materials associated with the source should be maintained and include such tools as well logs, piping (potable & non-potable) schedules, plant schematics, equipment maintenance and repair manuals, parts inventory list and so on. Such materials should be readily accessible and protected from any damaging elements.

While monitoring and recording may be time sensitive, the observation and collection of data is an important function and should not be overlooked. SCADA (Supervisory Control and Data Acquisition) systems that have customarily been utilized in larger systems to assist with the operational demands are now being developed for small systems and at less expense thanks to new and emerging technologies.

Transmission and Distribution

What you can't observe or locate can create an untenable situation. Since the majority of your infrastructure is buried, all records, drawings and maps are critical to the effective operation and efficient maintenance of your system. Remember, this is one of your hidden physical assets. A systems map that identifies the areas of the distribution system is critical. The map can be comprehensive or broken into components. At a minimum you should be able to identify not only the basic street, but also ascertain the locations of pipe including type and size, valves and hydrants, inter-system connections and high or low pressure areas. Other important information can include sources, pump stations, lift stations, tanks or reservoirs. It is advisable to have the map properly scaled. Maintaining and updating the maps should be considered as a major

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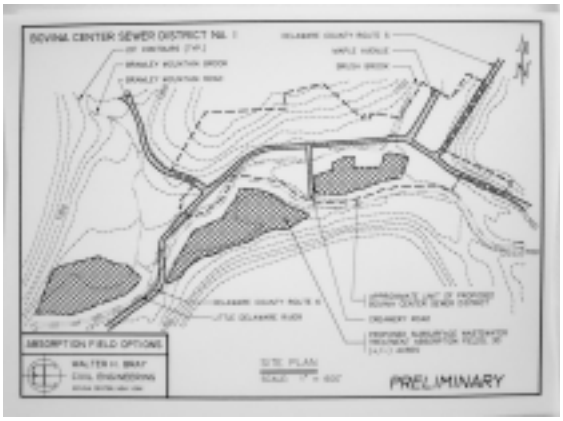


priority. Lack of information can impede operations and create critical problems or conditions during emergency situations. Other components should include drawings, measurements (commonly referred to as ties) and dates of installation of all valves, hydrants, blow-offs, meter pits, air or pressure relief valves, altitude or pressure reducing valves and service lines. High hazard cross connections should also be identified.

Records should be maintained not only as a supplement to your maps, plans or drawings, but are usually required to identify pertinent information that cannot be included in your mapping systems. Entry or placement can be as simple as an index card, loose-leaf binder, file folders, field books or computer print out. It's very important, however, to have the ability to cross-reference this information with your mapping data. Records can provide you with not only the necessary supplemental data to your maps but will also allow you the ability to track maintenance and repairs which can be helpful in setting rates and/or determining system upgrades. Such data is usually categorized into separate records for (a) numbered valves and hydrants, (b) total length of main laid by each size, whether in use or abandoned, (c) service records, which include service number, address, date installed, size and type of material, drawings, size and type of meters, location and note space regarding repairs, comments and customer inquiries, (d) flushing system details and consumption, (e) main or service easements, (f) dead ends and blow-offs, (g) meter statistics: make, size, serial numbers, date of placement, test results, repairs and locations, (h) tank or storage facilities to include inspection, testing and maintenance (i) cross connection control tracking including location of cross connection, type of hazard, device protection, survey and testing results, (j) leak detection information, dates of survey, locations and size of leak including type of pipe or connection, date of repair and list repair parts.

Logs are simple but invaluable

The recommendations above may be modified based on the size and or structure of each individual system. While all of the data is important in the overall operation of small, medium and large systems, a small or rural system may want to combine some of the records to minimize time constraints placed on the operators. Although small system operators have additional duties beyond maintaining the water systems, it is extremely important to set aside the time necessary to develop the critical references necessary for system operation and maintenance.

Water Quality

All customer complaints should not only be investigated, but also should be recorded and tracked to determine water quality changes in the system. A log should be kept noting the date and time, location, person reporting the condition, type of complaint, and field or operator report of the condition, including action taken and what response was made to the party. Monitoring, collection and storing of this information is vital to providing a safe and reliable source of potable water.

A permanent record of every sample collected should be considered. The following information is recommended: name of system and Public Water System Identification number, bottle or container number and preservative if used, date and time of sample collection, type of sample (raw, treated, grab, composite), location of sample, analysis requested, name of

(continued on page 12)

Consider the Basics When Managing Your Water Systems Information

(cont'd from pg. 11)

collector along with a chain-of-custody record. This information should be kept as a permanent record within the system.

Develop a water quality information record. Collecting samples for analysis based on a reporting schedule or specific incident is only part of the scenario. What you do with the results can and will have long-term impacts to the system. Proper recording and storage of analytical data will assist in obtaining regulatory compliance, help in providing easy access to information for dissemination to the public, will benefit staff when developing the annual consumer confidence report, may aid in obtaining various regulatory waivers and can also assist you in preparing annual reports. Tracking of this information is beneficial and can be utilized as an early warning device to avoid potential water quality problems in your system. Currently under the Safe Drinking Water Act there are specific requirements for the length of time a system must maintain records. Many states also have length of time requirements. Why not consider a permanent record?

Too Much or Too Little!

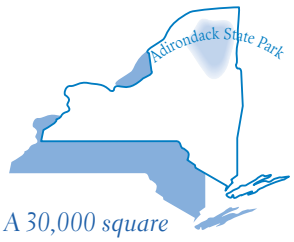
It's really your choice. As the manager or operator of your system, you are in charge. Many topics have been revealed here; however, other records such as billing and rates are also part of the process. Although the tasks are many in operating a water system, at times, records inadvertently are placed low in our level of priorities and may slip through the cracks. We need to be cognizant of the fact and remember that this information ultimately becomes necessary when making decisions regarding operations now or in the future!

It's clear that many systems need to consider the basics when developing their records. As a new Water Resource Specialist with this Agency, I have the privilege of providing technical assistance through site visits to many small systems. I have observed systems with inadequate records. Don't fret; it takes time, and improvements can be made step-by-step as time permits. Look at the bigger picture; it's a process that never ends. I know and have been there. Prior to this position, I have been involved for over 31 years in operating and/or managing Public Water Supplies and I have to tell you, the process can be tiring and never ends, but is effective and can be fruitful over the long term. Start with bits and pieces that you feel have value and remember the system wasn't developed overnight!

Technical Assistance Challenges: Working in Northern New York State

by Bruce G. Goodale, PE, Water Resources Specialist

Working as a technical assistance specialist with the Northeast RCAP for communities in northern New York State (NYS) has presented diverse and unique challenges. Over the past four years this author has served about 50 projects located in 35 different communities struggling with drinking, clean and waste water issues. RCAP specialists also work routinely in a cooperative effort with other technical assistance staff in the NYS Departments of Health and Environmental Conservation, the NYS Environmental Facilities Corporation and the New York Rural Water Association.



A 30,000 square kilometer sector of northern New York State served by the Northeast RCAP is one of the more rural and sparsely populated regions in the eastern United States. The core of this region is the vast, forested Adirondack Park. The surrounding peripheral areas are more agricultural. Communities in this region are generally very small. The regional economy is mature and heavily dependent on tourism, forest products, dairy farming and limited manufacturing. The incomes of residents in this region are significantly lower than other regions of the State. Recent growth rates have lagged behind national trends.

Compliance with the Surface Water Treatment Rule (SWTR)

Assisting communities to comply with requirements of the SWTR of the Safe Drinking Water Act has been a major Northeast RCAP technical assistance activity in northern New York State. The SWTR requires water supply systems using surface water as a source to develop or utilize an alternate water supply or to install filtration systems. Many small communities in the region currently use surface water supplies and provide only disinfection of the water before use. One community secures its water supply from the side of Whiteface Mountain, the site of a major ski center that hosted alpine skiing events during the 1980 Winter Olympics. While in most cases the surface water supplies are of high quality, there is, nevertheless, a risk of microbiological contamination. Giardia, associated with the distribution of beaver, occurs throughout the Adirondack region. Increasing development of the shorelines of the lakes with residential properties and recreation use also pose increased risk of surface water contamination.

The state and county health departments have worked to bring surface water systems into compliance with requirements of the SWTR. The author has provided technical assistance to eight communities in northern New York in efforts to achieve compliance. In two cases, it was determined that connection with other nearby public water systems was the most cost-effective alternative. With the remainder, development of satisfactory ground water supplies was determined to be the best alternate. RCAP has provided assistance in identifying new ground water sources, evaluating technical alternatives, conducting surveys, and seeking financial assistance to finance the development of groundwater supplies.

One of the more interesting and challenging technical assistance projects has been working with the community of Raquette Lake to comply with the SWTR. This small community is located in the heart of the Adirondacks and is totally surrounded by Forest Preserve land whose use is highly restricted by the New York State Constitution. It appears that to develop an alternative groundwater source or to construct filtration facilities on these lands may require an amendment to the constitution, a process that will take several years to achieve.

Rehabilitation of Old, Deteriorated Water and Sewer Systems

Northern New York State is a region that has been settled since the late 1700's. As communities in this region grew, many of the larger population centers developed water distribution facilities to provide safe drinking water and collection sewers to convey wastewater. However, many systems in northern New York are nearing the end of their useful lives and are in a bad state of repair. The author has been involved with several communities that have water and sewer lines nearly a century old. Frequent water line breaks, low water pressure, and excessive infiltration and inflow are common problems with these antiquated systems.

Water and Sewer Systems Serving Shoreline Populations

One of the more challenging technical assistance challenges has been dealing with the special problems posed by residential developments around the shorelines of major water bodies in the region. Because of the attractiveness of living close to water, there has been and continues to be substantial shoreline development. Many of the property owners are seasonal users, but there is a growing trend towards more year-round use. This pattern often creates serious water supply and water quality problems because many of the waterfront lots are small and/or have unsuitable soils and groundwater conditions to support individual systems. In these situations there is danger of both surface and groundwater contamination.

Serving the Needs of a Native-American Community

A more unusual technical assistance experience has been working with the St. Regis Mohawk Tribe. This native-American

(continued on page 14)

The author has had technical assistance involvement with residential communities around a number of water bodies in the region including: Lake George, Raquette Lake, Long Lake, Tupper Lake, Babcock Lake, Ballston Lake, and the Great Sacandaga Lake. In some cases, the community priority has been to provide a new or improved supply for users. With others, the emphasis has been on the development of community sewer facilities. RCAP has provided technical assistance in evaluation of technical alternatives, participated in public education activities and in seeking financial assistance to construct needed facilities.

community is located in extreme northern New York State adjacent to the St. Lawrence River and is one of the lowest income communities in the State. The water supply and wastewater treatment facilities serving the Tribe had a number of deficiencies requiring improved facilities and operations. The existing filtration plant that provides water to most tribal residents was operating beyond its design capacity. The Tribe's wastewater treatment plant operators also had inadequate training and sought training and other facility operational technical assistance.

The author worked with the Tribe, staff of USDA/Rural Development, the USEPA, and the Indian Health Service in completing funding and environmental applications supporting construction of a new Dual-Sand-Filtration water supply treatment system to replace the existing filtration plant. RCAP also worked with the NYS Department of Environmental Conservation in securing wastewater plant operator certification for the Tribe's staff and in providing other technical assistance.

Source Water Protection

Resource planning, including groundwater, watershed and wellhead protection is an activity where there is increased interest and a growing need for technical assistance in northern New York. The NYS Health Department (NYSDOH) has initiated a major Source Water Assessment Program (SWAP) whose goal is to evaluate systematically all 14,000 water sources in the State. The results of the SWAP will be produced over the next two-year period. The SWAP will provide impetus for communities to take measures to protect their source waters. Another impetus for action is the publicity surrounding the E-Coli contamination of a well at the Washington County Fair in northern New York State; contamination of the well from animal waste runoff resulted in two deaths and affected almost 1000 people.

Through RCAP, the author has advised communities on source water protection issues as part of its technical assistance activities. The author advised one northern New York community on a problem of salt contamination of wells from salt storage and road salting. He also assisted another community to construct wastewater collection and treatment facilities to protect both local surface water quality and a downstream public water supply reservoir that served a major community. RCAP also serves as a member of NYSDOH's advisory committee on the SWAP. It is expected that source water issues will be become an increasingly important technical assistance activity for New York RCAP staff in the future.

Achieving Affordable Solutions for Low-Income Communities

Achieving affordable solutions to water supply and water quality problems is a basic RCAP goal. Another RCAP goal is to serve the needs of low-income populations. However, when the two goals are combined, the challenge is particularly difficult, especially for very small systems that lack the efficiencies of scale of larger systems. Two of the technical assistance tools that have been applied in northern New York for achieving these goals are the use of income surveys and self-help approaches.

Technical assistance to communities in conducting income surveys has been frequent RCAP work activity in northern New York State. The sources of public financial assistance for water and sewer projects, such as the State Revolving Funds, USDA/Rural Development and the Community Development Block Grant Program, all use community income as a partial basis for determining need. Since census tract data are often not representative of the socio-economic makeup of residents in a water or sewer project area, it may behoove a community to conduct an income survey to demonstrate a lower income level and financial need.

RCAP typically serves as independent third party to supervise the conduct of income surveys. In the majority of cases, the income surveys were successfully completed and demonstrated that either the community's median household income was lower than published census data or that the percentage of low-income residents qualified it for CDBG funding. A minority of income surveys showed

Specific areas where RCAP staff provide assistance to communities include:

- *Completion of community water supply, water quality and solid waste surveys*
- *Establishment of eligibility for grants and loans*
- *Assistance in selecting engineers and other professional services*
- *Preparation of applications for financial assistance*
- *Determining the scope of new facilities and renovation/expansion of existing systems*
- *Completion of project environmental assessments*
- *Conducting water and wastewater rate and cost analysis*
- *Technical assistance on management of existing water, sewer and recycling systems*
- *Resource planning, including groundwater, watershed and wellhead protection*
- *Public education and participation activities*

higher incomes than the census; these cases usually occurred when there were a large number of seasonal residents in the project area whose incomes were higher than year-round residents.

In a few cases self-help techniques helped lower project construction costs for Lowville, Long Lake and St. Johnsville. This approach has usually has been taken in cases where the needed water or sewer facilities were relatively simple to construct and the community had the will and capability to undertake this effort.

Use of New and Innovative Technologies

Where circumstances have warranted, new and/or innovative technologies are considered for a number of community and water and wastewater projects in northern New York. There has been interest in employing new filtration technologies to achieve higher quality effluents and to meet equivalence of microfiltration. The New York City water supply system in southern New York has studied the use of Dual-Sand-Filtration (DSF) technology for advanced wastewater treatment within its tributary watershed area (Whitmore, 1998). This technology offers advantages in terms of low operating and maintenance cost in comparison to microfiltration or conventional sand. In northern New York, DSF technology is being considered for at least two community water supply systems. One of them is the proposed system for the aforementioned St. Regis Mohawk Tribe.

Another somewhat unique technology being considered for wastewater treatment is the use of natural mineral adsorptive materials to remove phosphorus. Eutrophication is a serious water quality problem for Lake Champlain and various measures are being considered to reduce phosphorus inputs to the lake from man-related sources. One approach being considered by the community of Willsboro is use of wollastonite tailings (calcium and ferrous metasilicate) as an adsorptive medium for phosphorus removal in a constructed subsurface flow wetland. Wollastonite is mined commercially in northern New York State near Willsboro and there is an abundance of these tailings as a by-product. Pilot studies have confirmed the effectiveness of this technology (Geohring, L.D., et al., 1998). Plans are underway to construct an operational wetland using wollastonite for the Town of Willsboro. This technology has the potential for use in other communities in the Lake Champlain basin as well as elsewhere.

The use of directional drilling for the installation of water and sewer lines under roads, waterways and other surface obstructions is now being widely used in New York. This technology has benefits in terms of cost, schedule and minimization of distributions to surface activities and facilities. The author has been involved with several communities where there this technology is being employed or has the potential for use in future projects.

On-Site Wastewater Management

A frequent problem encountered throughout upstate New York is the failure of individual systems within small, populated hamlet areas. The combination of small lot sizes and low permeable soils make individual septic and related waste disposal impractical and community-wide solutions must be sought. The cost of constructing conventional sewers and a wastewater treatment plant is often cost-prohibitive even with available sources of financial assistance.

An informal on-site wastewater management work group has been organized to focus attention on the use of alternative technologies; this group includes representatives from engineering firms, technical assistance providers, government staff, academia and other interests. There is much interest in using on-site technologies in the New York City watershed area as another tool for water supply source protection. To date, these technologies have not been employed in northern New York.

Geohring, L.D., T.S. Steenhuis, A.S. Brooks, M.N. Rosenwald, J.Chen, and V.J. Putman, "Cost Effective Phosphorus Removal from Secondary Wastewater Effluent through Mineral Adsorption", Prepared for the Town of Willsboro, Essex County, New York, September 1998

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